www.czasopisma.pan.pl PAN www.journals.pan.pl

JOURNAL OF PLANT PROTECTION RESEARCH Vol. 52, No. 4 (2012)

DOI: 10.2478/v10045-012-0071-y

NEMATODES ASSOCIATED WITH PLANT GROWTH INHIBITION IN THE WIELKOPOLSKA REGION

Grażyna Winiszewska[1], Ewa Dmowska[1], Aneta Chałańska[2], Renata Dobosz[3], Franciszek Kornobis[1,7], Krassimira Ilieva-Makulec[4, 8], Andrzej Skwiercz[5], Stefan Wolny[1,3], Elias Ishaqe[6]*

[1] Museum and Institute of Zoology Polish Academy of Science, Wilcza 64, 00-679 Warszawa, Poland
[2] Research Institute of Horticulture, Konstytucji 3 Maja 1/3, 96-100 Skierniewice, Poland
[3] Institut of Plant Protection – National Research Institute, Władysława Węgorka 20, 60-318 Poznań, Poland
[4] Centre of Ecological Research Polish Academy of Science, Konopnickiej 1, Dziekanów Leśny, 05-092 Łomianki, Poland
[5] University of Warmia and Mazury, Prawocheńskiego 17, 10-722 Olsztyn, Poland
[6] University of Al-Furat, DeirEzzor, Syria
[7] Adam Mickiewicz University, Department of Animals Morphology, Faculty of Biology, Umultowska 89, 61-614 Poznań, Poland
[8] Cardinal Stefan Wyszyński University, Institute of Ecology and Bioethics, Wóycickiego 1/3, 01-938 Warszawa, Poland

Received: May 15, 2012
Accepted: September 17, 2012

Abstract: The list of species of the plant parasitic nematodes presented in this paper (133 species belonging to 14 families) is based on the results of faunistic research conducted in the Wielkopolska region by Polish nematologists up until the year 2010, and the results obtained from the project "Elaboration of Innovative Methods for Rapid Identification of Nematodes Causing Damage to the Economy" managed by the Museum and Institute of Zoology of the Polish Academy of Sciences. During the two years of the project (2010–2011) we found 21 species of nematodes which had not yet been reported in the list of species from the Wielkopolska region. Two of them were reported for the first time in Poland.

Key words: plant parasitic nematodes, Wielkopolska, Poland

INTRODUCTION

The development of nematological research in the Wielkopolska region was influenced by the detection of the potato cyst nematode [*Globodera rostochiensis* (Wollenweber, 1923)] outbreaks. The potato cyst nematode is one of the most dangerous species of plant parasitic nematodes for agricultural production. Studies on this species were carried out mainly at the Institute of Plant Protection (IPP) in Poznań, created in 1951, now known as the Institute of Plant Protection – National Research Institute (IPP – NRI). With time, IPP research interests have expanded to other nematode species. Many years of research conducted by nematologists in the Wielkopolska region were focused on plant parasitic nematodes associated with agricultural crops (Wilski 1971; Radziwinowicz 1972; Wasilewska 1974; Kornobis 1983, 1993; Wolny 1986, 1989a, b, c, 1990; Kornobis and Ishaq 1990; Dobosz 1999), on weeds (Ishaq 1992; Kornobis and Wolny 1997; Dobosz et al. 2006), and planting trees and shrubs in forest nurseries (Wolny 1973, 1980; Skwiercz 2012). Data on plant-nematodes found in peat soils in Wielkopolska region has been published in the papers of Skwiercz (1989a, b). Data on plant-nematodes occuring on tulip plantations are found in the publication of Chałańska and Skwiercz (2011). Information on the occurrence of species belonging to the Longidoridae, Xiphinematidae and Trichodoridae families are included in the papers of Szczygieł and Brzeski (1985) and Karnkowski (2005).

All these results were used as a comparative material for the research coordinated by the Museum and Institute of Zoology in the project "Elaboration of Innovative Methods for Rapid Identification of Nematodes Causing Damage to the Economy". For the project, nematodes were collected in a variety of environments: agriculture fields, forests, wooded areas, orchards, forest nurseries, ornamental plants plantations, and in mid-field shelterbelts that are so characteristic for Wielkopolska region.

MATERIALS AND METHODS

Research was carried out in the 2010–2011 time period on areas used for agricultural purposes, on ornamental plants in nurseries, orchards, forests, and wooded areas.

*Corresponding address:
nicien@miiz.waw.pl

Soil samples were collected in the rizosphere of the plants using a soil sampler (in diameter 30 mm) to a depth of 30 cm (three puncture probes in an area of approximately 0.5 square meters). Nematodes were isolated from the soil using the Oostenbrink apparatus, modified Baermann method and centrifuge method. Cyst nematodes were extracted from the soil using a Fenwick can apparatus (Wilski 1967). Nematodes extracted from the soil were killed with hot water and preserved at liquid TAF [Tri-ethylamine, Aqua destillata, Formalin] (Wilski 1967). Nematodes identified based on morphological characteristics were classified according to the system adopted in the Fauna Europea (Bogdanowicz *et al.* 2008). Identified nematode species came from 110 samples.

RESULTS AND DISCUSSION

Analysis of data from the literature and the results from the project showed that in agricultural ecosystems and in natural environments of the Wielkopolska region, there are 133 species of herbivores and fungivores nematodes belonging to 14 families (Table 1). For most families, the number of species found in the Wielkopolska region was about half of the number of species previously reported from Poland (Fig. 1).

During the research period, two new species for Polish fauna were found: *Aphelenchoides conimucronatus* Bessarabova, 1966 and *Bitylenchus parvus* Allen, 1955.

Table 1. List of species of plant parasitic nematodes found in the Wielkopolska and the environment or place of the occurrence

Species	Environment/place of occurrence
1	2
Longidoridae	
L. attenuatus Hooper, 1961	garden, hop field, meadow, orchad, woods
L. elongatus (De Man, 1876)	barley field, deciduous forest nursery, meadow, orchad, rape field, shrubs in peat soils, weeds in cereal fields, woods
L. euonymus Mali & Hooper, 1973	meadow, weeds in cereal fields, woods
L. intermedius Kozłowska & Seinhorst, 1979	deciduous forest
L. leptocephalus Hooper, 1961	meadow
Paralongidorus maximus (Bütschli, 1874)	garden, grapevine, woods
Xiphinematidae	
Xiphinema diversicaudatum (Micoletzky, 1927)	deciduous forest nursery, orchad, woods
X. vuittenezi Luc, Lima, Weischer & Flegg, 1964	orchad
Xiphinema sp.	fallow
Trichodoridae	
Paratrichodorus anemones (Loof, 1965)	mixed forest, meadow
P. pachydermus (Seinhorst, 1954)	barley field, beet field, coniferous forest nursery, deciduous forest nursery, deciduous forest, field, grasses in peat soils, maize field, meadow, mixed forest, orchad, rape field, rye field, shrubs in peat soils, weeds in cereal fields, wheat field, woods
P. teres (Hooper, 1962)	barley field, coniferous forest nursery, deciduous forest, meadow, oat field, orchad, ornamental deciduous nursery, rape, rye field, weeds in cereal fields, wheat field
Trichodorus cylindricus Hooper, 1962	coniferous forest nursery
T. primitivus (De Man, 1880)	barley field, beet field, cereals, coniferous forest nursery, grasses in peat soils, lupine field, maize field, oat field, orchad, rape field, shrubs in peat soils, weeds in cereal fields, wheat field, woods
T. similis Seinhorst, 1963	coniferous forest nursery, grasses in peat soils, rape field, wheat field
T. sparsus Szczygieł, 1968	coniferous forest nursery
T. variopapillatus Hooper, 1972	grasses in peat soils, mixed forest
T. viruliferus Hooper, 1963	barley field, coniferous forest nursery, deciduous forest nursery, grasses in peat soils, lupine field, maize field, meadow, oat field, orchad, rape field, weeds in cereal fields,wheat field
Aphelenchidae	
Aphelenchus avenae Bastian, 1865	cereals, coniferous forest nursery, deciduous forest nursery, deciduous forest, maize field, mixed forest,orchad, ornamental bulbs nursery, ornamental conifer nursery, ornamental deciduous nursery, potatoe field, weeds in cereal fields, woods
A. eremitus Thorne, 1961	coniferous forest nursery
Aphelenchoididae	
Aphelenchoides asterocaudatus Das, 1960	triticale field
A. bicaudatus (Imamura, 1931)	coniferous forest nursery, deciduous forest nursery, field shelterbelt, triticale field, weeds in cereal fields

1	2
Aphelenchoides composticola Franklin, 1957	coniferous forest nursery, deciduous forest nursery
A. conimucronatus Bessarabova, 1966	maize field
A. cyrtus Paesler, 1959	triticale field
A. limberi Steiner, 1936	deciduous forest nursery
A. parietinus (Bastian, 1865)	mixed forest
A. saprophilus Franklin, 1957	coniferous forest nursery, deciduous forest nursery
Aphelenchoides sp.	field shelterbelt
Criconematidae	
Criconema annuliferum (De Man, 1921)	beet field, coniferous forest nursery, grasses in peat soils, meadow, mixed forest, orchad, rape field, shrubs in peat soils, weeds in cereal fields, wheat field, woods
C. princeps (Andrássy, 1962)	woods
C. sphagni Micoletzky, 1925	grasses in peat soils
Criconemoides informis (Micoletzky, 1922)	barley field, beet field, coniferous forest nursery, deciduous forest nursery, grasses in peat soils, lupine field, maize field, meadow, oat field, orchad, rape field, shrubs in peat soils, weeds in cereal fields, wheat field, woods
C. mongolensis Andrássy, 1964	deciduous forest nursery
C. morgensis (Hofmänner, 1914)	grasses in peat soils
C. parvus Raski, 1952	weeds in cereal fields
Mesocriconema curvatum (Raski, 1952)	barley field, beet field, deciduous forest nursery, lupine field, maize field, oat field, orchad, rape field, weeds in cereal fields, wheat field
M. pseudosolivagum (De Grisse, 1964)	maize field
M. rotundicaudatum (Loof, 1964)	grasses in peat soils
M. rusticum (Micoletzky, 1915)	beet field, grasses in peat soils, maize field, shrubs in peat soils, weeds in cereal fields
Mesocriconema solivagum (Andrássy, 1962)	woods
Mesocriconema sphaerocephalum (Taylor, 1936)	maize field
Mesocriconema xenoplax (Raski, 1952)	barley field, grasses in peat soils, mixed forest, orchad, ornamental conifer nursery, ornamental deciduous nursery, rape field, shrubs in peat soils, woods
Xenocriconemella macrodora (Taylor, 1936)	woods
Hemicycliophoridae	
Hemicycliophora conida Thorne, 1955	barley field, meadow, oat field, orchad, shrubs in peat soils, woods
H. thornei Goodey, 1963	shrubs in peat soils
H. typica De Man, 1921	shrubs in peat soils
Loofia thienemanni (Schneider, 1925)	grasses in peat soils, oat field, shrubs in peat soils
Paratylenchidae	
Paratylenchus aciculus Brown, 1959	rape field, wheat field
P. bukowinensis Micoletzky, 1922	coniferous forest nursery, grasses in peat soils, maize field, potato field, weeds in cereal fields
P. microdorus Andrássy, 1959	beet field, coniferous forest nursery, grasses in peat soils, oat field, rape field, weeds in cereal fields, wheat field
P. nanus Cobb, 1923	coniferous forest nursery, grasses in peat soils, maize field, shrubs in peat soils, weeds in cereal fields
P. projectus Jenkins, 1956	barley field, beet field, coniferous forest nursery, deciduous forest nursery, field shelterbelt, grasses in peat soils, maize field, meadow, oat field, ornamental conifer nursery, rape field, shrubs in peat soils, weeds in cereal fields, wheat field
P. steineri Golden, 1961	grasses in peat soils, weeds in cereal fields
P. straeleni (De Coninck, 1931)	grasses in peat soils, shrubs in peat soils
P. veruculatus Wu, 1962	coniferous forest nursery
Telotylenchidae	
Amplimerlinius globigerus Siddiqi, 1979	beet field, grasses in peat soils, rye field
A. macrurus (Goodey, 1932)	oat field
Bitylenchus bryobius (Sturhan, 1966)	meadow, woods

1	2
Bitylenchus dubius (Bütschli, 1873)	barley field, beet field, coniferous forest nursery, deciduous forest nursery, deciduous forest, field shelterbelt, grasses in peat soils, lupine field, maize field, meadow, oat field, orchad, ornamental conifer nursery, ornamental deciduous nursery, ornamental plants, potato field, rape field, rye field, shrubs in peat soils, triticale field, weeds in cereal fields, wheat field, woods
B. parvus (Allen, 1955)	woods
Geocenamus tenuidens Thorne & Malek, 1968	potato field, triticale field, weeds in cereal fields, wheat field,
Merlinius alboranensis (Tobar Jimenéz, 1970)	barley field, beet field, woods
M. brevidens (Allen, 1955)	barley field, beet field, coniferous forest nursery, deciduous forest nursery, grasses in peat soils, lupine field, maize field, oat field, potato field, rape field, shrubs in peat soils, weeds in cereal fields, wheat field
M. joctus (Thorne, 1949)	deciduous forest, maize field, meadow
M. microdorus (Geraert, 1966)	barley field, beet field, coniferous forest nursery, deciduous forest nursery, deciduous forest, field shelterbelt, grasses in peat soils, lupine field, maize field, meadow, oat field, orchad, potato field, rape field, weeds in cereal fields, wheat field, woods
M. nanus (Allen, 1955)	barley field, beet field, coniferous forest nursery, deciduous forest nursery, deciduous forest, lupine field, maize field, meadow, oat field, potato field, rape field, rye field, weeds in cereal fields, woods
M. nothus (Allen, 1955)	barley field, beet field, deciduous forest, grasses in peat soils, lupine field, maize field, meadow, oat field, rape field, weeds in cereal fields, wheat field, woods
Nagelus leptus (Allen, 1955)	shrubs in peat soils
N. obscurus (Allen, 1955)	barley field, grasses in peat soils, oat field, weeds in cereal fields, wheat field
N. camelliae (Kheiri, 1972)	weeds in cereal fields
N. microphasmis Loof, 1960	barley field, beet field, coniferous forest nursery, deciduous forest nursery, lupine field, maize field, meadow, mixed forest, oat field, rape field, wheat field, woods
N. judithae (Andrássy, 1962)	beet field, rape field, weeds in cereal fields, woods
N. lamelliferus (de Man, 1880)	grasses in peat soils
Quinisulcius capitatus (Allen, 1955)	maize field
Sauertylenchus maximus (Allen, 1955)	barley field, beet field, coniferous forest nursery, field shelterbelt, grasses in peat soils, lupine field, meadow, oat field, orchad, ornamental conifer nursery, rape field, shrubs in peat soils, weeds in cereal fields, wheat field, woods
S. lenorus (Brown, 1956)	barley field, beet field, deciduous forest
S. quadrifer (Andrássy, 1954)	barley field, coniferous forest nursery, grasses in peat soils, maize field, rape field, wheat field
S. tartuensis (Krall, 1959)	barley field, beet field, deciduous forest nursery, grasses in peat soils, lupine field, maize field, meadow, mixed forest, oat field, orchad, rape field, weeds in cereal fields, wheat field
S. tessellatus (Goodey, 1952)	coniferous forest nursery, grasses in peat soils, maize field, oat field, weeds in cereal fields, wheat field
S. tumensis Skwiercz, 1984	grasses in peat soils
S. rugosus (Siddiqi, 1963)	coniferous forest nursery
	Heteroderidae
Globodera artemisiae (Eroshenko & Kazachenko, 1972)	weeds in cereal fields
G. rostochiensis (Wollenweber, 1923)	barley field, beet field, coniferous forest nursery, oat field, rape field, weeds in cereal fields, wheat field
Heterodera avenae Wollenweber, 1924	barley field, beet field, lupine field, maize field, oat field, rape field, weeds in cereal fields, wheat field
H. bifenestra Cooper, 1955	weeds in cereal fields
H. carotae Jones, 1950	lupine field
H. cruciferae Franklin, 1945	rape field, weeds in cereal fields
H. goettingiana Liebscher, 1892	black fallow
H. hordecalis Anderson, 1975	weeds in cereal fields, wheat field

1	2
Heterodera humuli Filipjev, 1934	hop field, weeds in cereal fields
H. schachtii Schmidt, 1871	barley field, beet field, lupine field, maize field, meadow, oat field, rape field, wheat field
H. trifolii Goffart, 1932	barley field, beet field, lupine field, rape field, weeds in cereal fields, wheat field
Heterodera sp.	deciduous forest, maize field, meadow
Punctodera punctata (Thorne, 1928)	barley field, weeds in cereal fields
	Hoplolaimidae
Helicotylenchus canadensis Waseem, 1961	barley field, beet field, cereals, coniferous forest nursery, garlic field, grasses in peat soils, oat field, rape field, weeds in cereal fields, wheat field
H. digonicus Perry, 1959	barley field, beet field, coniferous forest nursery, deciduous forest nursery, garlic field, grasses in peat soils, oat field, ornamental conifer nursery, rape field, weeds in cereal fields, wheat field, woods
H. exallus Sher, 1966	grasses in peat soils
H. pseudorobustus (Steiner, 1914)	barley field, beet field, coniferous forest nursery, deciduous forest nursery, deciduous forest, grasses in peat soils, lupine field, maize field, meadow, mixed forest, oat field, ornamental conifer nursery, rape field, shrubs in peat soils, weeds in cereal fields, wheat field, woods
H. varicaudatus Yuen, 1964	garlic field, potato field, woods
H. vulgaris Yuen, 1964	beet field
H. pseudodigonicus Szczygieł, 1970	maize field
Rotylenchus agnetis Szczygieł, 1968	barley field, ornamental deciduous nursery, woods
R. buxophilus Golden, 1956	coniferous forest nursery, woods
R. goodeyi Loof & Oostenbrink, 1958	barley field, beet field, coniferous forest nursery, grasses in peat soils, maize field, mixed forest, rape field, weeds in cereal fields, woods
R. quartus (Andrássy, 1958)	coniferous forest nursery, deciduous forest nursery, grasses in peat soils, woods
R. robustus (De Man, 1876)	beet field, coniferous forest nursery, deciduous forest nursery, grasses in peat soils, rape field, weeds in cereal fields, woods
Rotylenchus sp.	woods
	Meloidogynidae
Meloidogyne hapla Chitwood, 1949	coniferous forest nursery, barley field, weeds on meadow, weeds in cereal fields,
Meloidogyne sp.	potato field, rye field
	Pratylenchidae
Hirschmanniella gracilis (De Man, 1880)	grasses in peat soils
Pratylenchoides crenicauda Winslow, 1958	coniferous forest nursery, weeds on meadow
P. laticauda Braun & Loof, 1967	shrubs in peat soils
Pratylenchus crenatus Loof, 1960	barley field, beet field, coniferous forest nursery, deciduous forest nursery, grasses in peat soils, las mixed forest, lupine field, maize field, meadow, oat field, potato field, rape field, shrubs in peat soils, weeds in cereal fields, wheat field, woods
P. fallax Seinhorst, 1968	coniferous forest nursery, deciduous forest nursery, grasses in peat soils, maize field, oat field, potato field, rape field, shrubs in peat soils
P. flakkensis Seinhorst, 1968	barley field, deciduous forest nursery, grasses in peat soils, lupine field, oat field, rape field, shrubs in peat soils, weeds in cereal fields
P. neglectus (Rensch, 1924)	barley field, beet field, deciduous forest nursery, field shelterbelt, grasses in peat soils, lupine field, maize field, meadow, meadow, oat field, orchad, ornamental conifer nursery, potato field, rape field, shrubs in peat soils,weeds in cereal fields, wheat field
P. penetrans (Cobb, 1917)	barley field, coniferous forest nursery, deciduous forest nursery, grasses in peat soils, maize field, oat field, orchad, potato field, rape field, shrubs in peat soils, weeds in cereal fields, wheat field
P. pinguicaudatus Corbett, 1969	weeds in cereal fields
P. pratensis (De Man, 1880)	deciduous forest nursery, weeds in cereal fields
P. thornei Sher & Allen, 1953	beet field, maize field, oat field, rape field, weeds in cereal fields, wheat field
Pratylenchus sp.	field shelterbelt, maize field, meadow, ornamental deciduous nursery, strawberry field, woods

1	2
	Anguinidae
Ditylenchus clarus Thorne & Malek, 1968	weeds in cereal fields
D. convallariae Sturhan & Friedman, 1965	coniferous forest nursery
D. destructor Thorne, 1945	beet field, potato field, rape field, weeds in cereal fields
D. dipsaci (Kühn, 1857)	barley field, oat field, potato field, rape field, rye field, weeds in cereal fields, wheat field
D. equalis Heyns, 1964	beet field, rape field, weeds in cereal fields
D. exilis Brzeski, 1984	beet field, weeds in cereal fields
D. medicaginis Wasilewska, 1965	barley field, beet field, coniferous forest nursery, lupine field, oat field, rape field, weeds in cereal fields
D. myceliophagus Goodey, 1958	deciduous forest nursery, potato field
D. intermedius (de Man, 1880)	deciduous forest nursery, potato field
Nothotylenchus ferepolitor Kazachenko, 1980	beet field
Safianema anchilisposomus (Tarjan, 1958)	deciduous forest nursery

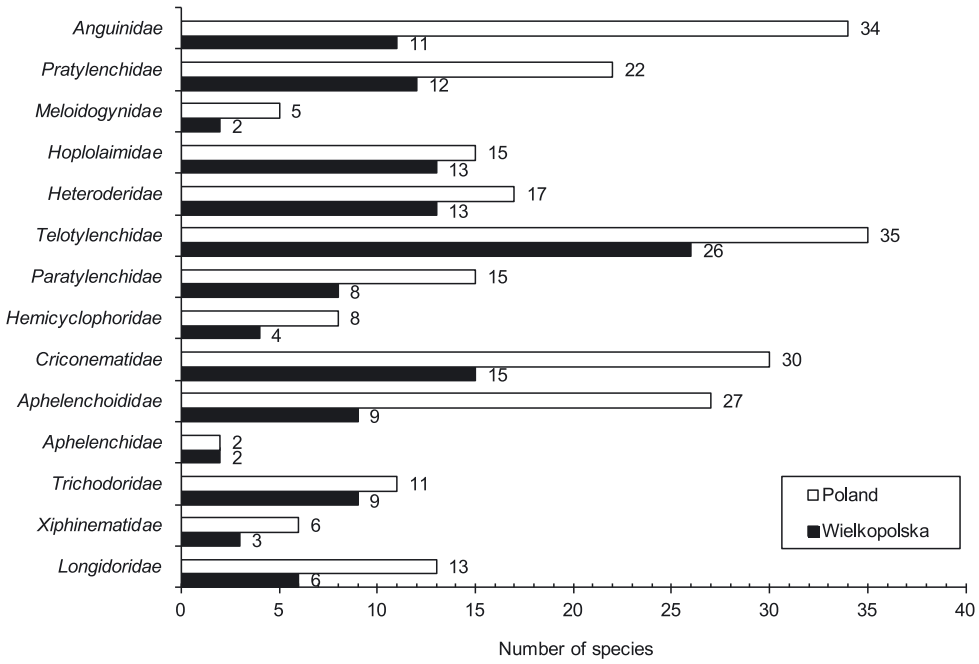

Fig. 1. Comparison of the number of species of plant parasitic nematodes from some families reported from Poland and found in Wielkopolska

The species *A. conimucronatus* was previously reported in Russia, Ukraine, Czech Republic (http:// www.faunaeur.org), and Slovakia (Háněl and Čerevková 2010). Up till now, *Bitylenchus parvus* was recognized in the soil around the roots of plants cultivated in the area of Cyprus, Hungary and Italy (http://www.faunaeur. org). Moreover, 16 species which had not been previously reported in Wielkopolska were found: *Longidorus euonymus* Mali & Hooper, 1973, *L. intermedius* Kozłowska & Seinhorst, 1979, *L. leptocephalus* Hooper, 1961 and *Paralongidorus maximus* (Bütschli, 1874) belonging to the Longidoridae family; *Xiphinema vuittenezi* Luc, Lima, Weischer & Flegg, 1964 belonging to the Xiphinematidae family; *Paratrichodorus anemones* (Loof, 1965) belonging to the Trichodoridae family; *Aphelenchoides cyrtus* Paesler, 1959, *A. parietinus* (Bastian, 1865) and *Aphelenchoides* sp. belonging to the Aphelenchoididae family; *Criconema princeps* (Andrássy, 1962), *Mesocriconema solivagum* (Andrássy, 1962) and *Xenocriconemella macrodora* (Taylor, 1936) belonging to the Criconematidae family, *Bitylenchus bryobius* (Sturhan, 1966), *Merlinius alboranensis* (Tobar Jimenéz, 1970) and *Scutylenchus lenorus* (Brown, 1956) belonging to the Telotylenchidae family; and *Helicotylenchus varicaudatus* Yuen, 1964 belonging to the Hoplolaimidae family.

Specimens identified as *Rotylenchus* sp. and *Pratylenchus* sp. are probably new species, what will be finally confirmed by molecular tests.

CONCLUSIONS

Due to two-year studies carried out in the project "Elaboration of Innovative Methods for Rapid Identification of Nematodes that Cause Damage to the Economy", which involved a wide range of environments, the list of 112 species recorded in the Wielkopolska region up till 2010 is extended by further 21 species, including 2 species new for polish fauna: *A. conimucronatus* and *B. parvus*.

REFERENCES

Bogdanowicz W., Chudzicka E., Pilipiuk I., Skibińska E. (eds). 2008. Fauna Polski. Muzeum i Instytut Zoologii PAN, Warszawa 3, 603 pp.

Chałańska A., Skwiercz A. 2011. Parasitic nematodes on Polish tulip plantations. J. Plant Prot. Res. 51 (1): 66–71.

Dobosz R. 1999. Additional data on plant parasitic nematodes on sugarbeet in the Wielkopolska region in Poland. J. Plant Prot. Res. 39 (2): 107–108.

Dobosz R., Obrępalska-Stęplowska A., Kornobis S. 2006. *Globodera artemisiae* (Eroshenko et Kazachenko, 1972) (Nematoda: Heteroderidae) from Poland. J. Plant Prot. Res. 46 (4): 403–407.

Háněl L., Čerevková A. 2010. Prvé nálezy pôdnych nematód (Nematoda) pre faunu Slovenska z CHKO Vihorlat. Folia Faunistica Slovaca 15 (10): 95–98.

Ishaqe E. 1992. Plant-parasitic nematodes associated with weeds in spring cereal fields in the region of Wielkopolska. Rocz. Nauk Rol. Seria E – Ochrona Roślin 22 (1/2): 7–30.

Karnkowski W. 2005. Ocena występowania długaczy (*Longidorus* spp.) i sztylaków (*Xiphinema* spp.) (Nematoda: Longidoridae) na podstawie badań gleby przeprowadzonych w centralnym laboratorium głównego inspektoratu ochrony roślin i nasiennictwa. [Evaluation of occurrence of needles nematodes (*Longidorus* spp.) and dagger nematodes (*Xiphinema* spp.)(Nematoda: Longidoridae) on the basis of soil examination performed in the Central Laboratory of the Main Inspectorate of Plant Protection and Seed Inspection]. Prog. Plant Prot./Post. Ochr. Roślin 45 (2): 764–767.

Kornobis S. 1983. Materiały do znajomości nicieni występujących w uprawach kukurydzy w Wielkopolsce. [Plant parasitic nematodes associated with poor growth of maize in Wielkopolska]. Z. Probl. Post. Nauk Roln. 278: 139–148.

Kornobis S. 1993. Plant parasitic nematodes associated with poor growth of lupines in the Wielkopolska region. Rocz. Nauk Rol. Seria E – Ochrona Roślin 23 (1/2): 93–95.

Kornobis S., Ishaqe E. 1990. Materiały do znajomości nicieni stowarzyszonych z objawami zahamowania wzrostu roślin buraka cukrowego w Wielopolsce. [Plant parasitic nematodes associated with poor growth of sugar beet in the Wielkopolska region]. Prace Nauk. Inst. Ochr. Roślin 32 (1/2): 93–98.

Kornobis S., Wolny S. 1997. Occurence of plant parasitic nematodes on weeds in agrobiocenosis in the Wielkopolska region in Poland. Fundam. Appl. Nematol. 20 (6): 627–632.

Radziwinowicz J. 1972. Badania nad występowaniem nicieni – szkodników roślin na ziemniakach w polu i przechowalniach. [Investigations on the occurrence of plant parasitic nematodes on potatoes in fields and clamps]. Prace Nauk. Inst. Ochr. Roślin 14 (1): 157–168.

Skwiercz A.T. 1989a. Plant parasitic nematodes in the peat soils in Poland, Part I. Biocenotic analyse. Rocz. Nauk Rol. Seria E – Ochrona Roślin 19 (1/2): 91–99.

Skwiercz A.T. 1989b. Plant parasitic nematodes in the peat soils in Poland, Part II. Frequency of occurrence and population density in different chemical properties of peat. Rocz. Nauk Rol. Seria E – Ochrona Roślin 19 (1/2): 101–111.

Skwiercz A.T. 2012. Nematodes (Nematoda) in Polish forests. I. Species inhabiting soils of nurseries. J. Plant Prot. Res. 52 (1): 169–179.

Szczygieł A., Brzeski M.W. 1985. Atlas of Plant Parasitic Nematodes of Poland. Distribution of Longidoridae, Xiphinemidae and Trichodoridae. Eur. Plant Parasitic Nematode Survey, 32 pp.

Wasilewska L. 1974. Number, biomas and metabolic activity of nematodes of two cultivated fields in Turew. Z. Probl. Post. Nauk Roln. 154: 419–442.

Wilski A. 1967. Nicienie Szkodniki Roślin Uprawnych. PWRiL, Warszawa, 336 pp.

Wilski A. 1971. Występowanie nicieni z rodzaju *Heterodera* w glebach województwa poznańskiego. [The occurrence of *Heterodera* cysts in soils of the province Poznan]. Prace Nauk. Inst. Ochr. Roślin 13 (1): 195–200.

Wolny S. 1973. Przyczynek do poznania fauny nicieni szkółek sosnowych Leśnego Zakładu Doświadczalnego Siemianice, powiat Kępno. [A contribution to the knowledge of the nematode fauna in pine seed-beds of the forest experimental farm, Siemianice, district Kepno]. Prace Nauk. Inst. Ochr. Roślin 15 (2): 127–132.

Wolny S. 1980. Nicienie, pasożyty roślin w szkółkach zadrzewieniowych. [Plant parasitic nematodes in tree nurseries]. Z. Probl. Post. Nauk Rol. 232: 121–132.

Wolny S. 1986. Występowanie nicieni – pasożytów roślin wyższych w uprawach zbóż jarych na terenie Wielkopolski. Mat. 26. Sesji Nauk. Inst. Ochr. Roślin, Cz. II: 45–46.

Wolny S. 1989a. Nicienie – pasożyty roślin wyższych stowarzyszone z objawami zahamowania wzrostu roślin jęczmienia jarego w Wielkopolsce. [Plant parasitic nematodes associated with poor growth of spring barley in the Wielkopolska region]. Prace Nauk. Inst. Ochr. Roślin 31 (1): 5–16.

Wolny S. 1989b. Nicienie – pasożyty roślin wyższych stowarzyszone z objawami zahamowania wzrostu roślin pszenicy jarej w Wielkopolsce. [Plant parasitic nematodes associated with poor growth of spring wheat in the Wielkopolska region]. Prace Nauk. Inst. Ochr. Roślin 31 (1): 17–28.

Wolny S. 1989c. Nicienie – pasożyty roślin wyższych stowarzyszone z objawami zahamowania wzrostu roślin owsa w Wielkopolsce. [Plant parasitic nematodes associated with poor growth of oat in the Wielkopolska region]. Prace Nauk. Inst. Ochr. Roślin 31 (1): 29–40.

Wolny S. 1990. Materiały do znajomości nicieni – pasożytów roślin wyższych stowarzyszonych z objawami zahamowania wzrostu roślin rzepaku ozimego w Wielkopolsce. [Plant parasitic nematodes associated with poor growth of winter rape in the Wielkopolska region]. Prace Nauk. Inst. Ochr. Roślin 32 (1): 85–91.