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Nematodes of the order Tylenchida in Germany – the non-phytoparasitic species

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Abstract

In the recently published checklist of plant-parasitic nematodes known from Germany (Sturhan 2014) genera and species of the order Tylenchida, which are generally considered as being parasites of higher plants, represent the largest taxonomic group with 212 species. The present paper gives an overview of the remaining trophic groups in Tylenchida: Root tip feeders, myceliophagous species and entomoparasites, the latter often having a free-living soil generation. A total of 165 species are included, most of them representatives of the suborder Hexatylina (96 species), followed by members of Tylenchina (67 species). Where available, first records for Germany are given together with data on habitat, distribution and the hosts of zooparasitic species. A high number of valid species (95) were originally described from Germany; 20 additional species have been synonymised with previously described species or are considered as *species inquirendae*. Published data are critically reviewed and some new records are added. Many published records are considered as questionable and need verification. Part of the species is deficiently characterised and requires further study. The number of unidentified and still undescribed species appears to be high. Two obviously new *Tenunemellus* species as well as a nematode population isolated from soil, which could not be attributed to any of the currently known tylenchid genera, are briefly characterised. An obviously still undescribed species of *Paurodontoides* is recorded and morphological characteristics are presented: it is the first record of the genus outside USA. Morphological characters of *Boleodorus clavicaudatus* populations from Germany are given and compared to the original description. Supplementing morphological characters of *Pleurotylenchus sachsi* and data on occurrence, habitat and distribution in Germany are presented. A *Safianema* population recovered in southern Germany, resembling *S. lutonense*, is briefly characterised morphologically.

Keywords Biodiversity | entomoparasitic nematodes | free-living soil nematodes | Hexatylina | mycophagous nematodes | nematofauna | *Paurodontoides* | *Pleurotylenchus* | *Safianema* | Tylenchina

1. Introduction

Nematodes with an estimated number of about 2000 species are ranking in the second position among the ca. 48000 animal species known from Germany, following Arthropoda as the largest group (http://www.bfn.de/index/htm). However, estimates about nematodes are highly speculative, because no updated lists of nematodes exist. The last comprehensive publications about nematodes in Germany (or Central Europe) date back to Meyl (1961) on free-living soil and freshwater nematodes and to Sprehn (1961) on zooparasitic nematodes. Faunistic publications from more recent times were generally confined to individual taxa or selected trophic groups or biota, and no comprehensive publications covering the entire order Nematoda are available. But during the past decades there has been a remarkable increase of publications containing data on nematode species, their presence and distribution in Germany, and updating and summarizing the present

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state of knowledge about the nematode fauna of Germany is highly required.

The recently published checklist of plant-parasitic nematodes (Sturhan 2014) may be considered as an updated contribution to a 'Nematofauna Germanica', but it is restricted to those nematodes, which are generally considered as feeding on vascular plants and being of potential economic significance as plant pests. In this trophic group, members of the nematode orders Tylenchida, Aphelenchida, Dorylaimida (fam. Longidoridae) and Triplonchida (fam. Trichodoridae) are included.

Among these phytoparasitic nematodes, Tylenchida with a total of 212 species currently mostly considered as valid, are forming the largest group of species. Sturhan (2014) listed all members of the Tylenchida suborders Criconematina and Hoplolaimina (except fam. Psilenchidae) among the plant-parasitic nematodes, likewise from the suborder Tylenchina the family Tylodoridae with the genera *Cephalenchus* Goodey, 1962 and *Pleurotylenchus* Szczygieł, 1969 and from the family Anguinidae the genera *Anguina* Scopoli, 1777, *Subanguina* Paramonov, 1967, *Halenchus* N.A. Cobb in M.V. Cobb, 1933 and the plant-parasitic species of the genus *Ditylenchus* Filipjev, 1936. The suborder Hexatylina with a total of 25 genera known from Germany is included in the present publication for the first time.

Main objective of the present publication is to extend the previous checklist (Sturhan 2014) to include all other members of the order Tylenchida recorded from Germany: besides the 'plant nematodes' the mycophagous soil-inhabiting species and nematodes associated with or parasitic in insects and a few other arthropods. Only some taxa of this last group had been included previously in the book publications by Meyl (1961) and, in particular, that by Sprehn (1961), whose information on zooparasitic Tylenchida is almost confined to a brief key of genera mentioning few species only.

Knowledge of presence (or absence) of nematode species in Germany may be considered as a basis for correct identifications and will hopefully stimulate future research on species diversity of this nematode group in Germany and fill the gaps in knowledge of the species present, their geographical distribution and their habitats.

In the present publication particular importance is given on providing information about those species, which had originally been described from Germany. Type specimens and voucher specimens have not been retained of most of these species. Recollection of material, designation and deposition of neotypes are highly recommended and resampling of identified specimens at or close to the type localities are considered as a prerequisite to future molecular studies and barcoding of species.

2. Classification

For convenience, similar to Sturhan (2014), the classification of tylenchid nematodes in 'Fauna Europaea' (www.fauna-eu.org) is also mostly used in the present paper. Exceptions are indicated in the respective taxa chapters. The classification is largely identical with that proposed by Siddiqi (2000), with Tylenchina, Hoplolaimina, Criconematina and Hexatylina as suborders, and considering Aphelenchida as a separate order. Almost all taxa included in the present checklist are grouped in Tylenchina and Hexatylina. Only the family Psilenchidae Paramonov, 1967 with *Psilenchus* de Man, 1921 as the only genus known from Germany is arranged in Hoplolaimina for the time being, because morphological as well as molecular characters are indicating distinction from other taxa in Tylenchina. Also Siddiqi (2000), Loof (2001) and Andrássy (2007) listed Psilenchidae as distinct from other taxa in Tylenchina, whereas Geraert (2008) arranged Psilenchinae as a subfamily in Tylenchidae.

The genera and species of non-phytoparasitic Tylenchida known from Germany and their taxonomic position are shown in the overview below. Different from Geraert (2008), Atylenchidae Skarbilovich, 1959 and Ecphyadophoridae Skarbilovich, 1959 are considered as families separate from Tylenchidae (Tylenchinae in the sense of Geraert 2008). In agreement with Geraert (2008), we accept synonymisation of the genus *Ottolenchus* (Andrássy, 1954) Siddiqi & Hawksworth, 1982 with *Filenchus* Andrássy, 1954. The genus *Safianema* Siddiqi, 1980, which had been considered as synonym of *Ditylenchus* by Brzeski (1991, 1998), is accepted as valid and a separate genus in Anguinidae. In "Fauna Europaea" the genera *Sychnotylenchus* Rühm, 1956, *Prothallonema* Christie, 1938 and most species of *Neoditylenchus* Meyl, 1961 are so far not yet enclosed among the nematodes known from Europe. The revised classification of Hexatylina proposed by Chizhov (2004) has not been considered in the present paper, but the synonymy of Paurodontidae Thorne, 1941 with Sphaerulariidae Lubbock, 1861, supposed by Siddiqi (2000) and accepted by Andrássy (2007) and Handoo et al. (2010), is followed.

In the overview below, the families distinguished in each suborder and each superfamily are arranged in alphabetical order, likewise the genera within each family. Most members of the suborder Tylenchina and species of the genus *Psilenchus* in Hoplolaimina are migrating soil nematodes, which feed on root hairs, epidermal cells, and/or fungal hyphae (Yeates et al. 1993). Members of Sychnotylenchidae are mostly associated with bark beetles and found in frass of beetle galleries in trees or

tree trunks (Rühm 1956), presumably feeding on fungi. Most members of Hexatylina are parasites in insects or mites, many of these with a free-living mycetophagous (soil) generation alternating with a parasitic generation (Siddiqi 2000).

TYLENCHINA

Tylenchoidea

Atylenchidae
- *Atylenchus* Cobb, 1913
- *Eutylenchus* Cobb, 1913

Ecphyadophoridae
- *Ecphyadophora* de Man, 1921
- *Lelenchus* Andrássy, 1954
- *Tenunemellus* Siddiqi, 1986

Tylenchidae
- *Aglenchus* Andrássy, 1954
- *Basiria* Siddiqi, 1959
- *Boleodorus* Thorne, 1941
- *Coslenchus* Siddiqi, 1978
- *Filenchus* Andrássy, 1954
- *Irantylenchus* Kheiri, 1970
- *Malenchus* Andrássy, 1968
- *Miculenchus* Andrassy, 1959
- *Neopsilenchus* Thorne & Malek, 1968
- *Tylenchus* Bastian, 1865

Anguinoidea

Anguinidae
- *Ditylenchus* Filipjev, 1936
- *Nothotylenchus* Thorne, 1941
- *Pseudhalenchus* Tarjan, 1958
- *Safianema* Siddiqi, 1980

Sychnotylenchidae
- *Neoditylenchus* Meyl, 1961
- *Sychnotylenchus* Rühm, 1956

HOPLOLAIMINA

Psilenchidae
- *Psilenchus* de Man, 1921

HEXATYLINA

Sphaerularioidea

Allantonematidae
- *Allantonema* Leuckart, 1884
- *Bovienema* Nickle, 1963
- *Bradynema* zur Strassen, 1892
- *Contortylenchus* Rühm, 1956
- *Howardula* Cobb, 1921
- *Metaparasitylenchus* Wachek, 1955
- *Neoparasitylenchus* Nickle, 1967
- *Parasitylenchoides* Wachek, 1955
- *Proparasitylenchus* Wachek, 1955
- *Protylenchus* Wachek, 1955
- *Scatonema* Bovien, 1932
- *Sulphuretylenchus* Rühm, 1956
- *Thripinema* Siddiqi, 1986

Neotylenchidae
- *Deladenus* Thorne, 1941
- *Gymnotylenchus* Siddiqi, 1961
- *Hexatylus* Goodey, 1926

Sphaerulariidae
- *Neomisticius* Siddiqi, 1986
- *Paurodontoides* Jairajpuri & Siddiqi, 1969
- *Prothallonema* Christie, 1938
- *Sphaerularia* Dufour, 1837
- *Tripius* Chitwood, 1935

Iotonchioidea

Iotonchiidae
- *Fungiotonchium* Siddiqi, 1986
- *Iotonchium* Cobb, 1920

Parasitylenchidae
- *Parasitylenchus* Micoletzky, 1922
- *Wachekitylenchus* Slobodyanyuk, 1986

3. Recognised species

The species and genera reported from Germany listed below are arranged in the order of taxa given under the heading ‘Classification’ above. Species originally described from Germany are marked by an asterisk (*),

the original species designations are mostly included and data about type locality and type habitat (if available) are added, also the known hosts of the zooparasites. In general, synonyms are given only if used in the last comprehensive publications from Germany or in last detailed studies (Meyl 1961, Wachek 1955, Rühm 1956 etc.) and if species are attributed to genera other than in 'Fauna Europaea', by Siddiqi (2000), Bongers (1988), Brzeski (1998), Andrássy (2007) or Geraert (2008). More detailed information on synonyms is given by Siddiqi (2000), Geraert (2008) and in other more recent publications.

The presence of voucher specimens in the German Nematode Collection (DNST) at Julius Kühn-Institut, Münster, Germany, is indicated by a (V), in case also types are deposited in this collection, by (VT). First records of species for Germany are mostly mentioned, often also additional data on distribution, habitat, hosts etc. Because records of individual species are often considered as unreliable or doubtful, a general overview of all published data is mostly not attempted. Geographical names and locations are generally given in their German versions.

TYLENCHINA Chitwood in Chitwood & Chitwood, 1950

Tylenchoidea Örley, 1880

Atylenchidae Skarbilovich, 1959

Atylenchus decalineatus Cobb, 1913
Hirschmann (1954) isolated a single female from wet sandy soil near the roots of *Scirpus lacuster* L. from a pond (no locality mentioned, but probably from close to Erlangen; no morphological details given and the only specimen not retained; a verification of identification is thus not possible). No other record from Europe of this species, which was originally described from Florida and New Jersey, USA.

Eutylenchus excretorius Ebsary & Eveleigh, 1981 (V)
First record for Germany and Europe by Sievert and Sturhan (1994) from the nature reserve 'Heiliges Meer' close to Ibbenbüren; later also reported from Poland, Russia (Karelia), Czech Republic and Spain (Palomares-Rius et al. 2009). In Germany, more recently found in sandy soil from Weser river bank vegetation in Harrier Sand east of Brake [specimens of this population were included in the Tylenchida molecular studies by Subbotin et al. (2006)] and in sandy soil from around *Phragmites australis* from the western bank of Elbe river at Hollern-Twielenfleth near Stade (Sturhan unpubl.). The three recovery sites in Germany are shown in Fig. 1.

Ecphyadophoridae Skarbilovich, 1959

Ecphyadophora tenuissima de Man, 1921 (V)
First record for Germany by Bassus (1960) from a spruce forest in Thüringen. Afterwards also recovered in several spruce stands in Bayern, in wet meadows and occasionally in arable soil.

Lelenchus leptosoma (de Man, 1880) Andrássy, 1954 (V)
According to Meyl (1961) very common in Central Europe. Reported by de Man (1884) from Erlangen. Afterwards recorded by several authors from a variety of beech and spruce forests (with morphological details provided by Zell 1988a), from moss cushions and meadow soil. Also reported from aquatic habitats: river sediments (Beier 2003, Traunspurger et al. 2015) and sediment of Lake Bodensee at more than 20 m depth (Traunspurger 1989).

Tenunemellus sp. (V)
Reported by Sturhan (1970) as *Ecphyadophoroides*; two probably new species were found in Germany (see under heading 5 below).

Tylenchidae Örley, 1880

Aglenchus agricola (de Man, 1884) Meyl, 1961 (V)
= *Tylenchus paragricola* Paetzold, 1958
Common in Central Europe according to Meyl (1961). First mentioned for Germany from Erlangen (de Man 1884). Found in a wide range of biotopes: forests, meadows, fields, soil from small fruit plantations etc., occasionally also reported from aquatic habitats. Paetzold (1958) described *T. paragricola* from salt meadows near Halle, where he also identified *A. agricola.*

Basiria duplexa (Hagemeyer & Allen, 1952) Geraert, 1968
= *Psilenchus duplexus* Hagemeyer & Allen, 1952
Described from California, in Europe e.g. reported from Belgium, Poland and the Netherlands (Bongers 1988, Brzeski 1998, Geraert 2008). First record for Germany from an opencast coal-mining site near Spremberg, Brandenburg (Hohberg, unpublished data).

Basiria gracilis (Thorne, 1949) Siddiqi, 1963 (V)
First record for Germany as a host of *Pasteuria* sp. by Sturhan (1989); specimens with this bacterial parasite had been isolated from loamy soil from a mixed forest in Lohr near Rothenburg/Tauber. In Poland relatively common in cultivated and uncultivated soils (Brzeski 1998).

Boleodorus clavicaudatus Thorne, 1941 (V)
= *Basiria clavicaudata* (Thorne, 1941) Ebsary, 1991
Found in loamy soil from meadows at Jestetten near Schaffhausen and at Loshausen near Schwalmstadt (new species record). The species has been arranged in *Boleodorus* (Brzeski 1998, Geraert 2008) or in *Basiria* (Siddiqi 2000, Andrássy 2007, 'Fauna Europaea'),

respectively. Morphological details of specimens from Germany are given under heading 5.

Boleodorus thylactus Thorne, 1941 (V)
Found in arable soil near Rendsburg, in an abandoned cherry tree plantation at Boppard/Rhein, a grassy site at Sperenberg near Luckenwalde/Brandenburg and in an aquatic habitat near Münster (new species record).

Boleodorus volutus Lima & Siddiqi, 1963 (V)
Reported by Lelifeldt and Sturhan (1994) from arable soil at Ahlum near Braunschweig, afterwards recovered in meadow soil at several localities and recorded by Handelmann et al. (2001) from coastal dunes in Norderney. Probably widely distributed in Germany.

Coslenchus andrassyi Brzeski, 1987 (V)
For Germany only recorded by Sturhan (1989) as a host of the bacterial parasite *Pasteuria* sp.; the nematodes had been isolated from meadow soil in Münster.

Coslenchus costatus (de Man, 1921) Siddiqi, 1978 (V)
= *Aglenchus costatus* (de Man, 1921) Meyl, 1961
First record for Germany by Schneider (1939), but location and habitat not mentioned. Later on recorded by Paesler (1959) from a beech forest in Siebengebirge near Bonn, by Bassus (1962a, b) in deciduous and spruce forests near Eisenach and Eberswalde, by Alphei (1995) in Solling beech forest near Göttingen and by Niemann (1996) in arable soil near Jülich, Neustadt am Rübenberge and Hildesheim; also reported from river sediment near Stuttgart (Beier 2003) and a sulphur spring near Minden (Pax & Soós 1943). Specimens of a population sampled in Münster were included in the Tylenchida molecular studies by Subbotin et al. (2006). According to Brzeski (1998) generally common in a variety of different soil types.

Coslenchus multigyrus Siddiqi, 1981 (V)
First record from Germany as a host of the bacterial parasite *Pasteuria* sp. (Sturhan 1989); subsequently found in field soil near Braunschweig (Lelifeldt & Sturhan 1994) and a vineyard in Kaiserstuhl, Baden.

Coslenchus polonicus Brzeski, 1982 (V)
Found in a mixed pine-oak forest near Neumarkt, Oberpfalz, Bayern (new species record).

Filenchus discrepans (Andrássy, 1954) Andrássy, 1972
= *Lelenchus discrepans* (Andrássy, 1954) Meyl, 1961
= *Ottolenchus discrepans* (Andrássy, 1954) Siddiqi & Hawksworth, 1982
Siddiqi (2000) and 'Fauna Europaea' retain this species in the genus *Ottolenchus*, which is not accepted by Andrássy (2007) and Geraert (2008), who consider it a *Filenchus* species. In Germany exclusively reported from forest soils, for the first time by Bassus (1960) and subsequently also by other authors (e.g., Zell 1985a, Alphei 1995, Ruess 1995) in different regions of Germany. According to Brzeski (1998) a common species in Poland found in various habitats.

Filenchus ditissimus (Brzeski, 1963) Siddiqi, 1986
Brzeski (1998), Siddiqi (2000), Andrássy (2007) and 'Fauna Europaea' consider this species a synonym of *Filenchus misellus*, but Geraert (2008) retains it as a separate species. First record for Germany by Ruess (1995) from spruce stands near Ochsenhausen, south-western Germany. Later reported by Handelmann et al. (2001) from coastal dunes in Norderney.

Filenchus helenae (Szczygieł, 1969) Raski & Geraert, 1987 (V)
= *Tylenchus helenae* Szczygieł, 1969
According to Siddiqi (2000) and Andrássy (2007) a synonym of *Ottolenchus discrepans* and *Filenchus discrepans*, respectively. 'Fauna Europaea' accepts the species as valid but transferred it to the genus *Ottolenchus*, while Geraert (2008) retains it as *Filenchus helenae*. Reported from Germany as host of the bacterial parasite *Pasteuria* sp. (Sturhan 1989); the species was recovered in a beech forest near Hollfeld/Oberfranken.and in an oak forest at Cochem/Mosel.

*Filenchus istvani** Zell, 1988
= *Tylenchus (Lelenchus) minutus* Cobb, 1893 *apud* Andrássy, 1954
Zell (1988a) found a population in a beech forest near Karlsruhe that equaled Andrassy's description of *Tylenchus minutus* and renamed it *Filenchus istvani*. First record for Germany by Paetzold (1958) from a salt meadow near Halle-Trotha; since he explicitely followed the description of *T. minutus* given by Andrássy, his findings clearly refer to *F. istvani*. Further reports by Ruess (1995) and Ruess & Funke (1995) from spruce stands in southern Germany.

Figure 1. Records of *Eutylenchus excretorius* in Germany.

The record of *T. minutus* by Paesler (1959) from a beech forest near Königswinter may also refer to *F. istvani*.

*Filenchus longicaudatulus** Zell, 1988
Type locality: Schluttenbach, northern part of Schwarzwald, beech forest (Zell 1988a). Holotype deposited in Staatliches Museum für Naturkunde Karlsruhe. Further reports from beech and spruce forests by Alphei (1995), Ruess (1995) and Ruess & Funke (1995).

Filenchus misellus (Andrássy, 1958) Raski & Geraert, 1987
= *Filenchus amaritus* Zell, 1988
Zell (1988a) described *F. amaritus* from leaf litter; type locality: a beech forest, Schluttenbach, northern part of Schwarzwald. Holotype deposited in Staatliches Museum für Naturkunde Karlsruhe. Possibly the first and yet only German report of *F. misellus*, with which it was synonymised. According to Brzeski (1998) very common in Poland in soil, moss and litter.

Filenchus polyhypnus (Steiner & Albin, 1946) Meyl, 1961
Reported by Paetzold (1958) from salt meadows near Halle-Trotha. Bongers (1988) probably refers to this finding when he states occurrence in 'O.-Duitsland'.

*Filenchus resistens** Zell, 1988
Described by Zell (1988a) from leaf litter under *Fagus sylvatica* at Schluttenbach, northern part of Schwarzwald. Holotype and paratypes deposited in Staatliches Museum für Naturkunde Karlsruhe.

Filenchus sandneri (Wasilewska, 1965) Raski & Geraert, 1987
= *Tylenchus sandneri* Wasilewska, 1965
For Germany only recorded by Zell (1985a) from a beech forest in the northern part of Schwarzwald. According to Brzeski (1998) mainly occurring in loamy soils.

Filenchus thornei (Andrássy, 1954) Andrássy, 1963 (V)
Reported for Germany by Bassus (1960, 1962a,b, 1964) from forest soils in Thüringen, Brandenburg and Mecklenburg-Vorpommern and by Traunspurger et al. (2015) from aquatic habitats in north-western Germany. Sturhan (1989) recorded this nematode as host of the bacterial parasite *Pasteuria* sp.; the nematode specimens originated from loamy soil in Dasburg/Eifel.

Filenchus valkanovi (Andrássy, 1958) Meyl, 1961
= *Ditylenchus valkanovi* (Andrássy, 1958) Zell, 1988
First and at present only record for Germany by Zell (1985a) from a beech forest in the northern part of Schwarzwald, where he also reported and described the first female of this species.

Filenchus vulgaris (Brzeski, 1963) Lownsbery & Lownsbery, 1985 (V)
= *Tylenchus vulgaris* Brzeski, 1963
Brzeski (1963) found this species around roots of plants at Buchenwald near Weimar. Further records for Germany from a beech forest in Schwarzwald (Zell 1988a), from a mixed forest with loamy soil at Lohr near Rothenburg/Tauber with *Pasteuria* spores attached to the cuticle (Sturhan 1989), from spruce stands in Baden-Württemberg and Bayern (Ruess 1995, Ruess & Funke 1995). Also reported from Lake Bodensee, where it was found in 10–120 m depth in the lake sediment (Traunspurger 1989), and from river sediments near Stuttgart and in north-western Germany (Beier 2003, Traunspurger et al. 2015).

Irantylenchus vicinus (Szczygieł, 1970) Brzeski & Sauer, 1983 (V)
Found in the nature reserve 'Oderhänge Mallnow' north of Frankfurt/Oder; isolated from a loamy sand sample taken from a grassy slope (new record of genus and species for Germany). Known also from adjoining countries (Poland, Belgium).

Malenchus acarayensis Andrássy, 1968
= *Malenchus cognatus* Andrássy, 1981
According to Brzeski (1998) a common species in Poland associated with organic and litter layer and moss. Alphei (1995) reported both, *M. acarayensis* and the now synonymized *M. cognatus* from the same site, a beech forest, Solling, Niedersachsen. Further records from spruce stands in Southern Germany by Ruess, (1995) and Ruess & Funke (1995).

Malenchus andrassyi Merny, 1970
First record for Germany by Alphei (1995) from a beech forest in Solling, Niedersachsen. According to Brzeski (1998) often associated with *Sphagnum* moss and decaying wood.

Malenchus bryophilus (Steiner, 1914) Andrássy. 1980
= *Aglenchus bryophilus* (Steiner, 1914) Meyl, 1961
According to Meyl (1961) common in Central Europe. For Germany reported for the first time by Kischke (1956) from peat bogs in Oberharz. Later recorded by several authors mainly from a variety of forest stands.

Malenchus exiguus (Massey, 1969) Andrássy, 1980
First record for Germany by Zell (1988a) from a beech forest in northern part of Schwarzwald. Later on reported by Ruess (1995), Ruess & Funke (1995) and Alphei (1995) from spruce stands in Baden-Württemberg and a beech forest in Solling, Niedersachsen, respectively.

Malenchus neosulcus Geraert & Raski, 1986 (V)
Found at several localities in north-western and central regions of Germany in sandy soils of deciduous and mixed forests (new species record).

Malenchus pachycephalus Andrássy, 1981
First and at present only record for Germany by Alphei (1995) from a beech forest in Solling mountains, Niedersachsen.

Malenchus pressulus (Kazachenko, 1975) Andrássy, 1981
First German record by Zell (1988a) from a beech forest in the northern part of Schwarzwald. Later reported by Ruess (1995) and Ruess & Funke (1995) from spruce stands at Schneeberg and Hochkalter, Bayern, and by Alphei (1995) from a beech forest in Solling, Niedersachsen.

Miculenchus sp.
Only record of the genus *Miculenchus* for Germany by Bongers et al. (1998) from temperate grasslands near Gießen.

Neopsilenchus magnidens (Thorne, 1949) Thorne & Malek, 1968 (V)
First and to date only record for Germany from aquatic habitats in Münster by Niemann (1992).

Tylenchus arcuatus Siddiqi, 1963
First and to date only record for Germany by Niemann (1996) from arable soil at Jülich-Merzenhausen and at Borstel near Neustadt am Rübenberge.

Tylenchus davainei Bastian, 1865 (V)
A cosmopolitan species and according to Meyl (1961) very common in Central Europe. First records for Germany by Bütschli (1873) from sandy soils around grass roots and under moss; no locality mentioned, but from Frankfurt/Main according to de Man (1884); among others recorded by Cobb (1888) from moss near Jena. Later on reported by many authors mainly from forest soils, but also from salt meadows, mushroom cultures, moss, peat bogs and occasionally aquatic habitats.

Tylenchus elegans de Man, 1876
For Germany reported from arable soil near Braunschweig (Lelifeldt & Sturhan 1994), from beech forests, Solling mountains, Niedersachsen (Alphei 1995), coastal dunes in Norderney island (Handelmann et al. 2001) and river sediment near Stuttgart (Beier 2003). In Poland, the most common *Tylenchus* species (Brzeski 1998).

*Tylenchus martini** Zell, 1988
Type locality: Schluttenbach, northern part of Schwarzwald, found in mosses in a beech forest (Zell 1988a). Holotype and paratypes deposited in Staatliches Museum für Naturkunde Karlsruhe. The synonymisation of this species with *T. davainei* by Brzeski (1996) has not been accepted by other authors.

Tylenchus ritae Siddiqi, 1963
Reported by Niemann (1996) from arable soil at Harsum-Hönnersum near Hildesheim. The proposed synonymisation of this species with *Tylenchus elegans* by Brzeski (1996) has not been accepted by Siddiqi (2000), Geraert (2008) and others.

Anguinoidea Nicoll, 1935

Anguinidae Nicoll, 1935

Ditylenchus brevicauda (Micoletzky, 1925) Filipjev, 1936
Described from Denmark. Reported by Paesler (1959) from a moist site with moss in Siebengebirge near Bonn.

*Ditylenchus elegans** Zell, 1988
Type locality: Schluttenbach, northern part of Schwarzwald; Luzulo-Fagetum, in leaf litter below *Fagus sylvatica* (Zell 1988b). Holotype deposited in Staatliches Museum für Naturkunde Karlsruhe.

*Ditylenchus halictus** Giblin-Davis, Erteld, Kanzaki, Ye, Zeng & Center, 2010
Collected from the bee *Halictus sexcinctus* Fabricius, 1775 in Brandenburg; type specimens deposited in US and Canadian collections (Giblin-Davis et al. 2010).

*Ditylenchus parvus** Zell, 1988
Type locality: Schluttenbach, northern part of Schwarzwald; Luzulo-Fagetum, in leave litter under *Fagus sylvatica* (Zell, 1988b). Holotype deposited in Staatliches Museum für Naturkunde Karlsruhe.

Nothotylenchus acutus Khan, 1965 (V)
= *Ditylenchus acutus* (Khan, 1965) Fortuner & Maggenti, 1987
Found in arable soil at Lathen/Ems (Sturhan unpubl.) and reported from sediment of Ems river (Traunspurger et al. 2015).

*Nothotylenchus drymocolus** Rühm, 1956
Brunn near Nürnberg (type locality) and Fichtelgebirge; found in frass of several Ipidae species from spruce trunks and pine wood but obviously not associated with these bark beetles.

Nothotylenchus thornei Andrássy, 1958
Reported from leave litter in a beech forest in the northern part of Schwarzwald; one female found and described (Zell 1988b).

Pseudhalenchus insolitus Mukhina & Morokhovec, 1985
Recorded by Zell (1988b) from leave litter in a beech forest at Schluttenbach, northern part of Schwarzwald.

Pseudhalenchus minutus Tarjan, 1958 (V)
Occasionally found in Germany, among others in coastal dunes in the nature reserve 'Weissenhäuser Brök' near Oldenburg/Holstein (new species record).

Safianema lutonense Siddiqi, 1980 (V)
= *Ditylenchus lutonensis* (Siddiqi, 1980) Fortuner, 1982
Recovered from humic soil in the upper 10 cm soil layer with pH 4.1, collected from a stand of spruce trees at Dreisesselberg-Hochstraße, south of Dreisesselberg in the southern part of Bayerischer Wald. The specimens collected are considered as conspecific with the type species of the genus *Safianema* (for details see under heading 5 below).

Sychnotylenchidae Paramonov, 1967

*Neoditylenchus abieticola** (Rühm, 1956) Meyl, 1961
= *Ditylenchus abieticolus* Rühm, 1956
Type locality Greding-Höbing (Mittelfranken); recovered by Rühm (1956) also at Stadtsteinach (Frankenwald) and St. Blasien (Schwarzwald); associated with the bark beetle *Cryphalus piceae* (Ratzeburg, 1837), living in *Abies alba*.

*Neoditylenchus autographi** (Rühm, 1956) Meyl, 1961

= *Ditylenchus autographi* Rühm, 1956
Type locality: Nürnberg and surroundings; also found at Greding-Untermässing (Mittelfranken); associated with the bark beetle *Dryocoetes autographus* (Ratzeburg, 1837) from *Picea excelsa*.

*Neoditylenchus dendrophilus** (Marcinowski, 1909) Meyl, 1961
= *Tylenchus dendrophilus* Marcinowski, 1909
Isolated from a branch of a cherry tree with pathological exudation of gum (Marcinowski 1909); no type locality given, but presumably near Berlin.

*Neoditylenchus eremus** (Rühm, 1956) Meyl, 1961
= *Ditylenchus eremus* Rühm, 1956
Described from Nürnberg and surroundings, probably associated with the bark beetle *Hylurgops palliates* (Gyllenhal, 1813); found in frass from pine wood.

*Neoditylenchus glischrus** (Rühm, 1956) Meyl, 1961
= *Ditylenchus glischrus* Rühm, 1956
Described from Nürnberg and surroundings (type locality), also found at Erlangen, Greding-Untermässing (Mittelfranken), Oberpfälzer Wald, Oberbayern; associated with the bark beetle *Pityogenes chalcographus* (Linnaeus, 1761) isolated from *Picea excelsa*.

*Neoditylenchus major** (Fuchs, 1915) Meyl, 1961
= *Tylenchus major* Fuchs, 1915
= *Ditylenchus major* (Fuchs, 1915) Filipjev, 1936
Described from Schwarzwald and Bavarian Alps, associated with the bark beetle *Ips typographus* (Linnaeus, 1758) living in pine trees. Rühm (1956) recovered the species at several localities in north-eastern Bayern and designated Erlangen as 'Leitfundort' (= designation used for the locality from where the species is being redescribed). Meyl (1961) ignored his own previous record (Meyl 1954) from rotten wood in a deciduous forest near Liebenburg.

Neoditylenchus ortus (Fuchs, 1938) Meyl, 1961
= *Anguillulina orta* Fuchs, 1938
= *Ditylenchus ortus* (Fuchs, 1938) Filipjev & Schuurmans Stekhoven, 1941
Originally described from Kärnten, Austria. Rühm (1956) found the species in Nürnberg and surroundings (designated as 'Leitfundort'), Erlangen and Greding-Höbing; associated with the bark beetle *Polygraphus poligraphus* (Linnaeus, 1758) living in *Picea excelsa*.

*Neoditylenchus panurgus** (Rühm, 1956) Meyl, 1961
= *Ditylenchus panurgus* Rühm, 1956
Described from Erlangen (type locality), also found in Nürnberg and surroundings, at Greding-Untermässing (Mittelfranken) and Süderlügum (Schleswig-Holstein); associated with the bark beetle *Hylastes ater* (Paykull, 1800) from *Pinus silvestris* and *Picea sitchensis*.

*Neoditylenchus petithi** (Fuchs, 1938) Meyl, 1961
= *Anguillonema petithi* Fuchs, 1938
= *Ditylenchus petithi* (Fuchs, 1938) Rühm, 1956
Originally described from frass galleries of the bark beetle *Hylesinus crenatus* (Fabricius, 1787) in *Fraxinus excelsior* wood obtained from a forest in Hessen (no particular type locality mentioned). Rühm (1956) provided a redescription based on specimens from München; also found at Greding-Höbing, Mittelfranken.

*Neoditylenchus pityokteinophilus** (Rühm, 1956) Meyl, 1961
= *Ditylenchus pityokteinophilus* Rühm, 1956
Type locality: Stadtsteinach north of Kulmbach (Frankenwald); also found in Regensburg and Nürnberg and surroundings; associated with the bark beetle *Pityokteines curvidens* (Germar, 1824) living in *Abies alba*.

Neoditylenchus striatus (Fuchs, 1938) Meyl, 1961
= *Ditylenchus striatus* (Fuchs, 1938) Rühm, 1956
Described from Kärnten, Austria. Rühm (1956) recovered this species at several localities in Franken, Oberpfalz, Schleswig-Holstein; he redescribed the species based on a population from Nürnberg and surroundings and designated the bark beetle *Pityogenes bidentatus* (Herbst, 1784) living in *Pinus* spp. as 'type host'.

Neoditylenchus xylebori (Roux, 1906) Goodey, 1963
= *Anguillonema xylebori* (Roux, 1905) Rühm, 1955
Found by Rühm (1955a) at Friedrichsruh, Sachsenwald; parasite of bark beetles.

*Sychnotylenchus abietis** Rühm, 1955
Described from Süderlügum and Karlum, Schleswig-Holstein; associated with the bark beetle *Cryphalus abietis* (Ratzeburg, 1837) living in *Picea excelsa* and *P. sitchensis* (Rühm 1955b). The species was described under this name prior to the designation of the genus *Sychnotylenchus* by Rühm (1956). In accordance with the International Code of Zoological Nomenclature the taxa proposed by Rühm (1960) in his Ph.D. thesis are not considered as valid.

*Sychnotylenchus intricati** Rühm, 1956
Type locality: Nürnberg and surroundings; found in galleries of the bark beetle *Scolytus intricatus* (Ratzeburg, 1837) in *Quercus sessiliflora* and *Q. pedunculata.*

*Sychnotylenchus ulmi** Rühm, 1956
Described from Erlangen (type locality), Nürnberg and surroundings, München; associated with the bark beetles *Scolytus scolytus* (Fabricius, 1775) (type host) and *S. multistriatus* (Marsham, 1802) living in *Ulmus campestris* and *U. montana*.

HOPLOLAIMINA Chizhov & Berezina, 1988

Psilenchidae Paramonov, 1967

Psilenchus aestuarius Andrássy, 1962 (V)
Found in arable soil at Hessloch near Alzey, Rheinhessen (new species record).

Psilenchus hilarulus de Man, 1921 (V)
First record for Germany by Meyl (1961). Later occasionally recovered in arable soil and aquatic or wet habitats.

HEXATYLINA Siddiqi, 1980

Sphaerularioidea Lubbock, 1861

Allantonematidae Pereira, 1931

*Allantonema matthesi** Wachek, 1955
Described from Franken (no type locality mentioned); parasite of *Ochthebius* sp. (Coleopt.).

*Allantonema mirabile** Leuckart, 1884
Described as a parasite of *Hylobius pini* Ratzeburg, 1855 (Coleopt.) from forests in Sachsen (Leuckart 1884), reported by Fuchs (1915) from Oberbayern and by Wülker (1921, 1923) from Bienwald (Rheinpfalz). *Allantonema picei* Fuchs, 1929 described from *Hylobius excavatus* (Laicharting, 1781) (syn. *Hylobius piceus* (de Geer, 1775)) occurring in larch (*Larix*) in the Alps, is considered conspecific with *A. mirabile* by Wachek (1955).

*Allantonema morosum** (Fuchs, 1929) Filipjev, 1934
= *Tylenchus morosus* Fuchs, 1929
No type locality given by Fuchs (1929), but presumably collected in the northern part of Schwarzwald; parasite of the bark beetle *Hylastes cunicularius* Erichson, 1836. Rühm (1956) recovered this species as a parasite of *Hylastes ater* (Paykull, 1800) in and near Nürnberg and presented a redescription.

*Allantonema philonthi** Wachek, 1955
Described from 'Franken' (no type locality mentioned); found under decaying vegetable; parasite of *Philonthus* spp. (Coleopt.).

*Allantonema silvaticum** von Linstow, 1893
Described by von Linstow (1893) as a parasite of *Anoplotrupes stercorosus* (Scriba, 1791) (syn. *Geotrupes sylvaticus* Panzer, 1799; Coleopt.) from the wooded hill Harrl near Bückeburg and from Göttinger Wald, east of Göttingen.

*Bovienema gifuchsi** Siddiqi, 1986
= *Parasitylenchus contortus chalcographi* Fuchs, 1938
= *Contortylenchus chalcographi* (Fuchs, 1938) Rühm, 1956
No type locality mentioned by Fuchs (1938), but probably recovered in Germany. Rühm (1956) recorded this parasite of the bark beetle *Pityogenes chalcographus* (Linnaeus, 1761) from *Picea excelsa* at Erlangen, Nürnberg and surroundings, Oberpfälzer Wald, Oberbayern, Sieber (Harz) and redescribed the species from Greding-Höbing, Mittelfranken. Siddiqi (1986) transferred the species to *Bovienema* and renamed it.

Bovienema tomici (Bovien, 1937) Nickle, 1963
= *Contortylenchus tomici* (Bovien, 1937) Rühm, 1956
Rühm (1956) found this species in and near Nürnberg, Erlangen, Pegnitz (population used for redescription), Oberpfälzer Wald, Vorderer Steigerwald and Süderlügum (Schleswig-Holstein) as a parasite of bark beetles, *Pityogenes* spp., recovered from *Pinus* species.

*Bradynema bibionis** Wachek, 1955
Described from the surroundings of Erlangen, Franken; parasite of *Bibio* sp. (Dipt.).

Bradynema rigidum (von Siebold, 1836) zur Strassen, 1892
= *Filaria rigida* von Siebold, 1836
Originally described by von Siebold (1836) as parasite of the beetle *Aphodius fimetarius* (Linnaeus, 1758) from Danzig (now: Gdansk, Poland); zur Strassen (1892) probably based his detailed studies on nematodes isolated from *A. fimetarius* near Leipzig. Wülker (1921) recovered the species near Frankfurt/Main, in Vogelsberg and Rhein valley near St. Goar.

*Bradynema strasseni** Wülker, 1921
Described from Bienwald (Rheinpfalz); parasitic in *Rhagium* larvae (Coleopt.) isolated from pine wood. Wülker (1923) added the capricorn beetle *Spondylis buprestoides* as host and presented an emendated diagnosis.

*Bradynema trixagi** Wachek, 1955
Described from Franken, type locality not mentioned but most probably found at Ebrach (Steigerwald); parasite of *Trixagus dermestoides* (Linnaeus, 1767) (syn. *Throscus dermestoides*; Coleopt.).

*Contortylenchus acuminati** Rühm, 1956
Type locality: Nürnberg and surroundings; also found in Erlangen, Greding-Höbing (Mittelfranken), Frankfurt/Main and surroundings, and in Schwarzwald; parasite of the bark beetle *Ips acuminatus* (Gyllenhal, 1827).

*Contortylenchus amitini** Rühm, 1956
Type locality: Greding-Höbing (Mittelfranken), also found in Oberpfälzer Wald; parasite of the bark beetle *Ips amitinus* (Eichhoff, 1871).

*Contortylenchus contortus** (Fuchs, 1915) Sudhaus & Loof, 2004
= *Tylenchus contortus* Fuchs, 1915
= *Tylenchus contortus typographi* Fuchs, 1915
= *Contortylenchus diplogaster* Hirschmann & Rühm, 1955
Type species of the genus *Contortylenchus* according to Sudhaus and Loof (2004). Described by Fuchs (1915) as parasite of the beetle *Ips typographus* (Linnaeus, 1758); type locality not mentioned, but according to Fuchs (1929, p. 274) specimens collected in July 1914 at Schluchsee, Schwarzwald. Rühm (1956) provided a detailed description of *C. diplogaster* based on studies of a population from Nürnberg, added new records from several regions in Germany and reported *Ips cembrae* (Heer, 1836) as an additional host.

*Contortylenchus cryphali** Rühm, 1956
Type locality: Greding-Höbing (Mittelfranken), also found at Waldsteinach (Frankenwald) and St. Blasien (Schwarzwald); parasite of the bark beetle *Cryphalus piceae* (Ratzeburg, 1837).

*Contortylenchus cunicularii** (Fuchs, 1929) Rühm, 1956

= *Tylenchus contortus cunicularii* Fuchs, 1929
Originally described from Schluchsee (Schwarzwald); parasite of the bark beetle *Hylastes cunicularius* Erichson, 1836. Rühm (1956) found the species in Erlangen, Nürnberg and surroundings, Greding-Höbing (population used for redescription), Süderlügum (Schleswig-Holstein) and added *H. ater* (Paykull, 1800) as an additional host living in *Pinus* and *Picea* species.

*Contortylenchus laricis** (Fuchs, 1929) Rühm, 1956
= *Tylenchus contortus laricis* Fuchs, 1929
Described as a parasite of *Orthotomicus laricis* (Fabricius, 1792) (syn. *Ips laricis*; Coleopt.); type locality not mentioned. Rühm (1956) found the species in the same host in and near Erlangen (population used for redescription), in *Orthotomicus suturalis* (Gyllenhal, 1827) (syn. *Ips suturalis*; Coleopt.) in Fichtelgebirge, Greding-Höbing (Mittelfranken), in and near Nürnberg; parasitised bark beetles isolated from *Pinus silvestris* and *Picea excelsa*.

*Howardula acarinorum** Wachek, 1955
Described from Franken (no type locality given); parasite of *Parasitellus fucorum* (de Geer, 1778) and *Poecilochirus necrophori* Vitzthum, 1930 (Mesostigmata, Acari).

Howardula oscinellae (Goodey, 1930) Wachek, 1955
Reported for Germany by Riggert (1935), for Franken by Wachek (1955); parasite of *Oscinella frit* (Linnaeus, 1758) (Brachycera, Diptera).

Howardula phyllotretae Oldham, 1933
Reported for Franken by Wachek (1955); parasite of *Phyllotreta undulata* Kutschera, 1860 (Coleopt.).

*Metaparasitylenchus boopini** (Wachek, 1955) Siddiqi, 1986
= *Parasitylenchus* (*Proparasitylenchus*) *boopini* Wachek, 1955
Described from near Erlangen; parasite of *Carpelimus (Carpelimus) fuliginosus* (Gravenhorst, 1802) (syn. *Trogophloeus* (*Boopinus*) *fuliginosus*; Coleopt.).

*Metaparasitylenchus cossoni** (Wülker, 1929) Nickle, 1967
= *Parasitylenchus* (*Metaparasitylenchus*) *cossoni* (Wülker, 1929) Wachek, 1955
Type locality: Erfelden (Hessen, Wülker 1929); reported by Wachek (1955) from Pommersfelden, Franken; parasite of *Cossonus* spp. (Coleopt.), found under the bark of *Populus*.

*Metaparasitylenchus cryptophagi** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Metaparasitylenchus*) *cryptophagi* Wachek, 1955
Described from Ebrach (Franken); parasite of *Cryptophagus distinguendus* Sturm, 1845 (syn. *Cryptophagus umbratus* Erichson, 1846; Coleopt.).

*Metaparasitylenchus helmidis** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Metaparasitylenchus*) *helmidis* Wachek, 1955
Described from Wiesent, Trubach and Leinleiter (Franken), type locality not specifically indicated; parasite of the beetles *Elmis maugetii* Latreille, 1802 (syn. *Helmis maugei* Bedel, 1878), *Limnius volckmari* (Panzer, 1793) (syn. *Latelmis volkmari*), *Riolus subviolaceus* (Müller, 1817).

*Metaparasitylenchus mycetophagi** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Metaparasitylenchus*) *mycetophagi* Wachek, 1955
Described from Steigerwald, Franken; parasite of the beetle *Mycetophagus* (*Ulolendus*) *piceus* (Fabricius, 1777).

*Metaparasitylenchus oschei** (Rühm, 1956) Nickle, 1967
= *Parasitylenchus* (*Metaparasitylenchus*) *oschei* Rühm, 1956
Described from Brunn near Nürnberg; parasite of the beetle *Rhizophagus ferrugineus* (Paykull, 1800).

*Metaparasitylenchus rhizophagi** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Metaparasitylenchus*) *rhizophagi* Wachek, 1955
Described from Steigerwald (Franken) and Hutberg near Nürnberg; parasite of the beetle *Rhizophagus bipustulatus* (Fabricius, 1792).

*Metaparasitylenchus strangaliae** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Metaparasitylenchus*) *strangaliae* Wachek, 1955
Described from Franken (no type locality mentioned) and Hunsrück; parasite of *Strangalia* spp. (Coleopt.).

*Metaparasitylenchus telmatophili** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Metaparasitylenchus*) *telmatophili* Wachek, 1955
Described from Erlangen, Franken; parasite of *Telmatophilus* spp. (Coleopt.).

*Metaparasitylenchus tetropii** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Metaparasitylenchus*) *tetropii* Wackek, 1955
Described from Forchheim, Franken; parasite of *Tetropium* spp. (Coleopt.).

*Neoparasitylenchus betulae** (Rühm, 1956) Nickle, 1967
= *Parasitylenchus* (*Parasitylenchus*) *betulae* Rühm, 1956
Type locality: Burglengenfeld (Oberpfalz); parasite of *Scolytus ratzeburgi* Janson, 1856 (Coleopt.) living in *Betula verrucosa*.

*Neoparasitylenchus chalcographi** (Fuchs, 1938) Nickle, 1967
= *Parasitylenchus dispar chalcographi* Fuchs, 1938
= *Parasitylenchus* (*Parasitylenchus*) *chalcographi* (Fuchs, 1938) Rühm, 1956

No type locality mentioned, but most likely described from southern Germany; parasite of the beetle *Pityogenes chalcographus* (Linnaeus, 1761) living in *Picea excelsa* and *P. sitchensis*. Rühm (1956) found the species at Brunn near Nürnberg.

*Neoparasitylenchus cinerei** (Fuchs, 1929) Nickle, 1967
= *Parasitylenchus* (*Parasitylenchus*) *cinerei* (Fuchs, 1929) Rühm, 1956
= *Parasitylenchus dispar pusilli* Fuchs, 1938
No type locality mentioned, but probably described from southern Germany; parasite of the bark beetle *Crypturgus cinereus* (Herbst, 1793) (type host) living in *Pinus silvestris* and *P. excelsa*. Also no type locality in Germany given for *P. dispar pusilli*, parasite of *Crypturgus pusillus* (Gyllenhal, 1813). Rühm (1956) found both hosts parasitised by the nematode in Nürnberg, Greding-Höbing, Oberpfälzer Wald, Oberbayern and used a population from Erlangen for redescribing the species.

*Neoparasitylenchus cryphali** (Fuchs, 1914) Nickle, 1967
= *Tylenchus dispar cryphali* Fuchs, 1914
= *Parasitylenchus* (*Parasitylenchus*) *cryphali* (Fuchs, 1914) Rühm, 1956
Described from Herrenwies, Schwarzwald; parasite of the bark beetle *Cryphalus piceae* (Ratzeburg, 1837) living in *Picea alba*. Rühm (1956) recovered the species at Stadtsteinach (Frankenwald), St. Blasien (Schwarzwald) and used a population from Greding-Höbing (Mittelfranken) for a redescription.

*Neoparasitylenchus hylastis** (Wülker, 1923) Nickle, 1967
= *Tylenchus hylastis* Wülker, 1923
= *Parasitylenchus* (*Parasitylenchus*) *hylastis* (Wülker, 1923) Filipjev, 1934
= *Tylenchus dispar ateri* Fuchs, 1929
= *Tylenchus dispar cunicularii* Fuchs, 1929
Described from Rheinland-Pfalz and the surroundings of Frankfurt/Main; parasite of the bark beetle *Hylastes ater* (Paykull, 1800). Rühm (1956) reported the species from several additional localities in southern Germany and from Schleswig-Holstein and mentioned five *Hylastes* species from *Pinus silvestris*, *Picea excelsa* and *P. sitchensis* as hosts.

*Neoparasitylenchus ligniperdae** (Fuchs, 1929) Nickle, 1967
= *Tylenchus ligniperdae* Fuchs, 1929
= *Parasitylenchus* (*Parasitylenchus*) *ligniperdae* (Fuchs, 1929) Filipjev, 1934
Type locality probably Herrenwies, Schwarzwald; found by Rühm (1956) in Erlangen, Nürnberg and surroundings. Parasite of the bark beetle *Hylurgus ligniperda* (Fabricius, 1787) living in roots of pine trees.

*Neoparasitylenchus notati** (Fuchs, 1929) Siddiqi, 1986
= *Tylenchus sulphureus notati* Fuchs, 1929
No type locality mentioned, but probably originating from southern Germany; parasite of *Pissodes notatus* Bosdorff, 1785 (Coleopt.) from pine trees; poorly described.

*Neoparasitylenchus orthotomici** (Rühm, 1960) Nickle, 1967
= *Parasitylenchus orthotomici* Rühm, 1960
Described as a parasite of *Orthotomicus laricis* (Fabricius, 1792) (syn. *Ips laricis;* Coleopt.) from Sachsenwald near Hamburg.

*Neoparasitylenchus pityophthori** (Rühm, 1956) Nickle, 1967
= *Parasitylenchus* (*Parasitylenchus*) *pityophthori* Rühm, 1956
Type locality: Herrsching am Ammersee (Bayern); parasite of the bark beetle *Pityophthorus micrographus* (Linnaeus, 1758) living in *Picea excelsa*.

*Neoparasitylenchus wuelkeri** (Rühm, 1956) Nickle, 1967
= *Parasitylenchus* (*Parasitylenchus*) *wuelkeri* Rühm, 1956
Type locality: Karlum (Schleswig-Holstein), also found at Süderlügum and Wallsbüll (Schleswig-Holstein); parasite of the bark beetle *Dendroctonus micans* (Kugelmann, 1794) living in *Picea* spp.

*Parasitylenchoides ditomae** Wachek, 1955
Found in Steigerwald, near Nürnberg and in Schwäbische Alb (no type locality given); parasite of *Bitoma crenata* (Fabricius, 1775) (syn. *Ditoma crenata*; Coleopt.).

*Parasitylenchoides koerneri** Wachek, 1955
Described from the surroundings of Erlangen; parasite of the staphylinid beetle *Anotylus tetracarinatus* (Block, 1799) (syn. *Oxytelus tetracarinatus*).

*Parasitylenchoides paederi** Wachek, 1955
Described from the surroundings of Erlangen; parasite of the staphylinid beetle *Paederus littoralis* Gravenhorst, 1802.

*Parasitylenchoides paromali** Wachek, 1955
Described from Niederbayern (no locality given); parasite of the curculionid beetle *Micromalus* (*Paromalus*) *parallelepipedus* (Herbst, 1792).

*Parasitylenchoides rheocharae** Wachek, 1955
Described from near Erlangen; parasite of staphylinid beetle *Aleochara* (*Rheochara*) *spadicea* (Erichson, 1837).

*Parasitylenchoides sciodrepae** Wachek, 1955
Described from near Erlangen; parasite of *Sciodrepoides watsoni* (Spence, 1815) (syn. *Sciodrepa* watsoni; Coleopt.).

*Parasitylenchoides steni** Wachek, 1955
Described from the surroundings of Erlangen; parasite of *Stenus* spp. (Coleopt.).

*Parasitylenchoides wichmanni** Wachek, 1955
Described from Bayerischer Wald, Schwäbische Alb and near Erlangen (no type locality given); parasite of *Plegaderus caesus* (Herbst, 1792) and *P. discisus* Erichson, 1839 (Coleopt.).

*Proparasitylenchus athetae** (Wachek, 1955) Nickle, 1967

= *Parasitylenchus* (*Proparasitylenchus*) *athetae* Wachek, 1955
Described from Franken, no type locality given, but probably from the surroundings of Erlangen; parasite of the staphylinid beetle *Nehemitropia lividipennis* (Mannerheim, 1830) (syn. *Atheta sordida* (Marsham, 1802)).

*Proparasitylenchus medonis** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Proparasitylenchus*) *medonis* Wachek, 1955
Described from the surroundings of Erlangen; parasite of *Medon ripicola* (Kraatz, 1854) (Coleopt.).

*Proparasitylenchus myrmedoniae** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus (Proparasitylenchus) myrmedoniae* Wachek, 1955
Described from near Erlangen; parasite of *Pella lugens* (Gravenhorst, 1802) (syn. *Zyras lugens* Gravenhorst, 1802; Coleopt.).

*Proparasitylenchus oxyteli** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Proparasitylenchus*) *oxyteli* Wachek, 1955
Described from near Erlangen; parasite of *Anotylus complanatus* (Erichson, 1839) (syn. *Oxytelus complanatus* Erichson, 1839; Coleopt.).

*Proparasitylenchus platystethi** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Proparasitylenchus*) *platystethi* Wachek, 1955
Described from near Erlangen; parasite of *Platystethus cornutus* (Gravenhorst, 1802) (Coleopt.).

*Proparasitylenchus trogophloei** (Wachek, 1955) Nickle, 1967
= *Parasitylenchus* (*Proparasitylenchus*) *trogophloei* Wachek, 1955
Described from near Erlangen; parasite of *Carpelimus* (*Paratrogophloeus*) *bilineatus* Stephens, 1834 (syn. *Trogophloeus bilineatus*; Coleopt.).

*Protylenchus anobii** (Wachek, 1955) Siddiqi, 1986
= *Parasitylenchoides anobii* Wachek, 1955
Described from Franken, type locality probably Erlangen; parasite of the beetles *Hadrobregmus pertinax* (Linnaeus, 1758) (syn. *Anobium pertinax*) and *Anobium striatum* Olivier, 1790.

*Protylenchus heteroceri** Wachek, 1955
Described from Franken and Schwaben, type locality probably Erlangen; parasite of *Heterocerus marginatus* (Fabricius, 1787) and *H. fenestratus* (Thunberg, 1784) (Coleopt.).

Scatonema wuelkeri Bovien, 1932
Described from Denmark; parasite of *Scatopse* (Dipt.). Wachek (1955) found the nematode in *Coboldia fuscipes* (Meigen, 1830) (syn. *Scatopse fuscipes*; Dipt.) in Franken.

*Sulphuretylenchus escherichi** (Rühm, 1956) Nickle, 1967
= *Parasitylenchus* (*Sulphuretylenchus*) *escherichi* Rühm, 1956
Type locality: Zusmarshausen (Oberbayern); also found by Rühm (1956) at Erlangen, Nürnberg and surroundings; parasite of the bark beetle *Dryocoetes autographus* (Ratzeburg, 1837) living in *Picea excelsa*.

*Sulphuretylenchus fuchsi** (Rühm, 1956) Nickle, 1967
= *Parasitylenchus sulphureus poligraphi* Fuchs, 1938
= *Parasitylenchus* (*Sulphuretylenchus*) *fuchsi* Rühm, 1956
Type locality: Erlangen, also found in and near Nürnberg, Greding-Höbing (Mittelfranken); parasite of the bark beetle *Polygraphus poligraphus* (Linnaeus, 1758) living in *Picea excelsa*.

*Sulphuretylenchus grosmannae** (Rühm, 1954) Nickle, 1967
= *Parasitylenchus* (*Sulphuretylenchus*) *grosmannae* Rühm, 1954
Described by Rühm (1954) from Südtondern and Flensburg (Schleswig-Holstein); parasite of the curculionid beetle *Pityogenes bidentatus* (Herbst, 1784).

*Sulphuretylenchus kleinei** (Rühm, 1956) Nickle, 1967
= *Parasitylenchus* (*Sulphuretylenchus*) *kleinei* Rühm, 1956
Type locality: Nürnberg and surroundings; also found at Greding-Höbing (Mittelfranken) and **Sü**derlügum (Schleswig-Holstein); parasite of the bark beetle *Hylastes ater* (Paykull, 1800) isolated from *Pinus silvestris* and *Picea sitchensis*.

*Sulphuretylenchus sulphureus** (Fuchs, 1938) Nickle, 1967
= *Parasitylenchus sulphureus chalcographi* Fuchs, 1938
= *Parasitylenchus* (*Sulphuretylenchus*) *sulphureus* Fuchs, 1938
No type locality mentioned, but most probably described from southern Germany; parasite of the bark beetle *Pityogenes chalcographus* (Linnaeus, 1761) living in *Picea excelsa*. Rühm (1956) reported the nematode from Erlangen (designated as 'Leitfundort'; supplementing morphological characters given), Nürnberg and surroundings, Oberpfälzer Wald and Oberbayern.

Thripinema aptini (Sharga, 1932) Siddiqi, 1986
= *Howardula aptini* (Sharga, 1932) Wachek, 1955
Reported from Franken by Wachek (1955); parasite of *Aptinothrips rufus* Haliday, 1836 (Thysanopt.).

Neotylenchidae Thorne, 1941

Deladenus aridus Andrássy, 1957
= *Deladenus crassus* Zell, 1985
Zell (1985b) described *D. crassus* from leave litter of a beech forest at Schluttenbach 15 km south of Karlsruhe; type specimens deposited in Naturkundemuseum Karlsruhe.

Deladenus durus (Cobb, 1922) Thorne, 1941 (V)
First recorded for Germany by Meyl (1961). Reported by Niemann (1996) from arable soil near Neustadt am Rübenberge.

*Deladenus minimus** Chizhov & Sturhan, 1998 (VT)
Described from a forest east of Braunschweig, found in a dead trunk of *Pinus silvestris.*

*Deladenus norimbergensis** Rühm, 1956
Type locality: Nürnberg and surroundings; also found at Greding-Höbing (Mittelfranken); occurring in rotten wood of *Quercus pedunculata and Q. sessiliflora*, probably associated with *Clytus* sp. (Coleopt.).

Deladenus obesus Thorne, 1941
Paesler (1957) reported this species from mushroom cultivation in Dieskau near Halle.

*Deladenus parvus** Zell, 1985
Type locality: Schluttenbach near Ettlingen and ca. 15 km south of Karlsruhe, described from leave litter of a beech forest in the northern piedmont of Schwarzwald (Zell 1985b). Type specimens deposited in Naturkundemuseum Karlsruhe.

Deladenus proximus Bedding, 1974 (V)
Specimens present in the German Nematode Collection (DNST) were probably collected in a forest near Braunschweig.

Deladenus rudyi Bedding, 1974
According to Andrássy (2007) known from Germany.

Deladenus siricidicola Bedding, 1968
Braasch and Apel (1997) reported an association of this species with the wood wasp *Sirex juvencus* (Linnaeus, 1758) isolated from *Pinus sylvestris* in a forest near Theessen (Brandenburg).

Deladenus wilsoni Bedding, 1968
According to Andrássy (2007) known to occur in Germany.

*Gymnotylenchus dendrophilus** (Rühm, 1956) Sumenkova, 1975
= *Neotylenchus dendrophilus* Rühm, 1956
Type locality: Nürnberg and surroundings; also found by Rühm (1956) in Fichtelgebirge and at Heiligenstadt (Fränkische Schweiz); mainly recovered from *Picea excelsa,* obviously not closely associated with species of Ipidae (Coleopt.).

Hexatylus viviparus Goodey, 1926 (V)
= *Hexatylus abulbosus* (Steiner, 1931) Goodey, 1933
= *Hexatylus brevicaudatus* Meyl, 1954
= *Hexatylus dipapillatus* Meyl, 1954
Occasionally reported from Germany, first by Goffart from rotting potatoes (Filipjev & Schuurmans Stekhoven 1941); later among others isolated from strawberry plants and around lucerne roots. Meyl (1954) reported *Hexatylus viviparus* and *H. abulbosus* from fungi in a deciduous forest at Liebenburg north of Goslar and described *H. brevicaudatus* and *H. dipapillatus* from fungi from the deciduous forest Buchhorst at Braunschweig-Riddagshausen. Later, he considered the last two species as being synonymous with *H. viviparus* (Meyl 1961). Both species are considered as *species inquirendae* by Siddiqi (2000).

Sphaerulariidae Lubbock, 1861

*Neomisticius rhizomorphoides** (Rühm, 1955) Siddiqi, 1986
= *Anguillonema rhizomorphoides* Rühm, 1955
Described from Friedrichsruh, Sachsenwald (Rühm 1955a); associated with the bark beetle *Xyleborus dryographus* (Ratzeburg, 1837).

Paurodontoides sp. (V)
Numerous females, males and juveniles found around *Begonia elatior* in a nursery at Pfaffenhofen, Bayern, were identified as members of the genus *Paurodontoides*; they are representing an obviously still undescribed species (details under heading 5 below; first record of the genus for Germany and Europe).

Prothallonema intermedium (Christie, 1938) Siddiqi, 1986
= *Hexatylus intermedius* Christie, 1938
= *Neotylenchus intermedius* (Christie, 1938) Thorne, 1941
Reported by Meyl (1954) from mushroom in a deciduous forest near Braunschweig.

*Prothallonema mycophilum** (Rühm, 1956) Siddiqi, 1986
= *Stictylus mycophilus* Rühm, 1956
Type locality: Nürnberg and surroundings; also found at Greding-Höbing (Mittelfranken); occurring in frass of various insects and under loose bark of *Fagus silvatica.*

*Prothallonema piceae** (Fuchs, 1929) Siddiqi, 1986
= *Tylenchus suphureus piceae* Fuchs, 1929
= *Stictylus sulphureus piceae* (Fuchs, 1929) Rühm, 1956
Described from Schwarzwald; found in and associated with the curculionid beetle *Pissodes piceae* (Illiger, 1807) isolated from spruce.

*Prothallonema pini** (Fuchs, 1929) Siddiqi, 1986
= *Tylenchus suphureus pini* Fuchs, 1929
= *Allantonema pini* (Fuchs, 1929) Wachek, 1955
= *Stictylus pini* (Fuchs, 1929) Rühm, 1956
Described from Hardtwald near Karlsruhe and Herrenwies/ Schwarzwald; parasitic in and associated with the curculionid beetle *Pissodes pini* (Linnaeus, 1758). Rühm (1956) reported the nematode from Nürnberg and surroundings and presented a detailed description.

*Prothallonema piniphili** (Fuchs, 1929) Siddiqi, 1986
= *Tylenchus sulphureus piniphili* Fuchs, 1929
= *Stictylus piniphili* (Fuchs, 1929) Rühm, 1956
Inadequately described from Schwarzwald; found associated with the curculionid beetle *Pissodes piniphilus* (Herbst, 1797).

*Prothallonema pseudobtusum** (Rühm, 1956) Siddiqi, 1986
= *Stictylus pseudobtusus* Rühm, 1956
Type locality: Nürnberg and surroundings; found in frass of various Cerambycidae species and of the bark beetle *Scolytus intricatus* (Ratzeburg, 1837) from *Quercus pedunculata*.

*Prothallonema stammeri** (Wachek, 1955) Siddiqi, 1986
= *Sphaerulariopsis stammeri* Wachek, 1955
= *Stictylus stammeri* (Wachek, 1955) Rühm, 1956
Described from Steigerwald, Franken; parasite of *Ernobius abietis* (Fabricius, 1792) (Coleopt.), found in spruce and fir cones.

Sphaerularia bombi Dufour, 1837
Early records from Germany by Schneider (1866), Leuckart (1886) and others. Parasite of Hymenoptera (*Bombus* spp. and *Vespa* spp.); heavy infections reported by Wachek (1955).

*Tripius gibbosus** (Leuckart, 1886) Chitwood, 1935
= *Asconema gibbosum* Leuckart, 1886
Originally described from Germany, type locality unknown; parasite of *Cecidomyia pini* (De Geer, 1776) (Dipt.), but host identity doubtful (Wachek 1955).

Tripius sciarae (Bovien, 1944) Wachek, 1955
Described from Denmark; found as a parasite of *Sciara* sp. (Dipt.) in Franken and Greifswald (Wachek 1955).

Iotonchioidea Goodey, 1953

Iotonchiidae Goodey, 1953

*Fungiotonchium fungorum** (Bütschli, 1873) Siddiqi, 1986
= *Tylenchus fungorum* Bütschli, 1873
= *Iotonchium fungorum* (Bütschli, 1873) Filipjev & Schuurmans Stekhoven, 1941
Described from decaying fungi in Germany; no type locality given.

*Fungiotonchium macrospiculatum** (Meyl, 1954) Siddiqi, 1986
= *Hexatylus macrospiculatus* Meyl, 1954
Type locality: Deciduous forest near Liebenburg south of Salzgitter, collected from mushroom.

*Iotonchium cephalostrictum** Meyl, 1954
Type locality: Mixed forest near Liebenburg south of Salzgitter, collected from mushroom.

*Iotonchium imperfectum** (Bütschli, 1876) Cobb, 1920
= *Tylenchus imperfectus* Bütschli, 1876
Described from decaying mushrooms in Germany; no type locality mentioned.

Parasitylenchidae Siddiqi, 1986

*Parasitylenchus curvidentis** (Fuchs, 1914) Micoletzky, 1922
= *Tylenchus dispar curvidentis* Fuchs, 1914
= *Polymorphotylenchus* (*Thylakolenchus*) *curvidentis* (Fuchs, 1914) Rühm, 1956
Described as parasite of the bark beetle *Pityokteines curvidens* (Germar, 1824) (Coelopt.), recovered from Schwarzwald. Reported by Rühm (1956) from Regensburg, Nürnberg and surroundings, Stadtsteinach in Frankenwald (designated as 'Leitfundort'; this population recovered used for redescription of the species).

Parasitylenchus dispar (Fuchs, 1915) Micoletzky, 1922
= *Tylenchus dispar typographi* Fuchs, 1915
= *Polymorphotylenchus* (*Polymorphotylenchus*) *typographi* (Fuchs, 1915) Rühm, 1956
Described as a parasite of *Ips typographus* (Linnaeus, 1758) (Coleopt.) from beetle specimens, which Fuchs had collected in Austria (Kärnten, Salzburg), Germany (Schwarzwald, Oberbayern) and Switzerland. The particular type locality and the 'type country' are thus unknown. Reported and redescribed in detail by Rühm (1956) from Erlangen, Greding-Höbing, Nürnberg and surroundings.

*Wachekitylenchus bovieni** (Wachek, 1955) Slobodyanyuk, 1986
= *Heterotylenchus bovieni* Wachek, 1955
Found in Franken and Schlesien; no type locality mentioned, but probably described from close to Erlangen; parasite of the carabid beetles *Notaphus* (*Notaphus*) *varius* (Olivier, 1795) (syn. *Bembidion varium*) and *Notaphus* (*Notaphus*) *obliquus* (Sturm, 1825) (syn. *Bembidion obliquum*).

*Wachekitylenchus stammeri** (Wachek, 1955) Slobodyanyuk, 1986
= *Heterotylenchus stammeri* Wachek, 1955
Described from close to Erlangen, Franken; parasite of the carabid beetle *Clivina fossor* (Linnaeus, 1758) (Coleopt.).

*Wachekitylenchus wuelkeri** (Wachek, 1955) Slobodyanyuk, 1986
= *Heterotylenchus wuelkeri* Wachek, 1955
Described from close to Erlangen, Franken; parasite of the carabid beetle *Trepanes* (*Trepanes*) *articulatus* (Panzer, 1796) (syn. *Bembidion articulatum*).

4. Synonyms, species inquirendae et incertae sedis and doubtful records

Species described from Germany, which are currently considered as *species inquirendae* or have been synonymised with previously described species, are also marked by an asterisk (*) in the overview below. Type localities of such species are mentioned if available. In general, only such synonyms are listed below, which were used in more recent or in the last comprehensive publications on nematodes in Germany, in particular, Wachek (1955), Rühm (1956), Meyl (1961). For more detailed lists of synonyms see Siddiqi (2000) and Geraert (2008).

*Aglenchus paragricola** (Paetzold, 1958) Meyl, 1961
= *Aglenchus agricola*

Allantonema diplogaster von Linstow, 1890
= *Oigolaimella diplogaster* (von Linstow, 1890) Fürst von Lieven, 2003 (see Sudhaus & Loof 2004).

*Anguillonema poligraphi** Fuchs, 1938
= *species inquirenda*
Found in frass galleries of the bark beetle *Polygraphus poligraphus* (Linnaeus, 1758) in fure bark.

*Contortylenchus chalcographi** (Fuchs, 1938) Rühm, 1956 = *Bovienema gifuchsi*

Contortylenchus diplogaster apud Rühm, 1956
= *Contortylenchus contortus*

*Deladenus crassus** Zell, 1985 = *Deladenus aridus*

Ditylenchus intermedius (de Man, 1880) Filipjev, 1936
According to de Man (1884) originally described from Sydenham, England. Considered as *species inquirenda* by Brzeski (1991) and not included among the 26 *Ditylenchus* species distinguished in Poland (Brzeski 1998); regarded as doubtful species by Bongers (1988) and Loof (2001), but retained among the valid *Ditylenchus* species by Siddiqi (2000), Andrássy (2007) and in 'Fauna Europaea'. Schneider (1939) mentioned its occurrence in Germany and according to Meyl (1961) very common in Central Europe; later on often reported by many authors from various localities and habitats in Germany, but the true species identity is unknown.

Ditylenchus aff. *nortoni* (Elmiligy, 1971) Bello & Geraert, 1972
Reported by Zell (1988b) from a beech forest in the northern part of Schwarzwald.

*Ditylenchus tenuis** (Kischke, 1956) Brzeski, 1991
= *species inquirenda*
= *Tylenchus davainei* var. *tenuis* Kischke, 1956
= *Tylenchus kischkei* Meyl, 1961
= *Ditylenchus kischkeae* (Meyl, 1961) Loof, 1885
Described from *Sphagnum*, peat soils and pools in Harz mountains.

Ecphyadophoroides sp. *apud* Sturhan (1970)
= *Tenunemellus* sp.

*Filenchus amaritus** Zell, 1988 = *Filenchus misellus*

*Filenchus filiformis** (Bütschli, 1873) Meyl, 1961
= *Tylenchus filiformis* Bütschli, 1873
Described by Bütschli (1873) from soil under moss in Germany; no type locality mentioned, but probably recovered in Frankfurt/Main (according to de Man (1884)). Due to Bütschli's sparse description based on a single female, Brzeski (1963, 1998) and later also Andrássy (2007) and Geraert (2008) considered *F. filiformis* as 'species inquirenda', while Siddiqi (2000) and 'Fauna Europaea' retained it among valid species. It must be assumed that the many records from Germany, e.g., from Erlangen (de Man 1884), Jena (Cobb 1888), from grass roots and under moss near Dinslaken and Hiesfeld (Schneider 1923), from forest soils near Bad Bergzabern and Karlsruhe (Volz 1951) and from many other localities and habitats, possibly refer to (more than one) other species. Zell (1985a) states that *F. filiformis, F. vulgaris, F. polyhypnus* and *F. orbus* had frequently been mixed in the past and records may thus not be reliable. Bassus (1962a) mentioned a number of different forms from forest soil that he did not distinguish. Some of the more recent reports might as well refer to the redescription of *T. filiformis* by Andrássy (1954), which was renamed to *T. vulgaris* by Brzeski (1963) and later transferred to the genus *Filenchus* (see above).

Hexatylus abulbosus (Steiner, 1931) Goodey, 1933
= *Hexatylus vivparus*

*Hexatylus boettgeri** Meyl, 1954
= *species inquirenda*
Described from fungi from a coniferous forest near Hahnenklee (Harz); retained as valid species by Meyl (1961).

*Hexatylus brevicaudatus** Meyl, 1954
= *Hexatylus viviparus*

*Hexatylus dipapillatus** Meyl, 1954
= *Hexatylus viviparus*

*Hexatylus velatus** (Bütschli, 1873) Ebsary, 1991
= *species inquirenda*
= *Tylenchus velatus* Bütschli, 1873
Described on the base of a single male from roots of a moss; no type locality given.

*Iotonchium mycophilum** Meyl, 1954
= *species incerta sedis*
Described from mushroom collected in forests near Braunschweig and Liebenburg.

Malenchus cognatus Andrássy, 1981
= *Malenchus acarayensis*

Neotylenchus consobrinus de Man, 1907 *apud* Paesler (1959) = *species dubia*

Neoparasitylenchus pessoni (Rühm in Rühm & Chararas, 1960) Nickle, 1967
Described from France; the information in 'Fauna Europaea' on presence in Germany is incorrect.

Neotylenchus abulbosus Steiner, 1938
= *Hexatylus viviparus*

*Parasitylenhus dispar pusilli** Fuchs, 1938
= *Neoparasitylenchus cinerei*

Parasitylenchus sulphureus poligraphi Fuchs, 1938
= *Sulphuretylenchus fuchsi*

*Polymorphotylenchus typographi** (Fuchs, 1915) Rühm, 1956 = *Parasitylenchus dispar*

Stictylus serpens (Andrássy, 1961) Zell, 1985
= *species dubia*
= *Neotylenchus serpens* Andrássy, 1961
= *Prothallonema serpens* (Andrássy, 1961) Siddiqi, 1986
Females described by Zell (1985b) from beech forest in northern part of Schwarzwald differed in some morphological details from the only female described by Andrássy (1961).

*Tylenchus contortus typographi** Fuchs, 1915
= *Contortylenchus contortus*

Tylenchus davainei var. *tenuis** Kischke, 1956
= *species inquirenda*
= *Tylenchus kischkei* Meyl, 1961
= *Ditylenchus kischkei* (Meyl, 1961) Loof, 1965
Inadequately described from moss, peaty soils and pools in Harz mountains.

*Tylenchus farwicki** Rahm, 1925
= *species inquirenda*
Inadequately described by Rahm (1925) from mosses in Rheinland.

*Tylenchus minimus** Rahm, 1925
= *species inquirenda*
Inadequately described from moss in Rheinland.

Tylenchus minutus Cobb, 1893
= *species inquirenda*
= *Lelenchus minutus* (Cobb, 1893) Meyl, 1961
Records by Paetzold (1958) and Paesler (1959) may refer to *Filenchus istvani* (see above).

Tylenchus pillulifer von Linstow, 1877
= *species inquirenda et incerta sedis*

*Tylenchus turbo** Marcinowski, 1909
= *species inquirenda et incerta sedis*
Only juveniles were described by Marcinowski (1909) from rotting potatoes.

Tylenchus uncinatus Fuchs, 1929
= *Parasitaphelenchus uncinatus* (Fuchs, 1929) Fuchs, 1937 (Aphelenchida)

*Tylenchus weidenbachi** Rahm, 1925
= *species inquirenda*
Inadequately described from mosses in Rheinland.

5. Notes on some unidentified taxa, undescribed and rare species

Among nematodes of the suborders Tylenchina and Hexatylina recovered by the first author in Germany many populations or specimens could not be identified to species mainly because too few or not properly preserved specimens were available for identification. Many still undetected species are expected to be present in the preserved sampling material deposited in the German Nematode Collection (DNST) in Münster. A few species and a genus, which appear to be new to science, are briefly characterised below. Data supplementing knowledge of *Boleodorus clavicaudatus* are given. Observations on morphology, habitat and distribution are presented for *Pleurotylenchus sachsi*, which has been designated by Geraert (2008) 'a very rare species, males only present in the original population'. This member of Tylenchina had already been included among the plant-parasitic nematodes by Sturhan (2014), but without any detailed information on its presence and distribution in Germany. An obviously still undescribed species of the genus *Paurodontoides* is recorded and its morphological characters are described. Furthermore, the finding of a nematode population is reported, which is considered as being conspecific with *Safianema lutonense*. It would be the first record of *S. lutonense* from Germany.

Boleodorus clavicaudatus Thorne, 1941 (V)

Geraert (2008) mentioned slight morphological differences between the original description of specimens from California, USA, and populations reported from Belgium (Geraert 1971) and Poland (Brzeski 1998). Morphological characters of specimens from two German localities (see under heading 3) are presented below.

Morphometrics. Females (n = 10, 5 from each of both localities): L = 625–740 (685) µm, stylet = 11–12.3 (11.5) µm, pharynx = 116–128 (120) µm, MB = 44–53 (50) %, tail = 61–74 (66) µm, a = 37–49 (42), b = 5.2–6.1 (5.7), c = 8.5–12 (10.5), c' = 5.1–7.2 (5.9), V = 54.4–62.6 (59.5), T/VA = 0.2–0.4 (0.3). Male (n = 1): L = 635 µm, stylet = 11.5 µm, pharynx = 113 µm, tail = 66 µm, spicules = 14 µm, a = 39, b = 5.6, c = 9.6.

The morphological characters of the German populations closely agree with the specimens described from Belgium and Poland. Different from the original description by Thorne (1941) of five females from California, the lip region of the European specimens is conical, anteriorly slightly flattened, the oral opening located in a slight depression and the stylet somewhat shorter. The stylet knobs are sloping backwards and

mostly distinctly separated at base; the excretory pore is situated two or three cuticle annuli behind the hemizonid, the excretory duct is distinct and can mostly be seen over a long distance and beyond the pharyngo-intestinal junction, the vagina is longer than half body width and without swollen walls, the well-offset spermatheca was sometimes seen filled with round, rather large sperm, the postvulval sac is mostly shorter than half body width (exceptionally 1.5 body widths). The male body is also straight, including tail. Males appear to be very rare in this species; among more than 100 females and juveniles isolated from the soil sample collected at Loshausen only a single male was found; previously only one male had been recorded from Belgium (Geraert 1971). In one female sporangia and early developmental stages of *Pasteuria* sp. were present. Absence of deirids, postdeirids and phasmids supports placement of this species in *Boleodorus* and not in *Basiria* (cp. Section 3).

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

= *Tylenchus sachsi* Hirschmann, 1952

Originally described by Hirschmann (1952) from the banks of a pond at Dechsendorf near Erlangen; description based on two females and two males. Subsequently reported from grassland with peat soil in Düsterdieker Niederung close to Bramsche (Diedrich et al. 1998), and more recently recovered at Essel near Schwarmstedt from wet loamy soil at the shore of a pond, under river bank vegetation at Rheinkassel near Köln and at Heeslingen near Zeven, in swamp forests at Heidenfeld near Schweinfurt and at Hardenburg near Bad Dürkheim, in a spruce forest at Dreisesselberg/ Bayerischer Wald (where 165 specimens were counted in a 200g soil sample and 405 specimens in another 200g soil sample), and in a total of nine soil samples collected from river bank vegetation along the lower course of the Elbe river from Borstel, Hollern-Twielenfleth and Krautsand to Freiburg/Elbe. The presently known distribution in Germany is shown in Fig. 2.

Males were present at several of the sampling sites and their number sometimes even exceeded that of the females. The first author collected one male also from a grassland soil sample taken at Hrušov in the Slovak Republic (species not recorded for this country before, according to Lišková & Čerevková 2011). *Pleurotylenchus sachsi* is also known from Poland, Hungary and Italy.

Morphological characters supplementing the species description by Hirschmann (1952), Szczygieł (1969), Geraert (2008): Body mostly C-shaped or in semicircular position in females and juveniles, in males posterior end hook-shaped or spirally coiled. Cuticle with eight longitudinal ridges (excluding lateral fields) divided into rectangular blocks by deep transverse annulation, beginning just behind cephalic region and extending to about anal region. Lateral fields slightly elevated, narrow, 2.5–3 µm wide in midbody region, lined by crenate margins, extending from head base to about one third of tail length. Deirids in lateral fields shortly posterior to excretory pore, postdeirids and phasmids absent. Female genital tract with spermatheca mostly filled with round sperm, about 2.5 µm in diameter; postuterine sac about one body width long. In precloacal region of males irregular groups of 3, 4, 5 or more elevated annuli in the subventral and the ventrolateral cuticle ridges. Bursa absent; a lobe-like structue present immediately posterior to cloaca.

Paurodontoides sp. (V)

Adult specimens from Pfaffenhofen (see heading 3 above) had the following main morphological characters: Body straight to slightly ventrally arcuate, cuticle finely annulated, lateral fields each with four incisures (inner ones mostly faint); deirids distinct, papilliform, postdeirids and phasmids absent; cephalic region continuous, framework lightly sclerotised, eight-

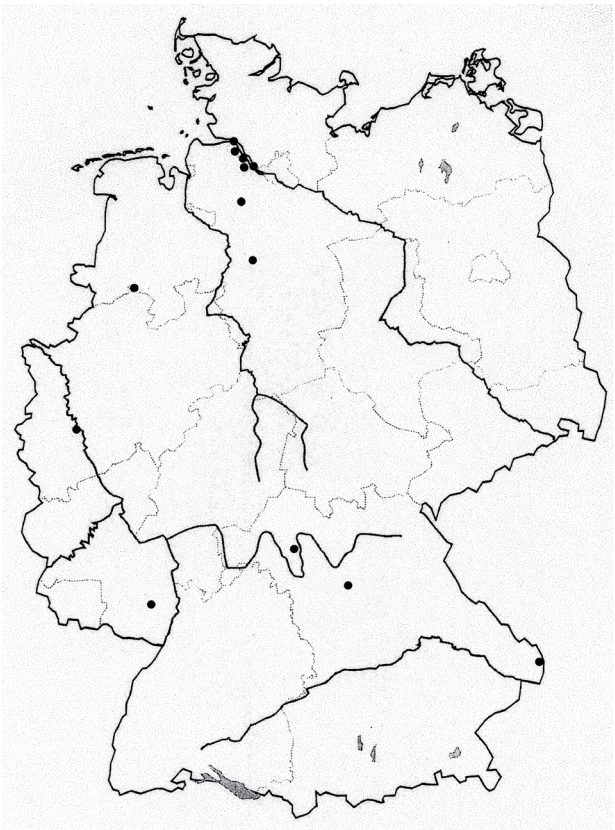

Figure 2. Known distribution of *Pleurotylenchus sachsi* in Germany.

sectored; stylet conus less than half total stylet length long, knobs more or less symmetrical, rounded and posteriorly directed; pharynx with elongate fusiform corpus, slender isthmus and elongate-pyriform basal bulb with stem-like extension projecting into the intestine at ventral side (bulb including extension 1.5–2 body widths long); exretory pore closely behind the distinct hemizonid (3 annuli wide), at level of anterior part of basal bulb and slightly anterior to deirids. - Female: Ovary outstretched, with oocytes in one row, axial spermatheca with densely packed sperm; postvulval uterine sac distinct, almost one body width long, sometimes with few large sperms (5–6 µm in diameter); vulva-anus distance = 2.4–2.6 body widths or 0.8–0.9 tail lengths; tail elongate-conoid, pointed. - Male: Bursa enveloping tail, faintly crenate; spicules arcuate, not distinctly cephalated, gubernaculum simple; tail conoid with pointed tip. - Morphometrics. Females (n = 6): L = 525–590 µm, stylet = 9.5–10 µm, tail = 44–53 µm, V = 83–84, a = 28–34, b = 4.1–5.6, c = 10.6–12, c' = 4.2–4.7. Males (n = 6): L = 425–465 µm, stylet = 9–10 µm, tail = 18–23 µm, spicules = 14–15 µm, gubernaculum = 4.5–5 µm, a = 28–31, b = 4.4–4.9, c = 20–24, c' = 2.1–2.4.

The population from Pfaffenhofen closely agrees with the diagnosis of the genus *Paurodontoides* given by Jairajpuri and Siddiqi (1969) and the emended diagnosis by Siddiqi (2000), in which erroneously absence of deirids is stated. It differs from the type species *P. linfordi* (Hechler, 1962) Jairajpuri & Siddiqi, 1969 described from Illinois, USA, mainly in some morphometric characters, shorter tail of female and size of sperm. The only other species currently in *Paurodontoides*, *P. latus* (Thorne, 1935) Siddiqi, 1986, described from Utah, USA, is distinguished by longer body, shorter female tail and longer postvulval uterine sac.

Safianema lutonense Siddiqi, 1980 (V)

Adult specimens of a nematode population recovered in the southern part of Bayerischer Wald (see heading 3 above) had the following diagnostic characters of the genus *Safianema*: Body slender, tail in both sexes filiform; lateral fields with six incisures; pharynx with valvated median bulb; dorsal pharyngeal gland lobelike, overlapping anterior end of intestine, with large nucleus; globular structure present at pharynx-intestine junction; lumen of anterior part of intestine indistinct; female genital tract with quadricolumella and postvulval uterine sac; bursa adcloacal. Additional characters: Body straight or arcuate; cuticle annuli around 1.5 µm wide in midbody region, subcuticle finely striated; deirids distinct, postdeirids almost setae-like, adjacent to dorsal incisures of lateral fields, phasmids absent; stylet 8–9 µm long, conus 1/3 of total stylet length, basal knobs rounded, measuring 2 µm across; tail terminus finely rounded, sometimes with short mucro in both sexes; oocytes in one row, spermatocytes in two rows; sperms in spermatheca and in postvulval uterine sac 5–6.5 µm in diameter; bursa extending to about 2/5 of tail length, with crenate margin.

Morphometrics. Female (n = 1): L = 1115 µm, a = 50, b = 6.5, b' = 5.3, c = 8.4, c' = 9.4, V = 71.4, distance from anterior end to centre of median pharynx bulb = 56 µm, dorsal gland lobe extension over intestine = 90 µm, excretory pore = 111 µm from anterior end, tail = 132 µm, postvulval sac = 37% of vulva-anus distance. Male (n = 1): L = 950 µm, a = 54, b = 7.1, b' = 4.9, c = 10, c' = 7.1, anterior end to centre of median pharynx bulb = 53 µm, excretory pore = 109 µm from anterior end, tail = 95 µm, spicules = 20 µm, gubernaculum = 6 µm.

Among the species presently arranged in *Safianema*, the population from Germany is morphologically very close to the type species of the genus, *S. lutonense*, which was described by Siddiqi (1980) from peaty soil underneath an oak tree in southern England and has probably been never recorded from somewhere else. There appear to be minor differences only in a few morphometrics: in body length of both sexes, tail length of females, c' of males, length of spicules and gubernaculum, diameter of body annuli. Despite this, the German population is tentatively considered as conspecific with *S. lutonense*.

Tenunemellus sp. A (V)

Females and males isolated from a field soil sample collected at Bockhorst near Papenburg/Emsland showed the following diagnostic characters of the genus *Tenunemellus*: Body extremely slender, cephalic region strongly flattened dorso-ventrally, amphidial apertures longitudinal clefts, lateral fields obscure and cuticle lacking longitudinal ridges, median pharyngeal bulb not muscular, basal bulb elongate and offset from intestine, tail very long and pointed, vulva flush with body contour and vulva lips not modified, spicules cephalated and ventrally arcuate, gubernaculum present, bursa flaps rectangular, lobed. Cuticle annuli about 0.5 µm wide, lip region smooth, vulva with lateral flaps, spermatheca elongate, postvulvar uterine branch less than half vulval body diameter long; shape of the bursa resembling that of *T. macrocephalus*. - Morphometrics. Females (n = 4): L = 650–770 µm, stylet = 9–10 µm, tail = 140–165 µm, V = 57.5–60, a = 82–92, c = 4.3–4.7. - Males (n = 4): L = 590–665 µm, tail = 94–107 µm, spicules = 9–10 µm, a = 94–107, c = 2.3–4.3. The specimens studied could not be attributed to any of the known six *Tenunemellus* species.

Tenunemellus sp. B (V)

A single male was recovered from a soil sample collected in the (then dry) river bed of Isar at Wallgau near Mittenwald/Bayern also showing diagnostic characteristics of the genus *Tenunemellus*. Bursa shape resembling that of *T. leptocephalus*, spicules arcuate, 10.5 µm long, gubernaculum present, cloacal lips not forming a spicular tube, stylet probably about 9 µm long, basal knobs small; body 930 µm long, tail 130 µm, a = 130, c = 7.2. No allocation to any of the currently known *Tenunemellus* species is possible.

Tylenchidae gen. et sp. indet. (V)

Many females and males of a nematode species were isolated in July 1983 by the first author from a peat-sandy soil sample collected in a heath area at Bondelum near Schleswig (natural reserve 'Bondelumer Heide'). The nematodes could not be attributed to any of the known Tylenchida genera and species, but can most likely be placed in the family Tylenchidae. In the cephalic region and some other characters the unidentified species resembles *Mukazia nova* (Mukhina & Kazachenko 1981) Siddiqi, 1986, in cuticle structures particularly members of the genus *Miculenchus*, from which it is clearly distinguished particularly in the presence of a bursa. Main morphological characters are given below.

Body of both sexes of similar length (840–1160 µm), straight or slightly arcuate, slender (a = 40–50), tail long and slender (140–150 µm, c = 5.7–7.0); cuticle finely annulated (ca. 1 µm), annules mostly with zig-zag margins and divided into minute squares; lateral field with two lines starting at level of median pharyngeal bulb and extending to 1.5 anal body widths behind anus; deirids at level of pharynx/intestine junction, postdeirids and phasmids absent; lip region continuous with body contour, evenly rounded and distinctly annulated to oral opening, which is located in a slight depression; amphids not seen; stylet = 11–12 µm long, conus ca. 1/3 total stylet length, basal knobs well developed, measuring 2.5 µm across, anteriorly slightly sloping; median pharyngeal bulb poorly developed, at around 50% of the total pharynx length, valve indistinct, basal bulb elongate, offset from intestine; excretory pore six to ten annules posterior to hemizonid, duct wide with sclerotized walls. Females: Vulva wide, vaginal walls thickened, V = 60–65, quadricolumella distinct, spermatheca large, offset and filled with globular sperm; postvulvar sac very short. Males: Spicules arcuate and distinctly cephalated, 19–21 µm long, gubernaculum 6–7 µm long, bursa fairly large, with crenate margin.

6. Conclusion and discussion

A total of currently 165 recognised species of non-phytoparasitic Tylenchida reported from Germany is listed in this paper. The number of actually occurring species is undoubtedly much higher, which may be supposed from several new records of species and even genera for Germany and the findings of obviously still undescribed species, populations and specimens, which could not be identified so far. Such conclusion can be drawn also from the recovery of the high number of still unidentified and undescribed species of phytoparasitic Tylenchida reported for Germany (Sturhan 2014), which are in general better studied than, for instance, the suborder Tylenchina.

The number of non-phytoparasitic species, of which type specimens or other voucher specimens from Germany are deposited in nematode collections, is only low compared to the plant-parasitic Tylenchida. Most records of - in particular - species of Tylenchina were published without morphological or other data, a verification of identification is thus impossible. This is in particular the case for 'old' records, from previous decades with still limited knowledge of the actually existing diversity of species and genera.

According to W. Rühm and A. Meyl (in letters to the first author) type or other sampling material studied had not been retained or is probably lost. This appears to be the case also for, for instance, the fundamental studies on entomopathogenic Tylenchida by Wülker (1921, 1923), Fuchs (1914, 1929, 1930, 1937, 1938) and Wachek (1955). An intention of the present paper, in which species originally described from Germany are particularly marked and data on type localities and habitat (if available) are given, is to stimulate re-collection of these species, to designate neotypes or topotypes and to collect fresh material for future molecular studies.

The preliminary 'checklists' presented are further considered to encourage faunistic surveys enlarging our knowledge on the actual species inventory in Germany, to retain voucher specimens enabling morphological comparison and verification of species identity and to sample information on species distribution and habitat requirements. Moreover, good faunistic knowledge is essential for correct identification. Deposition of voucher material in the German Nematode Collection (DNST) is recommended, in particular, of soil and freshwater nematodes. Data on the geographical distribution and habitat of nematode species are currently compiled in the non-commercial online data warehouse on soil organisms 'Edaphobase' (www.edaphobase.org, Burkhardt et al. 2014).

Together with the plant-parasitic species included in the previously published checklist (Sturhan 2014), a

total of 377 species of the order Tylenchida have been reported from Germany so far, with 84 species currently in the suborder Tylenchina, 129 species in the suborder Hoplolaimina, 68 species in the suborder Criconematina and 96 species in the suborder Hexatylina. In total, 24 Tylenchida families are known from Germany with 91 currently distinguished genera. Among the recognised Tylenchida species 131 were orignially described from Germany, most of these from the suborder Hexatylina. In addition, 35 species which have been synonymised or are considered as *species inquirendae* were described from Germany. The study and redescription of imperfectly characterised species are considered a particular scope for future research.

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