Mini data sheet on *Heterodera zeae*

Added in 2012 – Deleted in 2015

Reasons for deletion:
Heterodera zeae has been included in EPPO Alert List for more than 3 years and during this period no particular international action was requested by the EPPO member countries. In 2015, the Working Party on Phytosanitary Regulations agreed that it could be deleted, considering that sufficient alert has been given.

Heterodera zeae (Nematoda: Heteroderidae) –Corn cyst nematode

Why	*Heterodera zeae* is a cyst nematode which has been reported from different parts of the world on maize and other Poaceae. *H. zeae* was first described in India where it is considered to be the most important nematode problem in maize. It is also considered as widespread in Pakistan. Considering the importance of maize cultivation in the EPPO region, the EPPO Panel on Diagnostics in Nematology suggested adding *H. zeae* to the EPPO Alert List.
Where	*H. zeae* was first described in 1970 in India where it is now considered as widespread. It was then reported in Pakistan (1980), Egypt (1981), USA (1981), Thailand (1995), Nepal (2001), Portugal (2002), and Greece (2009). **Africa:** Egypt. **Asia**: Afghanistan, India (Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkand, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttaranchal, West Bengal), Nepal, Pakistan, Thailand. **North America:** USA (Maryland, Virginia). *H. zeae* is considered as an exotic and introduced species (federal regulations were put in place but lifted in 1996, as it was considered that the infestation was contained). **EPPO region:** Egypt, Greece, Portugal (Central region). In Portugal, *H. zeae* was detected in 2002 in soil samples collected near a fig tree (*Ficus carica*) and from two maize fields in 3 localities: Pego, São Facundo (both in municipality of Abrantes) and Granja (municipality of Coimbra). However, since this first record no further information could be found about the current distribution and impact of *H. zeae* in Portugal. In Greece, *H. zeae* was detected in 1 soil sample from Paleochori Kavallas (Northern Greece). This sample had been collected in 2009 from a field where maize plants showed stunting and wilting.
On which plants	*Zea mays* (maize) is the major host plant of *H. zeae*. Other cultivated or wild Poaceae species are also considered as suitable host plants, such as *Alopecurus pratensis*, *Avena sativa* (oat), *Coix lacryma-jobi*, *Euchlaena mexicana* (teosinte), *Hordeum vulgare* (barley), *Panicum miliaceum* (millet), *Setaria italica* (Italian millet), *Triticum aestivum* (wheat), *Oryza sativa* (rice), *Saccharum officinale* (sugarcane) *Sorghum sudanense* (Sudan grass), *Sorghum vulgare* (sorghum), *Vetiveria zizanioides* (vetiver). Studies conducted in Pakistan on *H. zeae* populations associated with maize and vetiver have suggested the existence of host races in *H. zeae*. In many papers, it is considered that the host range of *H. zeae* is limited to Poaceae. However, in Pakistan the presence of *H. zeae* has also been reported on plants of economic importance which belong to other plant families as: *Capsicum annuum* (sweet pepper – Solanaceae), *Citrus* (Rutaceae), *Corchorus capsularis* (jute - Malvaceae), *Pyrus communis* (pear - Rosaceae), *Prunus dulcis* (almond - Rosaceae), *Raphanus sativus* (small radish - Brassicaceae), *Solanum lycopersicon* (tomato - Solanaceae). More data would be needed to better understand the role of these plant species in the biology of *H. zeae* and assess the economic impact of the nematode on these crops.
Damage	*H. zeae* is a sedentary semi-endoparasite which feeds on roots. Affected plants are stunted, pale in colour, with narrow leaves. In the field, stunting frequently occurs in irregular patches. The development of maize tassels may be noticeably

delayed and the maize plants bear smaller cobs with relatively fewer grains. The root system is poorly developed with a bushy appearance, and the presence of cysts on the root surface can be observed. In Pakistan, plants of tomato and almond infested by *H. zeae* were severely stunted. Data on economic losses is generally lacking from countries where the pest occur, however, it has been observed that small numbers of nematodes could cause serious damage (e.g. 29% crop loss at 6 second stage juveniles/cm^3 soil in Rajasthan). During microplot experiments conducted in Maryland, it was observed that maize growth and yield could be reduced by 13 to 73% in the presence of *H. zeae*, and that damage was more severe in coarse-textured soil, as well as under hot and dry conditions.

Temperature plays an important role in the biology of *H. zeae*, and favourable soil temperatures for most phases of the life cycle lay above 25°C. At temperatures of 10-15°C, only 10-20% of the juveniles emerge from cysts. The total life cycle from egg to reproducing adult is short and takes 15 to 17 days under favourable temperatures (about 27-39°C). It is estimated that under these optimal conditions, *H. zeae* may complete 6-7 generations during a maize growing season.

Males of *H. zeae* are rare and reproduction is mainly parthenogenetic. Adult females are pear or lemon-shaped and pearly-white, turning light to dark brown as the cyst matures. Female produces a gelatinous egg mass; a portion of the eggs are deposited in an egg mass surrounded by this matrix. The remainder of the eggs are retained in the female body, which becomes a protective cyst after death.

Dissemination

As with most cyst nematodes, dissemination is largely ensured by passive transport with soil, water, and plant material. The mobile stages (juveniles, males) can only move over very short distances. As for other cyst nematode species, it is likely that *H. zeae* cysts remain viable in the soil for long periods. During fields and laboratory experiments conducted in Maryland, it was observed that infective *H. zeae* could survive at least 19 months in a fallow field with fine silty-clay soil and more than twice as long in the laboratory (i.e. up to 51 months at 2°C and 24°C, under moist conditions).

Pathway

Infested soil and growing media, plants for planting, bulbs and tubers from areas where *H. zeae* occurs are the most probable pathways to introduce or spread this pest into the EPPO region. Soil attached to machinery, tools, footwear, or plant products is also another possible pathway.

Possible risks

Maize is widely grown in the EPPO region and is of major economic importance. Other cereal hosts, such as wheat and barley are also major crops in the EPPO region. Cyst nematodes are generally difficult to control once established because of the persistence of the cysts in the soil. Nematicide treatments are becoming more and more difficult to apply in field crops for economic and environmental reasons. Fields studies conducted in Egypt have showed that crop rotation with non-host plants (*Vicia faba* and *Trifolium alexandrinum*) could reduce the nematode populations and prevent damage to the succeeding maize crop. In contrast, when maize was rotated with barley or wheat, nematode populations increased significantly. Concerning the use of resistant cultivars, although few moderately resistant maize cultivars have been identified, almost all tested cultivars have been found to be suitable hosts for *H. zeae*. Biological control has not been attempted against *H. zeae*, although some soil-inhabiting fungi (e.g. *Arthrobotrys, Dactylaria, Curvularia, Paecilomyces*) and bacteria (e.g. *Bacillus, Pseudomonas*) have showed some effects against *H. zeae*. Although more data is needed on the current distribution of this nematode in the EPPO region and its impact on maize and other cereal crops, it seems desirable to prevent its introduction or further spread.

Sources

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EPPO RS 2012/006, 2013/106, 2014/034
Panel review date 2015-03 Entry date 2012-01