SOIL ORGANISMS **86** (3) · December 2014 pp. 177–198

Plant-parasitic nematodes in Germany – an annotated checklist

Dieter Sturhan

Arnethstr. 13D, 48159 Münster, Germany,
and c/o Julius Kühn-Institut, Toppheideweg 88, 48161 Münster, Germany
E-mail: sturhandh@web.de

Received 15 September 2014 | Accepted 28 October 2014
Published online at www.soil-organisms.de 1 December 2014 | Printed version 15 December 2014

Abstract

A total of 268 phytonematode species indigenous in Germany or more recently introduced and established outdoors are listed. Their current taxonomic status and classification is given, which is not always in agreement with that applied in Fauna Europaea or recent publications. Recently used synonyms are included and comments on the species status are sometimes added. Species originally described from Germany are particularly marked, presence of types and other voucher specimens in the German Nematode Collection - Terrestrial Nematodes (DNST) is indicated; likewise potential occurrence or absence of species in field soil and similar cultivated land is noted. Species known from indoor plants and only occasionally observed outdoors are listed separately. Synonymies and species considered as *species inquirendae* are listed in case records refer to Germany; records and identifications considered as doubtful are also listed. In a separate section notes on a number of genera and species are added, taxonomic problems are indicated, and data on morphology, distribution and habitat of some recently discovered species and of still unidentified or undescribed species or populations are given. *Longidorus macroteromucronatus* is synonymised with *L. poessneckensis*. *Paratrophurus striatus* is transferred as *T. casigo* nom. nov., comb. nov. to the genus *Tylenchorhynchus*. Neotypes of *Merlinius bavaricus* and *Bursaphelenchus fraudulentus* are designated.

Keywords Aphelenchida | Biodiversity | German Nematode Collection | Longidoridae | *Longidorus macroteromucronatus* | Nematofauna | *Paratrophurus striatus* | Trichodoridae | Tylenchida

1. Introduction

Nematodes are the most abundant Eumetazoa among soil organisms. Several million specimens are commonly present below a single square-meter of soil, with most of the nematodes with body lengths between 0.5–2 mm. The trophic groups range from bacterial and fungal feeders, predatory and zooparasitic taxa to nematodes feeding on plants (Yeates et al. 1993). Phytonematodes feeding on tissue of vascular plants are generally designated as 'plant parasites', although this term is mostly not in full agreement with the definition of the term 'parasite'. Because of their economic significance as known or potential agents causing damage, inciting galls or other malformations on plants, acting as vectors of plant viruses or otherwise being responsible for crop losses, these phytophagous nematodes have gained particular scientific interest and they are thus the best known trophic group among soil-inhabiting nematodes. In general, phytonematodes are members of the soil biocenosis in almost every biotope and soil type, natural or cultivated. Only a minor part of these species is considered being 'pathogenic' to plants.

The first plant-parasitic nematode reported and described from Germany by Steinbuch (1799) was an endoparasitic species now known as *Anguina agrostis*. During the 19th century a few more soil and plant nematodes were described or their occurrence in Germany was reported. Marcinowski (1909) mentioned 10 phytonematodes for Germany, Schneider (1939) listed 20 species, Goffart (1951) about 30 species, Goffart (1960) reported 49 'most important plant-parasitic nematodes'

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ISSN 1864-6417
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for Germany, and finally Meyl (1961) mentioned about 40 species now considered as plant-parasites (excluding those species, which were subsequently synonymised), but members of the genera *Heterodera* and *Meloidogyne* had not been included in this last mentioned publication. Sturhan (1984b) estimated the presence of at least 250 species of phytonematodes in Germany.

Knowledge of nematode diversity within a geographic area is of general scientific interest; furthermore, data on presence of individual taxa in a region or country are basic for correct species identification, which is particularly essential for plant-parasitic nematodes of economic significance (Sturhan 1984b). Because no comprehensive species lists have been available since Meyl's (1961) book publication, preliminary species lists of plant-parasitic nematodes known from Germany were compiled for identification courses given in the last years at Julius Kühn-Institut (formerly: Biologische Bundesanstalt für Land- und Forstwirtschaft, Institut für Nematologie und Wirbeltierkunde) in Münster and annually updated, with the last list (Sturhan 2012a) comprising 260 valid species previously recorded for Germany or more recently observed and established outdoors.

An updated and more detailed checklist of phytonematode genera and species found in Germany is given in the present paper. This compilation is restricted to phytophagous nematodes feeding on higher plants and mostly characterised as 'plant-parasitic'. These are, in particular, all members of the Dorylaimida family Longidoridae and species of the Triplonchida family Trichodoridae, which can cause direct damage to plants by feeding on roots; moreover, many species from both families are known to be vectors of plant viruses. From the order Tylenchida, all members of the suborders Hoplolaimina (with only a few exceptions) and Criconematina are generally classified as 'plant parasites', whereas most nematodes currently placed in the suborder Tylenchina are usually considered as 'root tip feeders' or mycelial feeders, without being of economic significance and thus not included in the present list. Only species of the genera *Cephalenchus* and *Pleurotylenchus*, which are mostly arranged in the family Tylodoridae, were designated as 'root feeding' (Yeates et al. 1993). In the Tylenchina family Anguinidae, members of the genera *Anguina* and *Subanguina* are obligate endoparasites, but only a few species in the genus *Ditylenchus* and few members of the Aphelenchida genera *Aphelenchoides*, *Bursaphelenchus* and *Paraphelenchus* are of economic importance as parasites of higher plants or as pests of mushroom cultures. Only these species are included in the present paper, in addition also *Subanguina askenasyi*, which causes galls in mosses, and *Halenchus fucicola*, which incites galls in marine brown algae.

For convenience, the classification used for the present paper largely follows the systematics used for nematodes in 'Fauna Europaea' (www.faunaeur.org/nematoda), in which both Tylenchida and Aphelenchida are considered as separate orders. Because of controversial opinions about ranking of taxa and expected fundamental future changes in nematode systematics, the brief overview given below (under heading 2.), showing the genera known from Germany and their current taxonomic position, will be restricted to orders, suborders (in Tylenchida only) and families.

Nematodes reported as established in Germany and to occur outdoors are given in the subsequent species list (under 3.); many of these species are recorded for Germany for the first time. Species reported from indoor plants only are listed separately (4.); these are not (yet) considered as members of the nematode fauna of Germany, but future establishment of certain species outdoors can probably be expected. The next list (5.) includes species, which were synonymised and species, which are considered as *species inquirendae*. In particular, species are included in this list, which had originally been described and reported from Germany. Under heading 6., doubtful records and species not reliably identified or incorrectly named are listed. Some of these records had previously been included in more general publications (Andrássy 2007, 2009 and others) as records for Germany or even for Europe. Use of outdated keys and other literature including the book of Meyl (1961), may have led to such doubtful identifications. In paragraph 7., data on selected genera and species are given, including information on unidentified populations and still undescribed species found in Germany.

The main objective of compiling the present species list is to summarise and update our knowledge of phytonematode taxa known from Germany, of species currently considered valid, and to provide information on their actual species designation and their taxonomic position. Moreover, the intent is to present a list of species originally described or reported from Germany, but later synonymised or not accepted as valid, and to critically review previous doubtful records for Germany. The list of plant-parasitic nematodes, which are established outdoors, increased to 268 species, including a few genera, for which no species have yet been identified from Germany. Besides the taxa listed, there is sampling material of a high number of still unidentified populations and undescribed species present in the 'Deutsche Nematoden Sammlung (Terrestrische Nematoden)' = German Nematode Collection (terrestrial nematodes) = DNST (Sturhan 1996). Brief data on a number of such taxa are given under heading 7.

2. Classification

The taxonomic position of the families and genera of phytonematodes known from Germany is presented below; only genera occurring outsdoors are included. Only a few synonyms of genera are given, which have recently been applied for nematodes occurring in Central Europe. There are some differences to the classification used for Fauna Europaea or presented in some recent publications. Merliniidae in the Tylenchida suborder Hoplolaimina is ranked as family, *Pratylenchoides* is transferred from the family Pratylenchidae to Merliniidae, *Paramerlinius* and *Macrotylenchus* are added as newly designated genera. The recently erected genus *Telomerlinius* is tentatively also included in Merliniidae (Siddiqi & Sturhan 2014). The genera *Geocenamus*, *Merlinius* and *Nagelus* were recently redefined (Sturhan 2012b). The synonymy of *Scutylenchus* with *Geocenamus* is accepted, in agreement with Geraert (2011), but different from Fauna Europaea, Siddiqi (2000) and Andrássy (2007), where both genera are treated separately. In the family Telotylenchidae (= Dolichodoridae of Geraert 2011) the genus *Bitylenchus* is considered as a synonym of *Tylenchorhynchus* and tranfer of European species of *Tylenchorhynchus* to the genus *Sauertylenchus* by Siddiqi (2000) is rejected (in accordance with Geraert 2011). In agreement with Fauna Europaea, Siddiqi (2000), Loof (2001), Brzeski (1998) and others the present author accepts synonymy of *Pararotylenchus* with *Rotylenchus*, which Castillo & Vovlas (2005) maintain as valid separate genera.

Among the genera in Criconematidae, it is preferred in this paper to consider *Crossonema* Mehta & Raski, 1971 as a synonym of *Ogma* for the time being (in accordance with Brzeski 1998 and Wouts 2006) and to reject the tranfer of *Ogma palmatus* to the genus *Croserinema* Khan, Chawla & Saha, 1976. *Mesocriconema hymenophorum* is retained in *Mesocriconema* in accordance with Brzeski et al. (2002) and not transferred to *Neobakernema* Ebsary, 1981 as proposed by Geraert (2010). In agreement with Fauna Europaea, Brzeski et al. (2002), Geraert (2010) and Andrássy (2007), *Macroposthonia* de Man, 1880 is not accepted as a valid name and species are incorporated into the genus *Mesocriconema*, which were formerly placed in *Macroposthonia*. The genus *Loofia*, considered as separate genus in Fauna Europaea and by Siddiqi (2000), is retained as synonymous with *Hemicycliophora*, in accordance with Chitambar & Subbotin (2014) and other authors. *Gracilacus* is considered synonymous with *Paratylenchus* in Fauna Europaea and in most recent publications (Brzeski 1998, Ghaderi et al. 2014 etc.), but is retained as valid genus by Andrássy (2007) and as subgenus of *Paratylenchus* by Siddiqi (2000).

Under Dorylaimida, the genus *Xiphinema* is included in Longidoridae and not placed in a separate family Xiphinematidae (as in Fauna Europaea). The synonymisation of *Siddiqia* with *Paralongidorus*, which is retained as separate genus by Andrássy (2009), is accepted in the present paper. In Trichodoridae, the previously proposed synonymisation of *Nanidorus* with *Paratrichodorus* is maintained.

TYLENCHIDA

Tylenchina

Tylodoridae

Cephalenchus Goodey, 1962

Pleurotylenchus Szczygieł, 1969

Anguinidae

Anguina Scopoli, 1777

Ditylenchus Filipjev, 1936

Halenchus N.A.Cobb in M.V. Cobb, 1933

Subanguina Paramonov, 1967
= *Heteroanguina* Chizhov, 1980
= *Mesoanguina* Chizhov & Subbotin, 1985

Hoplolaimina

Telotylenchidae

Macrotrophurus Loof, 1958

Meiodorus Siddiqi, 1976

Neodolichorhynchus Jairajpuri & Hunt, 1984
= *Dolichorhynchus* Mulk & Jairajpuri, 1974

Quinisulcius Siddiqi, 1971

Telotylenchus Siddiqi, 1960

Trophurus Loof, 1956

Tylenchorhynchus Cobb, 1913
= *Bitylenchus* Filipjev, 1934

Merliniidae

Amplimerlinius Siddiqi, 1976

Geocenamus Thorne & Malek, 1968
= *Scutylenchus* Jairajpuri, 1971

Macrotylenchus Sturhan, 2012

Merlinius Siddiqi, 1970

Nagelus Thorne & Malek, 1968

Paramerlinius Sturhan, 2012

Pratylenchoides Winslow, 1958

Telomerlinius Siddiqi & Sturhan, 2014

Heteroderidae
Globodera Skarbilovich, 1959
Heterodera Schmidt, 1871
Meloidodera Chitwood, Hannon & Esser, 1956
Punctodera Mulvey & Stone, 1976

Meloidogynidae
Meloidogyne Goeldi, 1892

Hoplolaimidae
Helicotylenchus Steiner, 1945
Rotylenchus Filipjev, 1936
= *Pararotylenchus* Baldwin & Bell, 1981

Rotylenchulidae
Rotylenchulus Linford & Oliveira, 1940
Verutus Esser, 1981

Pratylenchidae
Hirschmanniella Luc & Goodey, 1964
Hoplotylus s'Jacob, 1960
Pratylenchus Filipjev, 1936
Zygotylenchus Siddiqi, 1963

Criconematina

Criconematidae
Criconema Hofmänner & Menzel, 1914
= *Nothocriconema* De Grisse & Loof, 1965
Criconemoides Taylor, 1936
= *Criconemella* De Grissse & Loof, 1965
Hemicriconemoides Chitwood & Birchfield, 1957
Mesocriconema Andrássy, 1965
Ogma Southern, 1914
= *Crossonema* Mehda & Raski, 1971
Xenocriconemella De Grisse & Loof, 1965

Hemicycliophoridae
Hemicycliophora de Man, 1921
= *Loofia* Siddiqi, 1980

Paratylenchidae
Paratylenchus Micoletzky, 1922
= *Gracilacus* Raski, 1962

Sphaeronematidae
Meloidoderita Poghossian, 1966
Sphaeronema Raski & Sher, 1952

Tylenchulidae
Trophotylenchulus Raski, 1957
= *Trophonema* Raski, 1957

APHELENCHIDA

Aphelenchoididae
Aphelenchoides Fischer, 1894

Parasitaphelenchidae
Bursaphelenchus Fuchs, 1937

Paraphelenchidae
Paraphelenchus Micoletzky, 1922

DORYLAIMIDA

Longidoridae
Longidorus Micoletzky, 1922
Paralongidorus Siddiqi, Hooper & Khan, 1963
= *Siddiqia* Khan, Chawla & Saha, 1978
Xiphinema Cobb, 1913

TRIPLONCHIDA

Trichodoridae
Paratrichodorus Siddiqi, 1974
= *Nanidorus* Siddiqi, 1974
Trichodorus Cobb, 1913

3. List of outdoor species

The nematodes listed below are considered as members of the German nematode fauna. Most of the species are assumed to be indigenous; many of them were obviously introduced and a few are quite recent 'neozoa', which have meanwhile established locally outdoors. A few genera are included, of which still undecribed species have been discovered in Germany.

The genera are arranged in the sequence shown in the classification presented above (under heading 2.) and the species are arranged alphabetically within each genus. Synonyms are given only, where the generic position is different from that used in Fauna Europaea or by Andrássy (2007, 2009), Geraert (2008, 2010, 2011) and Siddiqi (2000). Detailed lists of synonyms are to be found in relevant monographic publications. In only a few cases other publications are mentioned and taxonomic remarks are added.

The following **symbols and marks** are used in the list of species given below, in part also in the lists under headings 4. and 5.:

* = Species, which were originally described from Germany and with their type locality in Germany.
V = Voucher specimens collected in Germany on permanent microscopical slides deposited in the German Nematode Collection (DNST).
T = Type specimens (holotype, neotype, paratypes, topotypes) from Germany also deposited in DNST.
• = Species recovered in arable or horticultural soils, including vineyards, hop gardens etc., but excluding various types of grassland, forests, banks of inland waters, salt marshes, saline coastal soils and other biotopes close to natural.
○ = Species, which are only exceptionally found in cultivated soil.
- = Species generally occurring in more or less 'natural' habitats and not expected to be present in cultivated soil.

Those species, which were recovered in Germany too rarely to provide information on eventual occurrence in cultivated soils, are left without any mark. This is also the case for mycophagous species of economic significance for mushroom cultivation and species isolated from wood of trees (*Bursaphelenchus* spp.).

The information on potential occurrence and probable absence of individual species in arable and other farmed land is considered as an aid to facilitate correct species identification of commonly occurring plant-parasites. In general, phytophagous nematodes are expected to be present in any biotope with vascular plants. Moreover, the species list given below will hopefully assist in using currently accepted species and genus designations.

TYLENCHIDA

Tylodoridae Paramonov, 1967

Cephalenchus hexalineatus (Geraert, 1962) Geraert & Goodey, 1964 (V) ○

Cephalenchus illustris Andrássy, 1984 (V)

Cephalenchus leptus Siddiqi, 1963 -

*Pleurotylenchus *sachsi* (Hirschmann, 1952) Szczygieł, 1969 (V) -

Anguinidae Nicoll, 1935

*Anguina *agrostis* (Steinbuch, 1799) Filipjev, 1936 (V) ○

Anguina graminis (Hardy, 1850) Filipjev, 1936 -

Anguina tritici (Steinbuch, 1799) Filipjev, 1936 (V) •

*Ditylenchus *convallariae* Sturhan & Friedman, 1965 (VT) •

Ditylenchus destructor Thorne, 1945 (V) •

*Ditylenchus *dipsaci* (Kühn, 1857) Filipjev, 1936 (V) •

Ditylenchus gigas Vovlas, Troccoli, Palomares-Rius, De Luca, Liébanas, Landa, Subbotin & Castillo, 2011 (V) •

Ditylenchus myceliophagus Goodey, 1958 (V)

Halenchus fucicola (de Man & Barton in de Man, 1892) Cobb & Cobb, 1933 -

*Subanguina *askenasyi* (Bütschli, 1873) Brzeski, 1981 -

Subanguina graminophila (Goodey, 1933) Brzeski, 1981 (V) -

Subanguina millefolii (Löw, 1874) Brzeski, 1981 (V)

*Subanguina *radicicola* (Greeff, 1872) Paramonov, 1967 (V) ○

Telotylenchidae Siddiqi, 1960

Macrotrophurus arbusticola Loof, 1958 (V) ○

Meiodorus spec. (V) -
An undescribed species, which is tentatively arranged in this genus, has been found in Germany (see below).

Neodolichorhynchus judithae (Andrássy, 1962) Jairajpuri & Hunt, 1984 (V) •
Synonymised by Brzeski (1998) with *N. microphasmis*, but retained as separate species in Fauna Europaea and in various recent publications.

Neodolichorhynchus lamelliferus (de Man, 1880) Volkova, 1993 (V) ○

Neodolichorhynchus microphasmis (Loof, 1960) Jairajpuri & Hunt, 1984 (V) ○

Quinisulcius capitatus (Allen, 1955) Siddiqi, 1971 (V) ○

Telotylenchus ventralis Loof, 1963 (V) •

Trophurus imperialis Loof, 1956 (V) •

Trophurus sculptus Loof, 1956 (V) •

Tylenchorhynchus aduncus de Guiran, 1967 (V) -

Tylenchorhynchus bursifer Loof, 1960 (V) -
= *Paratrophurus bursifer* (Loof, 1960) Siddiqi, 1971
Returned to the genus *Tylenchorhynchus* by Sturhan & Liskova (2004), but still retained in *Paratrophurus* by Andrássy (2007), Geraert (2011) and in Fauna Europaea.

*Tylenchorhynchus *bryobius* Sturhan, 1966 (VT) -
= *Bitylenchus bryobius* (Sturhan, 1966) Jairajpuri, 1982

Tylenchorhynchus casigo nom. nov. (V) -
= *Paratrophurus striatus* Castillo, Siddiqi & Gomez-Barcina, 1989

Tylenchorhynchus clarus Allen, 1955 (V) •

Tylenchorhynchus claytoni Steiner, 1937 (V) •

*Tylenchorhynchus *dubius* (Bütschli, 1873) Filipjev, 1936 (V) •
= *Bitylenchus dubius* (Bütschli, 1873) Filipjev, 1934

*Tylenchorhynchus *huesingi* Paetzold, 1958
= *Bitylenchus huesingi* (Paetzold, 1958) Jairajpuri, 1982

Tylenchorhynchus latus Allen, 1955

Tylenchorhynchus maximus Allen, 1955 (V) •
= *Bitylenchus maximus* (Allen, 1955) Siddiqi, 1986
= *Sauertylenchus maximus* (Allen, 1955) Siddiqi, 2000

Tylenchorhynchus striatus Allen, 1955 (V) -

Merliniidae Ryss, 1993

Amplimerlinius globigerus Siddiqi, 1979 (V) ○

Amplimerlinius icarus (Wallace & Greet, 1964) Siddiqi, 1976 (V) •

Amplimerlinius macrurus (Goodey, 1932) Siddiqi, 1976 (V) •

Geocenamus arcticus (Mulvey, 1969) Tarjan, 1973 (V)
Syn. of *G. tenuidens* for Brzeski (1998) and Sturhan (2012b), but retained as separate species in Fauna Europaea, by Geraert (2011) and other authorities.

Geocenamus lenorus (Brown, 1956) Brzeski, 1991 (V) ○
= *Scutylenchus lenorus* (Brown, 1956) Siddiqi, 1979

Geocenamus longus (Wu, 1969) Tarjan, 1973 (V) -

Geocenamus quadrifer **(**Andrássy, 1954) Brzeski, 1991 (V) •
= *Scutylenchus quadrifer* (Andrássy, 1954) Siddiqi, 1979

Geocenamus rugosus (Siddiqi, 1963) Brzeski, 1991 (V) ○
= *Scutylenchus rugosus* (Siddiqi, 1963) Siddiqi, 1979 (V)

Geocenamus tartuensis (Krall, 1959) Brzeski, 1991 (V) •
= *Scutylenchus tartuensis* (Krall, 1959) Siddiqi, 1979

Geocenamus tenuidens Thorne & Malek, 1968 (V) •

Geocenamus tessellatus (Goodey, 1952) Brzeski, 1991 (V) •
= *Scutylenchus tessellatus* (Goodey, 1952) Siddiqi, 1979

Geocenamus thomasi (Skwiercz, 1984) Brzeski, 1991 (V)
= *Scutylenchus thomasi* Skwiercz, 1984

Geocenamus tumensis (Skwiercz, 1984) Brzeski, 1991 (V)
= *Scutylenchus tumensis* Skwiercz, 1984

*Macrotylenchu *hylophilus* Sturhan, 2012 (VT) -

*Merlinius *bavaricus* (Sturhan, 1966) Siddiqi, 1970 (VT) ○
= *Geocenamus bavaricus* (Sturhan, 1966) Brzeski, 1991

Merlinius brevidens (Allen, 1955) Siddiqi, 1970 (V) •
= *Geocenamus brevidens* (Allen, 1955) Brzeski, 1991

Merlinius joctus (Thorne, 1949) Sher, 1974 (V) ○
= *Geocenamus joctus* (Thorne, 1949) Brzeski, 1991

Merlinius microdorus (Geraert, 1966) Siddiqi, 1970 (V) •
= *Geocenamus microdorus* (Geraert, 1966) Brzeski, 1991

Merlinius nanus (Allen, 1955) Siddiqi, 1970 (V) •
= *Geocenamus nanus* (Allen, 1955) Brzeski, 1991

Merlinius nothus (Allen, 1955) Siddiqi, 1970 (V) •
= *Geocenamus nothus* (Allen, 1955) Brzeski, 1991

Merlinius processus Siddiqi, 1979 (V)
= *Geocenamus processus* (Siddiqi, 1979) Brzeski, 1991

Nagelus leptus (Allen, 1955) Siddiqi, 1979 (V) ○

Nagelus obscurus (Allen, 1955) Powers, Baldwin & Bell, 1983 (V) •

*Paramerlinius *hexagrammus* (Sturhan, 1966) Sturhan, 2012 (VT) •
= *Nagelus hexagrammus* (Sturhan, 1966) Siddiqi, 1979

*Pratylenchoides *acuticauda* Ryss & Sturhan, 2001 (VT) -

*Pratylenchoides *arenicola* Ryss & Sturhan, 2001 (VT) -

Pratylenchoides bacilisemenus Sher, 1970 (V) -

Pratylenchoides crenicauda Winslow, 1958 (V) •

Pratylenchoides laticauda Braun & Loof, 1967 (V) •

Pratylenchoides magnicauda (Thorne, 1935) Baldwin, Luc & Bell, 1983 (V) -

Pratylenchoides maritimus Bor & s'Jacob, 1966 (V) -

Pratylenchoides ritteri Sher, 1970 (V) -

*Pratylenchoides *rivalis* Ryss & Sturhan, 2001 (VT) -

*Telomerlinius *mellumensis* Siddiqi & Sturhan, 2014 (VT) -

Pratylenchidae Thorne, 1949

Hirschmanniella behningi (Micoletzky, 1923) Luc & Goodey, 1964 (V) -

Hirschmanniella gracilis (de Man, 1880) Luc & Goodey, 1964 (V) ○

Hirschmanniella loofi Sher, 1968 (V) -

*Hirschmanniella *halophila* Sturhan & Hallmann, 2010 (VT) -

Hoplotylus femina s'Jacob, 1960 (V) -

Pratylenchus convallariae Seinhorst, 1959 (V) •

Pratylenchus crenatus Loof, 1960 (V) •

Pratylenchus fallax Seinhorst, 1968 (V) •

Pratylenchus flakkensis Seinhorst, 1968 (V) •

*Pratylenchus *neglectus* (Rensch, 1924) Filipjev & Schuurmans Stekhoven, 1941 (V) •

Pratylenchus penetrans (Cobb, 1917) Filipjev & Schuurmans Stekhoven, 1941 (V) •

Pratylenchus pratensis (de Man, 1880) Filipjev, 1936 (V) ○

Pratylenchus pseudopratensis Seinhorst, 1968

Pratylenchus thornei Sher & Allen, 1953 (V) •

Pratylenchus vulnus Allen & Jensen, 1951 (V) •

Zygotylenchus guevarai (Tobar Jiménez, 1963) Brown & Loof, 1966 (V) •

Hoplolaimidae Filipjev, 1934

Helicotylenchus canadensis Waseem, 1961 (V) •
= *Helicotylenchus pseudodigonicus* Szczygieł, 1970
H. pseudodigonicus retained as separate species by Siddiqi (2000) and in Fauna Europaea.

Helicotylenchus cephalatus Brzeski, 1998 (V) -

Helicotylenchus coomansi Ali & Loof, 1975 (V)

Helicotylenchus digonicus Perry in Perry, Darling & Thorne, 1959 (V) •

Helicotylenchus paxilli Yuen, 1964 (V) -

Helicotylenchus pseudorobustus (Steiner, 1914) Golden, 1956 (V) •

Helicotylenchus varicaudatus Yuen, 1964 (V) •

Helicotylenchus vulgaris Yuen, 1964 (V) •

Rotylenchus agnetis Szczygieł, 1968 (V) ○

Rotylenchus blothrotylus (Baldwin & Bell, 1981) Brzeski & Choi, 1998 (V)

Rotylenchus buxophilus Golden, 1956 (V) -

Rotylenchus capitatus Eroshenko, 1981 (V) ○

Rotylenchus goodeyi Loof & Oostenbrink, 1958 (V) •

Rotylenchus laurentinus Scognamiglio & Talamé, 1973 (V) •

Rotylenchus pumilus (Perry in Perry, Darling & Thorne, 1959) Sher, 1961 (V)

Rotylenchus quartus (Andrássy, 1958) Sher, 1961 (V)

Rotylenchus robustus (de Man, 1876) Filipjev, 1936 (V) •
= *Rotylenchus fallorobustus* Sher, 1965
From Germany previously mostly reported as *R. fallorobustus*. Present species definition following Brzeski (1998) and Loof (2001) and definitions of *R. fallorobustus* given by Bongers (1988) and Andrássy (2007). Not in agreement with the definition of *R. robustus* given by Castillo & Vovlas (2005)!

Rotylenchus rugatocuticulatus Sher, 1965

Rotylenchus uniformis (Thorne, 1949) Loof & Oostenbrink, 1958 (V) •
From Germany previously mostly reported as *R. robustus*. Species definition now following Brzeski (1998) and Loof (2001) and definitions of *R. robustus* by Bongers (1988) and Andrássy (2007). Not in agreement with the definition of *R. uniformis* given by Castillo & Vovlas (2005), who curiously listed *R. uniformis* also among the synonyms of *R. robustus* (!), the same as Siddiqi (2000).
Rotylenchus uniformis is not included among the *Rotylenchus* species listed in Fauna Europaea.

Rotylenchulidae Husain & Khan, 1967

Rotylenchulus borealis Loof & Oostenbrink, 1962 (V) •

Verutus spec. (V) -
Genus not mentioned in Fauna Europaea; an undescribed species is present in Germany (see below).

Heteroderidae Filipjev & Schuurmans Stekhoven, 1941

Globodera artemisiae (Eroshenko & Kazachenko, 1972) Behrens, 1975 (V)

Globodera millefolii (Kirjanova & Krall, 1965) Behrens, 1975 (V)

= *Globodera achilleae* (Golden & Klindić, 1973) Behrens, 1975

Globodera pallida (Stone, 1973) Behrens, 1975 (V) •

*Globodera *rostochiensis* (Wollenweber, 1923) Skarbilovich, 1959 (V) •

Heterodera arenaria Cooper, 1955 (V) -

*Heterodera *avenae* Wollenweber, 1924 (V) •

*Heterodera *betae* Wouts, Rumpenhorst & Sturhan, 2001 (VT) •

Heterodera bifenestra Cooper, 1955 (V) ○

Heterodera carotae Jones, 1950 (V) •

*Heterodera *circeae* Subbotin & Sturhan, 2004 (VT) -

Heterodera cruciferae Franklin, 1945 (V) •

*Heterodera *daverti* Wouts & Sturhan, 1978 (VT)

Heterodera filipjevi (Madzhidov, 1981) Stelter, 1984 (V) •

*Heterodera *galeopsidis* Goffart, 1936 (V) •
Listed among valid species by Sturhan (2006) and Subbotin et al. (2010b); considered as syn. of *H. trifolii* in Fauna Europaea and by Siddiqi (2000).

*Heterodera *goettingiana* Liebscher, 1892 (V) •

Heterodera hordecalis Andersson, 1975 (V) •

Heterodera humuli Filipjev, 1934 (V) •

Heterodera mani Mathews, 1971 (V) ○

*Heterodera *pratensis* Gäbler, Sturhan, Subbotin & Rumpenhorst, 2000 (VT)

Heterodera ripae Subbotin, Sturhan, Rumpenhorst & Moens, 2003 (VT)

Heterodera salixophila Kirjanova, 1969 (V) -

*Heterodera *schachtii* Schmidt, 1871 (V) •

*Heterodera *scutellariae* Subbotin & Sturhan, 2004 (VT) -

*Heterodera *trifolii* Goffart, 1932 (VT) •

Heterodera urticae Cooper, 1955 (V) ○

Heterodera ustinovi Kirjanova, 1969 (V) ○

Meloidodera alni Turkina & Chizhov, 1986 (V) -

Punctodera punctata (Thorne, 1928) Mulvey & Stone, 1976 (V) •

Punctodera stonei Brzeski, 1998 (V)

Meloidogynidae Skarbilovich, 1959

Meloidogyne ardenensis Santos, 1968 (V) ○

Meloidogyne chitwoodi Golden, O´Bannon, Santo & Finley, 1980 (V) •

Meloidogyne fallax Karssen, 1996 (V) •

Meloidogyne hapla Chitwood, 1949 (V) •

Meloidogyne kralli Jepson, 1984 (V) -

Meloidogyne maritima Jepson, 1987 (V) -
First reported for Germany and later also for other European countries as *Meloidogyne graminis* Sledge & Golden, 1964.

Meloidogyne naasi Franklin, 1965 (V) •

Criconematidae Taylor, 1936

Criconema annuliferum (de Man, 1921) Micoletzky, 1925 (V) ○
= *Criconemoides annulifer* (de Man, 1921) Taylor, 1936
= *Criconema kirjanovae* Krall, 1963

Criconema demani Micoletzky, 1925 (V)

Criconema longulum Gunhold, 1953 (V) ○

Criconema loofi (De Grisse, 1967) Raski & Luc, 1985 (V) -

Criconema mutabile (Taylor, 1936) Raski & Luc, 1965 (V)

Criconema princeps (Andrássy, 1962) Raski & Luc, 1985 (V) -
= *Criconema tribule* (Raski & Golden, 1966) Siddiqi, 1986
Valid species for Zell (1987).

Criconema sphagni Micoletzky, 1925 (V) ○

Criconemoides amorphus De Grisse, 1967 (V) ○

Criconemoides informis (Micoletzky, 1922) Taylor, 1936 (V) •
= *Criconemoides flandriensis* De Grisse, 1964

Criconemoides morgensis (Hofmänner in Hofmänner & Menzel, 1914) Taylor, 1936 (V)
= *Criconemoides pseudohercyniensis* De Grisse & Koen, 1964

Criconemoides parvus Raski, 1952 (V)

Hemicriconemoides pseudobrachyurus De Grisse, 1964 (V) -

Mesocriconema antipolitanum (de Guiran, 1963) Loof & De Grisse, 1989 (V)

Mesocriconema axeste (Fassuliotis & Williamson, 1959) Loof & De Grisse, 1989 (V)

Mesocriconema crenatum (Loof, 1964) Andrássy, 1965 (V)

Mesocriconema curvatum (Raski, 1952) Loof & De Grisse, 1989 (V)

Mesocriconema dherdei (De Grisse, 1967) Loof & De Grisse, 1989 (V) ○

*Mesocriconema *hymenophorum* Wouts & Sturhan, 1999 (VT) -
= *Neobakernema hymenophorum* (Wouts & Sturhan, 1999) Geraert, 2010

Mesocriconema involutum (Loof, 1987) Loof, 1989 (V)

Mesocriconema irregulare (De Grisse, 1964) Loof & De Grisse, 1989 (V) -

Mesocriconema kirjanovae (Andrássy, 1962) Loof & De Grisse, 1989 (V)
= *Mesocriconema annulatiforme* (De Grisse & Loof, 1967) Loof & De Grisse, 1989

Mesocriconema maritimum (De Grisse, 1964) Loof & De Grisse, 1989 (V) -

Mesocriconema pseudosolivagum (De Grisse, 1964) Andrássy, 1965 (V)

Mesocriconema raskiense (De Grisse, 1964) Andrássy, 1965 (V)

Mesocriconema rotundicauda (Loof, 1964) Loof, 1989 (V) -

Mesocriconema rusticum (Micoletzky, 1915) Loof & De Grisse, 1989 (V) ○

Mesocriconema solivagum (Andrássy, 1962) Loof & De Grisse, 1969 (V)

Mesocriconema sphaerocephalum (Taylor, 1936) Loof, 1989 (V) ○

Mesocriconema vadense (Loof, 1964) Loof & De Grisse, 1989 (V)

Mesocriconema xenoplax (Raski, 1952) Loof & De Grisse, 1989 (V) •

Ogma cobbi (Micoletzky, 1925) Siddiqi, 1986 (V) -

Ogma hungaricus (Andrássy, 1962) Siddiqi, 1986 (V) -

Ogma menzeli (Stefański, 1924) Schuurmans Stekhoven & Teunissen, 1938 (V) -
= *Crossonema menzeli* (Stefański, 1924) Mehta & Raski, 1971
= *Criconema aculeatum* (Schneider, 1939) de Coninck, 1945

Ogma multisquamatus Kirjanova, 1948 (V) ○
= *Crossonema multisquamatum* (Kirjanova, 1948) Mehta & Raski, 1971

Ogma murrayi Southern, 1914 (V) -

Ogma octangularis (Cobb, 1914) Schuurmans Stekhoven & Teunissen, 1938

Ogma palmatus (Siddiqi & Southey, 1962) Siddiqi, 1986 (V) ○
= *Croserinema palmatum* (Siddiqi & Southey, 1962) Khan, Chawla & Saha, 1976

*Ogma *septemlineatus* Wouts & Sturhan, 2002 (VT) -

Ogma zernovi Kirjanova, 1948 (V) -

Xenocriconemella macrodora (Taylor, 1936) De Grisse & Loof, 1965 (V) -

Hemicycliophoridae Skarbilovich, 1959

Hemicycliophora aquatica (Micoletzky, 1913) Loos, 1948 (V) -
= *Hemicycliophora macristhmus* Loof, 1968
Brzeski (1998) synonymised this species with *H. aquatica*; Loof (2001) and Chitambar & Subbotin (2014) accepted the synonymy, but Siddiqi (2000), Andrássy (2007) and Fauna Europaea retained *H. macristhmus* as valid species.

Hemicycliophora conida Thorne, 1955 (V) •

Hemicycliophora epicharoides Loof, 1968 (V) -

*Hemicycliophora *micoletzkyi* Goffart, 1951 (V) -

Hemicycliophora nucleata Loof, 1968 (V) -

Hemicycliophora robusta Loof, 1968 (V) -
= *Loofia robusta* (Loof, 1968) Siddiqi, 1980

*Hemicycliophora *thienemanni* (Schneider, 1925) Loos, 1948 (V) ○
= *Loofia thienemanni* (Schneider, 1925) Siddiqi, 1980
Accomodated in *Loofia* in Fauna Europaea, but genus *Loofia* not accepted by Andrássy (2007) and other authorities.

Hemicycliophora thornei Goodey, 1963 (V) -

Hemicycliophora triangulum Loof, 1968 (V) ○

Hemicycliophora typica de Man, 1921 (V) ○

Paratylenchidae Thorne, 1949

Paratylenchus aculentus Brown, 1959 (V) -

Paratylenchus bukowinensis Micoletzky, 1922 (V) •

Paratylenchus dianthus Jenkins & Taylor, 1956

Paratylenchus goodeyi Oostenbrink, 1953 (V)

Paratylenchus hamatus Thorne & Allen, 1950 (V)

Paratylenchus macrodorus Brzeski, 1963 (V) •

Paratylenchus microdorus Andrássy, 1959 (V) •

Paratylenchus nanus Cobb, 1923 (V) •

*Paratylenchus *neoamblycephalus* Geraert, 1965 •

*Paratylenchus *peraticus* (Raski, 1962) Siddiqi & Goodey, 1964 (VT) •

Paratylenchus projectus Jenkins, 1956 (V)
= *Paratylenchus *amblycephalus* Reuver, 1959

Paratylenchus similis Khan, Prasad & Mathur, 1967 (V)

= *Paratylenchus italiensis* Raski, 1975
= *Paratylenchus tateae* Wu & Townshend, 1973
Andrássy (2007) accepted the synonymisation of *P. italiensis* with *P. similis* by Brzeski (1995), but retained *P. tateae* as separate species; Siddiqi (2000) and Fauna Europaea retain both *P. italiensis* and *P. tateae* as valid species.

Paratylenchus straeleni (de Coninck, 1931) Oostenbrink, 1960 (V) -

Sphaeronematidae Raski & Sher, 1952

Meloidoderita kirjanovae Poghossian, 1966 (V) -

Meloidoderita salina Ashrafi, Mugniery, van Heese, van Aelst, Helder & Karssen, 2012 (V) -

Sphaeronema alni Turkina & Chizhov, 1986 (V) -

Sphaeronema rumicis Kirjanova, 1970 (V)

Tylenchulidae Skarbilovich, 1947

Trophotylenchulus arenarius (Raski, 1956) Siddiqi, 1999 (V) -

APHELENCHIDA

Aphelenchoididae Skarbilovich, 1947

Aphelenchoides blastophthorus Franklin, 1952 (V) •

Aphelenchoides composticola Franklin, 1957 (V)

Aphelenchoides fragariae (Ritzema Bos, 1890) Christie, 1932 (V) •

*Aphelenchoides *ritzemabosi* (Schwartz, 1911) Steiner & Buhrer, 1932 (V) •

Aphelenchoides saprophilus Franklin, 1957 (V)

Aphelenchoides subtenuis (Cobb, 1926) Steiner & Buhrer, 1932

Paraphelenchidae Micoletzky, 1922

Paraphelenchus myceliophthorus Goodey, 1958

Paraphelenchus pseudoparietinus Micoletzky, 1922 (V) ○

Parasitaphelenchidae

*Bursaphelenchus *fraudulentus* (Rühm, 1956) Goodey, 1960 (VT) -

Bursaphelenchus mucronatus Mamiya & Enda, 1979 (V) -

DORYLAIMIDA

Longidoridae Thorne, 1935

Longidorus andalusicus Gutiérrez-Gutiérrez, Cantalapiedra-Navarrete, Montes-Borrego, Palomares-Rius & Castillo, 2013 (V) -

Longidorus arthensis Brown, Grunder, Hooper, Klingler & Kunz, 1994 (V) •

Longidorus attenuatus Hooper, 1961 (V) •

Longidorus caespiticola Hooper, 1961 (V) •

Longidorus carpathicus Liskova, Robbins & Brown, 1997 (V) -

Longidorus cylindricaudatus Kozłowska & Seinhorst, 1979 (V) -

Longidorus dunensis Brinkman, Loof & Barbez, 1987 -

Longidorus elongatus (de Man, 1876) Micoletzky, 1922 (V) •

Longidorus goodeyi Hooper, 1961 (V) ○

Longidorus helveticus Lamberti, Kunz, Grunder, de Luca, Agostinelli & Radicci, 2001 (V)

Longidorus intermedius Kozłowska & Seinhorst, 1979 (V) ○

Longidorus juvenilis Dalmasso, 1969 (V) ○

Longidorus leptocephalus Hooper, 1961 (V) •

Longidorus macrosoma Hooper, 1961 (V) •

*Longidorus *paraelongatus* Altherr, 1974 -

*Longidorus *poessneckensis* Altherr, 1974 (V) -
= *Longidorus *macroteromucronatus* Altherr, 1974, new synonymy

Longidorus profundorum Hooper, 1966 (V) •

*Longidorus *proximus* Sturhan & Argo, 1983 (VT) •

*Longidorus *pseudoelongatus* Altherr, 1976 -

Longidorus seinhorsti Peneva, Loof & Brown, 1998 (V)

Longidorus sturhani Rubtsova, Subbotin, Brown & Moens, 2001 (VT) •

*Longidorus *vineacola* Sturhan & Weischer, 1964 (VT) •

*Paralongidorus *maximus* (Bütschli, 1874) Siddiqi, 1964 (V) •
= *Siddiqia maxima* (Bütschli, 1874) Khan, Chawla & Saha, 1978

*Xiphinema coxi *europaeum* Sturhan, 1985 (VT) •

*Xiphinema *dentatum* Sturhan, 1978 (VT) -

Xiphinema diversicaudatum (Micoletzky, 1927) Thorne, 1939 (V) •

*Xiphinema *globosum* Sturhan, 1978 (VT) -

Xiphinema index Thorne & Allen, 1950 (V) •

Xiphinema pachtaicum (Tulaganov, 1938) Kirjanova, 1951 (V) •

*Xiphinema *pseudocoxi* Sturhan, 1985 (VT) ○

Xiphinema rivesi Dalmasso, 1969 (V) ○

Xiphinema taylori Lamberti, Ciancio, Agostinelli & Coiro, 1992 (V) ○
For Germany first reported as *X. brevicolle* and *X. brevicollum* Lordello & Da Costa, 1961; Andrássy (2009) considers *X. taylori* as synonymous with *X. brevicollum.*

*Xiphinema *vuittenezi* Luc, Lima, Weischer & Flegg, 1964 (VT) •

TRIPLONCHIDA

Trichodoridae (Thorne, 1935) Clark, 1961

Paratrichodorus anemones (Loof, 1965) Siddiqi, 1974 •

Paratrichodorus nanus (Allen, 1957) Siddiqi, 1974 (V) •

Paratrichodorus pachydermus (Seinhorst, 1954) Siddiqi, 1974 (V) •

Paratrichodorus renifer Siddiqi, 1974 (V) •
First reported for Germany as *Trichodorus christiei* Allen, 1957 and *T. minor* Colbran, 1956.

Paratrichodorus teres (Hooper, 1962) Siddiqi, 1974 (V) •

*Paratrichodorus *weischeri* Sturhan, 1985 (VT) •

Trichodorus cylindricus Hooper, 1962 (V) •

Trichodorus primitivus (de Man, 1880) Micoletzky, 1922 (V) •

Trichodorus similis Seinhorst, 1963 (V) •

Trichodorus sparsus Szczygieł, 1968 (V) ○
First reported for Germany as *Trichodorus aequalis* Allen, 1957.

Trichodorus variopapillatus Hooper, 1972 (V) ○

Trichodorus velatus Hooper, 1972 (V) •

Trichodorus viruliferus Hooper, 1963 (V) •

4. Indoor species

Species reported from greenhouse plants or only exceptionally found outside are listed below. Species, which are locally established outdoors, were already included in the list above (*Paratrichodorus renifer*, *Pratylenchus vulnus*, *Tylenchorhynchus claytoni*). Additional species were identified in quarantine inspections, but are not known to be established in Germany on ornamentals or other greenhouse plants, among others, *Bursaphelenchus* spp., *Cryphodera brinkmani*, *Helicotylenchus exallus*, *Hirschmanniella caudacrena*, *H. oryzae*, *Paratrichodorus minor*, *P. porosus*, *Rotylenchulus parvus*, *R. reniformis*, *Tylenchorhynchus leviterminalis*, *T. mexicanus*, *Tylenchulus semipenetrans, Xiphinema 'americanum*'.

Cactodera cacti (Filipjev & Schuurmans Stekhoven, 1941) Krall & Krall, 1978 (V)

Helicotylenchus dihystera (Cobb, 1893) Sher, 1961 (V)

Helicotylenchus erythrinae (Zimmermann, 1904) Golden, 1956

Helicotylenchus multicinctus (Cobb, 1893) Golden, 1956

Helicotylenchus retusus Siddiqi & Brown, 1964

Heterodera fici Kirjanova, 1954 (V)

Meloidogyne arenaria (Neal, 1889) Chitwood, 1949 (V)

Meloidogyne incognita (Kofoid & White, 1919) Chitwood, 1949 (V)

Meloidogyne javanica (Treub, 1885) Chitwood, 1949 (V)

Meloidogyne thamesi Chitwood in Chitwood, Specht & Havis, 1952

Paratylenchus minutus Linford in Linford, Oliveira & Ishii, 1949

*Pratylenchus *acuticaudatus* Braasch & Decker, 1989 (VT)

Pratylenchus coffeae (Zimmermann, 1898) Filipjev & Schuurmans Stekhoven, 1941
Reported as *Pratylenchus musicola* (Cobb, 1919) by Goffart (1953).

Pratylenchus scribneri Steiner in Sherbakoff & Stanley, 1943

Pratylenchus wescolagricus Corbett, 1984

Radopholus similis (Cobb, 1893) Thorne, 1949 (V)

Scutellonema brachyurus (Steiner, 1938) Andrássy, 1958 (V)

5. Synonyms and species inquirendae

The list below includes species synonymised with species mentioned above (under 3.), in particular, species accomodated in other genera in commonly used more recent publications and keys (Bongers 1988, Andrássy 2007, and others). In addition species are included,

which are generally considered as *species inquirenda* or *species dubia*. Moreover, many species are listed, which were originally described from Germany and later synonymised (marked: *). Synonyms not included in the present list are found in more general taxonomic publications (Siddiqi 2000; Andrássy 2007, 2009; Brzeski 1998; Geraert 2010, 2011; Hunt 1993; and others).

Amplimerlinius caroli (Fortuner, 1985) Siddiqi, 1986 = *Amplimerlinius macrurus*

Anguina radicicola (Greeff, 1872) Teploukhova, 1967 = *Subanguina radicicola*

Aphelenchoides olesistus (Ritzema Bos, 1892) Steiner, 1932 = *Aphelenchoides fragariae*

*Aphelenchoides olesistus *longicollis* (Schwartz, 1911) Goodey, 1933 = *Aphelenchoides fragariae*

Bitylenchus spp. = *Tylenchorhynchus* spp.

*Criconema *goffarti* Volz, 1951 (VT) = *Xenocriconemella macrodora*

Criconemella degrissei Lübbers & Zell, 1989 = *Xenocriconemella macrodora*

Criconemella macrodora (Taylor, 1936) Luc & Raski, 1981 = *Xenocriconemella macrodora*

Criconemella parva (Raski, 1952) De Grisse & Loof, 1965 = *Criconemoides parvus*

*Criconema *elegantulum* Gunhold, 1953 = *Criconema longulum*

Criconema guernei (Certes, 1889) *apud* Meyl (1961) = *Ogma menzeli*

Criconema menzeli Taylor, 1936 *apud* Paesler (1959) = *Ogma menzeli*

Criconema tribule (Raski & Golden, 1966) Siddiqi, 1966 = *Criconema princeps*
C. tribule valid species for Zell (1987) and retained as valid species in Fauna Europaea.

Criconemoides menzeli (Stefanski, 1924) *apud* Bassus 1962 = *Ogma menzeli*

*Criconemoides morgensis *hercyniensis* Kischke, 1956 = *Criconemoides morgensis*
Considered as *species inquirenda* by Siddiqi (2000).

Criconemoides rusticum (Micoletzky, 1915) Taylor, 1936 = *Mesocriconema rusticum*

Criconemoides sphagni (Micoletzky, 1925) Taylor, 1936 = *Criconema sphagni*

Dolichorhynchus spp. = *Neodolichorhynchus* spp.

Globodera achilleae (Golden & Klindić, 1973) Behrens, 1975 = *Globodera millefolii*

Gottholdsteineria spp. = *Rotylenchus* spp.

Gracilacus spp. = *Paratylenchus* spp.

Helicotylenchus pseudodigonicus Szczygieł, 1970 (V) = *Helicotylenchus canadensis*
Retained by Siddiqi (2000) and in Fauna Europaea as valid species.

Hemicycliophora membranifer (Micoletzky, 1925) Loos, 1948 = *Hemicycliophora typica*

Hemicycliophora straeleni (de Coninck, 1931) Loos, 1948 = *Paratylenchus straeleni*

*Hemicycliophora *strenzkei* Volz, 1951 = *Paratylenchus strenzkei* (Volz, 1951) Oostenbrink, 1960 = *species inquirenda*

Hemicycliophora typica apud Meyl (1955a, b, c) and Paetzold (1958a, b) = *Hemicycliophora thornei*

Heterodera iri Mathews, 1971 = *Heterodera ustinovi*

*Heterodera *longicaudata* Seidel, 1972 = *Heterodera bifenestra*

*Heterodera *riparia* Subbotin, Sturhan, Waeyenberge & Moens, 1997 = *Heterodera ripae*

Hirschmanniella diversa Sher, 1968 *apud* Decker & Mai (1972) = *Hirschmanniella behningi*

*Hirschmanniella *minor* (Goffart, 1933) Siddiqi, 1986 = *species inquirenda*

*Iota *aculeata* Schneider, 1939 = *Ogma menzeli*

*Longidorus *macroteromucronatus* Altherr, 1974 = *Longidorus poessneckensis*, new synonymy

*Longidorus *monohystera* Altherr, 1953 = *Longidorus elongatus*

Loofia spp. = *Hemicycliophora* spp.

Macroposthonia annulata de Man, 1880 = *species dubia*

Macroposthonia annulata apud Kischke, 1956 = *Criconema annuliferum*

Macroposthonia annulatiforme, *M. crenata*, *M. curvata, M. dherdei*, *M. irregularis, M. maritima*, *M. pseudosolivaga, M. raskiensis*, *M. rotundicauda, M. rustica*, *M. solivaga*, *M. sphaerocephala*, *M. vadensis*, *M. involuta*, *M. xenoplax* = *Mecocriconema* spp.

Meloidogyne acrita Chitwood, 1949 = *Meloidogyne incognita*

Meloidogyne graminis Sledge & Golden, 1964 *apud* Sturhan (1976) = *Meloidogyne maritima*
The record of *M. graminis* for Europe, cited by Andrássy (2007), is thus incorrect.

Meloidogyne thamesi Chitwood in Chitwood, Specht & Havis, 1952 = *M. arenaria*
Siddiqi (2000) and Fauna Europaea retain *M. thamesi* as valid species.

*Merlinius *semicircularis* Lüth, 1984 = *Merlinius nothus*

Nagelus hexagrammus (Sturhan, 1966) Siddiqi, 1979 = *Paramerlinius hexagrammus*

Pararotylenchus spp. = *Rotylenchus* spp.

*Paratylenchus *amblycephalus* Reuver, 1959 = *Paratylenchus projectus*
Synonymisation with *P. projectus* by Raski (1975) accepted by most authorities, but Siddiqi (2000) retained *P. amblycephalus* as valid species.

Paratylenchus macrophallus (de Man, 1880) Goodey, 1934 = *species inquirenda*
In Fauna Europaea listed among valid species.

*Paratylenchus *strenzkei* (Volz, 1951) Oostenbrink, 1960 = *species inquirenda*

Pratylenchoides arenarius Brzeski, 1998 = probably *Pratylenchoides bacilisemenus*

Pratylenchoides ivanovae Ryss, 1980 = *Pratylenchoides magnicauda*
Andrássy (2007) considers *P. ivanovae* as valid species.

Pratylenchus musicola (Cobb, 1919) Filipjev, 1936 *apud* Goffart (1953) = *Pratylenchus coffeae*

Radopholus gracilis apud Hirschmann (1955) = *Hirschmanniella gracilis*

Radopholus oryzae apud Hirschmann (1954) = *Hirschmanniella gracilis*

*Rotylenchus *deckeri* Braasch, 1980 (VT) = *species inquirenda*

Rotylenchus fallorobustus Sher, 1965 = *Rotylenchus robustus*

Sauertylenchus maximus (Allen, 1955) Siddiqi, 2000 = *Tylenchorhynchus maximus*

Scutylenchus spp. = *Geocenamus* spp.

Siddiqia maxima (Bütschli, 1874) Khan, Chawla, & Saha, 1978 = *Paralongidorus maximus*
Synonymy of *Siddiqia* with *Paralongidorus* accepted in most recent publications, but *Siddiqia* retained as separate genus by Andrássy (2009).

*Subanguina *klebahni* (Goffart, 1942) Siddiqi, 1986
Considered by Brzeski (1981) as *genus et species inquirenda* and not included in Fauna Europaea, but retained among valid species by Siddiqi (2000).

Tetylenchus joctus Thorne, 1949 = *Merlinius joctus*

Trophonema arenarium (Raski, 1956) Raski, 1957 = *Trophotylenchulus arenarius*

Tylenchorhynchus acti Allen, 1955 = *Quinisulcius capitatus*

Tylenchorhynchus bavaricus Sturhan, 1966 = *Merlinius bavaricus*

Tylenchorhynchus hexagrammus Sturhan, 1966 = *Paramerlinius hexagrammus*

Tylenchorhynchus lenorus Brown, 1956 = *Geocenamus lenorus*

Tylenchorhynchus nanus Allen, 1955 = *Merlinius nanus*

Tylenchorhynchus nothus Allen, 1955 = *Merlinius nothus*

Tylenchorhynchus ornatus Allen, 1955 = *Geocenamus quadrifer*

Tylenchorhynchus ventralis (Loof, 1963) Fortuner & Loof, 1987 = *Telotylenchus ventralis*

*Tylenchus *phlei* Horn, 1889 = *Anguina agrostis*

*Vibrio *phalaridis* Steinbuch, 1799 = *Anguina agrostis*

Xiphinema brevicolle/brevicollum Lordello & Da Costa, 1961 *apud* Rössner (1967), Sturhan (1967) and other authors = *Xiphinema taylori*

Xiphinema mediterraneum Martelli & Lamberti, 1967 = *Xiphinema pachtaicum*

*Xiphinema *paraelongatum* Altherr, 1958 = *Xiphinema diversicaudatum*

*Xenocriconemella *degrissei* (Lübbers & Zell, 1989) Brzeski, 1998 = *Xenocriconemella macrodora*
Synonymised by Sturhan (2013a), still retained as valid species in earlier publications and in Fauna Europaea.

6. Doubtful identifications or records

The species listed below were reported from Germany by various authors. Most of these records are considered here to be misidentifications, others need confirmation of identification, or the species in question were possibly observed in glasshouses only or were isolated from soil or plant samples imported to Germany. No voucher specimens originating from Germany are deposited in DNST and there is no information, if voucher specimens have been retained elsewhere.

Helicotylenchus anhelicus Sher, 1966

Helicotylenchus dihystera (Cobb, 1893) Sher, 1961
Outdoor records for Germany require verification.

Helicotylenchus erythrinae (Zimmermann, 1904) Golden, 1956
Meyl (1961) mentioned this subtropical/tropical species as commonly occurring in Central Europe; the species identity is unknown, also in several subsequent reports from Germany.

Helicotylenchus hydrophilus Sher, 1966

Helicotylenchus multicinctus (Cobb, 1893) Golden, 1956
The species identity of populations reported from Germany as *H. multicinctus* and *Rotylenchus multicinctus* by Meyl (1961) and other authors is unknown.

Helicotylenchus retusus Siddiqi & Brown, 1964

Hemicycliophora similis Thorne, 1955 *apud* Altherr (1968) = species identity unsolved

Heterodera latipons Franklin, 1969

Longidorus sylphus Thorne, 1939

Merlinius alboranensis (Tobar-Jiménez, 1970) Tarjan, 1973
= *Geocenamus alboranensis* (Tobar-Jiménez, 1970) Brzeski, 1991
Records from the former DDR probably refer to *M. microdorus.*

Paratrophurus loofi Arias, 1970

Paratylenchus curvitatus van der Linde, 1938

Paratylenchus minutus Linford in Linford, Oliveira & Ishii, 1949

Paratylenchus vexans Thorne & Malek, 1968 *apud* Braasch (1978) = most probably *P. similis*

Pratylenchus pinguicaudatus Corbett, 1969

Rotylenchus breviglans Sher, 1965

Rotylenchus multicinctus (Cobb, 1893) Golden, 1956
See notes above under *Helicotylenchus multicinctus.*

Trichodorus hooperi Loof, 1973

Tylenchorhynchus mexicanus Knobloch & Laughlin, 1973

Tylenchorhynchus parvus Allen, 1955
= *Bitylenchus parvus* (Allen, 1955) Jairajpuri, 1982

Tylenchorhynchus phaseoli Sethi & Swarup, 1968
= most probably *Neodolichorhynchus microsphasmis*

Xiphinema radicicola Goodey, 1936

7. Notes on individual taxa, unidentified populations and undescribed species

Besides the species and genera listed above under heading 3., there is sampling material (permanent microscopical slides, fixed specimens and nematode suspensions in glycerine) of a high number of still unidentified populations and undescribed species from Germany available in DNST. Most of these nematodes were collected by the author during the past decades. Brief data on several of such nematodes, on their main morphological characters, their habitat and occurrence in Germany are given below. Moreover, information on several identified species is presented, taxonomical problems are indicated and some changes in generic position are proposed. The taxa mentioned below are arranged in alphabetical sequence. In addition to the taxa presented, specimens or populations which could not be reliably identified to (known) species, were found in the genera *Hemicycliophora*, *Merlinius*, *Mesocriconema*, *Paratylenchus*, *Pratylenchoides* and *Pratylenchus.*

Amplimerlinius globigerus: Variation in several morphological characters among populations collected at many localities in Germany suggests presence of other species close to the identified species *A. globigerus.* The wide range of habitats from fine textured salt marshes and coastal dune sand to a mountain pasture at an elevation of 1700 m in the Alps appears to support this assumption.

Anguina agrostis: Southey et al. (1990) discussed the justification of the synonymisation of *Anguina* (= *Vibrio*) *phalaridis* Steinbuch, 1799 described from close to Erlangen and of *Tylenchus phlei* Horn, 1889 described from Waren/Müritz with *A. agrostis*. An attempt failed to recollect *A. agrostis* and *A. phalaridis* at the type locality of both species for further studies. The authors above believe that an *Anguina* population isolated in England from *Puccinellia maritima* is an undescribed species. Dreyling (1972) reported an *Anguina* infestation of this host from the German coast of the North Sea and described and illustrated the symptoms.

Bursaphelenchus fraudulentus: According to Rühm (pers. comm.) no type specimens or other material used by him has been retained. In June 1987 the present author isolated nematodes identified as *B. fraudulentus* at Möhrendorf close to Erlangen from wood of cherry trees, the type locality and type 'host' of this nematode species. One male was designated as neotype, two more males and two females as topotypes (deposited in DNST). Main morphometrics of the neotype (fixed in TAF and mounted in glycerine on permanent mount): Length = 0.72 mm, a = 39, b = 10.8, b' = 5.1, c = 26, c' = 1.75, stylet = 12.3 µm, tail = 27 µm, spicules = 20.5 µm. The body length of the four topotypes ranged from 0.52 to 0.60 mm. Based on comparative microscopical studies of several populations of *B. fraudulentus* and the similar species *B. mucronatus* the size of sperm in the uterus and postvulvar sac of inseminated females was identified as a valuable distinguishing character: 3–5 µm in *B. fraudulentus*, 6–8 µm in *B. mucronatus.*

***Cactodera* sp.**: A few second-stage juveniles recovered from soil samples collected in northern Germany were tentatively attributed to this genus. *Cactodera estonica* (Kirjanova & Krall, 1963) Krall & Krall, 1978 is known from several adjoining countries.

Ditylenchus convallariae: *Ditylenchus* specimens isolated from discoloured leaves of the fern *Blechnum spicant* collected at an altitude of 1300 m in the Alps above Bayrischzell and of specimens obviously belonging to the same nematode species collected from the moss *Polytrichum* in the Tatras, Poland (Sturhan & Brzeski 1991) could not be distinguished by morphological characters from *D. convallariae.* The species identity of the nematodes found parasitsing these 'unusual' *Ditylenchus* hosts has still to be determined.

Ditylenchus 'dipsaci': Molecular studies by Subbotin et al. (2005) confirmed previous assumptions that *D. dipsaci* is a species complex. The 'giant race' from *Vicia faba* has meanwhile been designated and described as a separate species (see below). *Ditylenchus* populations parasitising *Plantago maritima* also have 48–54 chromosomes; molecular data indicate a separate species status (Sturhan 1970, Sturhan & Brzeski 1991, Subbotin et al. 2005). *Ditylenchus* sp. was isolated from *P. maritima* growing in salt marshes and other saline biotopes at several localities along the coast of the North Sea; specimens of populations from Mellum island and Altenbruch near Cuxhaven were used for the molecular studies. The results of the molecular analyses by Subbotin et al. (2005) indicate a separate species status also for *Ditylenchus* sp. from several Asteraceae species; among these, populations from *Cirsium*, *Crepis* and *Pilosella* (*Hieracium*). Similarly, populations with high chromosome numbers ranging from 36 to 60 parasitising the Asteraceae *Picris* sp., *Sonchus oleraceus*, *Taraxacum officinale* and the Apiaceae species *Falcaria vulgaris* (Sturhan & Brzeski 1991) may deserve separate species status. All these plants were reported as hosts of '*D. dipsaci'* in Germany (Buhr 1964, 1965).

Ditylenchus gigas: The former 'giant race' or 'Riesenrasse' of *D. dipsaci* is particularly characterised by its body size, the relatively high number of chromosomes (2n = 48–60 *vs.* 2n = 24 in *Ditylenchus dipsaci* s. str.) and the inability to hybridize with 'normal' stem nematodes (Sturhan & Brzeski 1991, Sturhan et al. 2008). Molecular analyses confirmed a separate species status of populations from *Vicia faba*; a population from Erding had been included in these studies (Subbotin et al. 2005).

Geocenamus tessellatus and ***G. tumensis***: Because of variation in shape of the cephalic region ranging from continuous with body contour to offset by a distinct constriction, differences in stylet length and in tail shape, several populations could neither be reliably attributed to one of these species nor to other similar *Geocenamus* species known from northern Europe.

***Helicotylenchus* spp.**: Specimens recovered at many localities throughout the country, particularly in non-agricultural soils, could not be identified to species level. Unidentified or still undescribed species were found mainly in coastal biotopes, at river banks, in forests and various types of grassland. Some of such species seem to be widely dispersed, particularly in southern Germany including the Alps region, while others appear to be restricted in their occurrence. For example, a small species, which is mainly characterised by a stylet length of only 18–21 µm, appears to be restricted to the upper Weser river region. A species resembling in most morphological characters *H. exallus* Sher, 1966, which was originally described from arable soil in the USA and subsequently recorded for several European countries, was found in salt marshes and other saline habitats in the North Sea islands Sylt, Hooge, Nordstrand and Mellum; the species identity should be confirmed. Specimens with morphological characters close to *H. cephalatus* isolated from sandy soil at the coast of the Baltic Sea near Gelting, Schleswig-Holstein, were considered as representatives of this species; *H. cephalatus* had originally been described from dune soil at the Baltic coast in Poland.

***Heterodera* spp.**: Sturhan (2006) reported findings of juveniles and cysts, which could not be attributed to any of the *Heterodera* species identified in Germany, mainly from salt marshes, forests, permanent grassland, bank vegetation along rivers and lakes, and soil from around *Armeria*, *Limonium* and *Valerianella*.

***Hirschmanniella* sp.**: A population resembling *H. gracilis* and *H. halophila* was found at the left bank of the Elbe river near Stade (Sturhan & Hallmann 2010).

Longidorus paraelongatus and ***L. pseudoelongatus***: Both species are inadequately described. The attempts of the present author failed to collect more material at the type localities in Thüringen and close to Wiesbaden, respectively, but *Longidorus* specimens resembling both species were isolated from forest soil collected at many localities in Germany. Detailed morphological studies are needed to characterise *L. paraelongatus* and *L. pseudoelongatus* and to distinguish both from morphologically close species, in particular, *L. cylindricaudatus* and *L piceicola* Liskova, Robbins & Brown, 1997.

Longidorus poessneckensis: Altherr (1974) based the description of *L. macroteromucronatus* on a single female collected at a wet site at Ranis near Pössneck, Thüringen. Morphometrics and other morphological characters closely agree with those of *L. poessneckensis.* An exceedingly long 'mucro' or spare odontostyle in the pharyngeal tissue of females has been reported also for this species (Sturhan & Loof 2001), which supports the synonymisation of *L. macroteromucronatus* with *L. poessneckensis.*

***Longidorus* spp.**: At least two still undescribed species occur in Germany. Specimens collected at many localities throughout Germany indicate that several more unidentified or even undescribed species are present; some of these are morphologically similar to species known from Germany, but differ in certain characteristics. Most of these findings are from forests, coastal sites, river banks and other biotopes close to natural. A reliable identification has not been possible so far, including that of *Longidorus euonymus* Mali & Hooper, 1974, which had been described from the Czech Republic and recorded also from other countries east of Germany.

***Meiodorus* sp.**: Nematodes isolated from brackish soil around *Phragmites australis* growing at the bank of the Elbe river estuary near Freiburg/Elbe closely fit in most morphological characters the *Meiodorus* genus diagnosis: Females with elongate-conoid tail, males with shorter tails and trilobed bursa, cephalic region circular and lightly sclerotised with inconspicuous labial disc, terminal pharyngeal bulb offset from intestine, cuticle without longitudinal ridges or striae, body length 1.3–1.5 mm, stylet length 25–27 µm. The main morphological character distinguishing the undescribed species recovered in Germany from the three species currently in *Meiodorus* is the presence of four lateral incisures in each lateral field (vs. 3 incisures). Members of the genus are known so far from Canada, USA and Argentina only. First mentioned for Germany by Sturhan (2007).

Meloidoderita kirjanovae: A comparison of *Meloidoderita* juveniles collected in Germany with *M. kirjanovae* specimens from Israel and the presence of type hosts (*Mentha* spp.) at the sampling site or close to it at Wüstenstein, Bavaria, reported by Sturhan (1984b), strongly suggest species identity of the German population with *M. kirjanovae*. The main morphological characters: Second-stage juveniles 360–375 µm long, stylet = 13 µm, tail = 49 µm long with pointed tip, hyaline tail portion = 9–13 µm. Males: L = 365–395 µm, spicules = 14–15 µm, gubernaculum = 3.7–4.3 µm, tail = 36–37 µm, stylet absent, pharynx degenerate, tail terminus pointed. *Meloidoderita* juveniles were later identified in soil samples from three more localities in Germany.

Meloidoderita salina: A nematode species found parasitizing *Atriplex* (= *Halimione*) *portulacoides* in the North Sea island Hallig Hooge and also recovered in a salt marsh around the same halophytic plant at Hilgenriedersiel near Norden, Ostfriesland, closely agrees in morphological characters of juveniles and males, in habitat and host with *M. salina*, which was recently described from northern France and subsequently also found at the coast in the Netherlands (Ashrafi et al. 2012, Ashrafi et al. 2014). Based mainly on juvenile and male characters, the population from Hooge had been considered first as an undescribed *Sphaeronema* species (Sturhan & Geraert 2005, Sturhan 2013b); later also females and cystoid bodies were isolated from soil samples and observed on roots of the type host.

***Meloidogyne* spp.**: Besides the species recorded, second-stage juveniles of about four unidentified or even undescribed species were found in Germany; rarely also a few females could be isolated. One of the species, with juveniles characterised mainly by an evenly conoid tail 33–37 µm long and a blunt terminus and posterior edges of the cephalic framework quite distinct, was found along the river banks of Rhein and Main; hosts are most probably Poaceae. Another species with juveniles having a slender 62–81 µm long tail with a peg-like terminal mucro was isolated from soil and root samples of *Phragmites australis*, *Leymus arenarius* and other plants growing along the Rhein, Weser and Elbe rivers and at a few other localities. *Salix* sp. and possibly other ligneous plants were identified as hosts of a species with similar juveniles. Morphological characters of second-stage juveniles isolated from salt marshes, various river bank and grassland sites indicate the presence of still more unidentified *Meloidogyne* species. Juveniles of *M. chitwoodi* and *M. fallax* were recovered exclusively from a few fields; there is no indication so far that the close species *Meloidogyne minor* Karssen et al., 2004 is present in Germany.

Merlinius bavaricus: The description of *Tylenchorhynchus bavaricus* Sturhan, 1966 was based on a single female. This holotype was lost in remounting. More specimens of the species were collected at the type locality and in the type habitat in August and September 1965. One female was selected as Neotype, deposited in DNST under slide no. 4/15/5. Slides of specimens from other localities in Germany are also deposited in the same collection. A more detailed species description, including males, and based on specimens from Germany was given by Saltukoglu et al. (1976).

***Merlinius* sp.**: Nematode specimens showing the general diagnostic morphological characters of the genus *Merlinius* were found in sandy soil at the coast at Knock near Emden and in Mellum island, but deirids – considered as a 'key character' of the genus (Sturhan 2012b) – could not be seen in females, males and juveniles. The species in question would thus rather fit the genus diagnosis of *Geocenamus*. Main characters of females: L = 550–680 µm, stylet = 11–13 µm, tail = 48–56 µm, c' = 3.2–3.8; cephalic region almost spherical, slightly offset and extending beyond the basal plate of the faint labial framework, with 6–8 annules, spermathecae bilobed, tail with conoid smooth terminus, juveniles with only 4 incisures in each lateral field.

***Nagelus* sp.**: Populations of a *Nagelus* species appearing new to science and clearly distinguished from the nine species retained in the genus (*sensu* Sturhan 2012b) were found in salt marshes and other biotopes with saline soil at several localities along the coast of the North Sea. The main morphological characters: L = 750–1250 µm, stylet = 30–36 µm, stylet base = 3.8–4.5 µm in diameter, c' = 2.6–3.3, cephalic region slightly offset with elevated perioral disc and 7–8 annules, valve of median pharyngeal bulb large (5–6 µm), posterior bulb pyriform, female tail conoid or subcylindrical with hyaline terminus 6–12 µm long, spermathecae offset, males common.

***Neodolichorhynchus* sp.**: Specimens resembling *N. lamelliferus* in most morphological characters, but exceeding all known *Neodolichodorus* species in stylet length (30–36 µm) and body length (1.10–1.54 mm) of females and males, were isolated from soil samples collected at several localities from soil of river bank vegetation along the Elbe river below Hamburg.

Paratrichodorus anemones: Only once reported for Germany; no voucher specimens from Germany available in DNST. Commonly occurring in the Netherlands and reported from other European countries.

***Rotylenchus* spp.**: At least 4–5 species were found in Germany, which appear to represent still undescribed species and need further detailed studies. The species identity of more populations showing certain differences in morphology to species described or recorded from Europe is still unsolved. Some of these species appear to be widely dispersed in Germany, others may be restricted in their occurrence. Most of the unidentified populations are from biotopes close to natural.

***Sphaeronema* spp.**: Both species reported for Germany are inadequately distinguished by morphological characters; further comparative studies are needed, with *S. rumicis* included in future molecular studies. Most of the total of more than 200 *Sphaeronema* records throughout Germany are considered to be *S. alni*, particulalry so in cases where the occurrence of second-stage juveniles concurred with the presence of *Alnus* spp. or other Betulaceae (*Betula*, *Carpinus*, *Corylus*) at the collection sites. First recorded for Germany as *Sphaeronema* spec. from river bank vegetation, subsequently from *Alnus glutinosa*, and later reported as *S. rumicis* (Sturhan 1970, 1977, 1983: all records prior to the description of *S. alni* in 1986!). Variation in stylet lengths of second-stage juveniles and the common occurrence of males at some collection sites are considered as an indication that additional *Sphaeronema* species are present in Germany. Due to the extraction methods mostly applied, females were rarely recovered from soil samples. An obviously undescribed species, which is tentatively considered as a member of *Sphaeronema*, is particularly characterised by a wide elevated and refractive perioral disc in the males and second-stage juveniles with slightly projecting lip papillae and only 3 incisures in each lateral field. The population was found in a deciduous forest along the bank of the Rhein river at Heidesheim am Rhein. A population from Hallig Hooge, which had previously been considered as an undescribed *Sphaeronema* species, was recently identified as *Meloidoderita salina* (see above).

***Trichodorus* sp.**: A few specimens resembling *T. aequalis* Allen, 1957 in most morphological characters were isolated from a sandy soil sample taken on the bank of the Elbe river near Stade.

Trophotylenchulus: The synonymisation of *T. asoensis* (Minagawa, 1983) Siddiqi, 1999 and *T. okamotoi* (Minagawa, 1983) Siddiqi, 1999 with *T. arenarius* has not been generally accepted. Both are retained as separate valid species by Siddiqi (2000). Brzeski (1998) reported *T. okamotoi* from Poland, which he recorded earlier as *Trophonema arenarium*. As long as the species identity of European *Trophotylenchulus* populations is unsolved, it is preferred to designate German records as *T. arenarius* in the present checklist. *Trophotylenchulus* specimens were isolated from soil samples at ten localities with grassland or halophilic vegetation along the coast of the North Sea and in Rügen island; only two more findings are from inland sites with wet meadows. The first record of the genus for Germany is by Sturhan (1984).

***Tylenchorhynchus casigo* nom. nov., comb. nov.**: Telotylenchid nematodes isolated from a brackish soil sample, collected by the author in May 2002 in a nature reserve with halophilic vegetation south-west of Sülldorf near Magdeburg and close to the small river Sülze, have the following morphometric characters: Females (n=10): L = 740 (610–810) µm, a = 31 (28–34), b = 5.4 (4.9–5.6), c = 20 (19–22), c' = 2.3 (2.2–2.4), V = 54 (52–56), stylet = 20.3 (19.2–21.4) µm, pharynx = 136 (123–147) µm, MB = 52 (50–54.5)%, tail length = 37 (32.5–39) µm, hyaline tail terminus = 10.2 (7.5.–11.3) µm or 27.6 (23–30)% of total tail length. Males (n=11): Spicules = 31 (30–32) µm, gubernaculum = 15.2 (14.5–16) µm. The main other morphological features: Body of heat-relaxed specimens C-shaped to slightly ventrally curved, lateral fields with four smooth lines (only occasionally crenate), without areolation along body, cephalic region continuous with 5–7 annuli, slightly flattened, cephalic framework moderately sclerotised at its base, stylet knobs with anterior faces inclined, flat or lightly concave, terminal pharyngeal bulb well offset from intestine, spermathecae with sperm, tail cylindrical with hemispherical or slightly conoid terminus, about 30 tail annules which mostly become indistinct around the tail terminus, phasmids well developed, at 26–38% of total tail length posterior anus level. Males are common in this population.

In morphometrics and other morphological characters the population from Germany is almost identical with *Paratrophurus striatus* Castillo, Siddiqi & Gomez-Barzina, 1989 described from Andalusia, Spain. The cephalic framework appears to be slightly less developed, the tail end in females was never clavate but often rather slightly conoid. A comparison with *P. striatus* paratypes (kindly loaned by P. Castillo) revealed that the cephalic framework in this species is only moderately sclerotised and distinct mainly at its base (similar to the German

population). The only remarkable difference observed is the presence of intestinal fasciculi, which are reported to be absent in *P. striatus*.

Striation of the lip region, a hyaline tail portion of less than one-third of the tail length and other morphological details suggest best placement of the species in the genus *Tylenchorhynchus*, which already includes several species with 'abnormally' long hyaline tail portion. Because of the presence of the senior species *Tylenchorhynchus striatus* Allen, 1955 in this genus, it is required to propose a different species name. In honour of the three authors of *Paratrophurus striatus* the name *Tylenchorhynchus casigo* nom. nov. is proposed.

Tylenchorhynchus dubius: Specimens found at several coastal sites are distinguished from 'normal' *T. dubius* mainly by slightly longer stylets (21–24 µm). Variation in tail shape among populations isolated from different habitats appears to indicate presence of similar species; some of these were identified first as *T. parvus* (Sturhan 1966).

Tylenchorhynchus huesingi: A re-description based on specimens from the type locality and type habitat near Merseburg or close to it is a high priority; apparently no type specimens were retained. The species identity of the Spanish population described by Gomez-Barcina et al. (1992) with *T. huesingi* needs confirmation, because of differences in morphological details. According to figures in the original description of *T. huesingi* by Paetzold (1958a) an areolation of the lateral fields is lacking, a postanal intestinal sac is absent, the terminal hyaline tail portion is about 11 µm long (= 25 % of the total tail length) and c' = 2. There appear to be also differences in habitat (saline soil with halophilic vegetation *vs* pasture soil in Spain).

Tylenchorhynchus striatus: Congruence in morphology and habitat confirmed correct identification of a population recovered from saline soil with halophyte vegetation in the North Sea island Hooge; Allen (1955) described *T. striatus* from soil above the tide level in the Netherlands.

***Verutus* sp.**: Nematode specimens attributed to this genus were recovered from moist biotopes at 16 localities in Germany and *Scirpus sylvaticus* was identified as the host (Sturhan 2006). In most morphological characters the specimens found in Germany can be distinguished from the only two known species of *Verutus*, both described from USA. Juveniles (n = 20): Length = 540 (490–600) µm, stylet = 25 (24–26) µm, tail = 74 (64–85) µm, hyaline tail portion = 46 (38–50) µm, lateral fields with 4 incisures, cephalic region continuous with body contour, with 5–6 annules, stylet knobs rounded and occasionally slightly directed anteriorly, phasmids situated at about 20 % of the total tail length below anus level, number of tail annules mostly exceeding 50. Males (n = 10): Stylet = 26 (25–27) µm, spicules = 42 (38–45) µm, gubernaculum = 18 (16.5–20) µm, body of heat-killed specimens C-shaped to almost circular, untwisted. Females: Stylet = 29–30 µm, cuticle = 7.5–10 µm thick with 1.3–1.8 µm wide annules at mid-body, vulval lips only occasionally protruding.

Mainly because of the similarity of second-stage juveniles and males to the same stages in heteroderids, the genus *Verutus* had first been considered as a primitive member of Heteroderidae (Sturhan 2006 and other authors). Molecular studies using juveniles of a *Verutus* population originating from a wet meadow at Bad Zwischenahn supported the present position of the genus in Rotylenchulidae (Subbotin et al. 2010a). *Verutus* had been recorded for Germany first as 'a new genus probably linking Heteroderidae with Nacobboderidae' (Sturhan 1977), prior to the description of the genus *Verutus* by Esser (1981).

8. Discussion

Two hundred sixty eight phytonematode species considered as valid are known from Germany so far, including one still undescribed species in each of the genera *Meiodorus* and *Verutus*. Among these nematodes 212 are members of the order Tylenchida, 10 members of Aphelenchida, 33 species belong to the family Longidoridae of the order Dorylamida and 13 species are members of the family Trichodoridae in the order Triplonchida, altogether arranged in 53 genera. The gaps of knowledge of the nematode diversity, particularly indicated in paragraph 7, suggest that a considerably higher number of species is present in Germany. In particular, nematodes recorded from neighbouring countries but not (yet) recovered in Germany will probably be found, but even the recovery of additional 'exotic' species can be expected, as recently shown for *Longidorus andalusicus* (Sturhan, 2013b). Whereas most of the phytonematodes occurring in arable soil or other cultivated soils appear to be known and identified, the number of unidentified species recovered in more or less natural biotopes is comparatively high. The estimated number of phytonematode species in Germany will certainly far exceed 300.

The present-day nematofauna of Germany is largely composed of three elements: (1) A rather small group of indigenous or autochthonous species, which survived the last ice age in Germany and northern Europe, (2) the majority of species, which probably invaded and recolonised the northern parts of Europe during the

postglacial period from the refuge and dispersal centers in the Mediterranean and Pontic regions, and (3) finally 'exotic' nematodes, which were introduced in more recent times from somewhere worldwide, almost eclusively through man's activities (Sturhan, 2014). Restriction of individual nematode species to fields or comparable cultivated habitats may be considered as an indication that such species are not native members of the German nematofauna. Nematode species found in glasshouses and on indoor ornamentals are not considered as members of the German nematofauna as long as they are not established outdoors. As a result of increasing 'globalisation', climatic and other environmental changes, introduction of more nematode 'neozoa' has to be expected.

The high number of doubtful species records for Germany and of identifications, which should be queried, strongly indicates the nessecity to retain voucher specimens, which may allow subsequent identification or verification of previous identifications. Deposition of such sampling material in the German Nematode Collection (DNST) is highly recommended! This applies also for recoveries of species in 'unusal' habitats or far outside the known distribution area. Data about the geographical distribution and habitat of nematode species recovered in Germany are currently compiled in the non-commercial online data warehouse on soil organisms 'Edaphobase' (www.edaphobase.org, Burkhardt et al. 2014).

The compilation of our current knowledge of phytonematodes known from Germany may be considered as basic for a reliable identification of species and for further studies on the nematode fauna. It is suggested to stimulate future research on nematode biodiversity, hopefully more often combining traditional morphologically based identification with molecular methods. The particular marking of species, which had been orginally described from Germany (*), may be helpful for selecting 'suitable' nematode populations for molecular characterisation and future bar coding of species, which should preferably be based on specimens originating from the type locality or close to it. Knowledge about the type localities of those species, which have subsequently been synonymised, may be of significance also in cases where the justification of synonymisation appears questionable.

The preliminary checklist presented should be considered also as a guideline to facilitate correct identification of phytophagous nematode species occurring in Germany. The indication of potential presence or absence of individual species in cultivated soils or in more or less natural biotopes may be helpful for attaining correct identifications. Moreover, the present lists will hopefully help in using actual designations of species and genera.

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