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## **RECORD OF A NEW LOCATION FOR TROPICAL ROOT KNOT NEMATODE *Meloidogyne luci* IN SLOVENIA**

**Barbara GERIČ STARE, Polona STRAJNAR, Saša ŠIRCA, Nik SUSIČ, Gregor UREK**

Agricultural Institute of Slovenia, Plant Protection Department, Hacquetova ulica 17, 1001 Ljubljana, Slovenia.

Running head: New location for *Meloidogyne luci* in Slovenia

Corresponding author: Barbara Gerič Stare

Fax number: +386 1 280 5262

E-mail addresses of all authors: [barbara.geric@kis.si](mailto:barbara.geric@kis.si), [polona.strajnar@kis.si](mailto:polona.strajnar@kis.si), [sasa.sirca@kis.si](mailto:sasa.sirca@kis.si), [nik.susic@kis.si](mailto:nik.susic@kis.si), [gregor.urek@kis.si](mailto:gregor.urek@kis.si)

### **Abstract**

The plant parasitic nematode *Meloidogyne ethiopica* Whitehead has been reported from several European countries, including Slovenia, where it was first found in 2003. However, the description in 2014 of a new sister species, *Meloidogyne luci* Carneiro *et al.*, 2014, called for the reclassification of all European and Turkish populations of *M. ethiopica* reported up to this date as *M. luci*. Both species *M. ethiopica* and *M. luci* have a very wide host range of monocotyledons and dicotyledons. They are pests of important agricultural crops such as maize, potatoes and variety of vegetables, and represent a serious threat for agricultural production in greenhouses as well as in the open fields in many EPPO countries. This paper reports a new location of the tropical root knot nematode species *M. luci* found in Slovenia in 2015.

## **Signalement du nématode a galles tropical *Meloidogyne luci* dans un nouveau site en Slovénie**

La présence de nématode parasite des végétaux *Meloidogyne ethiopica* Whitehead a été constatée dans plusieurs pays européens, y compris en Slovénie où il a été découvert pour la première fois en 2003. Cependant, la description en 2014 d'une nouvelle espèce proche, *Meloidogyne luci* Carneiro *et al.*, 2014, a nécessité la reclassification de toutes les populations européennes et turques de *M. ethiopica* signalées jusqu'alors comme étant *M. luci*. Les espèces *M. ethiopica* et *M. luci* ont toutes deux une très large gamme d'hôtes d'espèces monocotylédones et dicotylédones. Il s'agit d'organismes nuisibles d'importantes cultures telles que le maïs, les pommes de terre et différents légumes. Ils représentent une menace sérieuse pour la production agricole sous serre ainsi qu'en plein champ dans de nombreux pays membres de l'OEPP. Cet article signale la présence du nématode à galles *M. luci* dans un nouveau site en Slovénie en 2015.

### **галловой нематоды *Meloidogyne luci* в Словении**

Присутствие паразитирующей на растениях нематоды *Meloidogyne ethiopica* (Whitehead) было зарегистрировано в нескольких европейских странах, включая Словению, где она впервые была обнаружена в 2003 году. Однако описание в 2014 году новой сестринской группы *Meloidogyne luci* (Carneiro *et al.*, 2014), привело к реклассификации всех европейских и турецких популяций *M. ethiopica* отмечавшихся до этого как *M. luci*. Оба вида, *M. ethiopica* и *M. luci*, имеют очень широкий круг однодольных и двудольных хозяев. Они вредят важным сельскохозяйственным культурам, таким как кукуруза, картофель и различные овощи, и представляют серьезную угрозу для сельскохозяйственного производства, как в теплицах, так и в открытом грунте во многих странах ЕОКЗР. В этой статье сообщается о новом местонахождении тропической галловой нематоды *M. luci*, обнаруженной в Словении в 2015 году.

### **Introduction**

*Meloidogyne ethiopica* Whitehead, a tropical group root knot nematode species was recorded in Slovenia for the first time in 2003, on tomato roots from a greenhouse situated in the village of Dornberk (Širca *et al.*, 2004). This was also the first report of this species in

Europe. All infested plants were destroyed and the nematode pest was eradicated and considered as not established in Slovenia. *M. ethiopica* was later reported from other EPPO countries: Greece (Conceição *et al.*, 2012), Italy (Maleita *et al.*, 2012) and Turkey (Aydinli *et al.*, 2013). In 2014, *M. luci* n. sp. Carniero *et al.*, 2014 a new root knot nematode species parasitizing different crops in Brazil, Chile and Iran was described. The species was found to be closely related to *M. ethiopica*. Description of a new sister species, which has slight morphological differences and different esterase isozyme phenotype, called for re-examination of the populations previously identified as *M. ethiopica*. All populations of *M. ethiopica* from Europe and Turkey reported in the past were recognised as being *M. luci* (EPPO RS 2016; Janssen *et al.*, 2016; Gerič Stare *et al.*, 2017).

### **New record of *M. luci* in Slovenia**

During a root knot nematode field survey in Slovenia in 2015 the root knot nematode *M. luci* was found in a greenhouse in the village Šmartno near Ljubljana. Infested tomato plants showed symptoms of decline, leaf chlorosis and large galls were present on the roots. Nematode infestation was relatively high as more than 80 % of plants were severely infested. Tomato roots were examined and thirty root knot nematode females were isolated for species identification using isozyme esterase and malate dehydrogenase phenotypes analyses. The nematodes were identified as *M. luci* based on L3 esterase phenotype and N1 malate dehydrogenase phenotypes. In addition, a single egg mass was used for DNA isolation and a region of mtDNA, stretching from the gene for cytochrome oxidase subunit II through to a portion of the 16S rRNA gene was amplified, cloned and sequenced. Phylogenetic analysis of mtDNA sequences (acc. nos. LT837518 and LT837519) confirmed species identification of *M. luci*.

The new location of *M. luci* the Šmartno village is situated approximately 100 km apart from the 2003 *M. luci* infestation (identified as *M. ethiopica* at that time). Strict phytosanitary measures were imposed in the infested greenhouse in 2015 including the use of Dazomet a soil sterilant. All infested plant material from the affected greenhouse was destroyed. However, the eradication program implemented in the past two years has not been successful to date. Therefore only resistant tomato cultivars carrying *Mi* gene and poor- to non-host crops were allowed to be grown in the infested greenhouse. The success of this crop rotation in eliminating the nematode will be assessed in the future.

### **Potential threat for the EPPO region**

As the climate conditions are favourable for survival of *M. luci* in many regions of EPPO countries (Širca *et al.*, 2017), the authors suspect that this nematode species could already be or become more widespread in Slovenia and possibly in other Mediterranean countries. *Meloidogyne luci* has a very wide host range of monocotyledons and dicotyledons including important agricultural crops such as maize, potatoes and variety of vegetables (Strajnar *et al.*, 2009; Maleita *et al.*, 2017). The fact that there is no known differential host plant to distinguish between *M. ethiopica* and *M. luci* found so far, suggests that the two species are very closely related (Gerič Stare *et al.*, 2017). Phylogenetic analyses further confirmed a very close relationship between *M. ethiopica* and *M. luci* species (Janssen *et al.*, 2016; Gerič Stare *et al.*, 2017). Therefore a serious threat to agriculture is represented by *M. ethiopica* (Carneiro *et al.*, 2003, 2007, Aballay *et al.*, 2009, Medina *et al.*, 2014) as well as *M. luci* (Maleita *et al.*, 2017). *Meloidogyne luci* has already been detected in the open field agricultural production in Europe as it has been found in kiwi and maize production in Greece (Conceição *et al.*, 2012) and potato production in Portugal (Maleita *et al.*, 2017). In addition it has been shown that *M. luci* survives open field winter conditions in continental and sub-Mediterranean climate (Strajnar *et al.*, 2011). The authors anticipate that climate change and increased temperatures may result in significantly greater spread and damage in several agricultural crops in the open field by *M. luci* in the future.

The *Mi-1* resistance gene has been introgressed into many commercial tomato cultivars to control the root knot nematode species *M. incognita*, *M. javanica* and *M. arenaria*. It has also been shown that *Mi-1* prevents the reproduction of *M. luci* (Strajnar & Širca, 2011). In Turkey *Mi-1* tomato cultivars are widely used to control root knot nematode species including *M. luci*. However, the finding of virulent populations of *M. luci* in Turkey that can reproduce on tomato plants bearing *Mi-1* resistance gene adds to the concern about the damage potential of this pest (Aydinli & Mennan, 2016) which could become an emerging problem for the Mediterranean and other temperate regions in Europe.

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