

CZU: 582.852:632.651

DOI: <https://doi.org/10.5281/zenodo.7442363>**NEMATODES ASSOCIATED WITH DECORATIVE PLANTS*****SPECIES SCHLUMBERGERA TRUNCATA****Olesea GLIGA, Maria MELNIC**Institute of Zoology*

Most decorative plants are susceptible to phytonematodes and this association results in symptoms that compromise the plants commercial value. Were investigated potted epiphytic plants of the species *Schlumbergera truncata* (Haw.) Moran, 1953, family Cactaceae, with obvious symptoms of disease. As a result, at the decorative room plants *Schlumbergera truncata* with external symptoms of disease, in the rhizosphere area, an outbreak of parasitic nematodes (180-210 individuals/100 cm³ of soil), saprophytic (950-1120 individuals/100 cm³ of soil), enchytraeids (45-50 individuals/100 cm³ of soil) and microorganisms associated with these, were detected. It has been determined that the cause of wilting and drying of room decorative plants species *Schlumbergera truncata* are root ectoparasitic nematodes from the families Hoplolaimidae and Telotylenchidae, followed by saprophytic species, most of them being from the family Cephalobidae. Remains of putrefied vegetal tissue of plant roots attracted species from the family Enchytraeidae genus. As a result of the associated parasitism, the underground stem and the root of plants are completely deformed, in the process of putrefaction, which led to the total wilting of the plants.

Keywords: *nematodes, parasitic, saprophytic, association, decorative plants.*

NEMATODE ASOCIATE CU PLANTELE DECORATIVE SPECIA *SCHLUMBERGERA TRUNCATA*

Majoritatea plantelor decorative sunt susceptibile la fitonematode și această asociere rezultă în simptome care compromit valoarea comercială a plantelor. Obiect de studiu au fost plantele epifite de cameră din specia *Schlumbergera truncata* (Haw.) Moran, 1953, familia Cactaceae, din ghiveciuri, cu simptome evidente de boală. Ca rezultat, în zona de rizosferă a plantelor *Schlumbergera truncata* cu simptome exterioare de boală au fost depistate focare de nematode parazite (180-210 indivizi/100 cm³ de sol), saprofite (950-1120 indivizi/100 cm³ de sol), enchitreide (45-50 indivizi/100 cm³ de sol) și microorganisme asociate cu acestea. S-a stabilit că cauza ofilirii și uscării speciilor de plante decorative de cameră *Schlumbergera truncata* sunt nematozii ectoparaziți de rădăcină din familiile Hoplolaimidae și Telotylenchidae, urmate de speciile saprofite, cele mai numeroase fiind din familia Cephalobidae. Deșeurile de țesut vegetal au atras specii din familia Enchytraeidae. Ca rezultat al parazitării asociate, tulpina subterană și rădăcina plantelor sunt complet deformate, în proces de putrefacție, ceea ce a condus la ofilirea totală a plantelor.

Cuvinte-cheie: *nematode, parazite, saprofite, asociere, plante decorative.*

Introduction

Most ornamental plants are susceptible to phytonematodes and this association results in symptoms that compromise the plants commercial value. Previous research has established that more than 600 species of ornamental plants are parasitized by 40 species of ecto- and endoparasitic nematodes [1], the more dangerous being species: *Rotylenchus robustus*, *Helicotylenchus dihystra*, *H. multincinctus*, *Helicotylenchus* sp., *Tylenchorhynchus dubius*, *T. claytoni*, *Ditylenchus destructor*, *D. dipsaci*, *Pratylenchus penetrans*, *P. scribneri*, *Heterodera cacti*, *Meloidogyne arenaria*, *M. incognita*, *Aphelenchoides ritzemabosi*, *Aphelenchus fragariae* etc. [2,3,4,5,1]. The strawberry nematode *Aphelenchus fragariae* is quite varied, parasitizing more than 260 species of plants, including cactus plants – *Phyllocactus*. According to data obtained by some authors [5] in the Republic of Moldova, for decorative crops such as: *Rosa L*, *Mentha L*, *Salvia L*, *Lavandula angustifolia*, etc. ectoparasitic root nematodes of the genera: *Helicotylenchus*, the species *H. multincinctus*, *H. dihystra* and *Tylenchorhynchus*, the species *T. claytoni*, *T. dubius* are very dangerous. For example, the nematode *Helicotylenchus multincinctus* was permanently common in the rhizosphere area of rose plants, sometimes the density being 60 individuals/ sample. Nematodes cause root invasion forming necrosis, as a result the roots deform and perish.

In this context, our researches focuses on decorative plants of the species *Schlumbergera truncata*, fam. Cactaceae, from pots, with obvious external symptoms of phytohelminthosis, about to dry out. This species belong to Genus *Schlumbergera*, wich includes six species of cactus from the family Cactaceae, native to the Brazil rainforests. The purpose is to determine the outbreak of phytonematode, which causes the loss of plants.

Material and methods

There were investigated potted epiphytic plants of the species *Schlumbergera truncata* (Christmas cactus), family Cactaceae with obvious symptoms of disease, withered about to dry out. The extraterrestrial part of the plants, the underground part (stem, root) and rhizosphere soil (horizons between 0-5cm; 5-15cm) were analyzed. Faunistic material was obtained by the method of extracting nematodes from plant tissue, using Baermann funnels modified by Nesterov (1979) [6]. The obtained suspension was fixed with hot formalin (60°C) at a concentration of 4%. Mounting of permanent preparations was performed according to the Seinhorst method, by transferring nematodes to glycerin [7]. The nematodes were examined under optical microscope, and their density was determined using the De Grisse camera.

Results and discussion

At decorative room plants of the species *Schlumbergera truncata* (Haw.) Moran, 1953 (Christmas cactus), fam. Cactaceae, external symptoms of disease – total wilting was observed, (fig.1a). In the laboratory, the extraterrestrial part of the plants, the underground part – the stem, the root, as well as the soil in rhizosphere of the plants at the horizons of 0-5 cm and 5-15 cm (tab.) were analyzed. The results of the research determined that nematodes are not common in the extraterrestrial part of the plants, the underground stem is completely macerated, and only root segments in the process of putrefaction, have been preserved (fig.1b; 1c; 1d). In the soil of the plant rhizosphere and vegetable tissue of the underground stem outbreaks of ectoparasitic nematodes, saprophytic species and enchytraeids have been detected.

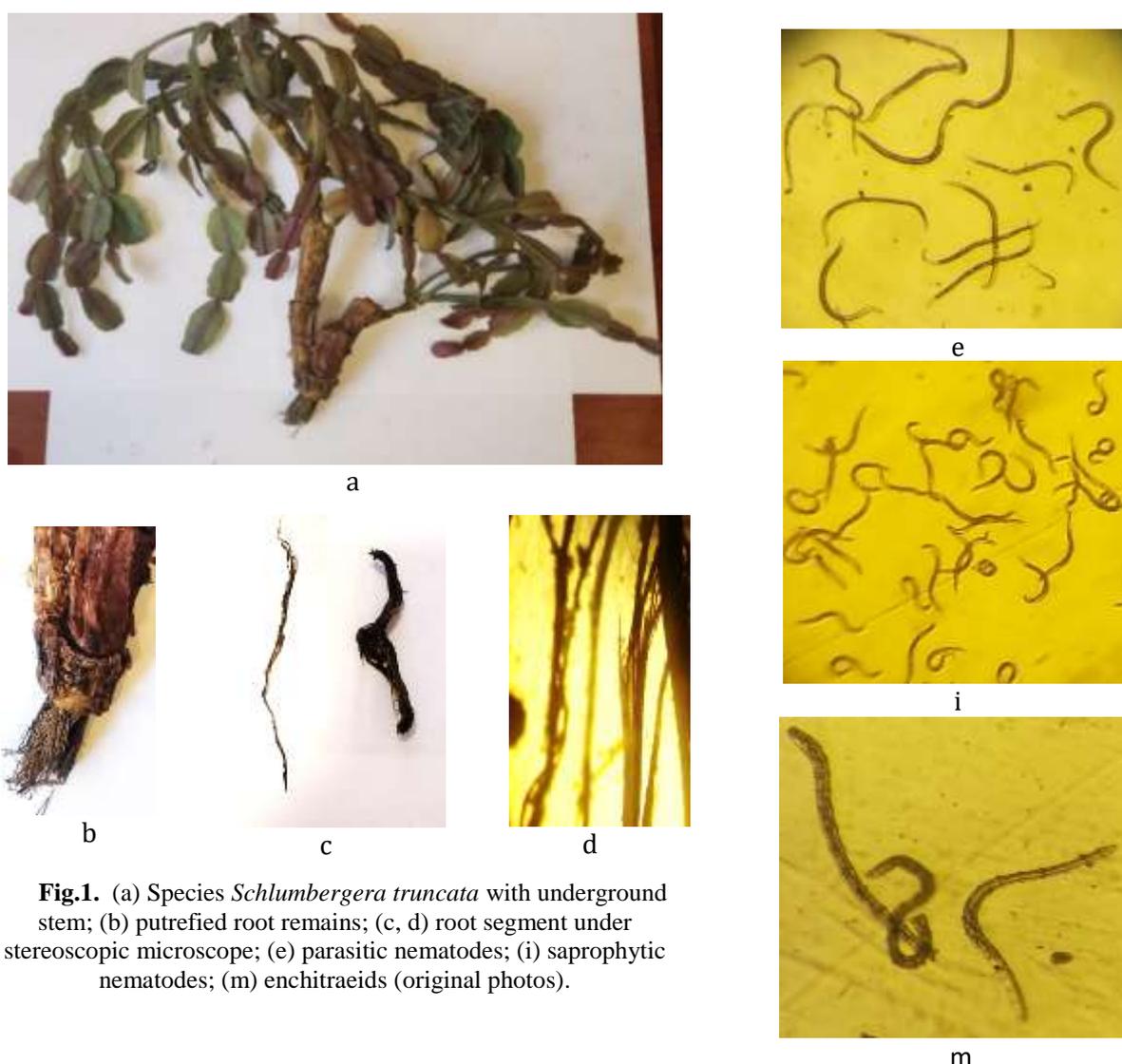


Fig.1. (a) Species *Schlumbergera truncata* with underground stem; (b) putrefied root remains; (c, d) root segment under stereoscopic microscope; (e) parasitic nematodes; (i) saprophytic nematodes; (m) enchytraeids (original photos).

Table

**Distribution of nematodes and enchytraeids in various vegetative organs of the plants
Schlumbergera truncata and in their rhizosphere soil**

Analyzed components	Parasitic nematodes	Saprophytic nematodes	Enchytraeids
Extraterrestrial stem segment	-	-	-
Plant, extraterrestrial part	-	-	-
Underground stem segment	-	++	-
Putrification root segments	-	+	+
Soil (horizon 0-5 cm)	-	++	+
Soil (horizon 5-15 cm)	++	+	++

- lack; + unique specimens; ++ outbreak

In the rhizosphere soil of *Schlumbergera truncata*, an outbreak of ectoparasitic root nematode species, about 180-210 individuals/100 cm³ of soil, at the horizon of 5-15 cm, was detected. Laboratory analyzes determined that these belong to families Hoplolaimidae (*Helicotylenchus* sp., *Rotylenchus* sp.) and Telotylenchidae (*Tylenchorhynchus* sp.) (fig.1e; 2a; b).

The cosmopolitan genus *Tylenchorhynchus* was described by Cobb (1913). Nematodes *Tylenchorhynchus* spp. are economically important plant pathogens and include 111 valid species that parasitize a wide variety of plants [8]. According to some authors [1], species of the genus *Tylenchorhynchus* are the primary parasites of ornamental plants. In several countries (Spain, Kazakhstan, etc.), the external symptoms are characterized by: poor development, no flowers, wilting and drying. And in the Republic of Moldova, species of genus *Tylenchorhynchus* pose a great danger to flowering plants [5]. In the process of nutrition, they absorb the contents of the cells of the hair follicles of the root, as well as of the epidermal ones, settling on their tip. In the research process, it was observed that some species of nematodes of the genus *Tylenchorhynchus* are permanently common in the rhizosphere of plants such as: *Rosa*, *Mentha*, *Salvia*, *Lavandula angustifolia*, etc. In the parasitic segments, necrotic outbreaks occur, which eventually causes deformation and root rot. According to some authors [6,8], some species of the genera *Tylenchorhynchus* and *Helicotylenchus* are geographical ubiquitous, frequently found in phytohelminthological research.

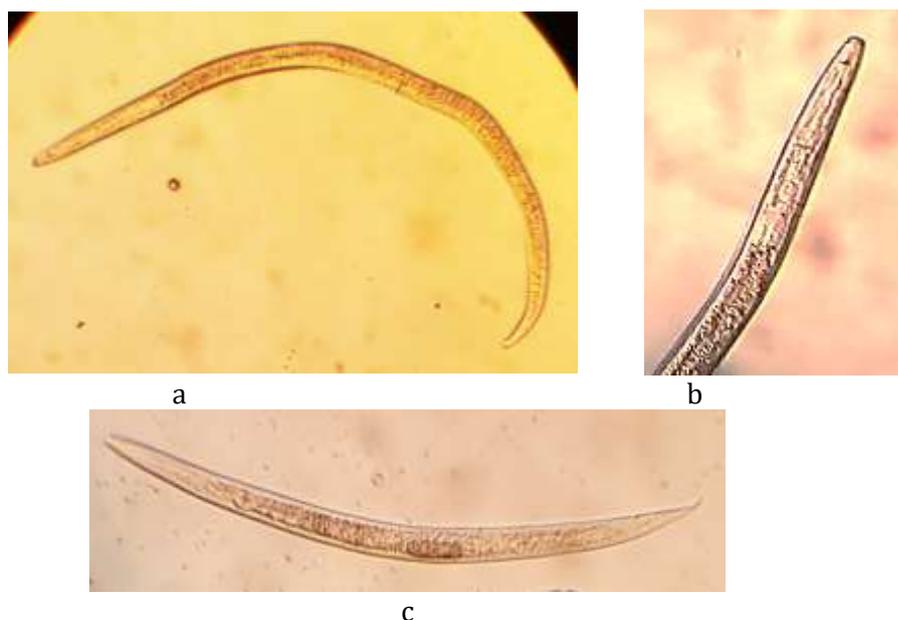


Fig.2. a; b – Parasitic nematodes (family Hoplolaimidae); c – Saprophytic nematodes (family Cephalobidae)

Microscopic analysis of plant tissue of the rotten underground stem and in the rhizosphere soil area (horizon 0-5 cm) of *Schlumbergera truncata* plants, an outbreak of saprophytic nematodes of 950-1120 indivi-

duals/100 cm³ of soil was detected, most of them being from the family Cephalobidae Filipjev, 1934, with the dominance of the species *Heterocephalobus* sp. (fig.1i; 2c). In the rhizosphere area of species *S. truncata*, an outbreak of enchytraeids of the genus *Fridericea* (fig.1m) of 45-50 individuals/100cm³, of soil horizon 5-15 cm, was detected.

Outbreaks of nematodes from the family Hoplolaimidae (*Helicotylenchus multicinctus*, *H.dihystera*, *Helicotylenchus* sp.) were found in the soil from the rhizosphere of decorative room plants species *Ficus elastica* and the genera *Rosa* and *Dianthus* [3,9]. According to some authors [9], the density of *Helicotylenchus* sp. in the rhizosphere of plants *Ficus elastica*, collected from pots, (protected areas), reaches thousands of individuals/sample. *Helicotylenchus* species infest the roots of the plants and their hairs, causing necrotic outbreaks, which spread over the entire surface of the root and hairs, which are then completely rotted, as a result, the plants wither and dry out. According to research from Brazil (Parana) concerning the susceptibility of nematodes associated with roots, soil and substrate to 38 ornamental plants (*Rosa grandiflora*, *Salvia splendens*, *Schlumbergera truncata*, *Iris germanica*, etc.), determined that out of 114 soil and stem samples examined the highest density (35.1%) of nematodes recorded the genus *Helicotylenchus*. For example, in the species *Schlumbergera truncata* in 100 cm³ soil/10 grams stem was determined a nematodes density of 302/1470 specimens of *Helicotylenchus*, respectively [10].

According to the classification, all phytoparasitic nematodes include 4 groups: 1 – migratory ectoparasites (ectoparasites – foliar; root; short-stemmed; long-stemmed); 2 – migratory endoparasites (leaf endoparasites; endoparasites of the underground organs of plants); 3 – sedentary endoparasites; 4 – semi-endoparasites [11]. In our case, the detected phytoparasitic nematodes are included in the group of migrating root ectoparasites, which feed on the contents of the plant cells of the epidermis at the top of the root and the root hairs. Some species of Hoplolaimidae and Telotylenchidae penetrate the plant tissue of parasitized organs, where they lay eggs from which the larval forms develop, then leave the plant tissue only at the stage when they are capable of parasitism, later migrating into the soil.

Accumulations of species from the family Cephalobidae in decorative crops have been observed by other authors [3,4]. Saprophytic nematodes are secondary parasites that enter plant tissue only through the pathways formed by the obligatory primary parasites, in our case the species of the families Hoplolaimidae and Telotylenchidae. About the saprophytic nematodes from the fam. Cephalobidae, they are known to be bacteriovore by nutrition [12], soil sanitation, which it purifies from the putrefied remains of the plants. Saprophytic nematodes not only feed on bacteria, but stimulate their division with the products eliminated by them. However, they can also have a negative effect on plants, due to the increased content of bacteria and fungal spores on the cuticle and in the digestive tract. Moving from the putrefied remains of the plants towards the healthy segments, they cause the elimination of the infections with microorganisms, which was also observed in the case of our researches. The underground part (stem) of species *S. truncata* infested plants proved to be completely rotten (fig.1a; 1b; 1c), and from the root (soil horizon 5-15 cm) only remnants remained (fig.1b; 1c).

Enchytraeids forms one of the most important groups of soil animals, actively participating in the formation of humus by decomposing and mixing plant detritus with mineral soil particles. About 100 species have been found in Europe, the most widespread are: *Fridericea bisetosa* – 11500 ind./m², *Fridericea bulboides* and *Fridericea bulbosa* – 4500 ind./m² [13]. Due to the numerical strength and biomass, all enchytraeids are of major importance in the processes of transformation of plant residues into humus compounds. According to previous data [14], enchytraeids of the genus *Fridericea* are saprophages and usually inhabits the layer of dead leaves under trees, being their main food, or the superficial substrate of the soil – the horizons – 0-2 cm; 2-4 cm and 4-6 cm. At depths greater than 10-15 cm and 15-30 cm, the enchytraeids are common only in single specimens. Also, enchytraeids are organisms nematode consuming, including phytoparasites. According to some authors [15], the enchytraeids of the genus *Fridericea* cause the decrease of the density of phytoparasitic nematodes in sugar beet, these being attacked not by the mature forms of the enchytraeids, but by the larval ones.

Conclusions

1. It has been determined that the cause of wilting and drying of room decorative plants species *Schlumbergera truncata* are root ectoparasitic nematodes from the families Hoplolaimidae (*Helicotylenchus* sp., *Rotylenchus* sp.) and Telotylenchidae, (*Tylenchorhynchus* sp.), their density being 180-210 individuals/100 cm³ of soil.

2. Phytoparasitic nematodes were followed by saprophytic species, most of them being from the family Cephalobidae Filipjev, 1934, *Heterocephalobus* sp., with a density of 950-1120 individuals/100 cm³ of soil.

3. Remains of putrified vegetal tissue of plant roots attracted species from the family Enchytraeidae, genus *Fridericia*, having a density of 45-50 individuals/100 cm³ of soil.

4. The results of the research showed that the association of phytoparasitic nematodes, saprophytes and microorganisms caused the total putrefaction of the underground stem and root of the species *Schlumbergera truncata*.

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Acknowledgment: The research was carried out within the project: *Diversity of hematophagous arthropods, zoo and phytohelminths, vulnerability, climate tolerance strategies and development of innovative procedures for integrated control of species of socio-economic interest*, 20.80009.7007.12.

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Prezentat la 01.08.2022