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Occurrence of the entomopathogenic nematode in parts of South Andamans

Entomopathogenic nematodes (EPNs) of the families Steinernematidae and Heterorhabditidae have considerable potential for biological control of insect pests[1]. The non feeding infective juvenile (IJ), carrying cells of the symbiotic bacteria, *Xenorhabdus* spp. in gut, migrate through the soil, enter a susceptible host and release the symbiont into the haemocoel. Proliferation of the bacteria lead to death of the insect within days, followed by nematode growth and reproduction.

Surveys for EPNs have been conducted in many parts of the world, including Australia[2], the USA[3,4], Europe[5–8] and India[9,10], both for the purpose of recovering potentially useful isolates and gaining an insight into the ecology of the nematodes. An understanding of the factors governing the natural occurrence and abundance of the nematodes is of importance in formulating a rational approach to their utilization as bio-control organism[11].

A total of 139 soil samples from 10 localities representing cultivated area, forest, scrub land and coastal sandy region were sampled randomly for EPNs during August 1995–August 1998 in South Andamans. One to five samples were taken from each site. Samples collected 1 km away from the sea were considered as inland samples (Table 1).

Samples were baited with rice moth, *Corcyra cephalonica* St., (Galleridae: Lepidoptera) larvae[12]. Baited soils were incubated at room temperature (27–30°C). At intervals, the jars were inspected in the dark for bioluminescence. Insects parasitized by the nematode were recovered from the soils after luminescent cadavers were detected. The cadavers were transferred on whites trap for the emergence of IJs. Emerging nematodes were used to infect fresh *Corcyra* larvae for identification and establishment of cultures.

A representative selection of soil samples from which *Heterorhabditis* was recovered were analysed for pH and determination of organic carbon[13].

The EPNs recovered during the present survey were identified as *Heterorhabditis* sp. (Siva Kumar, pers. commun.) coming close to *H. indicus*; however species level confirmation is awaited. No Steinernematid nematode was encountered.

Heterorhabditis was recovered from North Bay, Mt. Harriet, Mithakhadi, Wandoor, Sippighat, Garacharma and Burmanallah and Chidiyatapu (Table 1). A total of 139 sites were sampled, 86 sites were coastal and 53 sites were inland. Nearly 16.27% of the coastal sites harboured *Heterorhabditis* sp. and only 3.77% of inland sites had *Heterorhabditis* sp. (Table 2). The difference in the frequency of recovery between coastal and inland sites was significant (χ^2-test $P < 0.05$).

Most sites at which *Heterorhabditis* was detected, were within a few hundred metres of the sea. The coastal sites

Table 1. Number of sites sampled in South Andamans and number of sites at which *Heterorhabditis* sp. was recovered

Region	Coastal sites		Inland sites*	
	No. of sites sampled	*Heterorhabditis* positive sites	No. of sites sampled	*Heterorhabditis* positive sites
North Bay	17	5	8	0
Mt. Harriet	6	0	9	1
Bambooflat	6	0	5	0
Mithakhadi	5	2	8	0
Wandoor	12	2	4	0
Sippighat	7	0	4	0
Garacharma	13	0	8	0
Burmanallah	8	1	5	0
Chidiyatapu	12	4	2	1

*Sites are at least 1 km from the sea.

Table 2. Distribution of *Heterorhabditis* sp. in parts of South Andamans

Habitat	Samples collected	Positive samples	*Heterorhabditis* prevalence (%)
Tropical forests	33	3	9.09
Coastal area, beaches	33	6	9.09
Cultivated area	48	7	14.58
Scrub land	25	0	0
Total	139	16	11.51

were cropped with vegetation like banana, yam, paddy, cucurbits, coconut, littoral forest and *Ipomoea pes-caprae,* a coastal weed. The coastal soils are sandy or sandy loam with a good amount of organic matter. The inland soils were heavy due to high clay content. The organic matter content of soils ranged from 0.14 to 3.02%, and the pH from 4.89 to 7.42. Altogether 16 *Heterorhabditis* isolates were recovered, 14 from coastal sites and 2 from inland sites.

From the results of these surveys, it appears that *Heterorhabditis* sp. is of widespread occurrence in South Andamans. Fourteen of the isolations have been made in coastal areas in sandy soils and 2 from inland clayey soils. It is clearly evident that *Heterorhabditis* is distributed predominantly along the coastal fringe, as observations were noted in Hawaiian Island[4] and its occurrence was positively correlated with ocean beaches. In Sri Lanka[14], *Heterorhabditis* was reported to be restricted to sandy soils within 100 m of the sea.

Heterorhabditis sp. was found occurring in cultivated soils under coconut, yam, paddy, cashewnut and cucurbits. The coastal sandy soils were mostly occupied by *I. pes-caprae.* Except yam and cashewnut, all other crops are attacked by a variety of pests in these islands and the samples from forest and coastal sandy soils were found to harbour chaffer grubs. In a survey of Tasmania[2], it was found that sometimes EPN distribution was attributed to the occurrence of insect host. However, during our study no insect host was present most of the time, but EPN was recovered from those sites. The third stage IJs survive for several months without feeding[2], so it appears that for the perpetuation of EPN in the soil continuous presence of host insect is not necessary.

Mobility and survival of EPN are favoured in sites with high sand content[15]. Soils with a high clay content have many pores which physically restrict the movement of nematodes[16], and have poor aeration properties which can result in inefficient utilization of stored food reserves[15]. An average temperature of 30°C prevails throughout the year. The association of *Heterorhabditis* with coastal sandy type of soil of this island without dense shading vegetation, represents a thermally favourable habitat which may be especially important for species at the limits of their range[17].

The population of EPNs may drop at certain sites, followed by re-establishment from adjacent sites[18]. All the sandy patches being along the coastal fringe at closer proximity to each other, wherein immigration is possible, recorded sizeable nematode populations, hence more of the recoveries were along the coastal fringe. Inland sandy locations are scattered and may not be well-located for recharging of EPN following local extinctions. This could be the reason for low recovery from inland regions. Another reason could be that the inland soils are mostly clayey and there could be asynchrony between their life history and that of hosts.

During our survey in the coastal region chaffer grubs and some Lepidopterous larvae were occasionally found; all these were their host as confirmed by pathogenicity tests.

The study reveals that *Heterorhabditis* is well distributed in coastal sandy soils and is capable of tolerating a wide range of pH and salinity. So far 16 have been isolated and further studies are in progress.

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