

Studies on the Floral Malady of *Polianthes tuberosa* L. in West Bengal

H. S. CHAKRABORTI AND S. C. GHOSH*

*Zonal Adaptive Research Station, Krishnanagar,
Nadia, West Bengal, India*

Symptomology on foliar and floral parts, isolation identification of the pathogen, extraction of the nematode, laboratory culture of the nematode, pathogenicity tests, cross-inoculation and characterisation of the floral malady of tuberose were studied. Effects of micronutrients, fungicides and insecticides were studied in an exploratory field trial on the control of floral malady of tuberose.

Key words : Floral malady, *Polianthes tuberosa*, *Aphelenchoides besseyi*

INTRODUCTION

The incidence of floral malady of tuberose was first reported in the year 1987 from Purnanagar in Ranaghat Block-II, Dist. Nadia. Since then the problem appeared in severe form in the major tuberose growing areas of Nokuri, Purnanagar, Dhanola and Matikumrah of Ranaghat Block-II. Severe yield loss due to malformed flowers from both the first planted crop and successive ratoon crops was reported from Purnanagar and Matikumrah during the year 1988-1989.

Uptil now the cause of the floral malady of tuberose is not known. As such the present investigation has been undertaken in 1992 in order to find out the causal organism and a suitable control measure of the disease.

An exploratory trial was conducted in the farmers' field at Matikumrah in Ranaghat Block II, Dist. Nadia. The pot experiments were conducted at Z.A.R.S., Krishnanagar, Nadia.

* Zoological Survey of India, New Alipore, Calcutta-53.

MATERIALS AND METHODS

The traditional single flowered plant was grown during 3rd week of March, 1992. The experimental plot was 3 M length and 2 M breadth. Each plot had three replications for each treatment. Plants were sown with a spacing of 25 cm between two plants in each row and there was 20 cm space between two adjacent rows. Fertilizers were used as 45 t/ha of FYM and 3Q/ha of oil cake as basal dose and N,P, and K were applied as 60 : 100 : 190 kg/ha respectively for all experimental plots except in Krishnanagar farm where it was 60 : 100 : 100 kg/ha of N.P.K. The pH of the soil was between 6.3 to 6.9.

Zn, Mn, and Cu (all as sulphate) and B (as Borax) were applied at the rate of 25, 25, 5 and 5 kg/ha respectively.

Fungicides namely Mancozeb (2 g/l) Bavistin (1 g/l), Furadon (2 kg/h) and Metacide (1 ml/l) were applied by spraying on the plants, or by furrow application. The furrow application of Furadon was done at 2 leaf stage. Foliar application of Mancozeb and Bavistin were sprayed at maximum elongation stage of the crop and of Metacin 50 at spike initiation stage.

Appearance of symptom initiation and further spread of symptoms were studied periodically.

Periodic isolations from leaf, bract, petal, scape, flower bud, stamen and stigma were made in PDA medium. Identification of the pathogen and pathogenicity tests were made following the usual procedures.

Extraction of the nematode from malformed plant parts was made through modified sieve technique following Pitcher and Flagg (1968). Nematodes collected through sieve was fixed in FAA. Nematodes cultures were maintained in Plant Pathology Herbarium, Z.A.R.S., Krishnanagar, Nadia.

RESULTS

Foliar symptoms

Water-soaked necrotic spots appeared near the base of the lower leaves during 2nd week of August. Spots enlarged linearly along the margin of the lamina. Spots were reddish brown and later turned blackish. The upper part of the leaf turned yellow. Scapes and bracts were found to be twisted with rusty brown streaks.

Floral symptoms

Symptoms appeared during 4th weeks of August. Spike became shorter. Flower turned rusty brown and became small and crinkled. Stamen, stigma

and ovary were malformed and turned rusty brown. Receptacle was rusty brown at base. Peduncle also found to have rusty brown streaks and streaks coalesced later.

Isolation studies

Erwinia carotovora was the predominant bacterium and found to cover the whole PDA slant within 20 hrs following isolation. *Fusarium oxysporum*, *Alternaria alternata* and *Botrytis cinerea* appeared on the 5th day following isolation. *Aphelenchoides besseyi* in association with *F. oxysporum* and *A. besseyi* in association with *A. alternata* were found in the PDA slants 2 weeks later after isolation.

Extraction studies of nematodes

Aphelenchoides besseyi appeared in course of extraction of malformed foliar and floral parts through sieve method. The nematodes appeared quiescent when allowed to settle down in water in petri plates for 45 minutes at 28°C. It became active again when warmed by a gentle heat and died immediately following heat treatment for 5 minutes at 50°C. It was identified easily as male in having hooked tail.

Nematode culture

A consistent association of *A. besseyi* with *F. oxysporum* and with *A. alternata* were observed in the culture. Plenty of adults, both males and females, juveniles and egg masses of *A. besseyi* were found. They pierced the fungal hyphae frequently with their stylets. They multiplied quickly at a temperature of 25-30°C and a relative humidity of 80-90%. The number of nematode as well as conidial number of both *F. oxysporum* and *A. alternata* declined simultaneously from 90 days onwards following the date of isolation. A few nematodes, mostly females in association with *F. oxysporum* thrived up to 160 days in the original PDA slants.

Pathogenicity test

E. carotovora was found to be saprophytic and caused soft rot of the leaf with an offensive odour. *F. oxysporum*, *A. alternata*, and *B. cinerea* appeared to be contaminants. *A. besseyi* was found to be pathogenic.

Inoculation studies of A. besseyi

Both the foliar and floral symptoms appeared on tuberose on the 4th day following inoculation of nematode from culture and sieve method respectively. Zn, Mn, Cu and B treated pots also showed similar nematode infestation on the same day following both inoculation procedures under pot experimental studies (Table 1). The nematode infestation was also observed in plants grown in soil where previous source of inoculum was not the nematode.

Table 1. Showing inoculation effects of *A. besseyi* on Tuberose plants in micronutrient treated pot experiments under two different soil sources

Date of planting	Treatments	Dose (Kg/ha.)	Soil ^a		Soil ^b	
			Field : Matikumrah Ranaghat-II		Farm : Z.A.R.S. Krishnanagar.	
			Inoculated ^c (with <i>A. besseyi</i>)	Uninoculated (Control)	Inoculated ^c (with <i>A. besseyi</i>)	Uninoculated (Control)
April 29 '92	Zn	25	++ Ve	— Ve	++ Ve	+ Ve
	Mn	25	++ Ve	— Ve	++ Ve	— Ve
	Cm	5	++ Ve	+ Ve	++ Ve	— Ve
	B	5	++ Ve	— Ve	++ Ve	+ Ve

^aSoil : N.P.K. 60 : 110 : 190 kg/ha.; ^bSoil : N.P.K. 60 : 100 : 100 kg/ha. used per treatment.

^c : Inoculations made on August 9, '92.

+ Ve : Delayed foliar symptoms only, appeared on September 22, '92.

++ Ve : Both foliar and floral symptoms appeared on August 13, '92.

— Ve : No symptom appeared.

Inoculation studies with *A. besseyi* on BR-11, a 55 days old healthy rice seedling was made. Distortion of leaf, leaf sheath and twisting of panicles were observed. The leaves formed characteristic 'white tip disease symptoms'. The panicles bore chaffy grains.

When the infested plant parts from both tuberose and rice plants were reisolated, *A. besseyi* reappeared with *F. oxysporum* and *A. alternata* separately in the respective isolations.

Duplicate samples of malformed leaf (No. 1), malformed flower (No. 2) of tuberose and chaffy seeds (No. 4) of rice plant, due to *A. besseyi* infestation

have been deposited to IIP, St-Albans, Herts, U. K. (IIP No - 3/93(1), 3/93(2) and 3/93(4) respectively).

Field studies

Foliar and floral infestation due to *A. basseyi* appeared in both treated and untreated (control) plots (Table 2). The range of nematode infestation in both the treated and untreated plots was 3-7% only. The nematode infestation could not progress further and masking of symptom appeared during the month of December, when the day and night temperature were 10°-18°C and 9°-12°C respectively and the maximum and minimum relative humidity were 80—90% and 40—50% respectively.

Table 2. Mean data on the incidence of *A. basseyi* infestation on the spikes of Tuberose under exploratory control trial

Date of planting	Fertilizer schedule	Treatments	Dose	Data recorded	Spike infestation (%) incidence)	Data recorded	Spike infestation (%) incidence)
March 22 '92	N.P.K. 60:110:190 kg/ha.	Mancozeb	2gms/l	Sept. 17 '92	6.1	Dec. 20 '92	5.2
		Bavistin	1gm/l		6.7		5.9
		Furadon-3G					
		a.i	2kg/ha		5.8		4.9
		Metaciate-50	1ml/lit		3.9		3.1
		Zn	25kg/ha		6.9		7.1
		Cu	5kg/ha		7.0		6.2
		B	5kg/ha		6.6		7.3
		Mn	25kg/ha		6.8		5.5
		Control (Plain water)			6.4		5.1

Studies under pot experiments

Delayed symptoms on leaf to *A. basseyi* were also observed in a few plants grown in soil free from *A. basseyi* under natural condition (Table 1). This indicated that the symptom masked the mother plant initially in the field and later the symptoms expressed in the newly developed runners in pots.

A. basseyi Christie has been characterised here following the original description of *A. basseyi* Christie (1942), as made by Allen (1952). The

nematode is characterised in having a well-developed stylet, about 10—12 m μ long, with a distinct basal knob, a well developed medium oesophageal bulb and a conoid tapering tail. Male becoming distinctly hooked and with a ventrally curved paired spicule. The nematode basically appears to be a fungi feeder.

DISCUSSION

The present studies revealed that *Aphelenchoides basseyi* Christie appeared to be a first time report from India for its occurrence on both the foliar and floral parts of tuberose. The nematode invaded the flower bud ectoparasitically, pierced the stamen, stigma as well as ovary before anthesis and resulted in the formation of crinkled flower. The nematode behaved as a facultative parasite too for its consistent association with the fungi in the culture.

The scanty precipitation of rains following monsoon was the obvious reason for the low incidence of nematode in the field and subsequent spread of nematode infestation to the foliar and floral parts of tuberose. Chakraborty *et al.* (1985) observed that even a few days partial submergence of the crop during mid week of March due to flood water caused severe incidence of *Ditylenchus angustus* (Butter) Filipjev in summer rice. Low temperature coupled with low relative humidity during winter checked the further progress of nematode infestation on the tuberose. The similar effects of temperature in reducing the survivability of *A. basseyi* in rice was observed by Huang and Chiang (1975).

Results from micronutrient studies under pot experiments confirmed that the floral malady of tuberose was not due to deficiency of Zn, Mn, Cu and B in the field.

Field studies indicated also that potash even at the rate of 190 kg/ha could do little influence on the control of floral malady of tuberose.

Effects of fungicide and insecticide treatments could not controlled the disease because of low level of nematode incidence in the field. Metacin 50, however, indicated a little bit promising effect in minimising the spike infestation due to *A. basseyi*. Further works on this aspect are in progress.

ACKNOWLEDGEMENT

Thanks are due to Mr. D. Mukherjee, Director of Agriculture and Ex-officio Secretary to the Department of Agriculture, Govt. of West Bengal, Writers'

Buildings, Calcutta-700 001, for giving an opportunity to undertake the present investigation.

Thanks are also due to Dr. D. J. Hunt, Senior Taxonomist, IIP, St. Albans, Herts, U. K., for confirming the pathogen involved in the floral malady of tuberose.

REFERENCES

- Allen, M.W. (1952). Taxonomic status of the bud and leaf nematodes to *Aphelenchoides fragariae* (Ritzema 'Bos. 1891). *Proc. Helminthol. Soc*, Washington **19** : 108-120.
- Buchanan, R.E and Gibbons, N.E (1974). *Bergey's Manual of Determinative Bacteriology* 8th edition, The Williams & Wilkins Co., Baltimore.
- Chakraborti, H.S., Nayak D.K., and Pal, A. (1985). Ufra incidence in Summer rice in West Bengal, *IRRN* **10** : 1-15.
- Huang, C.S. and Chiang, Y.C. (1975). The influence of temperature on the ability of *Aphelenchoides besseyi* to survive dehydration. *Nematologica*, **21** : 351-357
- Pitcher, R.S and Flegg, J.J.M. (1968). An improved final separation sieve for the extraction of plant parasitic nematodes from soil debris *Nematologica*, **14** : 123-127.

(Accepted for publication 17 August, 1993)