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Effect of seasonal variations in nematode population and gall formation on *Pueraria phaseoloides*

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INTRODUCTION

Natural rubber (*Hevea brasiliensis* Muell. Arg.) is an important plantation crop in India. A number of agricultural practices have been introduced to improve the production of natural rubber. Establishment of leguminous cover crops in the initial stages of cultivation is an important agronomic practice adopted in rubber plantations. Leguminous cover crops enrich soil with nitrogen, prevent soil erosion, reduce soil temperature, augment organic carbon in soil and support soil microbial activity. All these beneficial effects of cover crop help in increasing the growth rate and yield of *Hevea* (Prathapan *et al*., 1995). Among the various cover crops used in rubber plantations, *P. phaseoloides* is the most popular one in India and elsewhere. A number of biotic and abiotic factors are reported to influence the growth, nodulation and nitrogen fixation of *P. phaseoloides*. One of the important biotic factors that adversely affect *P. phaseoloides* is the root-knot nematode, *M. incognita* (Mammen, 1973). The population of plant parasitic nematodes fluctuated with seasonal changes. The influence of seasons on the nematode population was reported to be more evident at the upper layer of the soil than in the deeper layers (Khan and Sharma, 1990). Due to availability of fresh and actively growing roots, post monsoon period is reported to be congenial for the survival and multiplication of root-knot nematodes (Eapen, 1993). The root-knot nematode, *M. incognita* cause significant changes in growth parameters in a variety of leguminous crops. In rubber plantation, there are no reports on the incidence and intensity of root-knot nematode in the cover crop, *P. phaseoloides* and its adverse effect on the growth of the plant. A study on the incidence of *M. incognita* on *P. phaseoloides* and the influence of seasonal variations in its infestations will help in understanding the host pathogen interaction and to device suitable management practices for their control. Hence this study was carried out.

MATERIALS AND METHODS

Three different locations were selected within the experiment station of RRII and *Pueraria phaseoloides* seedlings were raised at these sites as per the recommendations. Eight replications were maintained for each location. Soil samples and root samples were collected on 16th of every month from September 2000 to August 2001 from the rhizosphere of these plants. Population of root-knot nematode per 250g soil was assessed by Cobb's sieving and petridish extraction method. Number of nematode galls per plant was recorded and root-knot indices were worked out. The monthly rainfall and mean monthly atmospheric temperature were also recorded. The data were statistically analyzed to study the correlation of nematode population in the soil with temperature, rainfall and with host infection. The seasonal variation in nematode population and in the formation of galls in *P. phaseoloides* was also studied.

RESULTS AND DISCUSSION

Seasonal fluctuations of root-knot nematode (*M. incognita*) population and intensity of infection on *P. phaseoloides* with respect to atmospheric temperature and rainfall are studied. During the study period, the maximum temperature ranged from 29.1°C to 34.5°C. Increase in the temperature was noticed from November onwards with a maximum of 34.5°C during March. From April onwards, the temperature declined to 29.1°C. The trend of population showed that at the maximum temperature of 31.9°C to 34.5°C the nematode population was high while decrease in temperature recorded from May onwards caused a perceptible decrease in population. Unlike temperature, significant differences were observed in the month wise distribution of rainfall and root infection. Maximum rainfall was observed during June but the nematode population and host infection were comparatively low. Highest nematode population (1400/250g soil) and host infection (17.17 galls/plant) were noticed during the month of March . The rainfall recorded during March was only 27.6 mm. Nematode population of soil showed an increasing trend during the summer months. Correlation coefficient analysis among variables showed that environmental temperature had significant influence on the nematode population and host infection. Similarly the intensity of infection was highly correlated with the nematode population.

Table1. Mean monthly atmospheric temperature, rainfall, nematode population and host infestation) (Sept.2000-Aug.2001) (Mean of eight replications)

Month	Temperature °C	Rainfall mm	*Nematode Population	*Galls per plant
September	30.7	246.0	533	6.25
October	30.8	155.1	488	5.67
November	32.0	90.7	366	3.56
December	31.9	30.2	710	7.54
January	32.9	23.0	976	9.34
February	33.1	47.6	1000	10.04
March	34.5	27.6	1400	17.17
April	33.6	367.0	1200	11.88
May	32.1	240.0	976	8.71
June	29.5	657.2	350	3.0
July	29.1	600.07	283	3.0
August	29.7	284.9	462	3.25

Table 2. Correlation of nematode population and infection with temperature and rainfall

Variable	Covariance	Correlation
Temperature Vs Population	531.3109	0.9097
Temperature Vs Infection	6.1203	0.9038
Rainfall Vs Population	-36811.493	-0.4964NS
Railfall Vs Infection	-445.99	-0.5188 NS
Population Vs Infection	1412.98	0.96815

Environmental temperature is significantly correlated with nematode population and host infestation. A high correlation was also observed between the intensity of infection and soil population of nematodes. Even though no significant effect of quantity of rainfall on nematode population and host infestation was observed, monthly distribution of rainfall showed reducing effect in the population and infestation in succeeding months.

REFERENCES

Eapen,S.J.(1993). Seasonal variations of root-knot nematode population in a Cardamom plantation. *Indian Journal of Nematology,* **23** (1): 63-68.

Khan, M. L. and Sharma, G. C. (1990). Effect of temperature and moisture on population fluctuation of nematodes in apple orchad. *Indian Journal of Nematology,* **20**(1): 10-13.

Mammen, K. V. (1973). *Meloidogyne incognita* infesting the cover crops of rubber in Kerala. *Current Science,* **42**(18): 659.

Prathapan,K., Sreedharan,C. and Potty, S.N. (1995). Effect of leguminous cover crops on the growth of immature rubber plants. *Proceedings of the Seventh Kerala Science Congress,* 27-29 January 1995, Palakkad, India ,pp.177-178.

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Management options for controlling the weedy rice complex (*Oryza sativa* f.sp. *spontanea*) in rice fields of Kerala

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INTRODUCTION

Weedy rice is a complex of *Oryza* morphotypes widely distributed in the commercial rice fields, especially in areas where farmers have switched to direct seeding due to labour shortage and high cost (Kumar *et al.*, 2008). Heavy infestation of weedy rice in rice fields of Kerala is forcing farmers to abandon the crop due to huge reduction in crop yield (40-60%) and net loss of over one lakh rupees per hectare. As no herbicides are available for selective control of weedy rice in cultivated rice, herbicidal control is not a viable option. Morphological similarity of weedy rice to cultivated rice, variable seed dormancy and seed shattering makes hand weeding incomplete and ineffective. Hence, evolving a suitable package for integrated management of weedy rice is inevitable.

MATERIALS AND METHODS

The experiments were undertaken during 2009-11 in the major rice growing tracts of Kerala viz., Kuttanad, Kole and Palakkad, where weedy rice was a serious problem. Infested fields were subjected to various Stale Seed Bed (SSB) treatments like burning of stubbles, stimulated germination of weed seeds for 10 days from moist soil, later destroyed either by applying broad spectrum herbicides or flooding for 10- 15 days. The time and frequency of operations in SSB preparation varied in mildly infested (2-3 mature weedy plants m^{-2}), moderately infested (5-7 mature weedy plants m^{-2}) and heavily infested fields (> 10 mature weedy plants m^{-2}). Effectiveness of herbicides like Butachlor, Pretilachlor and Oxyfluorfen in preventing early emergence of weedy rice was evaluated at different doses by pre sowing surface application three days before sowing (DBS). In severely infested fields, further addition of weed seeds to soil from the standing crop was reduced by destroying weedy panicles selectively, using specially designed equipment called Wick Wipe Applicator (WWA) with broad spectrum herbicides like Ammonium Glufosinate, Gramaxone or Glyphosate.

RESULTS AND DISCUSSION

Effectiveness of SSB in reducing weedy rice infestation in succeeding crop

The study revealed that preparation of SSB by doing the various operations twice in the field (before taking first crop) prior to sowing provided all possible conditions for germination of weed seeds having variable dormancy and reduced weeds in the succeeding crop (Table 1). In double cropped fields, where farmers did not get ample time for doing the SSB operations twice, burning of straw before SSB, broke seed dormancy and prevented staggered germination. As weedy rice seeds did not germinate under continuous submergence and emerged only from top 4 cm of soil (Chin *et al.*, 2000), land was left undisturbed till sowing.

Table 1. Efficiency of Stale Seed Bed Technique in Managing Weedy Rice

Treatment	No of tillers m^{-2} 45 DAS		No of plants m^{-2} 45 DAS		Grain yield $t\ ha^{-1}$	WCE %
	Weedy rice	Rice	Weedy rice	Rice		
One SSB	16	201	6	75	5.688	50
Two SSB	8	241	3	75	6.562	75
SSB with crop skip	4	323	1	74	7.500	90
Control	29	195	12	73	2.420	0
CD(0.05	3.2	48	2	NS	0.587	-

Effectiveness of Pre-sowing application of herbicides in reducing soil seed bank

Sadohara *et al.*, (2000) suggested that surface application of herbicides 3-4 DBS was effective for reducing soil seed bank and early weed growth. Among the different herbicides tried, surface application of Oxyfluorfen @ 0.3kg ai /ha in 2cm standing water three DBS, effectively controlled weeds during the critical period of 8-10 days (Table 2). Contact and residual action of Oxyfluorfen, and standing water inhibited seed germination and killed weed seeds in the top layer of soil (Fig.1).

Table 2. Control of weedy rice using pre-sowing application of herbicides

Treatment	Rate kg ai ha^{-1}	No of plants m^{-2} 15 DAS	No. of plants 15 DAS	Plant height cm65 DAS		Weed dry weightg m^{-2} 65 DAS	Grain yield $t\ ha^{-1}$
		Rice	Weedy rice	Rice	Weedy rice		
Butachlor	2.5	79	74	58	86	107.70	3.670
Butachlor	2.0	88	66	56	83	108.20	3.293
Pretilachlor	2.0	110	78	53	84	101.40	4.103
Pretilachlor	1.5	116	73	57	86	88.70	4.446
Oxyfluorfen	0.3	130	52	60	87	55.36	4.646
Oxyfluorfen	0.4	114	48	63	81	59.73	4.866
Unweeded control	0	86	86	46	89	108.45	3.073
Hand weeding	25,45,65 DAS	78	78	57	87	18.96	4.900
CD (0.05)		NS	NS	NS	NS	29.20	NS

Fig.1. Management of weedy rice using pre-sowing herbicides

Fig. 2. Dried panicles of weedy rice after using wick wipe applicator

Jse of wick wipe applicator for selective drying of panicles of weedy rice

Jormally mature seeds of weedy rice shattered by around 80-100 DAS, replenishing the soil seed bank. Better VCE was obtained by selective killing of weed panicles using WWA at 65 and 75 DAS using broad spectrum erbicides like Ammonium Glufosinate, Gramaxone or Glyphosate @ 100-150 ml l^{-1} (Table 3), taking advantage f 15-20 cm height difference between rice and weeds (Fig 2).

able 3. Efficiency of wick wipe applicator for destroying panicles of weedy rice

reatment	No of weedy panicles m^{-2} 70 DAS		No. of skipped panicles m^{-2}	No. of new side shoots m^{-2}
	Before application	Dried after application		
mmonium glufosinate 100ml l^{-1}	56	48	14	20
mmonium glufosinate 150ml l^{-1}	60	48	16	12
ramaxone 100ml l^{-1}	68	48	18	8
ramaxone 150ml l^{-1}	54	46	12	16
lyphosate 100ml l^{-1}	66	50	12	14
lyphosate 150ml l^{-1}	70	62	22	14
D(0.05)	NS	NS	NS	4

ffective management of weedy rice was possible only by integrating SSB, use of pre sowing herbicides and /WA along with other management options like higher seed rate, scientific water management, straw burning, ppropriate tillage practices, adoption of mechanized transplanting or dibbling and hand weeding.

EFERENCES

hin, D.V., Hein, T.V., and Thiet, L.V. (2000). Weedy rice in Vietnam. In: Baki, B.B., Chin, D. V., and Mortimer, M. (eds.), *Wild and weedy rice in rice ecosystems in Asia- A review*, IRRI, Manila, pp. 45-50.

umar, V., Bellindera, R.R., Brainardb, D.C., Malikc, R.K., and Gupta, R.K. (2008). Risks of herbicide resistant rice in India: A review. *Crop Prot.* 27: 320-329.

ıdohara, H., Watanabe O., and G. Rich. (2000). Control of red rice In: Baki, B.B., Chin, D. V., and Mortimer, M. (eds.), *Wild and weedy rice in rice ecosystems in Asia- A review*, IRRI, Manila, pp. 83-86.