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THE CEREAL CYST NEMATODE *HETERODERA FILIPJEVI* (MADZHIDOV) IN TURKEY

by

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Summary. In Central Anatolia cyst nematodes were found in 41.1% of the cereal fields surveyed. Three species belonging to the *Heterodera avenae* group were differentiated. At two sites *H. latipons* was present and at one site a species which may be identical to *H. avenae* (s. str.). The majority of records (25) belonged to a third species close to *H. avenae*. Based on electrophoretic studies and morphological characters of cysts and second-stage juveniles this species was identified as *H. filipjevi* (Madzhidov, 1981), of which populations from the former USSR were available for comparison.

Three species of cyst nematodes of the *Heterodera avenae* group have been recorded from Turkey so far: *H. avenae* Wollenweber has been reported by Yüksel (1973) from East Anatolia and *H. avenae*, "*H. avenae* group", *H. mani* Mathews and *H. latipons* Franklin from Central Anatolia (Enneli *et al.*, 1994). Only a few additional cyst nematode species are known from Turkey to date: *H. schachtii* Schmidt (Diker, 1959; Yüksel, 1966, 1973; Franklin, 1972), *H. cruciferae* Franklin (Yüksel, 1966, 1973; Bora, 1970); *H. fici* Kirjanova (Yüksel, 1981); *H. ciceri* Vovlas, Greco *et Di Vito* (Di Vito *et al.*, 1994); "*H. goettingiana* group" and "*H. schachtii* group" (Enneli *et al.*, 1994) and *Cactodera estonica* (Kirjanova *et Krall*) (Mulvey, 1972).

A survey of cyst nematodes carried out in cereal fields in Central Anatolia revealed the common occurrence of *Heterodera* spp., which almost exclusively belonged to the *H. avenae* group. Comparative morphological and biochemical studies on cysts and second-stage

juveniles were undertaken for species identification. The results of these studies are reported here.

Materials and methods

Soil samples were collected from several wheat fields in the Konya region, Central Anatolia. Cysts and free-living nematode stages were extracted from samples by using the Fenwick can and a modified Baermann funnel technique, respectively.

For morphological studies and species identification cysts, which in part contained fully developed juveniles, were available from 15 samples and second-stage juveniles from an additional 12 samples. Vulval cones were prepared from brown cysts and permanent microscope slides from second-stage juveniles fixed in TAF and embedded in glycerine.

Cysts with viable contents from populations

originating from Çumra, Merkez, Karapınar, Selçuklu (2 populations) and Kadinhani were used to study protein patterns by isoelectric focusing in polyacrylamide thin layer gels. The method used was identical to that described by Subbotin *et al.* (1996). Populations of *H. avenae* Wollenweber from Germany and of *H. filipjevi* (Madzhidov) Stelter from the former Soviet Union were used for comparison.

Results

Cyst nematodes were present in soil samples from 41.1% of all cereal fields sampled in Central Anatolia, with an average of 93 cysts/100 g of soil.

Morphological examination of samples revealed the presence of four *Heterodera* species. In one sample only an unidentified member of the *H. schachtii* group was present. The other 26 samples contained members of the *H. avenae* group, characterized by the fenestration type of the cysts and certain characters such as lens-like phasmids in the second-stage juveniles. Three different species belonging to this group could be differentiated by cyst and/or juvenile characters from the 26 samples, two of which contained a mixture of two *Heterodera* species.

H. latipons Franklin was identified in two samples from wheat fields at Kadinhani and Yunak. In a sample from Polatli the second-stage juveniles showed close agreement in morphological characters with *H. avenae* (s. str.) juveniles. Since only a little sampling material and no cysts were available, the species identity could not be determined. The third species differentiated appeared similar but obviously not identical to *H. avenae* Wollenweber.

The results of isoelectric focusing showed that for all six Turkish "*H. avenae*" populations included in these studies there were differences in their protein pattern from *H. avenae* populations from Germany which were used for com-

parison. However, they showed close agreement with populations from the former USSR, which are considered as representatives of *H. filipjevi* (Madzhidov) Stelter and were used here for comparison (Fig. 1).

Morphological studies on the populations used for the electrophoretic studies also showed that cyst and juvenile characters closely agree with those of *H. filipjevi* from Tadjikistan and other populations from the former USSR. Cyst characters such as weak to medium development of bullae in the vulval cone and presence of an underbridge as well as stylet and tail shape of the second-stage juveniles are features useful for identification of this species (see Subbotin *et al.*, 1996). Cysts and/or juveniles of additional 20 locations in the Konya region were also identified as *H. filipjevi*.

Discussion

The present study confirmed the presence of *H. latipons* in Turkey, which also is known from many other countries in the Mediterranean region. The most remarkable result is that most populations belonging to the *H. avenae* group are representatives of the species *H. filipjevi*, which had originally been described from Tadjikistan (Madzhidov, 1981). Recent studies by Subbotin *et al.* (1996) and Sturhan and Rumpenhorst (1996) have shown that this species is widespread in the former USSR and that *H. "avenae"* - like populations from Germany, England and Sweden, which for many years were known as "race 3" or "pathotype 3" of *H. avenae* or as "Gotland strain", do also belong to *H. filipjevi*.

From the present observations relating to Turkey and still unpublished data for *H. "avenae"* populations from Iran, it may be argued that the main area of distribution of this species is in the east-European/Oriental region. Further studies are needed to confirm if *H. avenae* (s. str.) is present in Turkey.

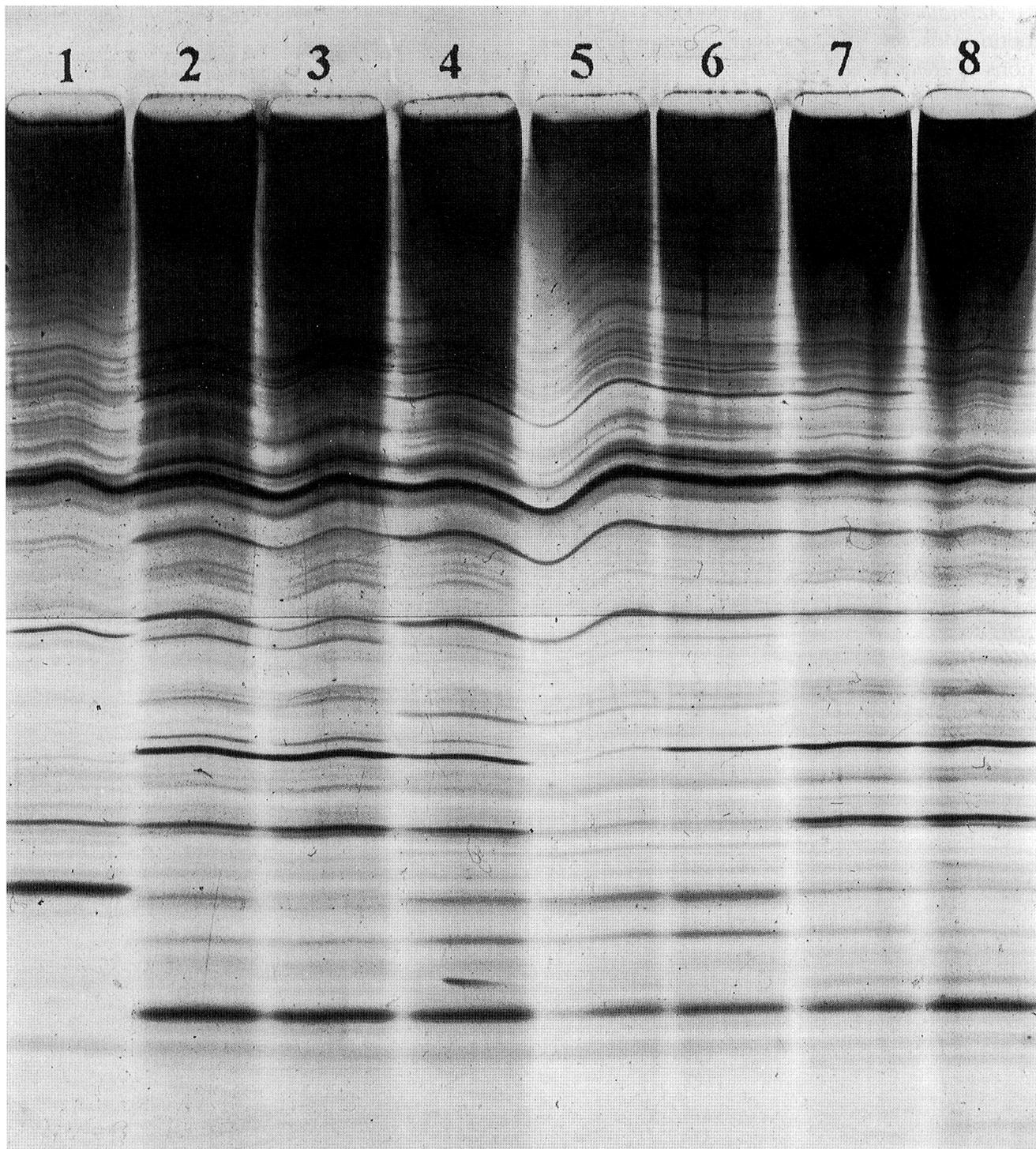


Fig. 1 - IEF protein pattern of *Heterodera avenae*, population Grafenreuth, Germany (lane 1) and *H. filipjevi*, populations Çumra (2), Merkez (3), Karapınar (4), Selçuklu I (5), Selçuklu II (6), Pushkin, Russia (7) and Baimak, Russia (8). (5% polyacrylamide gel, Servalyt 3-10 ISO-DALT, silver staining)

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