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“Reconcile land system changes  
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## Ecological characterisation of indigenous entomopathogenic nematodes against *Spodoptera frugiperda* in Nigeria

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### Abstract

The successful deployment of entomopathogenic nematodes (EPNs) in biological pest control hinges on their ecological fitness, stress tolerance, and field performance under local conditions. In this study, we assessed the ecological traits and field efficacy of six indigenous EPN isolates previously identified from distinct agroecological zones in Nigeria, targeting the invasive pest *Spodoptera frugiperda* (fall armyworm, FAW).

The isolates, identified as *Heterorhabditis bacteriophora* (Ib-CRIN68), *Steinernema carpocapsae* (Ib-IART45, Ib-ITUC102), *Steinernema nepalense* (Ib-HORT), *Steinernema feltiae* (Za-SAM), and *Oscheius myriophilus* (Ib-FRIN32), were subjected to a series of ecological bioassays to evaluate their performance under temperature variation, moisture stress, oxygen limitation, oxidative stress, and foraging conditions.

Results revealed significant inter- and intra-isolate variability in ecological tolerance traits. Optimal infectivity and reproduction were recorded between 25–30 °C, while mortality sharply declined at 10 °C and 35 °C. Foraging ability varied across substrates and soil depths, with *S. carpocapsae* isolates exhibiting strong host-finding capability under dry and surface conditions. Desiccation and oxidative stress assays also demonstrated the superior resilience of *S. carpocapsae* isolates, which sustained low mortality under Polyethylenglycol 600 induced water stress and H<sub>2</sub>O<sub>2</sub> exposure. Hypoxia assays indicated that all isolates were moderately tolerant to short-term anoxia, but only *H. bacteriophora* and the *S. carpocapsae* isolates maintained survival above 50 % at 72 h.

Our findings suggest that *H. bacteriophora* Ib-CRIN68 and *S. carpocapsae* Ib-IART45 together would make a formidable pair – the former ensuring persistence and recycling in soil, the latter providing quick action against active larvae. This study highlights the relevance of ecological screening as a prerequisite for selecting robust EPN candidate species and isolates suitable for biological control under variable field conditions. The findings support the integration of indigenous EPNs into sustainable pest management frameworks in sub-Saharan Africa.

**Keywords:** Biological control, ecological fitness, entomopathogenic nematodes, environmental stress tolerance, indigenous isolates

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