© 2016 *RELS*
http://rels.comxa.com
rel_sci@yahoo.com

ISSN: 0974-4908
Res. Environ. Life Sci.
9(5) 585-587 (2016)

First report of false root-knot nematode (*Nacobbus* sp.) in Buckwheat from Sikkim, India

Sobita Simon*, Abhilasha A. Lal, Kamaluddeen and Ratna K. Subba
Department of Plant Pathology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad- 211007, India
***e-mail:** sobitasimon@gmail.com

(Received: August 03, 2015; Revised received: March 15, 2016; Accepted: March 17, 2016)

Abstract: Buckwheat *(Fagopyrum esculentum)* is a moisture loving, cool climate, annual grain with much potential for use in sustainable tropical cropping systems. It is a reliable cover crop in summer to fit a small slot of warm season for establishment. It establishes quickly and suppresses summer weeds. Buckwheat plants grow quickly and produce seeds in about 6 weeks and ripening at 10 to 11 weeks. They grow 30 to 50 inches (75 to 125 cm) tall. It is an erect, glabrous annual herb, leaves are ovate-shaped, flowering in July-September, in Sikkim. These plants were found to be affected by false root knot nematode which induced the galls on root of buckwheat. The symptomatic and microscopic examination revealed that the nematode was *Nacobbus* sp. Perusal of available literature revealed that this is the first report of false root knot nematode of buckwheat from India.

Key words: Buck wheat, False root knot, *Nacobbus* sp., Sikkim

Introduction

The Himalayan region of South Asia includes the mountain ranges of Pakistan, India, Nepal and Bhutan. Geographically these ranges are contiguous with the Tibet region of Southern China culminating in Eastern Myanmar. This area is very diverse in its topography, climate and agro-ecology. These are the rich buckwheat (*Fagopyrum esculentum*) genetic resource region (Govil, 1984; Ohnishi, 1989). Buckwheat is a broadleaf, annual crop that reaches 2-5 ft. (60-150 cm) in height (Fig. 1). It has a single, succulent stem with several branches. Its flowers vary from white or light green to pink or red. It forms a dense, fibrous root system with a deep taproot. Most of its roots are concentrated in the top 10 inches of the soil. It is grows on a wide variety of soil, including infertile and acidic soils pH 4-6. Buckwheat has been grown as a grain crop in China for over 1000 years. In World production Russia, China and Ukraine are the top most producers of buck wheat, respectively (FAO, 2011). It is also grown as short-season cover crop. It is one of the quickest growing green manure crop taking only 4-5 weeks from seeding to flowering. It can be used to suppress weeds, protects the soil from erosion, attracts beneficial insect, and build soil organic matter. Buckwheat also increases phosphorus and micronutrient availability in the root zone (Valenzuela and Smith, 2002). Buckwheat contains a glucoside called rutin, a phytochemical that strengthens capillary wall and d-chiroinositol, a component of the secondary messenger pathway for insulin signal transduction. It also contains galloylated propelargonidins and procyanidins (Yasui and Ohnishi, 1998). The present distribution of buckwheat extends from subtropical to temperate and cold arid habitats between 400- 4200 m. The crop is well adapted to marginal lands and harsh environments and is cultivated under low input conditions. It provides security under subsistence farming practices to the traditional farmers of the Himalayan region, where diverse ethnic communities grow this crop for grain and as a leafy vegetable, besides using this as animal feed, and for medicinal purposes (Arora *et al*., 1995). The objective of this study was to identify the diseases caused by nematodes to the buckwheat plant because it has high medicinal value which contains a glucoside (used for insulin signal transduction).

Material and Methods

During a visit to Sikkim some buckwheat plants were found to have a poor root system with galling (Fig. 2). The symptoms were similar to the one caused by the genus *Meloidogyne,* the galls induced were generally irregular or warty in shape as opposed to the smoother and more rounded ones caused by the species of *Meloidogyne* (Harvenson, 2008). Fields were uniformly infested, but severe damage normally occurred only in localized areas. Infection generally occurred on young plants, resulting in early season loss of stand. In these situations, foliar and root growth were stunted and severely reduced throughout the season. In mid- to late-season, severely infected plants wilted and exhibited pronounced yellowing during hot periods of the day. The most visible symptom on roots was the presence of galls or swellings with a proliferation of

side branches (Fig. 2). The similar symptoms were observed by Harveson (2014) in the crop of sugarbeet.

For nematode identification, the galls were teased out and observed under stereoscope and found to be morphologically different from *Meloidogyne* sp. (Fig. 3). For further details the root galls were determined by staining with hot acid fuchsin in lactophenol and examining them with the aid of stereomicroscope. This staining method of nematode was followed by Inserra *et al.* (1983). The stained galls teased out and females were picked out on cavity slide and observed under the compound microscope.

Results and Discussion

The female was seen as tapered at both ends, resembling a sweet potato. This was in contrast to *Meloidogyne* species. The immature females were vermiform and migratory and were found in roots and in soil. Several females were found in a single gall. This characteristics features of the *Nacobbus* sp. was supported by Inserra *et al*. (1983). *Nacobbus* spp. commonly referred to as false root-knot nematodes, are thought to be more closely related to the root-knot nematodes than the cyst nematodes (Holterman *et al.,* 2006, 2009; Van Megen *et al.,* 2009).

The false root knot nematode was first collected from sugar beet in 1949, near Mitchell, Neb., but had been recognized and mistaken for root knot (*Meloidogyne* sp.) for many years prior to that. Cobb was apparently the first to record specimens of *Nacobbus* from Colorado in 1918, which he considered to be *Heterodera schachtii.* The genus *Nacobbus* was first proposed in 1944 by Thorne and Allen (Harvenson, 2008).

Fig. 1: View of buckwheat field in Sikkim

Fig. 2: Infected roots of buckwheat

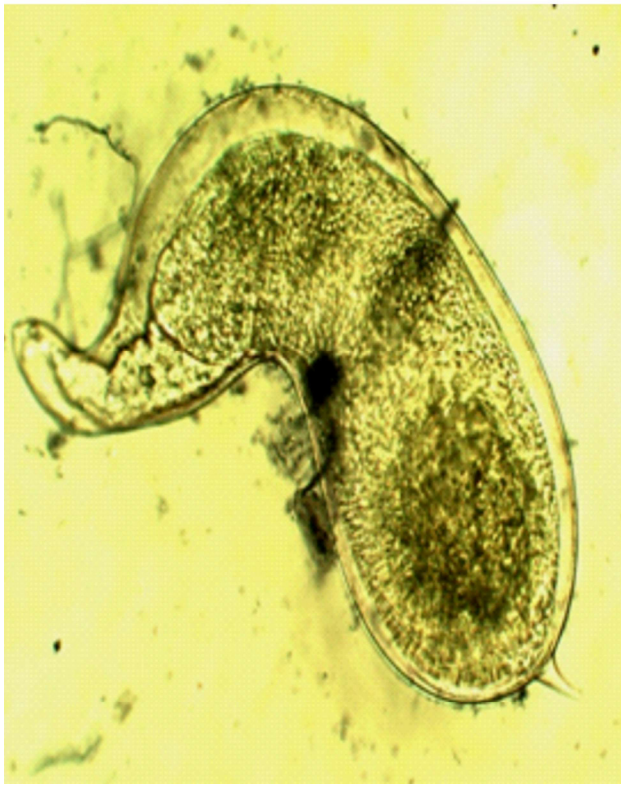

Fig. 3: Microscopic view of female of *Nacobbus* sp. (40 x)

Nacobbus sp. is thought to originate in South America, from where it has subsequently spread to the rest of the Americas, Europe and Asia (Manzanilla-Lo´ pez, 2010; Jones *et al.,* 2013). It has a broad host range encompassing 84 known plant species across 18 families including crops such as potato, tomato, beans and sugar beet and many common weeds (Brodie *et al.,* 1993; Manzanilla-Lo´ pez *et al.,* 2002; Manzanilla-Lopez, 2010). *Nacobbus* spp. is restricted by many countries because of the severe yield losses it causes in many crops, and especially potato. The state of California includes *Nacobbus* spp. on the list of organisms that require state-enforced action involving eradication, quarantine regulation, containment, rejection or other holding action (A list). Countries that restrict *Nacobbus* spp. include Argentina, Brazil, Bulgaria, Colombia, the European Union, Iceland, Indonesia, Japan, Morocco, Norway, Paraguay, Republic of Korea, Thailand, Tunisia, the United States (California), Uruguay and the Former Republic of Yugoslavia. Potato crop losses of 65% that are reported in the Andean regions of South America could occur in the cool potato growing areas of the Pacific Northwest and other northern states. The indirect economic and regulatory impact to the U. S. potato industry and other U. S. Agricultural interests such as the ornamental industry should not be underestimated (Inserra *et al*., 1978). Perusal of available literature revealed that this is the first report of the incidence of *Nacobbus* sp. on buckwheat from India.

References

Arora, R.K., B.K. Baniya and B.D. Joshi: Buckwheat genetic resources in the Himalayas: their diversity, conservation and use. *Current Advances in Buckwheat Research,* p. 39-45 (1995).

Brodie, B.B., K. Evans, J. Franco: Nematode parasites of potatoes. In: Nickle WR, editor. Plant and insect nematodes. New York and Basel: Marcell Dekker, Inc, p. 169-181(1993).

FAO: En. wikipedia. Org / wiki / Buckwheat (2011).

Govil, R.N.: Buckwheat in India: Past, present and future. *Fagopyrum*, **4**: 3-6 (1984).

Harvenson, R.M.: False root-knot nematode, University of Nebraska-Lincoln extension Publication (2008).

Harveson, R.M.: The false root knot nematode: A unique plant pathogen native to the Western Hemisphere. *APS Features,* p. 1-7 (2014).

Holterman, M., G. Karssen, S. Van den Elsen, H. Van Megen, J. Bakker and J. Helder: Small subunit rDNA-based phylogeny of the tylenchida sheds light on relationships among some high-impact plant parasitic nematodes and the evolution of plant feeding. *Nematology*, **99**: 227-235 (2009).

Holterman, M., A. Van der Wurff, S. Van den Elsen, H. Van Megen, T. Bongers, O. Holovachov, J. Bakker, and J. Helder: Phylum-wide analysis of SSU rDNA reveals deep phylogenetic relationships among nematodes and accelerated evolution toward crown clades. *Mol Biol Evol.*, **23**: 1792–1800 (2006).

Inserra, R.N., J.J. Chitambar, D.J. Chitwood and Z. Handoo: The potato pathotype of the false-root knot nematode, *Nacobbus aberrans*, working group of the son exotic nematode plant pest list (1978).

Inserra, R.N., N. Vovi As, G.D. Griffin and J.L. Anderson: Development of the false root-knot nematode, *Nacobbus aberrans*, on sugarbeet. *Journal of Nematology,* **15**: 288-296 (1983).

Jones, J.T., A. Haegeman, E.G. Danchin, H.S. Gaur, J. Helder, M.G. Jones, T. Kikuchi, R. Manzanilla-López, J.E. Palomares-Rius, W.M. Wesemael and R.N. Perry: Top 10 plant-parasitic nematodes in molecular plant pathology. *Mol. Plant Pathol.,* **14**: 946–961 (2013).

Manzanilla-Lo´ pez, R.H.: Speciation within *Nacobbus*: consilience or controversy? *Nematology,* **12**: 321-334 (2010).

Manzanilla-López, R. H., M. A. Costilla, M. Doucet, J. Franco, R. N. Inserra, P. S. Lehman, I. Cid del Prado-Vera, R. M. Souza and K. Evans: The genus *Nacobbus* Thorne & Allen, 1944 (Nematoda: Pratylenchidae): systematics, distribution, biology and management. *Nematropica,* **32**: 149-227 (2002).

Ohnishi, O.: Cultivated buckwheat and their wild relatives in the Himalayas and Southern China. pp. 562-571 in Proc. 4th International Symposium on Buckwheat, Orel, USSR (1989).

Valenzuela, H. and J. Smith: Green manure crops: Buckwheat (2002).

Van Megen, H., S. Van den Elsen, M. Holterman, G. Karssen, P. Mooyman, T. Bongers, O. Holovachov, J. Bakker and J. Helder: A phylogenetic tree of nematodes based on about 1200 full-length small subunit ribosomal DNA sequences. *Nematology*, **11**: 927–950 (2009).

Yasui and O. Ohnishi: Interspecific relationships in *Fagopyrum* (Polygonaceae) revealed by the nucleotide sequences of the *rbcl* and *accd* genes and their intergenic region. *American Journal of Botany*, **85**: 1134–1142 (1998).