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Phytonematodes are a real concern for horticultural productivity in Ethiopia

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Introduction

Food security is the national priority in the Ethiopian agricultural development. The foreign exchange generated from this sector is estimated to be about 274 million US$ indicating its significance to the country's economy (Dube *et al*., 2018). Despite the diverse and conducive agro-ecological conditions for potential production of horticultural crops, the quantity and quality of yield remains low ascribed to several reasons of which pest damage being paramount importance. Among the pests, phytoparasitic nematodes are the major constraints that infect growing horticultural crops (O'Bannon, 1975; Meressa *et al*., 2018), although, nematodes as a pest are usually either overlooked or misdiagnosed in the country. Hence, limited information exists on the distribution and occurrence of phytonematodes associated with horticultural crops (Abebe *et al*., 2015). For the past five years, we have been conducting nematological surveys in some part of the country mainly to uncover the presence of potentially damaging plant parasitic nematode species; create better understanding on the nematode diversity; and establish baseline information for designing nematode management strategies. Accordingly, morphological and molecular based identifications of some phytoparasitic nematodes from major horticultural crops such as tomato, carrot, beetroot, potato, enset, green beans, pepper, coffee and ornamentals were carried out (Meressa *et al*., 2014; Aseffa *et al*., 2018; Meressa *et al*., 2018).

Material and Methods

Randomly selected horticultural crop fields (*tomato, potato, pepper, carrot, enset, beetroot, coffee, green beans* and *lavandula*) were assessed systematically in a diagonal pattern. Both soil and plant samples were collected mainly along the main and all accessible rural roads. Accordingly, 20 soil cores were collected from the top 20-25 cm depth of the plant rhizosphere. After thoroughly mixing by hand, a sub-sample of a half kg of soil was put into labeled plastic bags (Meressa *et al*., 2014). Thereafter, samples were transported to the laboratory, and stored at 5°C until further analysis. Nematodes were extracted from the root system (after cutting the roots into 2-3 cm long pieces) and aliquot of soil separately using modified Baermann method (Fig. 1) over an incubation period of 48 h (Hooper *et al*., 2005). After collecting the nematodes on a 38 µm sieve, they were rinsed into a 100 ml polypropylene bottle and stored at 5°C until further analysis. For each sample, nematodes were identified at a genus level under a light compound microscope (A. KRUSS OPTRONIC, Germany). Roots that showed characteristic damage symptoms caused by *Meloidogyne* spp. were snapped.

Fig 1. Sample collection (a), sample packing (b), Baerman nematode extraction (c) and nematode identification under compound light microscope (d)

Results and Discussion

The presence and detection level of the phytonematodes vary depending on the assessed horticultural crop in the surveyed locality which might be due to pesticide applications in some farms and the presence of resistance with some horticultural crop varieties (Aseffa et al., 2018; Meressa et al., 2018). Accordingly, various nematode genera including *Meloidogyne, Pratylenchus, Helicotylenchus, Cryphodera, Paratylenchus, Rotylenchulus, Hemicycliophora, Scutellonema, Belonolaimus, Discocriconemella, Criconemoides, Xiphinema, Longidorus, Ogma, Mesocriconema, Rotylenchus, Scutellonema, Paratrichodorus, Trichodorus, Tylenchorhynchus, Radopholus, Ditylenchus, Macroposthonia, Hoplolaimus, Amplimerlinius, Tylenchus, Trophurus and Tylenchulus* were detected associated with one or more of the surveyed horticultural crops (Aseffa et al., 2018; Meressa et al., 2018).

Morphological and molecular approaches were implemented for species identification for nematodes associated with horticultural crops. For instance *Paratylenchus leptos*, *Tylenchorhynchus* cfr. *zee* and *Helicotylenchus multicinctus* were identified and characterized from coffee (Aseffa, 2020). Other nematode species including *Meloidogyne hapla*, *Mesocriconema sphaerocephaloides, Paratylenchus obtusicaudatus* Raski, 1975, *Longidorus laevicapitatus* Williams, 1959 and *Nanidorus minor* (Colbran, 1956) Siddiqi, 1974 were reported from commercial cut-flowers (Meressa et al., 2015). Moreover, *Pratylenchus goodeyi* (Enset), *Meloidogyne incognita* (Pepper & green beans) and *M. javanica* (Lavandula, carrots & Hypericum) were among the identified species from their respective hosts in parenthesis.

Among the identified nematode genera, *Meloidogyne, Pratylenchus, Scutellonema* and *Helicotylenchus* were found to be the most dominant genera. Root knots are formed due to the existence of adult female in the root (Fig. 2) on the root systems result in a weak and poor yielding plants because nutrients and water uptake are reduced (Abad *et al*., 2003). However, the damage caused by the root-knot nematode infection caused to horticultural crops was the most prominent with noticeable root gall symptoms as shown on Fig. 3 (Aseffa *et al*., 2018; Meressa et al., 2018). *Meloidogyne* spp. cause high levels of economic loss in several agricultural crops worldwide with a yield losses being reported on vegetables in tropical and sub-tropical areas (Sikora and Fernandez, 2005). The reaction of a plant to parasitism by this nematode genus depends on the plant species. In addition to reduced yield, sever infection could result in poor yield quality in particularly root crops. Infected tubers such as potato produced small swellings

over their surface, which become quite prominent causing quality distortions and unmarketable yield.

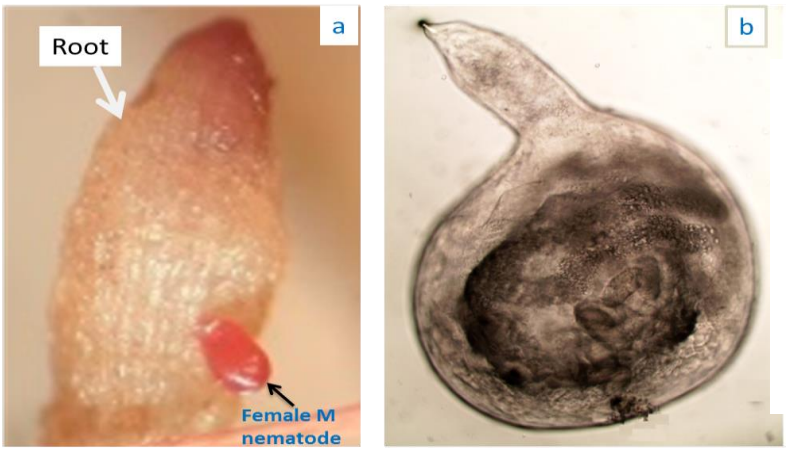

Fig 2. Female *Meloidogyne* attached to galled tomato root (*a*) and retrieved from infected galled roots (*b*)

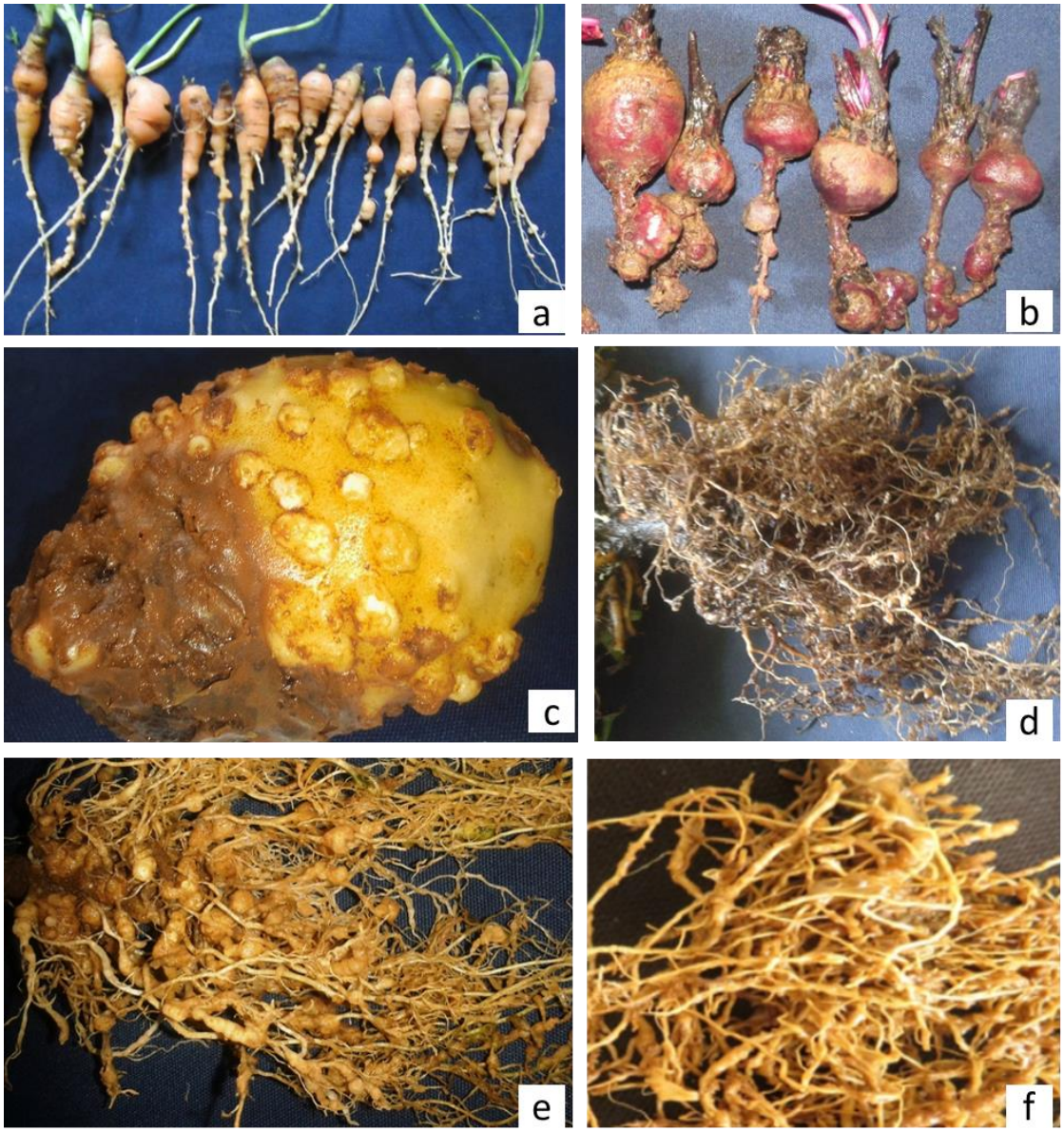

Fig 3. Damage symptoms caused by *Meloidogyne* spp: *Daucus carota* (a), *Beta vulgaris* (b), *Solanum tuberosum* (c), *Lavandula* spp (d), *Solanum lycopersicum* (e) and *Capsicum spp* (f)

Conclusions

All the horticultural crops assessed were found hosting one or more plant parasitic nematodes. The level of damage caused by *Meloidogyne* spp. appears to be significant that needs immediate attention for appropriate management strategy.

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