DISEASE NOTES

First Report of Sugar Beet Cyst Nematode, *Heterodera schachtii* on Beetroot and Broccoli in Mexico

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Published Online: 12 Apr 2019 | https://doi.org/10.1094/PDIS-11-18-2000-PDN

The sugar beet cyst nematode, *Heterodera schachtii*, is considered one of the most serious pests of sugar beet and parasitizes many different plants (**Perry et al. 2018**). In Mexico, this nematode has been recorded in Chalco, Mexico State, in sugar beet (*Beta vulgaris* var. *saccharifera* L.) (**Sosa-Moss 1986**). The Tepeaca Valley, in Puebla State, is an important vegetable-producing area in Mexico. In 2017, this state was the first and second producer of beetroot (*Beta vulgaris* var. *conditiva* L.) and broccoli (*Brassica oleracea* var. *italica* Plenck), respectively (**SIAP 2018**). In October 2017 and September 2018, two populations of cyst nematodes from Quecholac (18° 53' 28" N; 97° 39' 36" W) and Palmar de Bravo (18° 59' 51" N; 97° 59' 58" W) were found in beetroot and broccoli, respectively. White females and cysts

were found attached to both plant roots. In the field, beetroot plants were stunted and chlorotic, whereas there were no above-ground symptoms in broccoli. Cysts, second-stage juveniles (J2s), and males were extracted from each soil sample by Fenwick's can (**Fenwick 1940**) and centrifugal flotation methods (**Jenkins 1964**). Cysts were lemon shaped, light to dark brown, and ambifenestrate with strongly developed bullae and underbridge. Measurements are given in micrometers and in the following format: range (mean ± SD). Cysts (*n* = 60): length excluding neck = 470 to 997 (740.1 ± 122); width = 300 to 786 (517.8 ± 107); fenestral length = 24 to 44 (33.3 ± 4.9); and semifenestral width = 19 to 42 (26 ± 4.6). J2s (*n* = 30): length = 374 to 484 (436.4 ± 29.3); width = 16 to 31 (23.6 ± 4.03); stylet = 21 to 25 (23.1 ±1.06); labial region height = 3.9 to 6 (4.9 ± 0.47); labial region diameter = 8.5 to 11.6 (9.7 ± 0.8); DGO = 3 to 4.6 (3.8 ± 0.4); anterior end to excretory pore = 79 to 120 (97 ± 8.0) and to median bulb valve = 68 to 93 (78 ± 6.0); pharyngeal length = 107 to 173 (144 ± 19.8); tail length = 39 to 63 (47.4 ± 5.4); and hyaline region of tail length = 19 to 31 (25.3 ± 3.0). Males (*n* = 30): length = 975 to 1,511 (1,222 ± 111); width = 24 to 48 (37.4 ± 5.3); stylet = 20 to 31 (25.2 ± 2.5); and spicules = 23 to 36 (31.1 ± 2.9). The morphological and morphometrical characters of cyst nematodes from beetroot and broccoli were in the same range of each other and within those of other *H. schachtii* populations (**Subbotin et al. 2010**). Genomic DNA was extracted from single cysts collected from both plants. Protocols for DNA extraction, polymerase chain reaction, and sequencing were as described by **Subbotin et al. (2018)**. Two primer sets (TW81 and AB28; Het-coxiF and Het-coxiR) were used for amplification of the internal transcribed spacer (ITS) rRNA and partial mitochondrial *COI* genes, respectively. New sequences are deposited in GenBank under accession numbers MK130992, MK134701, and MK134702. Sequences of the ITS rRNA and *COI* genes of *H. schachtii* from Mexico were identical to the corresponding gene sequences of this species from Belgium (EF611107) and Poland (KC172918). Reproduction of *H. schachtii* was confirmed by planting three replicate beetroot (cv. Crosby) and three replicate broccoli (cv. Waltham) plants into separate pots with 1 kg of sterilized soil and inoculating with a total of 250 eggs and J2s. After 120 days, plants growing at 20 to 25°C were removed, and their roots were washed and stained using acid fuchsin lactoglycerol technique (**Byrd et al. 1983**). All nematode stages were found inside or on roots. On average, 1,500 ± 397 and 963 ± 219 J2s were extracted from beetroot and broccoli pots, respectively, demonstrating successful *H. schachtii* reproduction in both plant hosts. To our best knowledge, this is the first report of *H.*

schachtii parasitizing beetroot and broccoli in Mexico. This nematode causes important losses on these crops; thus, additional surveys must be carried out to determine the distribution of this nematode in Mexican agricultural areas. Control measures should be taken to stop the spread of this nematode species.

The author(s) declare no conflict of interest.

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