The Community Structure and Function of Nematodes in Naturally Growing Mangrove of Segara Anakan, Indonesia

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Abstract

The research explored the nematode community in the sediment of a naturally growing mangrove area in a part of the Segara Anakan Mangrove Ecosystem to answer how diverse the nematodes inhabit the tropical mangrove and how they relate to environmental variables. Thus, we examined nematode functional traits and their community structure, and associated them with selected sediment properties. The nematodes were extracted from 14 plots across the study site by the Baermann funnel and identified based on their morphological characters. We applied a Detrended Correspondence Analysis to follow nematode functional trait patterns, and Redundancy Analysis to investigate the correlation between the nematode community and the environmental variables. The results showed the subtle changes in nematode functional traits according to their proximity to the marine ecosystem, in which slender nematodes increased in proportion in plots toward terrestrial ecosystems. Nematodes with the conical tail and those of epistrate feeders, predators, or omnivores appeared more pronounced than in the remaining plots. Accordingly, the community structure demonstrated various genus compositions and was associated with salinity and organic Carbon. There were 37 genera observed, of which *Anoplostoma* reached 21% in plots next to the marine ecosystem. *Halichoanulaimus* (21%) and *Chromadorina* (38%) characterized plots next to the terrestrial ecosystem and plots in between.

Keywords: community function, community structure, mangrove, nematodes,

Introduction

Mangroves are critical coastal ecosystems that provide numerous ecological services, including carbon sequestration, shoreline protection, and habitat for diverse organisms (Sasmito et al. 2020). Nematodes are microscopic roundworms that inhabit the soil and sediment of mangroves, playing essential roles in nutrient cycling and energy transfer (Van Den Hoogen et al. 2019). Despite their ecological significance, there is limited knowledge about the community structure and function of nematodes in naturally growing mangroves, particularly in the Segara Anakan region of Indonesia. This study aims to examined nematode functional traits and their community structure, and associated them with selected sediment properties.

Methods

Study area

The field study was conducted in the naturally growing mangrove forest of Segara Anakan, located in Indonesia. The complete description of the site is available in (Maharning, Ardli, and Prabowo 2022) . The site was selected due to its unique ecological characteristics and unexplored nematode communities.

Sampling design

A line transect was employed to collect nematode samples from different plots of the mangrove. A total of 14 sampling sites were selected based on a lagoon distance. Soil and sediment samples were collected using a corer (diameter: 5 cm) at each site (4 cores).

Laboratory analysis

Nematodes were extracted from the soil and sediment samples using a modified Baermann funnel technique (Carter and Gregorich 2008). The extracted nematodes were then fixed, counted, and identified to the genus or family level under a microscope.

Functional traits of nematodes, including feeding habits, life strategy, and trophic level, were determined using established literature (Singh and Ingole 2016). These traits provide insights into the ecological functions performed by nematodes in the Segara Anakan mangrove ecosystem.

Results

There were subtle **changes** in nematode functional traits according to their proximity to the marine ecosystem. Slender nematodes **increased** in proportion in plots toward terrestrial ecosystems. Nematodes with the **conical** tail and those of **epistrate** feeders, **predators**, or **omnivores** appeared more pronounced [NT] than in the remaining plots (**Figure 1**)

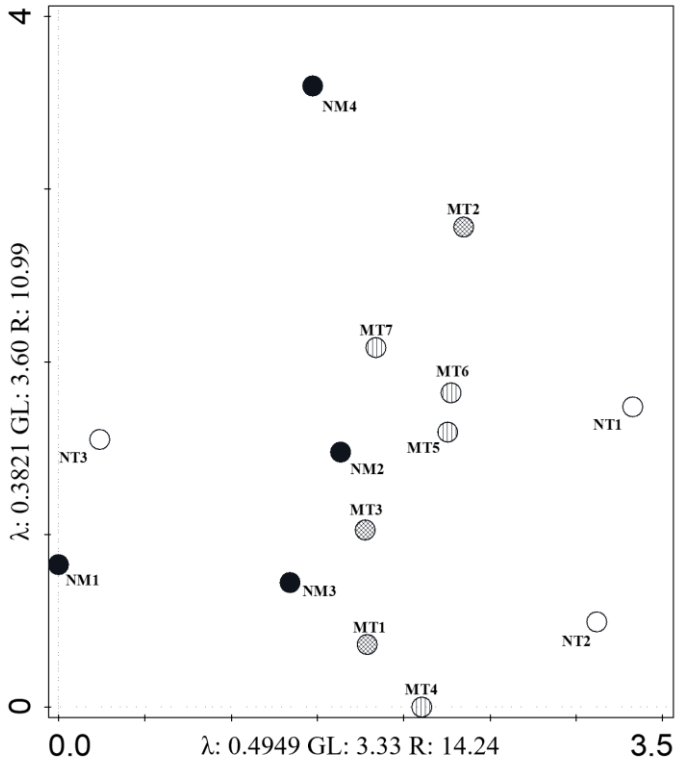

Figure 1. DCA biplot for nematode functional traits (NM: next to marine ecosystem, NT: next to terrestrial ecosystem, MT: in between)

There were 37 genera observed, where their abundance reached 14 ind.g^{-1}. It was more diverse in comparison to another study by Pinto et al. (2013). Three genera showed high abundance. They were *Anoplostoma* (21%) in plots next to the marine ecosystem [NM], *Halichoanulaimus* (21%) in plots next to the terrestrial ecosystem [NT], and *Chromadorina* (38%) in plots between NM and NT. The changes in community structure were less pronounced and possibly due to salinity and organic carbon content (**Figure 2)**.

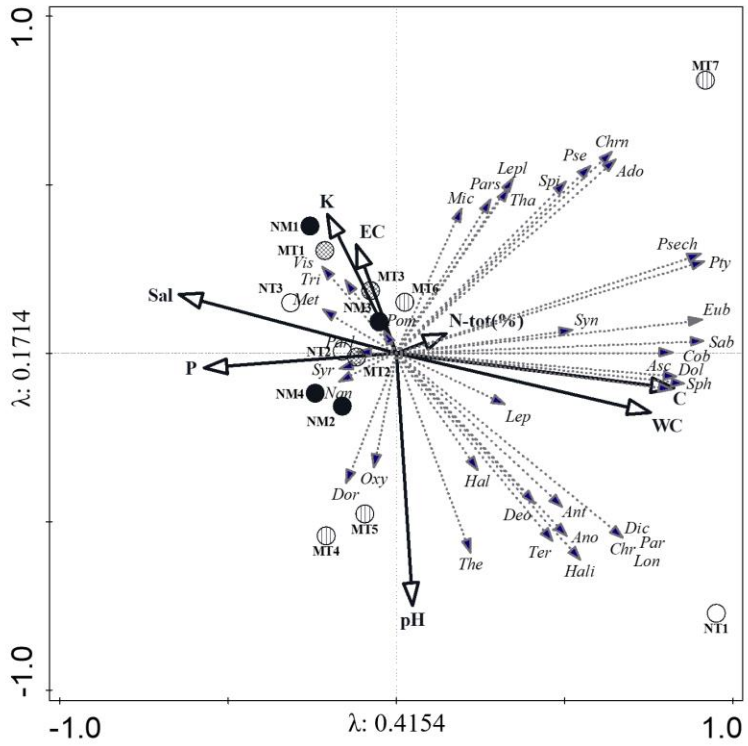

Figure 2. RDA triplot for nematode distribution (NM: next to marine ecosystem, NT: next to terrestrial ecosystem, MT: in between, EC: electrical conductivity, Sal: salinity, WC: water content)

It was concluded that changes in the nematode community are more evident for functional traits than taxonomic groups and are associated with organic carbon and salinity.

Acknowledgements

We thank Universitas Jenderal Soedirman for the research funding granted for our research project.

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