



RESEARCH ARTICLE



Effect of varying inoculum densities of *Meloidogyne javanica* on biomass and forskolin content of *Coleus forskohlii*

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Abstract

This research investigates the effects of different inoculum densities of the root-knot nematode, *Meloidogyne javanica* on the growth and biomass parameters of *Coleus forskohlii* var. Selection-K, and determines the critical thresholds at which root-knot nematode significantly deter the plant health. Inoculated coleus cuttings with varying levels of *M. javanica* (100–8000) kg⁻¹ soil significantly reduced the plant growth and biomass (16–52%), forskolin (26–47%) over control. While at the lower nematode inoculum levels (250–500 J2), fresh weight and tuber production not only sustained the stress but exhibited a slight enhancement (0.4–2.3%) when compared to the control plants. Moreover, we found with the help of principal component analysis that the damaging threshold for *M. javanica* in *C. forskohlii* is 1000 J2 kg⁻¹ soil as this level marked significant reduction in overall plant growth, biomass accumulation and forskolin content. This finding highlights the critical threshold at which root-knot nematode infestation begins to severely reduces both biomass and medicinal value of coleus, that warrant further investigation for its potential agricultural significance.

Keywords Nematode pathogenicity · Plant growth reduction · Tuber weight response · Plant health · PCA

Introduction

Plants have historically served as a source of treatment for numerous human sicknesses, and even in the present day many pharmaceutical drugs continue to be derived from various plant components highlighting the enduring significance of botanical resources in modern medicine (Gurib-Fakim 2006). One such plant is *Coleus forskohlii* (Willd.)

Briq., commonly known as medicinal coleus, a perennial herb belongs to family Lamiaceae. The coleus thrives as a perennial plant across wide regions including India, Nepal, Thailand, Sri Lanka, East Africa, and Brazil, typically at elevations ranging from 600 to 800 m (Khan et al. 2012; Kavitha et al. 2010). The *C. forskohlii* is cultivated extensively in various regions of India, notably in Gujarat, Maharashtra, Rajasthan, Karnataka, and Tamil Nadu. This crop is not only integral to the agricultural landscape but also significantly contributes to the livelihoods of local farmers by providing a valuable source of income and promoting sustainable agricultural practices (Singh et al. 2011). It has become an important agricultural commodity producing 800–1000 kg ha⁻¹ primarily for its valuable tuberous roots (Mastiholi 2008). The tubers of this particular plant serve as an abundant natural reservoir of forskolin (7 β-acetoxy 8, 13-epoxy-1α, 6β, 9α-trihydroxy labd-14-en-11-one), a diterpenoid compound with a complex chemical structure (Pullaiah 2022). Forskolin is the major active ingredient responsible for the therapeutic properties of the plants, and has extensive applications in the treatment of diverse human disorders (Kamyab et al. 2021). Furthermore, *C. forskohlii*, like many other crop plants, is vulnerable to plant parasitic nematode including *Meloidogyne* spp. (Senthamarai et al.

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