

Original Research Article

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Field Evaluation of Tuberose Cultivars and Symptom Manifestation Caused by Foliar Nematode, *Aphelenchoides besseyi* in Tuberose

Suvash Chandra Bala* and Nihal Ravindranath

Department of Agricultural Entomology attach with AINP on Agril. Acarology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal, India

*Corresponding author

ABSTRACT

Fourteen tuberose (*Polianthes tuberosa* L.) cultivars were evaluated under field condition to understand their performance against foliar nematode (*Aphelenchoides besseyi* Christie). Significant differences were recorded among the tested cultivars for their yield attributing parameters as well as nematode population in flower samples. However, the height stalk length obtained from the cultivar Sikkim Selection while maximum spike length was recorded from Prajwal (33.79 cm). The cultivar Vaibhav was recorded maximum number of florets per spike (26.45) and maximum percentage of infestation was estimated in cultivar GKTC Hyderabad (79.48%) followed by Single Hyderabad (79.48%) and Bidhan Rajani-III (78.65%). However, minimum number of nematode population was registered in the cultivar Phule Rajani and Prajwal respectively. Symptom appearance in tuberose due to profuse feeding on the stalk epidermis as a result stalk became irregular and rugged, spiny structures of variable number were found on the surface of the flower stalk along the length. Sometimes spike developed but the florets did not bloom or partially bloomed with either lower most or the top most few florets. In few cases the flower stalk emerged with a blind flower head where no spike developed.

Keywords

Tuberose, Cultivars, Screening, Foliar nematode, Symptom manifestation

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Introduction

Tuberose (*Polianthes tuberosa*) is the bulbous ornamental plant; its value is high in respect of artistic world for its beautification and fragrance and occupies a very unique position in flower loving people by virtue of sweet pleasant and attractiveness. Due to dual demand, it is currently cultivated in most of the tropical and subtropical countries of the world. It is commercially cultivated in many countries of world like Hawaii, China, Brazil, Italy, Iran, U.K., USA and India. In India,

commercial cultivation of tuberose is mainly confined to the state of West Bengal, Karnataka, Tamil Nadu, Maharashtra, Orissa, Assam, Uttar Pradesh. The foliar nematodes *Aphelenchoides besseyi* Christie has been identified as a key pest to this crop and posing a serious threat to the tuberose cultivations all over the country (Khan and Pal, 2001). This nematode first time recorded from Hawaii Island (Holtzmann, 1968) and in consequential time it was reported from Ranaghat region of Nadia district in West Bengal (Chakraborti and Ghosh, 1993). In India, this nematode was first reported by Dastur (1936) on rice. This

nematode can cause yield losses upto 59% in tuberose (Pathak and Khan 2009). Presence of foliar nematode (*Aphelenchoides besseyi*) in the flower stalk is main hindrance to export in foreign countries. However, Different management options have been recommended for controlling of foliar nematode problem (Chakraborti and Dutta, 1997, Chakraborti, 1995, Khan *et al.*, 2005, and Cuc *et al.*, 2010) in tuberose. Though, few fungicides, insecticides and botanical products have been tested against foliar nematode (Chakraborti and Ghosh, 1993, Chakraborti 1995, Chakraborti and Dutta, 1997, Khan and Ghosh, 2011) but none of the management strategies provided promising against the threat of foliar nematode in tuberose. Hence, several cultivars had been evaluated under field condition to know the performance against foliar nematode that caused flower malady in tuberose.

Materials and Methods

This present experiments were conducted during 2015-2017 at Net house condition, Directorate of Research Building, Kalyani (22°59'18.89"N and 88°27'10.14"E, 10 m above MSL) to screen different tuberose cultivar (*Polianthes tuberosa* L.) on the basis of nematode infestation in flower. Fourteen cultivars of tuberose namely, Prajwal, Vaibhav, Phule Rajani, Shringar, Subhashini, Bidhan Rajani-1, Bidhan Rajani-2, Bidhan Rajani-3, Arka Nirantara, GKTC Hybrid, Single Hyderabad, Hyderabad Double, Sikkim Selection, and Calcuta Single were taken for screening purpose. The experiment was design in Randomized block having three replications. The experimental field was divided into forty two plots, measuring 2.0X2.0 m². Bulbs of tuberose cultivars were collected from AICRP on Floriculture project, Directorate of Research, BCKV, Kalyani. Collected bulbs was washed thoroughly and soaked in plain water for overnight and planed

in field as per treatment schedule. Agronomic practices adopted as per recommendations for the cultivar of the crop in the region. The yield attributing parameters of the crop *viz.*, stalk length, spike length, number of florets per spike, percentage of infested flower and nematode population per 10g of flowers were also noted. All the data presented here based on 24 observations during the period of experiment. Another experiment was done on symptom manifestation and its progress in tuberose due to infestation by the foliar nematode. Here observation was taken day by day by visual estimation regarding progress of symptom. For recording nematodes from flower samples, samples were chopped into small pieces with the help of sharp knife, then they were placed on wire-gauge fitted over a Petriplate containing clean water in such a manner that the bottom of the gauge remained just in touch to the water. The wire gauge was then covered by another Petridish to prevent water loss from the assembly and kept undisturbed for 12 hrs. Nematodes suspension was then passed through 20 and 400 mesh sieves serially and final population count was taken with the help of multi-chambered counting disc under stereoscopic binocular microscope. All the data obtained were statistical analysis by using MSTAT-C computer software and significance of treatments was considered at P=0.05% level.

Results and Discussion

Screening of tuberose cultivars against foliar nematode (*Aphelenchoides besseyi* Christie)

The experiments were conducted at the net house situated near Directorate of Research complex, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, and Nadia. Total fourteen cultivars were screened under field condition. Observations taken from July 2015 to January 2017 on different yield attributing

parameters like stalk length, spike length, number of florets per spike, percentage of infestation and population of foliar nematode per 10 g of flowers. It is evident from the perusal data presented in table 2 that stalk length range from 59.38 to 124.91 cm but maximum length was obtained from the cultivar Sikkim selection (124.79 cm) which was statistically at par with the cultivar Prajwal, and Calcutta Single whereas minimum stalk length was recorded in the cultivar Bidhan Rajani –II followed by GKTC Hybrid, Phule Rajani and Single Hybrid. The next best stalk length recorded from the cultivars Bidhan Rajani-III, Subhashini and Vaibhav. These findings are in accordance with the result of Sarita *et al.*, 2017.

Observation on spike length have been presented in table 2 where maximum spike length was obtained in the cultivar Prajwal (33.79 cm) which was statistically at par with the cultivar Vaibhav, Subhashini, Bidhan Rajani-I and the minimum spike length was recorded in the cultivar Bidhan Rajani-II (20.26 cm) followed by Calcutta Single, Bidhan Rajani –III, Sikkim Selection and Phule Rajani though they are statistically at par with each other's.

Regarding number of florets per spike ranged from 12.24 to 26.45, but maximum number of florets per spike was recorded in the cultivar Vaibhav (26.45).

Comparison among different cultivars for the number of florets per spike revealed that cultivar Prajwal and Single Hyderabad and Subhashini are statistically at par with each other and minimum number of florets per spike was recorded from the cultivar Bidhan Rajani-III (12.24) followed by Culcutta Single. The finding is in confirmed with the report of Gaurav *et al.*, 2005 and Krishnamoorthy, 2014. Concerning the percentage of infested flower caused by foliar

nematode in tuberose, it was revealed that the maximum infestation was observed in cultivar GKTC Hyderabad (79.48%) which was statistically at par with Single Hyderabad (79.48%) and Bidhan Rajani-III (78.65%) whereas, minimum infestation was observed in the cultivar Phule Rajani (25.57%) followed by Prajwal (34.07%). Nematode population per unit of flower sample is one of the important considerations to evaluate the cultivar of tuberose (Fig. 1).

However, it was revealed from the present study that none of the cultivar were registrant against foliar nematode infestation although the cultivars Phule Rajani (59.16 nematode per 10g flowers) and Prajwal (64.34 nematode per 10g flowers) were found to least susceptible to foliar nematode *Aphelenchoides besseyi*. On the other hand, the cultivar GKTC Hyderabad (365.47 nematode per 10g flowers) Bidhan Rajani-III, Bidhan Rajani-I, Bidhan Rajani-II and Double Hyderabad were most susceptible to foliar nematode infestation.

Symptom manifestation and its progress in tuberose due to infestation by the foliar nematode

Symptom development in tuberose due to foliar nematode and its progress were keenly observed right from sprouting of the bulbs. The symptoms were initially marked by emergence of yellowish green or pale green leaves.

This might be due to reduction in chlorophyll contain of the leaves following nematode infestation. The leaves as well as the flower heads emerged out of the top portion of the bulbs where from maximum number of nematodes was recovered. The tiny organisms while feeding entered in developing flower head and also fed on the epidermal layer of the newly formed stalk.

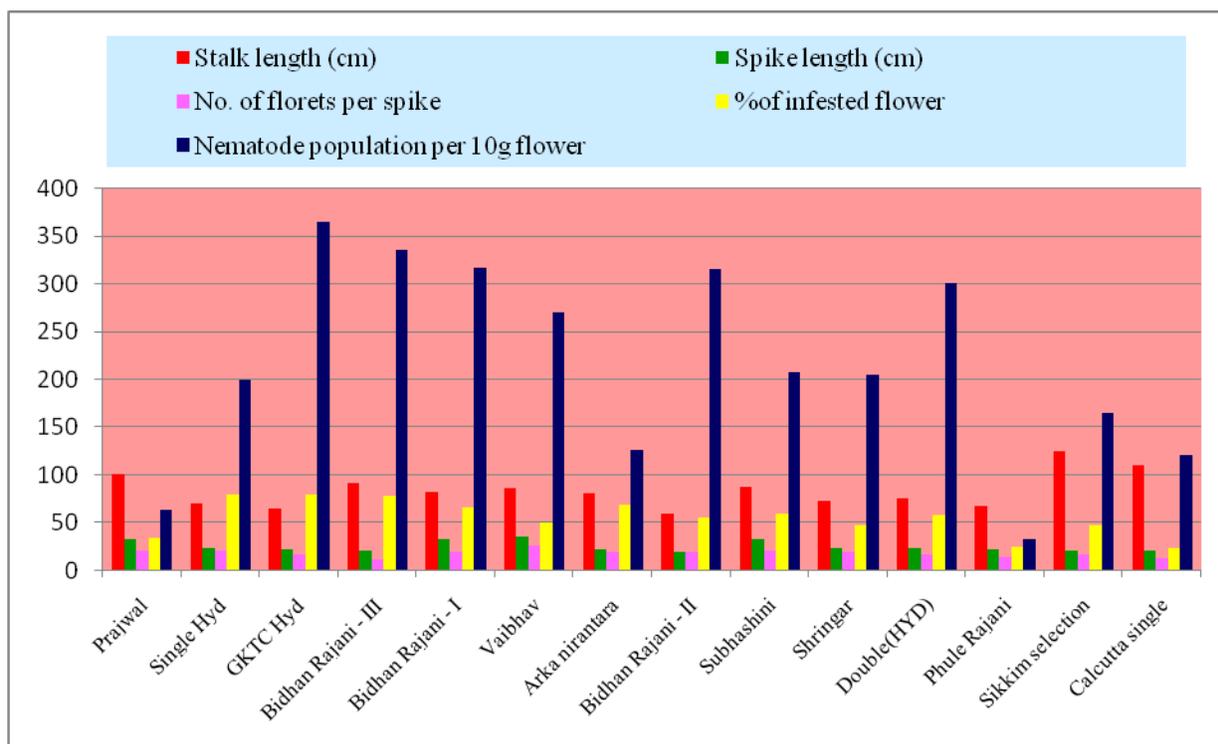
Table.1 Comparison between healthy and foliar nematode infested flower stalk and their related parameters

Sl. No.	Healthy flower stalk									Infested flower stalk								
	Stalk length (cm)	Stalk circumference (cm)	Stalk weight (gm)	Spike length (cm)	Spike weight (gm)	Individual floret weight (gm)	Floret length (cm)	Weight of florets/ spike	Population of <i>A besseyi</i> per spike	Stalk length (cm)	Stalk circumference (cm)	Stalk weight (gm)	Spike length (cm)	Spike weight (gm)	Individual floret weight (gm)	Floret length (cm)	Weight of florets/ spike	Population of <i>A besseyi</i> per spike
1.	108.3	4.0	115.8	49.0	95.0	3.15	6.5	74.0	0.0	78.5	2.8	52.2	37.2	28.0	0.70	3.6	14.8	30250.0
2.	95.2	3.8	87.4	45.0	60.0	2.65	6.3	43.0	13.0	80.3	3.0	54.0	38.5	29.5	0.50	3.3	13.3	18510.0
3.	111.2	4.2	121.9	47.0	100.0	3.20	6.6	78.0	0.0	60.2	2.3	29.3	25.5	18.2	0.45	3.1	9.8	15362.0
4.	106.0	3.3	74.6	33.0	68.9	2.58	5.8	32.0	34.0	60.0	2.9	28.4	26.2	15.0	0.50	3.2	8.0	8890.0
5.	96.0	3.0	85.0	43.0	58.7	2.8	6.0	42.5	16.0	58.3	2.5	48.6	26.0	27.0	0.80	3.7	14.0	30369.0
6.	86.0	2.40	74.0	30.4	42.8	2.0	5.8	34.4	21.0	56.4	2.4	53.0	25.0	24.8	0.75	3.5	17.0	32560.0
7.	102.0	3.50	101.5	44.0	82.0	2.7	6.0	65.2	0.0	63.0	3.0	26.3	19.0	17.0	0.45	3.2	9.0	12826.0
8.	86.3	2.40	72.2	29.5	47.5	2.6	6.4	30.8	23.0	74.1	2.1	48.1	22.0	10.0	0.50	2.8	8.5	11763.0
9.	90.4	2.70	82.3	29.6	36.9	1.9	5.4	31.5	0.0	48.6	2.0	46.0	16.8	8.5	0.40	3.0	4.5	9970.0
10.	95.5	3.0	83.9	42.4	53.2	2.5	5.8	41.8	15.0	63.8	3.2	32.5	28.3	19.3	0.68	3.2	13.8	20314.0

Table.2 Observation of different yield attributing parameters as well as nematode population in flower samples in the year 2015-17

Name of the variety	Stalk length (cm)	Spike length (cm)	No. of florets per spike	%of infested flower	Nematode population per 10 g flower
Prajwal	101.95	33.79	21.16	34.07	64.34
Single Hyd	70.76	23.81	21.68	79.46	200.59
GKTC Hyd	65.54	22.92	16.90	79.48	365.47
Bidhan Rajani - III	92.35	21.89	12.24	78.65	336.55
Bidhan Rajani - I	82.49	33.18	19.75	66.34	317.63
Vaibhav	86.51	33.03	26.45	50.45	270.12
Arka nirantara	80.72	22.62	20.08	69.66	127.23
Bidhan Rajani - II	59.38	20.26	19.87	56.57	315.43
Subhashini	87.78	33.05	21.65	60.50	207.85
Shringar	73.63	23.80	19.56	47.42	204.93
Double(HYD)	76.02	24.43	17.72	58.13	300.71
Phule Rajani	67.84	22.34	14.81	25.57	59.16
Sikkim selection	120.91	21.88	17.54	47.98	165.99
Calcutta single	110.38	20.97	13.53	23.74	120.70
S. Em. ±	5.34	1.97	0.27	2.53	3.78
CD (0.05)	19.05	5.09	0.82	6.98	20.77

Fig.1 Screening of tuberose cultivars under field condition



Due to their profuse feeding on the stalk epidermis became irregular and rugged. Spiny structures of variable number were found on the surface of the flower stalk along the length which with aging pricks on touch. In comparison between the uninfected or healthy plants and foliar nematode infested plants, the severely infested stalks became stunted and reduced in length and weight (Table 1). In most of the cases length of spikes as well as number of florets declined. Average weight of the florets sharply decreased to almost $\frac{1}{4}$ of the healthy one while the length of floret also declined substantially (Table 1). Brownish patches developed on flower stalk and on florets, petals of the flower became thicker, anther became black in colour. Degree of infestation by the nematodes in terms of development of spike and blooming of florets was manifested differentially. Sometimes spike developed but the florets did not bloom whereas, development of apparently normal spike with partial blooming of either lower most or the top most few florets was also recorded. In few cases the flower stalk emerged with a blind flower head where no spike developed. Market value of the flowers greatly reduced due to wrinkling of flowers and reduction of fragrance. Chakraborti and Ghosh (1993) observed that the nematodes invaded the flower bud ectoparasitically, pierce the stigma as well as ovary before anthesis resulted to crinkled flower. Hassan (1999) recorded spiny structures and brownish patches on the flower stalks. He also found that sometimes flower stalks became twisted and chlorosis occurred followed by drying up of leaves and retarded growth of tuberosa plants. The present investigations are confirmed with the findings of above mentioned authors.

It can be concluded from the experiment that out of 14 cultivars screened under new alluvial zone of West Bengal, the cultivar Prajwal performed best stalk length, spike

length, minimum percentage of flower infestation and nematode population per unit of flower followed by Vaibhav, Subhashini, Bidhan Rajani-III, Bidhan Rajani-I. However, this cultivar could be popularized among the farmers in West Bengal condition.

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