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CHECKLIST OF SOIL NEMATODES,BASED ON VEGETATION, FROM THE SOUTH GOA DISTRICT,GOA

A.C. Maria Lizanne and I.K.Pai*

Carmel College of Arts, Science & Commerce for Women, Nuvem, Salcette Goa, India. 403604.

email. id: marializanne@gmail.com (corresponding author)

*Department of Zoology, Goa University, Taleigao Plateau, Goa, India. 403206.

email. id: ikpai @unigoa.ac.in

ABSTRACT

Tendency amongst the world's conservationists is to focus on large charismatic species (Vandermeer and Perfecto, 1997). But loss of inconspicuous species, belowground biota, is one of the very bases of biodiversity crisis. Nematodes constitute a major part of belowground diversity and are most abundant and important metazoans in the soil ecosystem. As part of soil organic matter, nematodes are key soil components in soil fertility, crop productivity and ecosystem functioning, thus sustaining soil ecosystem health by playing a major role in decomposition or recycling dead organic matter. For the present study 50 samples were collected from five talukas of South Goa District (Fig.1), covering 25 villages and 20 different landscapes (Table-1). Permanent slides were prepared using Cobb's decanting and sieving method and modified Baermann's Funnel method. The study resulted in recording 52 species of 7 orders and their presence or absence in various landscapes.

Key words: Goa, Western Ghats, soil nematode diversity, different landscapes.

INTRODUCTION

Plants can affect the soil organism community through several mechanisms (Wardle, 2002). Nematodes are an abundant component of the soil community, and may reflect soil processes including root production and microbial activity. They take a significant part in the decomposition of soil organic matter, mineralization of plant nutrients and nutrient cycling (Griffiths, 1994; Boag and Yeates, 1998; Yeates and Bongers, 1999). It has been demonstrated that various plant species have great influence on the abundance of nematodes (Wardle et al., 2003; De Deyn et al., 2004; Viketoft et al., 2005). Theoretically, aboveground plant diversity may promote belowground diversity by increasing the variety of food resources (litter quality and composition), the range of environmental conditions (temperature, humidity), or the structural complexity of the habitat (Anderson, 1995). If there are a great number of specific connections between particular plant and nematode species an increased diversity of plant species should be coupled to an increase in number of nematodes species. Current studies

indicate that there is a strong association between number of plant species and number of nematode species. The questions that need to be addressed are:

Are individual nematode taxa influenced by plant species or functional diversity?

Is plant species identity the most important determinant for variation in abundance of nematode populations in a specific soil?

Based on the results obtained, present paper reports the diversity of the soil inhabiting nematode fauna from South Goa district of Goa state in different landscapes.

MATERIALS AND METHODS

The nematodes collection was carried out with major emphasis on diversity of nematode fauna in different landscapes. Soil samples were collected from August 2011 to November 2011 and from July 2012 to December 2012 from the five talukas of South Goa District, namely Canacona, Marmagoa, Quepem, Salcette and Sanguem. About 50 soil samples were randomly collected from 5 different villages of each taluka covering 20 landscape elements (Table 1). From each type of landscape, soil samples of about 500 -1000g near the roots of the plants were collected by taking care to avoid the top soil of about 10 to 15cms depth. Each sample was collected in a self sealing plastic bag with a label containing necessary field information. They were either processed immediately or stored in the refrigerator at 4oC and were processed later. The processing involved soaking the samples in freshwater for a few minutesbased upon the soil type and then collecting the nematodes from these samples by Cobb's decanting and sieving method (1919), followed by the modified Baermann's Funnel method (Thorne, 1961). The nematodes, that were isolated were killed and fixed in warm 4% formalin and processed by slow glycerine method (Seinhorst, 1959). They were mounted in dehydrated glycerine after four to five weeks of dehydration and permanent slides of the specimens were prepared using paraffin wax ring method and numbered serially (de Maeseneer and d'Herde, 1963). For classification the nematodes were listed according to Goodey (1963); Jairajpuri and Khan (1982); Jairajpuri and Ahmad (1992); Andrassy (1999) and Siddiqi (2000); Choudhary et.al. (2010) and websites of NEMAPLEX.

Table: 1 Details of sampling sites and various landscapes.

SR. NO.	LOCATION TALUKAS VILLAGES	LANDSCAPES
1.	Marmagoa: i) Chicalim	Flower gardens, banana grove
	ii) Consua	Bushy plants, Radish plantation
	iii) Sao Jacinto Island	Coconut plantation
	iv) Cortalim	Cashew plantation, Banana plantation
	v) Vasco	Coconut plantation, Paddy fields
2.	Salcette: i) Raia	Flower gardens, Arecanut plantation
	ii) Nuvem	Banana plantation, Cashew plantation, *Acacia* plantation
	iii) Carmona	*Casuarina* plantation, near roots of vegetables plants-chillies, tomatoes, brinjal, etc.
	iv) Curtorim	Paddy fields, Roadside weeds
	v) Loutolim	Rubber plantation, chikoo (sapota) plantation
3.	Quepem: i) Ambaulim	Bamboo reeds, *Terminalia* species
	ii) Balli	Scrub jungle, Roadside weeds
	iii) Quepem	Teak plantation, *Acacia* plantation
	iv) Avedem	Paddy fields, Cashew plantation
	v) Xeldem	Mango plantation, Jackfruit plantation
4.	Canacona: i) Agonda	Forest area, Bamboo reeds, Cashew plantation
	ii) Loliem	Arecanut plantation, Banana plantation
	iii) Cabo da Rama	*Casuarina* plantation, Bushy plants
	iv) Butpal	Near the roots of vegetable plants-chillies, tomatoes, etc.
	v) Palolem	*Casuarina* plantation, Roadside weeds
5.	Sanguem: i) Darbandora	Coconut plantation, Flower gardens
	ii) Molem	Forest area, Roadside weeds
	iii) Sanvordem	Acacia plantation, Bushy plants
	iv) Colem	Forest area, Paddy fields
	v) Rivona	Acacia plantation, coconut plantation

Figure 1: Maps of India, Goa and South Goa District with the talukas

RESULTS AND DISCUSSION

In the present study, about 400 permanent slides were prepared. It has resulted in recording a total of 52 species of nematodes belonging to 7 orders. Of which 27 species were from Order Dorylaimida, 6 from Mononchida, 9 from Tylenchida, 3 from Alaimida, 4 from Rhabditida, 2 from Enoplida, and 1 from Araeolaimida. The landscapes as well as the villages were chosen randomly. Table 1 shows the 20 different landscapes, the 5 talukas of South Goa and the 25 villages; 5 villages in each of the taluka. Table 2 indicates that, all the 52 species were found in more than half the number of landscapes ranging from 11 to 15. Table 2 also demonstrates that, the soil samples that were collected from the flower gardens harbours the highest number of nematode species i.e, 46, while soil samples collected near the roots of roadside weeds was 43. The least number of nematode species was 17 from the soil samples collected near the roots of casuarina plantation. The soil samples collected near the roots of bushy plants had 22 nematode species while Arecanut plantation had 26 species of nematodes.

Table 2: Showing the presence and absence of nematode species in various landscapes.

(+ = present, - = absent)

Sr. No	ORDERS	SPECIES	LANDSCAPES																				
			Flower Garden	Banana Grove	Bushy Plants	Radish Fields	Acacia Plantation	Coconut Grove	Cashew Plantation	Paddy Fields	Arecanut Grove	Casuarina Plantation	Vegetable Fields	Roadside Weeds	Rubber Plantation	Chikoo Plantation	Wild Bamboo	Terminalis Species	Mango Grove	Jackfruit Grove	Teak Plantation	Forest Area	TOTAL
I	DORYLAIMIDA	*Amphidorylaimus infecundus*	+	+	–	+	–	+	+	+	–	–	+	+	+	–	+	+	–	+	–	+	13
		Afrodorylaimus bwana	+	+	–	–	–	+	+	+	–	+	+	–	+	+	–	+	+	+	+	–	13
		Prodorylaimus longicaudatus	+	+	–	+	–	–	+	+	+	–	+	+	–	+	+	–	–	+	+	+	13
		Prodorylaimus obesus	+	+	–	+	+	–	+	+	+	–	+	+	+	–	+	+	+	–	+	–	14
		Mesodorylaimus mesonyctius	+	+	+	+	–	–	+	+	+	+	–	+	+	+	–	+	+	+	+	–	15
		Thornenemabaldum	+	+	+	–	–	+	+	–	+	–	+	–	+	+	–	–	–	+	–	+	11
		Thornenemalissum	+	+	+	–	+	–	–	+	+	–	+	+	+	+	–	+	+	+	+	–	14
		Coomansinemadimorphicauda	+	–	+	+	+	–	–	+	+	–	+	+	+	–	+	+	+	+	–	–	13

		Baqriellaqaiseri	+	–	–	+	+	–	+	–	–	+	+	+	–	+	+	–	–	+	+	+	**12**
		Ecumenicusmonohystera	+	+	–	+	–	+	+	+	+	–	+	+	+	+	–	+	+	+	+	–	**15**
		Labronemaferox	+	+	–	+	+	+	–	+	+	–	+	+	–	+	+	–	+	+	–	+	**14**
		Eudorylaimushimalus	+	+	+	–	–	+	+	+	–	–	+	–	+	+	–	+	+	–	+	–	**12**
		Discolaimustexanus	+	–	+	+	–	+	+	–	+	+	–	+	–	+	+	–	–	+	–	+	**12**
		Discolaimuslaksi	+	+	–	+	–	+	+	+	–	–	+	+	+	–	+	+	+	+	+	–	**14**
		Enchodeluscon strictus	+	+	–	+	+	–	+	+	–	–	+	+	–	+	+	–	+	+	+	–	**13**
		Enchodeluslongidens	–	+	–	+	–	+	+	+	+	–	–	+	+	+	–	+	–	+	–	+	**12**
		Oriverutuslabiatus	+	+	+	+	+	+	+	–	–	+	+	+	–	–	+	+	+	–	+	–	**14**
		Oriverutusparagus	+	+	+	–	–	–	+	+	+	–	–	+	+	+	–	+	+	+	+	+	**14**
		Aporcelaimellusobscurus	+	+	+	+	–	+	+	+	–	–	+	+	–	+	+	–	+	+	–	+	**14**
		Aporcelaimellusbaqrii	+	+	–	+	–	+	–	+	+	+	–	+	+	+	–	+	–	+	+	+	**14**
		Aporcelaimusregius	+	+	–	+	+	+	+	–	+	–	+	+	–	+	+	–	+	+	+	–	**14**
		Longidorusbrevicaudatus	+	+	–	+	–	+	+	+	–	–	+	+	+	+	–	+	+	+	+	+	**15**
		Longidoruselongatus	+	+	+	+	–	+	+	+	–	+	–	+	–	+	+	–	–	+	–	+	**13**
		Xiphinemainsigne	+	+	–	–	+	+	–	+	+	–	+	+	+	–	+	+	+	+	+	–	**14**
		Xiphinemaamericanum	+	–	+	+	–	+	+	+	+	–	+	–	–	+	+	–	+	+	–	+	**13**
		Axonchiumampicolle	+	+	–	+	–	+	+	+	–	–	+	+	+	+	–	+	+	–	+	+	**14**
		Axonchiumvulvulatum	+	+	–	+	+	–	+	+	–	+	–	+	+	+	–	+	+	+	+	–	**14**
II	MONONCHIDA	*Mononchusaquaticus*	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	-	+	-	+	**12**
		Mononchustunbridgensis	+	+	-	+	-	+	+	+	-	-	-	+	+	+	-	+	+	+	-	+	**13**
		Iotonchustrichurus	+	+	+	+	–	–	+	–	+	–	+	+	+	–	+	+	+	–	+	–	**13**
		Iotonchusindicus	+	+	+	–	–	+	+	+	–	+	–	+	+	+	–	+	–	+	+	–	**13**
		Parahadronchusshakili	+	+	–	+	–	+	–	+	–	+	+	–	+	+	+	–	+	+	+	–	**13**
		Parahadronchusandamanicus	–	+	–	+	+	+	–	–	+	–	+	+	–	+	+	–	–	+	–	+	**11**

III	TYLENCHIDA	*Tylenchusfiliformis*	+	–	–	+	+	+	+	+	+	–	–	+	+	+	–	+	+	–	+	+	**14**
		Tylenchusindicus	+	+	–	+	–	+	+	+	–	–	+	+	–	+	+	–	+	+	+	+	**14**
		Ottolenchusparvus	+	+	+	–	–	+	+	+	–	+	+	+	–	+	+	–	+	+	–	+	**14**
		Psilenchusminor	+	–	–	+	+	+	–	+	+	–	+	–	+	+	–	+	–	+	+	–	**12**
		Tylenchorhynchuselegans	+	+	–	+	–	+	+	+	–	–	–	+	+	–	+	+	+	–	+	–	**12**
		Hoplolaimusindicus	+	+	–	+	+	+	+	–	–	+	+	–	–	+	+	–	+	+	+	–	**13**
		Hoplolaimusseinhorsti	–	+	+	+	–	+	–	+	–	+	+	+	–	+	+	–	–	+	–	+	**12**
		Helicotylenchusindicus	+	+	+	–	–	+	+	+	+	+	–	+	+	+	–	+	+	–	+	+	**15**
		Criconemellaxenoplax	–	+	–	+	+	+	–	–	+	–	+	–	+	+	+	–	+	+	–	+	**12**
IV	ALAIMIDA	*Alaimusprimitivus*	+	+	–	–	+	+	+	+	–	–	+	+	+	–	+	+	–	+	+	+	**14**
		Alaimushamulus	+	–	+	+	+	–	+	–	–	+	+	+	–	+	+	+	+	–	+	+	**14**
		Amphidelusnovus	+	+	+	+	–	+	–	+	+	–	+	+	+	+	–	+	+	–	+	+	**15**
V	RHABDITIDA	*Caenorhabditiselegans*	+	–	+	+	–	+	–	+	+	–	+	+	+	–	+	+	–	+	+	–	**13**
		Cephalobuspersegnis	+	–	–	+	+	+	+	–	–	–	+	+	–	+	+	–	+	+	–	+	**12**
		Acrobelestimmi	–	+	–	–	+	+	+	+	+	+	–	+	+	+	–	+	+	–	+	+	**14**
		Panagrolaimusfuchsi	+	–	+	–	+	+	+	+	–	–	+	–	+	+	+	–	–	+	–	+	**12**
VI	ENOPLIDA	*Ironuslongicaudatus*	+	–	–	–	+	+	+	+	–	–	+	+	–	+	+	–	+	+	–	+	**12**
		Ironusignavus	+	+	+	+	–	+	+	+	+	+	–	+	+	–	+	+	+	–	+	–	**15**
VII	ARAEOLAIMIDA	*Plectuscirratus*	+	–	–	+	+	+	–	+	–	–	+	+	–	+	+	–	–	+	–	+	**11**
		TOTAL	**46**	**40**	**22**	**38**	**23**	**41**	**38**	**41**	**26**	**17**	**38**	**43**	**32**	**41**	**33**	**30**	**35**	**39**	**32**	**31**	

From the results, it is clear that, flower gardens had the maximum number of nematode species. As the flower garden has variety of plants, provides different kinds of foods for nematodes. Further, as nematodes are usually classified based upon the type of mouth parts they possess and these mouths parts are structured depending upon their feeding habits and so the maximum number of species will be found where there are varieties of plant species. Further, the soil samples collected near the roots of bushy plants demonstrated the presence of only two species of nematodes in proportion with the plant species.On the other hand, in Casuarina plantation area, where almost monoculture is seen, exhibited the least number of nematode species.

Based on the present finding it looks that number of nematode species is influenced by the number of plant species existing in a given area. Further it also looks that nematode species is specific to a particular landscape.

REFERENCES

Anderson, J. M. (1995).Soil organisms as engineers: microscale modulation of macroscale processes. In: Jones, C.G., Lawton, J.H. (Eds.), linking Species and Ecosystems. Chapman, Hall, New York, pp. 94-106.

Andrassy, I. (1999).A census of genera and subgenera of free-living nematodes.Journal of nematode morphology and systematic2: 45-68.

Boag, B.and Yeates, G.W. (1998). Soil nematode biodiversity in terrestrial ecosystems. Biodiversity and Conservation7:617-630.

Choudhary, M., Ahmad, W. and Jairajpuri, M. (2010).Alaimina Free-living soil-inhabitingnematodes, Aligarh Muslim University Press, Aligarh.

Cobb, N. A. (1919).Plant parasitic nematodes of India, An identification Manual. Ed. Wasim Ahmad. Litho offset Printers, Aligarh.

De Deyn, G. B., Raaijmakers, C. E., van Ruijven, J., Berendse, F. and Van der Putten, W.H. (2004).Plant species identity and diversity effects on different trophic levels of nematodes in the soil food web. Oikos 106, 576-586.

De Maeseneer, J.and D'Herde, J. (1963).Methodesutilisees pour l'etude des anguillules libres du sol. Revue de l' AgricultureBruxelles 16: 441-447.

Griffiths, B. S. (1994). Approaches to measuring the contribution of nematodes and protozoa to nitrogen mineralization in the rhizosphere. Soil Use and Management 6, 88-90.

Goodey, T. (1963).Soil and Freshwater Nematodes. Second edition, revised and rewritten by J. B. Goodey, London: Methuen & Co. Ltd.

Jairajpuri, M. S. and Khan, W.U. (1982).Predatory Nematodes (Mononchida). Associated Publishing Company, New Delhi, India.

Jairajpuri, M.S. and Ahmad,W. (1992).Dorylaimida, Predaceous and Plant - Parasitic Nematodes, Oxford & IBH Publ. Co.

Seinhorst, J. W. (1959).A rapid method for the transfer of nematodes from fixatives to anhydrous glycerin. Nematologica 4; 67-69.

Siddiqi, M.R. (2000).Tylenchida. Parasites of plants and insects.2nd edition. CAB International Wallingford Oxon OX10 8DE. UK.

Thorne, G. (1961).Principles of Nematology.McGrawHill Book Co. New York. pp 533.

Vandermeer, J. and Perfecto, I. (1997).The agroecosystem: a need for the conservation biologist's lens. Conserv. Biol. 11, 591-592.

Viketoft, M.,Palmborg, C.,Sohlenius, B., Huss-Danell, K. and Bengtsson,J. (2005). Plant species effects on soil nematode communities in experimental grasslands. Appl. Soil Ecol. 30, 90-103.

Wardle, D.A . (2002). Communities and Ecosystems: Linking the Aboveground and Belowground Components. Princeton University Press, New Jersey.

Wardle, D.A., Yeates, G.W., Williamson, W. and Bonner,K.L.(2003). The response of a three trophic level soil food web to the identity and diversity of plant species and functional groups, Oikos 102, 45-56.

Yeates, G.W. and Bongers,T.(1999). Nematode diversity in agroecosystems. Agric. Ecosyst. Environ. 74: 113-135.

WEBSITE: *NEMAPLEX: The Nematodes Plant Expert Information System*