Plant parasitic nematode species found in strawberry fields in Northwestern Anatolia

Hasan Celal Akgul

This study was done to determine the species of plant parasitic nematodes that attacked strawberries in the Bursa region (Northwestern Anatolia) of Turkey from 1998 to 2000. Soil and plant samples were harvested from approximately 5% of the strawberry fields in this region. Species of plant parasitic nematodes and population densities were determined in these samples. Fourteen species belonging to the family Aphelenchoididae, order Aphelenchida and 13 species belonging to several families within the order Tylenchida were identified. The rate of occurrence of the different species and the researchers who originally described those species in Turkey are also reported. Jpn. J. Nematol. 34(2), 73-78 (2004).

Key words: strawberry, plant parasitic nematodes, population densities, Bursa, Turkey.

INTRODUCTION

In Turkey the largest number of strawberry fields producing most of the strawberry harvested is in the Bursa region. Strawberries are grown in a region extending from the Bursa plain to an altitude of 1400 m. This large region is such that the harvest period is extended and makes available a continuous yield to the market. One factor responsible for decreasing yield in this region is that of plant parasitic nematodes. These organisms attack strawberries as well as other crops (Anonymous, 1998).

Enneli and Ozturk (1989) carried out nematode surveys during 1987-1988 in the Bartin and Eregli counties of Zonguldak, Turkey, where strawberries are cultivated economically. Aphelenchoïdes fragariae and Ditylenchus dipsaci were found as important harmful nematodes in this district. It was determined that 25% of the plant samples and 35.5% of the soil samples were found to be contaminated with A. fragariae, and 17.1% of plant and 11.8% of soil samples were contaminated with D. dipsaci. The populations of both nematodes were found in higher numbers in 1988 than those in 1987. 14.5% of soil samples were found contaminated with Pratylenchus spp., 57.9% with Helicotylenchus spp., 39% with Xiphinema spp., 32.9% with Hoplolaimus spp., 22.4% with Tylenchorhynchus spp., and 1.3% with Paratylenchus spp. The population densities of these nematodes were low.

The research described here investigates the involvement of nematodes in growth and production of strawberries from the Bursa region of Turkey.

MATERIALS AND METHODS

Soil and root samples were collected from areas of strawberry fields throughout the Bursa region of Turkey (Fig. 1, Table 1).

Soil was taken extensively throughout each
strawberry field such that in excess of 1 Kg of soil from a field was mixed and approximately 200 g of the mixed soil, along with root material found in the soil, was put into individual polyethylene bags.

Nematodes were extracted from the soil using a modified Baermann funnel procedure and from roots using a root incubation technique (Young, 1954). Plant parasitic nematodes were separated from soil nematodes by observation with a low-power microscope.

The specimens were collected with a very thin steel needle and transferred to a very small drop of water in a small embryo dish or similar stable deeply concave glass vessel. The suspension was then concentrated to the smallest volume. Nematodes were killed and fixed by adding 1 ml of 70-80°C hot fixative as proposed by De Grisse (1969) with the following composition: 88 parts distilled water, 10 parts formaline (40 % HCHO), 1 part glacial acetic acid and 1 part glycerin.

The container was placed in a closed glass vessel, containing about 1/10 of its volume of 96% ethanol and left in this saturated alcohol atmosphere for at least 12 hours in an oven at 40°C. The suspension was concentrated again to
the smallest possible volume, then the container
was filled with a solution of 5 parts glycerin and
95 parts 96% ethanol and placed in a partly
closed petri-dish and left for at least 3 hours at
40°C. The third solution of 50 parts glycerin
and 50 parts 96% ethanol was then added to the
container and left also for 3 hours at 40°C after
which the nematodes were in pure glycerin. The
containers were placed into desiccators with
CaCl₂ and after some hours the nematodes were
ready for mounting.

This method was developed by Seinhorst
(1959) and modified by De Grisse (1969). A small
drop of dehydrated glycerin is placed in the cen-
ter of a square cover slip on an aluminum slide.
A number of nematodes belonging probably to
the same group were picked out and transferred
to the drop of glycerin. Three short pieces of
glass fibre of similar diameter as the nematodes
were selected and arranged radially in the
mounting drop. The nematodes were pushed to
the bottom of the drop with a needle. A rounded
cover slip was warmed over a small flame and
applied to the drop. The cover slip was secured
at three points with small drops of glyceel. It
was then left in desiccators with CaCl₂ for 3-4
hrs, the cover slip was then ringed with glyceel.

A small droplet of glycerin jelly was placed
on a perspex plate and melted over a small
flame. It was spread out at one point with a dis-
secting needle. The nematode was transferred
from pure dehydrated glycerin to the melted
glycerin jelly. It was placed with the head-end
pointing outward. After cooling and hardening
of the jelly, the head-end was cut off with a scalp.
A small bit of glycerin jelly was placed
in the centre of a clean cover slip on a slide. The
head-end was transferred with a very fine steel
needle to the droplet of the glycerin jelly on the
cover slip. Three small glass fibres with diame-
ter equal to the height of the section were select-
ed and arranged triangularly in the droplet. A
rounded cover slip was put over the droplet. The
slide was warmed over a small flame and by
adjusting the cover slip carefully under a com-
pound microscope (medium power) the head-sec-
tion was put in an upward position. The cover
slip was then fixed and ringed with glyceel.

Preparations of transverse section through
the body were made in the same way; care was
taken to make them as thin as possible.

For handling nematodes and preparation of
slides an Olympus stereoscopic microscope was
used. For examination, identification, measure-
ment and drawing of the specimens an Olympus
light microscope was at our disposition.
Measurements were done using a method
described by Siddiqi (1986) and morphological
characters and morphometric values were deter-
dined following the work of Perry et al. (1959).
Other nematode species were identified follow-
ing the work of Sher and Allen (1953), Thorne
and Malek (1968), Brzeski (1963, 1991), Allen
(1955), Hunt (1993), Thorne (1941, 1949), Raski
(1991), Kheri (1972), and Waseem (1961).

RESULTS AND DISCUSSION

Soil and plant parasitic nematodes were
widely dispersed throughout strawberry fields
in the Bursa region of Turkey. The largest con-
centration of nematodes was found in
Kucukyenice village where 22.9% of the fields
had species of nematodes parasitic to strawber-
ries. Gozede village had a 16.6% and 15.4%
infestation rate, respectively. Within these fields
14 species of nematodes were identified. Among
these species was one species belonging to the
family Aphelenchoididae (order Aphelenchida)
and 13 species which belonged to several fami-
lies within the order Tylenchida (Table 2).

The rice white tip nematode *A. besseyi*
attacks strawberries in addition to attacking
rice, however, it was not found in the strawberry
fields of the Bursa region.
Table 2. Plant parasitic nematode species in strawberry fields in Bursa region, and the rate of nematodes in samples.

<table>
<thead>
<tr>
<th>Nematode species</th>
<th>Families</th>
<th>Orders</th>
<th>The Rate in Samples (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicotylenchus digonicus</td>
<td>Hoplolaimidae</td>
<td>Tylenchida</td>
<td>43</td>
</tr>
<tr>
<td>Pratylenchus neglectus</td>
<td>Pratylenchida</td>
<td>Tylenchida</td>
<td>37</td>
</tr>
<tr>
<td>Filenchus plattensis</td>
<td>Tylenchida</td>
<td>Tylenchida</td>
<td>30</td>
</tr>
<tr>
<td>Ditylenchus dipsaci</td>
<td>Anguiniidae</td>
<td>Tylenchida</td>
<td>30</td>
</tr>
<tr>
<td>Bitylenchus dubius</td>
<td>Dolichodoridae</td>
<td>Tylenchida</td>
<td>30</td>
</tr>
<tr>
<td>Merlinus brevidens</td>
<td>Dolichodoridae</td>
<td>Tylenchida</td>
<td>27</td>
</tr>
<tr>
<td>Aphelenchoidea fragariae</td>
<td>Aphenelcooida</td>
<td>Aphenelchida</td>
<td>17</td>
</tr>
<tr>
<td>Boeolodorus thylactus</td>
<td>Tylenchida</td>
<td>Tylenchida</td>
<td>13</td>
</tr>
<tr>
<td>Tylenchus davainei</td>
<td>Tylenchida</td>
<td>Tylenchida</td>
<td>10</td>
</tr>
<tr>
<td>Psilenchus hilarulus</td>
<td>Psilenchida</td>
<td>Tylenchida</td>
<td>3</td>
</tr>
<tr>
<td>Paratylenchus italiensis</td>
<td>Tylenchulida</td>
<td>Tylenchida</td>
<td>3</td>
</tr>
<tr>
<td>Irantylenchus clavidorius</td>
<td>Tylenchida</td>
<td>Tylenchida</td>
<td>3</td>
</tr>
<tr>
<td>Helicotylenchus canadensis</td>
<td>Hoplolaimidae</td>
<td>Tylenchida</td>
<td>3</td>
</tr>
<tr>
<td>Filenchus dittissimus</td>
<td>Tylenchida</td>
<td>Tylenchida</td>
<td>3</td>
</tr>
</tbody>
</table>

Fig. 2. Population densities of strawberry nematodes (Aphelenchoidea fragariae) at different altitudes.
It is clear from this survey that strawberry parasitic nematodes are dispersed in Bursa fields. In the Bursa region, Kucukyenice village was found to have the most nematodes with the rate of 22.9%. It was followed Gozede village (16.6 %) and Barakli village (15.4 %). The results of the study determined that a total of 14 species which includes a species belonging to the family Aphelenchoididae of the order Aphelenchida and 13 species belonging to several families of the order Tylenchida were present (Table 2).

*Aphelenchoides fragariae* (Ritzema Bos) the major pest of strawberry production was found at a population density lower than expected in strawberry fields of the Bursa region of Turkey. The population density of this nematode was less in high altitude fields than in those fields at lower altitude (Fig. 2).

The morphologic characters and morphometric values used were similar to Perry et al. (1959). Species were identified as, *P. neglectus* (Sher and Alen, 1953); *T. davainei* and *F. platensis* (Thorne and Malek, 1968); *D. dipsaci* (Brzeski, 1991); *B. dubius* and *M. brevidens* (Allen, 1955); *A. fragariae* (Hunt, 1993); *B. thylactus* (Thorne, 1941); *P. clava caulatus* (Thorne, 1949); *P. italicensis* (Raski, 1991); *I. clavidorus* (Kheri, 1972); *H. canadensis* (Waseem, 1961); and *F. ditissimus* (Brzeski, 1963; Thorne and Malek, 1968).

Although *Bitylenchus dubius*, *Merlinius brevidens*, *Pratylenchus neglectus*, *Filenchus platensis* and spiral nematodes *Helicotylenchus digonicus* were the most frequently found ectoparasites, they are polyphagous pests. They can be harmful if they are present in high density populations.

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**Literature Cited**


Kheiri, A. (1972) Tylenchus (Irantylenchus) clavidorus n. sp. and Merlinius camellie n. sp. (Tylenchida: Nematoda) from Iran. Nematologica 18, 339-346.


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