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First report of *Heterodera hordecalis*, a cereal cyst nematode, on wheat in Algeria

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The cyst nematodes (*Heterodera* spp.) are a major group of plant-parasitic nematodes that attack many crop species and cause serious yield losses in major food crops (Jones et al. 2015). Nematodes in the genus *Heterodera* occur in all major cereal production areas in the Mediterranean Basin (Dababat et al. 2015). In June 2016, six soil samples were collected from durum wheat (*Triticum durum*) fields of Guellal (36°2'7" N; 5°20'12" E), Hammam Sokhna (35°58'60" N; 5°48'0" E), Ain Arnat (36°10'60" N; 5°19'0" E), Seriana (35°41'37" N; 6°11'12" E), Sebaine (33°39'0" N; 0°12'0" E), and Maghnia (34°51'42" N; 1°43'50" W), located in the Algerian provinces of Setif, Batna, Tiaret, and Tlemcen. The surveyed wheat fields had stunted patches, poor plant growth, chlorotic lower leaves, and few or no tillers. Cysts were extracted from the soil using a Fenwick Can technique (Fenwick 1940) and identified. Morphologically, cysts were rounded, deep yellow to brown, with a thick subcrystalline layer, small vulval cone, bifenestrate, two almost circular semifenestrates separated from each other by a rather wide vulval bridge, vulval slit obviously covered by a flap, and bullae present at the underbridge level. Cysts also displayed a strong underbridge with pronounced thickening in the middle and bifurcation at both ends. Measurements (range, mean ± sd) of cysts (n = 10) were: body length (425-638 µm, 525.7 µm ± 76); body width (312-475 µm, 365.8 µm ± 51); fenestra length (56-64 µm, 60 µm ± 2.9); fenestra width (22-29 µm, 25.6 µm ± 2.2); underbridge (83-102 µm, 94.5 µm ± 5.5); and

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vulval slit (15-21 μm , 17.2 $\mu\text{m} \pm 2$). J2 (obtained after crushed cysts, $n = 11$) measurements were: body length (425-472 μm , 450.9 $\mu\text{m} \pm 16.6$); stylet (23-26 μm , 24.2 $\mu\text{m} \pm 1.1$); tail (50-60 μm , 53.6 $\mu\text{m} \pm 3$); and hyaline tail terminal (31-37 μm , 34 $\mu\text{m} \pm 1.8$). Values of the morphological and morphometrical characters of the six populations were within the range of *H. hordecalis*, as reported by Tanha Maafi et al. (2007). The ITS region was used for molecular analysis. DNA was extracted from individual juveniles ($n = 3$) from different cysts (Holterman et al. 2006). Sequencing was performed using primers TW81 and AB28 (De Ley et al. 1999). The sequences obtained (GenBank Accession Nos. KX574287, KX574289, KX574307, KX574309, KX574293, and KX574306) were 99-100% similar to other *H. hordecalis* populations. To verify nematode viability, a single 5 week old seedlings of the durum wheat variety (Capa) were grown in pots. Pots were inoculated with 500 eggs and juveniles and left to grow for 9 weeks under growth chamber condition at 22°C. Then, cysts were extracted from both soil and root and an average of (92 cysts, $n = 3$) were recovered and approved that this nematode multiply on this host. These morphological and molecular analyses as well as the bioassay test confirmed the identity of the nematode species as *H. hordecalis*. This nematode can cause considerable damage to wheat, one of Algeria's main cereal crops, thus action should be taken to prevent spread to other regions and provinces. To our knowledge, this detection represents a new record of *H. hordecalis* in Algeria.