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Arthrobotrys tortor sp. nov.
New predacious nematode-killing fungus

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In the course of investigations conducted since 1961 on the nematode-killing fungi of Poland (J a r o w a j a 1963, 1964) two strains B114 and B116 were isolated from sandy garden soil from Świder near Warsaw on April 10, 1962, the identification of which was difficult. Closer morphological analysis disclosed that these strains represent a new species of the genus *Arthrobotrys* Corda.

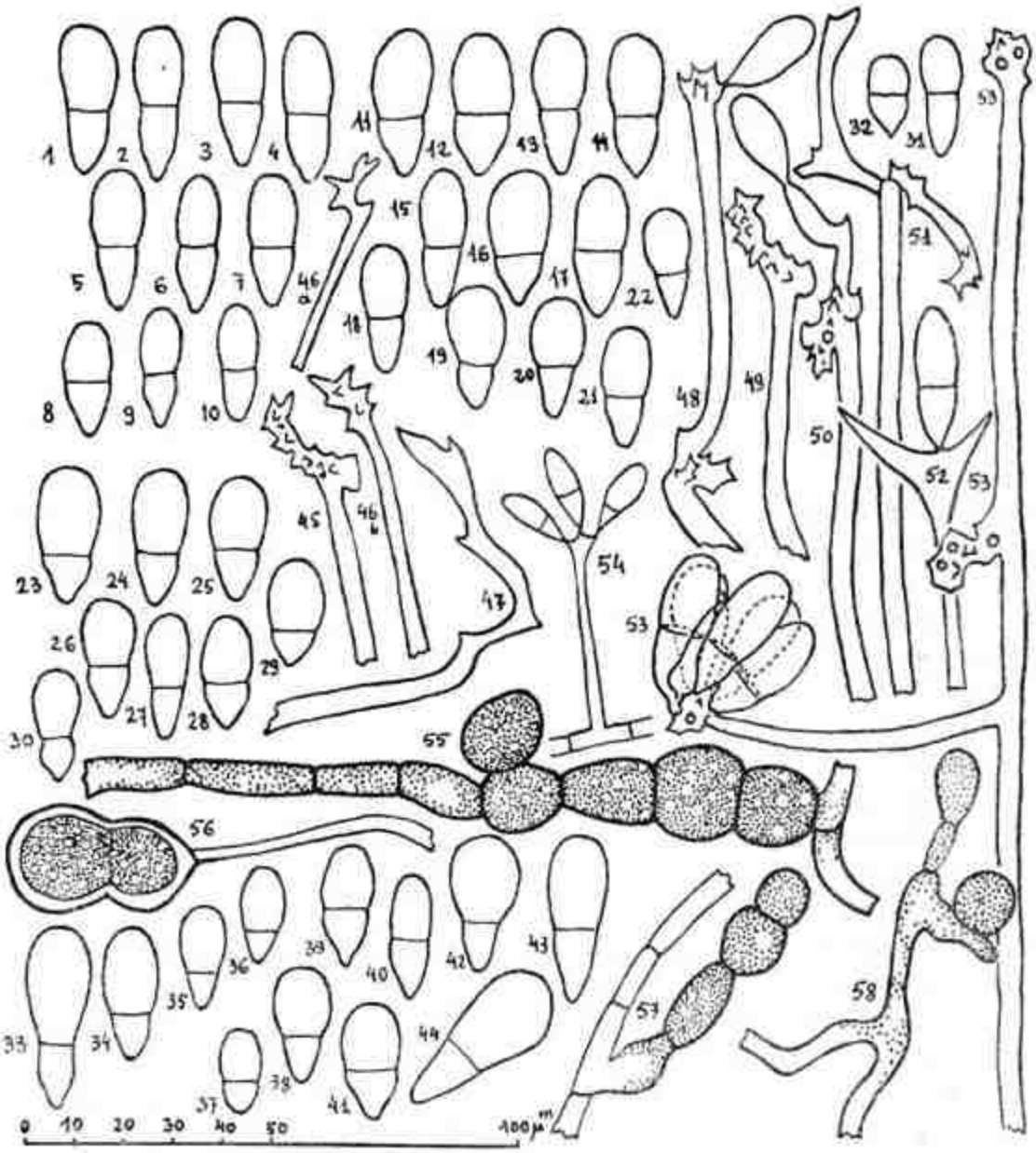
Arthrobotrys tortor sp. nov.

Etymology: *Tortor, -ris* (lat). — executioner, torturer, tormentor.

Diagnosis: Mycelium ex multicellulis filiformis hyphis compositum et laqueos tenaces arcuatos adhaesives in reticula evolventibus. Conidiophores erectae, simplices vel paene ramosae, 240—360 μm altae, basi 6,8—8,4 μm crassae, subter apicem ca 3,4 μm crassae, apice ex sterigmatibus spiniformis conidia in capitulum irregulare aggregata ferentes vel digesta gerentes. Conidia bicellulata, oblonge-elliptica, oblonge-ovoidea vel subcilindrica, apice rotundata, basi paulo attenuata, 20,4—27,7—39,1 μm longa et 9—11—14 μm crassa. Habitat in terra prope Świder, Polonia, vermiculos nematodeos consumet.

Typus: numerus B 114 (cultura) et figurae 1—58.

Mycelium spreading, composed of the filamentous, septate hyphae 3,4—5,1 μm wide, in the presence of nematodes giving rise to adhesive hyphal loops and bails, which though at first discrete are later usually woven into three-dimensional networks (traps). Internal diameter of the loops is commonly about 32 μm. Conidiophores hyaline, erect, septate, unbranched or sparingly branched, mostly 6,8—8,4 μm wide at base, tapering gradually to about 3,4 μm beneath the apex, attaining a height of 240—360 μm, with apical part irregularly inflated and covered with spine-like small sterigmata (Fig. 49, 53) or bearing at apex 2—4 finger-



Figs 1—58. *Arthrobotrys tortor* sp. nov., type strain B 114, subculture (*figurae typicae*):

1—29 — most frequently found conidia,
30—44 — conidia of extremal size and proportions,
45—53 — apical parts of conidiophores,
54 — microconidiophore with whorl of microconidia,
55—58 chlamydospores

(all figures drawn with the use of camera lucida)

-like shoots, each ending with one small sterigma; the apical part of the conidiophore sometimes repeatedly flexed, geniculate, with one or two small spindle-like sterigmata on each bend. Conidia arranged in loose, more or less verticillate, sympodial or irregular clusters on the tips of the conidiophore and its branches, more rarely in intercalary clusters, 20,4—**27,7**—39,1 μm long and 9—**11**—14 μm wide (relative width 33—**44**—57% of length), hyaline, prolonged, obovoid, oval or almost cylindrical, broadly rounded at the tip, with rounded sides above the septum, lower cell obconical, more strongly tapered at the base and ended by the small papilla, relative length (expressed in % of the total length) of proximal (lower) cell usually exceeds one half of total spore length (ca 57%) and fluctuates from 47 to 66%. Sometimes the fungus forms small additional conidiophores, 18 μm long and 6,8 μm wide at base tapering to 1,7—2 μm beneath apex, bearing a loose apical verticillate head of 2—11 drop-like microconidia (Fig. 54), 11,9—17 μm in length and 5,1—6,8 μm in width, with one septum. Chlamydospores intercalary, globose or prolonged to cylindrical, solitary or arranged in short chains, the diameter of the rounded ones attains 25 μm, the dimensions of the others are about 15—25×8—12 μm.

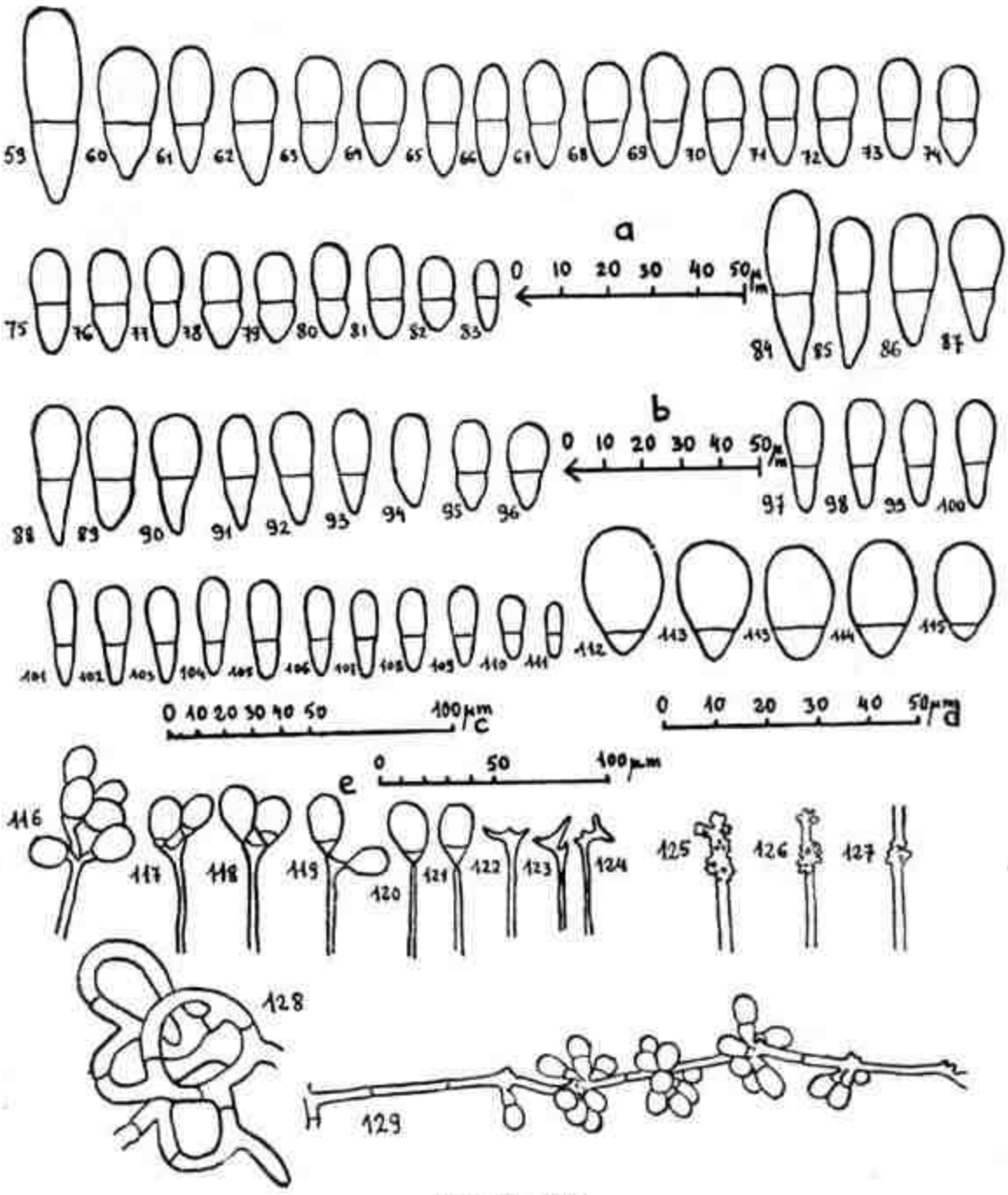
The fungus occurs in sandy soil of the small orchards in Świder near Warsaw (type locality), it captures and consumes eelworms *(Nematoda)*.

Type: culture of the strain B 114 deposited in the Fermentation Industry Institute, Division of the Technical Microbiology and Biochemistry, The Culture Collection, Warsaw, 36 Rakowiecka Street, Poland (index II-Ar. t./1). Type figures 1—58 were drawn from a subculture of the type strain.

Arthrobotrys tortor as regards the morphology of conidia is a species closely related to *Arthrobotrys conoides* Drechsler (1937). However, the conidia of *A. conoides* (Figs 84—111) are slimmer than those of both strains of *A. tortor* (Figs 1—44 for the strain B 114 and 59—83 for B 116). The lower cell of *A. conoides* conidia is more elongated and wedge-shaped. Moreover the conidia of *A. conoides* arise on blunt papillose sterigmata and are collected in regular apical and intercalary clusters (Figs 125—127 and 129).

Arthrobotrys tortor exhibits a great morphological variability of the conidia, and the establishment of more or less stable characters requires the elaboration of large series of spores collected from a culture with nematodes. Most such conidia (ca 80%) exhibit dimensions and proportions close to mean values (Figs 1—29), and conidia with extremal traits constitute barely 20 per cent of the harvest. To the latter category belong conidia with a very short (Figs 31, 32) or very long (Figs 33—36) apical cell, conidia exceeding the mean size (Figs 33, 43, 44), those expanded at the septum (Fig. 40) etc. The average-sized conidia

Plate II

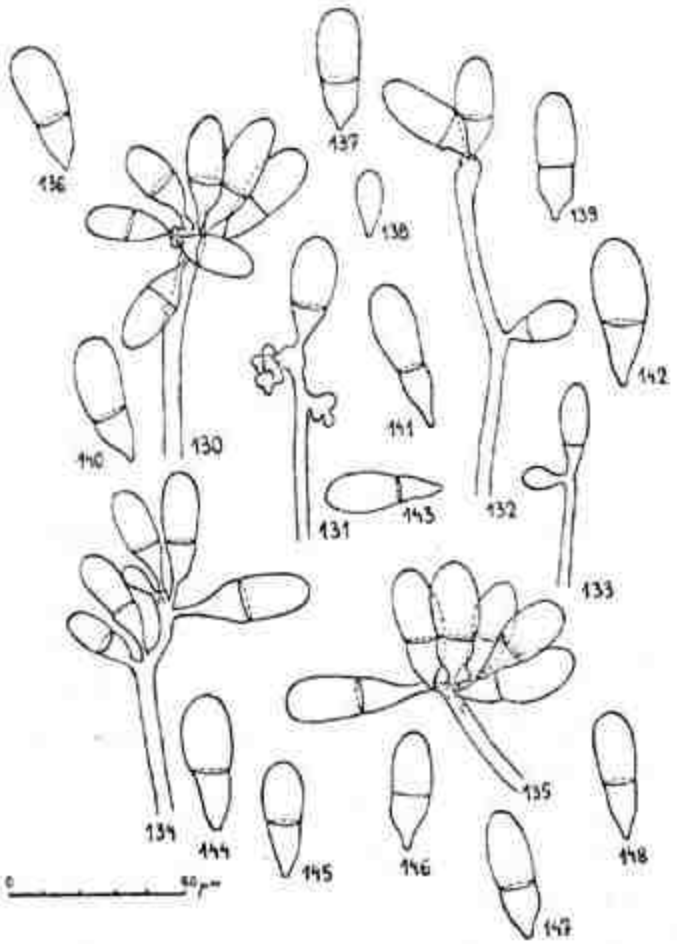


Figs 59—129

59—83 — *Arthrobotrys tortor* sp. nov., strain B 116 conidia; (scale a),
84—96 — *A. conoides* Drechsler, conidia after Soprunov 1958 (scale b),
97—111 — *A. conoides*, conidia after Drechsler 1937 (scale c),
116—124 — *A. cystosporium* (Duddington) Mekhtieva, conidiophores with conidia and 112—115 — conidia after Duddington 1951 (scales d and e),
125—127 — *A. conoides*, conidiophores after Drechsler 1937 (scale c),
128 — trap of *A. conoides* after Soprunov 1958 (without scale),
129 — conidiophore and cluster of conidia *A. conoides* after Soprunov 1958 (without scale).

(59—83 drawn with the use of camera lucida)

Plate III



Figs 130—148 — *Arthrobotrys tortor* sp. nov., strain B 114; fresh pure culture:
130—135 — apical parts of conidiophores with conidial clusters,
136—148 — conidia
(all figures drawn with the use of camera lucida)

of *A. tortor* composing the above mentioned 80 per cent of the harvest differ from those of *A. conoides* markedly, although single specimens with extremal characters may by quite similar in both species.

As regards the structure of the condidiophore apex, *A. tortor* resembles *A. cystosporium* (Duddington) Mekhtieva (1964) (cf. Figs 45—53 and 116—124). However, the elongated obovoid conidia of *A. tortor* differ distinctly from those of *A. cystosporium* both by their shape and the relative length of the proximal cell (Figs 112—115).

Duddington (1951) has described this species as *Trichothecium cystosporium*, however, as early as 1892, Matruchot investigated the sporogenesis in the type species of genus *Trichothecium* Link ex Fries, namely in *T. roseum* (Persoon) Link and found that it has a specific

course: the conidia are formed successively on one apical sterigma of the conidiophore, and coalescing at their base they form an ear-like cluster. These observations have been later confirmed by numerous authors, recently by Meyer (1958), Ingold (1956), Mechtieva (1964) and Sidorova, Gorlenko and Nalepina (1964). The type species of genus *Arthrobotrys* Corda, *A. superba* Corda *sensu* Soprunov (1958) *nec* Drechsler (1937)* forms, on the contrary, single conidia on separate sterigmata. They are aggregated in apical and intercalary clusters owing to an appropriate distribution of the sterigmata on the conidiophore and they do not coalesce. Sporogenesis in *A. tortor* occurs doubtlessly according to this second pattern and for this reason I have assigned this fungus to the genus *Arthrobotrys*.

At present 24 species of fungi showing wide morphological differences may be classified to the genus *Arthrobotrys*. Rifai and Cooke (1966) suggested a split of this genus into three genera: *Arthrobotrys* Corda *sensu stricto*, *Genicularia* Rifai et Cooke ** [type: *G. cystosporia* (Duddington) Rifai et Cooke] and *Candelabrella* Rifai et Cooke (type: *C. javanica* Rifai et Cooke). The above named authors classify to the genus *Arthrobotrys s. s.* only those species of *Arthrobotrys sensu lato* which have minute sterigmata collected on the apical or intercalary surfaces of the inflated part of the conidiophore. They assigned to the genus *Genicularia* the species with conidiophores bent several times in the apical part, and conidia fixed on minute sterigmata in the bends of the conidiophore. Finally they assigned to the genus *Candelabrella* the species forming at the apex of the conidiophores a whorl of short branches with minute sterigmata at the top, forming together a structure reminiscent of a candelabrum (e.g. in *Arthrobotrys musiformis* Drechsler 1937).

Arthrobotrys tortor exhibits a varied structure of the sporebearing part of the conidiophores. Figs 45, 46b, 49 and 53 show the conidiophores of the *Arthrobotrys s. s.*-type. In figs 52, 134 and 135 the conidiophores of the *Candelabrella*-type are visible although not very pronounced. Conidiophores of the *Genicularia*-type are found in the fungus studied more frequently (Figs 46a, 47, 51). There also occur conidiophores difficult to classify according to the scheme suggested by Rifai and Cooke, particularly frequent — of the type intermediate between the *Arthrobotrys s. s.*-type and *Genicularia*-type. I, therefore consider that the classification suggested by these authors is in practice difficult

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* Soprunov (1958) established *A. superba* auct. non Corda, sensu Drechsler (1937) to be a different species — *A. drechsleri* Soprunov.

** Nomen praeoccupatum, homonym prius: *Genicularia* de Bary, Unters. über die Familiae der Conjugaten, 1858.

to establish, the more so, as even in *Arthrobotrys cystosporium* conidiophores of an intermediate structure have been described (Figs 116—124). Nevertheless, the distinction of these three types of conidiophore structure in *Arthrobotrys* by these authors is an achievement of penetrating observation and it may prove useful for establishing the range of variation in the descriptive morphology of these fungi.

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Arthrobotrys tortor sp. nov.

Streszczenie

Autorka opisuje nowy gatunek strzępczaka łapiącego nicienie za pomocą lepkich sieci — *Arthrobotrys tortor* sp. nov., wyizolowany z próbki piaszczystej gleby ogrodowej pobranej w Świdrze k. Warszawy. *A. tortor* jest gatunkiem zbliżonym do *A. conoides* Drechsler 1937 i — w słabszym stopniu — do *A. cystosporium* (Duddington) Mekhtieva 1964; w pracy omówiono różnice między tymi trzema gatunkami.