

Records on some lower fungi occurring in mites (Acarina) from Poland

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As result of the investigations on fungal diseases of the mites occurring in ant hills, forest litter and galleries of subcortical insects 12 species of the fungi have been recorded. The majority of them are the resting spore stages of *Entomophthoraceae* from the genus *Tarichium* Cohn; 9 new species of this genus have been described and the tabular comparison of their morphological features has been estimated.

INTRODUCTION

The majority of so far published data on fungal diseases of mites (*Acarina*) concerns the phytophagous species of the families *Tetranychidae* and *Eriophyidae*. The mycoses of others have been mentioned circumstantially or occasionally, often without any precise determination of the pathogen species. This results from the fact that the acarologists in general pay too little attention to the problem of invertebrate pathology. A review of the reference of this field is given by Lipa (1962, 1971), Nemoto and Aoki (1974) and supplemented by Tsintsadze and Vartapetov (1976), Balazy and Wiśniewski (1977, 1983) and Egina and Tsinovskii (1980).

MATERIALS AND METHODS

In the years 1975-1983 acarologic materials were gathered mostly from ant nests and forest litter as well as from the galleries of subcortical insects. During the taxonomical elaboration of these collections several dozen of the mites with

A synoptic characteristics of the investigated *Tariclavus* species from miles

Number of the strain	Taxonomic species	C ¹⁸ abundance intervals	Atherine: mean \pm standard deviation	Standard error	Variation coefficient	Extreme dimensions		Sexual dimorphism		Remarks about the shore
						mm	mm	male	female	
1477	<i>T. macrotis</i> n. sp.	32.71 - 83.90	33.34 \pm 2.04	0.269	6.13	27.70	37.40	4.5 - 5.5	high yellow-brownish	regularly globose
1533	<i>T. lamellosus</i> n. sp.	17.72 - 18.22	17.92 \pm 0.72	0.100	4.01	16.30	19.90	10 - 1.8	thick pitted	regularly globose
1538	<i>T. deltoideus</i> n. sp.	26.76 - 35.81	27.69 \pm 2.32	0.446	8.36	22.30	32.00	3.2 - 5.5	blackish brown; rugose or warty	irregularly globose
1534	<i>T. pusillus</i> n. sp.	10.64 - 10.96	10.80 \pm 0.57	0.081	5.31	9.00	12.10	1.7 - 2.3	light yellow	ovoid subangular
1478	<i>T. sphaerovum</i> n. sp.	17.17 - 18.77	17.67 \pm 2.87	0.406	15.96	11.40	23.00	1.5 - 5.0	shakily crumpled	globose or subglobose
1475c	<i>T. subglobosus</i> n. sp.	23.51 - 25.38	24.40 \pm 3.19	0.451	13.07	17.90	32.80	2.0 - 2.5	colorless; smooth	globose or few sub-globular
1118*	<i>T. acanthodes</i> (STL) Bal. et Wül.	17.07 - 17.59	17.33 \pm 0.95	0.134	5.45	15.50	19.50	2.0 - 3.0	high brownish-yellow; smooth or finely rough	regularly globose or ellipsoidal
1484	-	17.45 - 17.87	17.66 \pm 0.77	0.109	4.35	16.00	19.60	2.0 - 2.8	colorless; smooth	regularly globose
1535	-	19.12 - 19.97	19.54 \pm 1.53	0.216	7.81	16.40	23.36	1.5 - 1.5	colorless; smooth	irregularly globose sometimes with small concavities
1476c	<i>T. aurifer</i> n. sp.	15.51 - 15.86	15.73 \pm 0.75	0.108	4.84	14.11	22.00	about 0.5	colorless; smooth	regularly globose
1530	<i>T. formosus</i> n. sp.	14.7 - 15.87	15.7 \pm 0.99	0.409	19.08	11.25	23.00	0.5 - 2.0	colorless; smooth	irregularly globose
1477b	<i>T. pseudocylindricus</i> n. sp.	20.27 - 21.21	20.22 \pm 0.54	0.071	11.71	19.30	17.40	3.2 - 3.2	light golden-yellow	irregularly globose
1477d	-	20.81 - 21.22	20.79 \pm 0.42	0.073	11.70	23.00	17.40	2.5 - 2.9	density yellow or rough	irregularly globose
1537	-	31.51 - 31.92	31.51 \pm 0.37	0.013	0.46	31.11	40.10	2.6 - 3.2	yellow grey smooth	irregularly globose
1499**	<i>T. ovipositor</i> Bal. et Wül.	26.57 - 26.56	26.50 \pm 0.11	0.022	14.84	19.80	32.70	5.0 - 6.2	yellow grey smooth	irregularly globose

* The sample described by Galley and Wainwright (1978)

** The sample described by Galley and Wainwright (1983)

signs suggesting infections with enthomopathogenic fungi were separated. The majority of the mites collected were put into 70% alcohol, which made impossible the observation of the development cycle of the pathogens. Efforts were made to rediscovery of infected mites in the known localities. However, such endeavours as well as attempts at isolation and laboratory culturing of particular fungal strains were usually unsuccessful.

The mites with their pathogens were prepared in lactophenol often with aniline blue staining; sometimes also aceto-carmin was applied. Infected species were often devoid of their extremities or even gnathosoma, which made the determination of the host species very difficult or entirely impossible. The characteristics of the fungi were prepared on the basis of the accessible elements of their morphology. The resting spores of particular samples have been compared with respect to their general morphology, colour, thickness and ornamentation of the epispore and dimensions based on 50 measurements, considering the standard deviation and standard error of the arithmetic mean and the range of variability (Table 1). Such characteristics of two species of *Tarichium* from mites described earlier are also included. The materials including the types of newly described species have been preserved in the Department of Agricultural and Forest Biology of the Polish Academy of Sciences in Poznań.

RESULTS AND DISCUSSION

Among numerous forms of the fungi developing as necrophytes on dead mites or on separate parts of their exoskeletons the hyphomycetes were the most common. Their hyaline or dematiaceous mycelia usually grew superficially giving often abundant conidial sporulation. The majority of the isolated strains were determined as *Acremonium* spp., *Acrodontium crateriforme* (v. Beyma) de Hoog, *Aspergillus* sp., *Botrytis cinerea* Pers. ex Nocca et Balb., *Cladosporium* spp., *Hormiscium* sp., *Oedocephalum* sp., *Penicillium* spp., *Sporothrix* sp., *Trichoderma* spp. *Virgaria* sp. and some others, occurring commonly on dead insects, too (K o v a l 1974; B a ł a z y 1976). Only the species *Hirsutella thompsoni* Fisher and a number of the strains related to *Verticillium lecanii* (Zimm.) Viégas seemed to show some pathogenic relationships to their hosts. However, the aim of the present work has been the separation of the forms of the lower fungi which should be able to infect, develop, and sporulate in mites. Thus, elements having a character of the resting spores found usually in great numbers inside the mites and — in all appearances — related to the family *Entomophthoraceae* as the representatives of the provisional genus *Tarichium* Cohn are considered here. In the recent monographs of the *Entomophthoraceae* including that of *Tarichium* (M a c L e o d, M ü l l e r - K ö g l e r 1970) only few species from mites

have been included, which do not allow to identify the majority of the forms obtained by means of the comparison. Consequently, a number of the forms were described as new species. Some samples contained the material inconvenient for the full identification or sure description of the species. In such cases only some suppositions as to the taxonomy of the fungi have been expressed.

IDENTIFIED OR NEWLY DESCRIBED SPECIES

Erynia phalangicida (Lagerh.) Rem. et Kell. (Pl. I)

The mycelium on the host's body surface cream-white, radially setose, consisting of the conidiophores about 10 µm thick, richly digitately branched in their top parts (Pl. I) intermixed with numerous straight pseudocystidia about 18 µm thick at the basis and gradually narrowing to 8 µm below the slightly inflated, obtuse tip, sticking out 250-350 µm over the sporulating layer of the mycelium (Pl. I c). The primary conidia ovoidal with slightly convex papilla 4.5-6.0 µm wide, monokaryotic, bitunicate, (18.1)-20.0-21.9 × 10.5-12.4 µm, with strongly vacuolized content. The secondary conidia smaller, 14.4-18.7 × 10.0-11.7 µm stronger narrowed towards the semispherically convex papilla 3.8-4.7 µm wide. The host attached to the substrate with few unbranched, ribbon-like rhizoids 12-20 µm wide, expanded at ends into disc-like structures with deeply sinuose margins. Inside host's body the irregularly branched segments of the hyphae, 6-12 µm in diameter, and globose azygospores (25.7)-27-34-(36.7) µm, with the wall smooth, 0.5-1.0 µm thick, occurred. The regularly finely granular content of the resting spores easily staining with aniline blue in lactophenol indicates that they were still unripe. This fungus was found on 20 August 1976 in the Wielkopolski National Park, protected district Jeziory, on a dead female of the mite *Pergamasus septentrionalis* (Oud.) (det. Dr. W. M i c h e r d z i ń s k i) attached to the underside of a leaf of *Tussilago farfara* in the deciduous forest undergrowth (*Galio silvatici-Carpinetum*).

The morphology of this fungus agrees entirely with the description of *Entomophthora phalangicida* Lagerheim, known from harvest spiders (*Opiliones, Phalangidae*) in two localities in Sweden. L a g e r h e i m (1898) did not give any information concerning resting spores. In spite of extremely careful searches carried on in the described locality in the Wielkopolski National Park till 1982, directed to the fungous diseases of small insects, mites and harvest spiders (B a l a z y 1978, 1982 a, b) the discussed fungus has not been found again. In morphological respect this fungus shows some affinities with some other *Erynia* species pathogenic for insects — e.g. *E. dipterigena* (Thaxt.) Rem. et Henneb., *E. dacnusa* Bal. — however, up to date there have not been worked out any sure

criteria for the differentiation of the similar species in this genus. Thus, at least up to the moment of more precise determination of the parasitic specialization and physiology of nutrition of the fungi of this group, particular strains originating from distant hosts and showing simultaneously certain morphological differences should be treated as different species. From among entomophthoracean species so far described from mites *Empusa acaridis* Petch seems to be the closest to the genus *Erynia*. However, incomplete data on the character of the conidiophores and pseudocystidia as well as the lack of the rhizoids underlined in the description (P e t c h 1944: 87) make impossible any comparisons.

Tarichium acaricolum n. sp.

Resting spores light yellow-brownish, regularly globose, of the diameter (27.7)-32.8-33.9-(37.4) μm , with the wall 4.5 - 5.5 μm thick and the epispore regularly thickly pitted. A condensed protoplasm forms a thin layer around the great, transparent central vacuole. The resting spores fill the host's body cavity together with the basal parts of its legs. The conidial sporulation, rhizoids and pseudocystidia lacking.

In dead mite *Pergamasus* sp. found under the Scotch pine bark on 16 May 1981 in the forest district Zielonka, forestry Zielonka. The type signed with the N^o. 1477 in the collection.

Diagnosis (Pl. II a-b). *Sporae perdurantes regulariter globosae, pallide brunneo-flavae, diametro (27.7)-32.8-33.9-(37.4) μm , cum membrana externa 4.5 - 5.5 μm crassa, superficie regulariter forte sinuata, corpus hospitis cum basalibus extremitatum articulis complent. In sporis centralis hyalina vacuola tenui densae plasmae strato continetur.*

In mortuo Pergamasus specie (Acarina) sub cortice Pini in silva Zielonka prope Posnaniam die 16 mense Maio anno 1981 coll. Typus numero 1477 in collectione designatus.

In the available references no description of *Tarichium* species corresponding with the above morphological characteristics has been found.

Tarichium fumosonigrum n. sp.

Resting spores regularly globose, dark brownish or smoky black of the diameter (16.3)-17.7-18.1-(19.9) μm with the wall 3.0-3.8-(4.0) μm thick and the epispore rugose, warty or in some parts spinulose. The content formless, undifferentiated or thickly granular. The resting spores fill the posterior half of host's body. Vegetative mycelium and conidial sporulation lacking.

In the dead mite *Pergamasus* sp. devoid of legs and gnathosoma, found in the hill of *Formica polyctena* Först. in the coniferous forest Potasze, forest district Zielonka on 16 March 1964. The type signed with the N°. 1533 in the collection.

Diagnosis (Pl. II c-d). *Sporae perdurantes regulariter globosae, obscu-ro-brunneae vel fumoso-nigrae diametro (16.3)-17.7-18.1-(19.9) µm cum membrana 3.0-3.8-(4.0)µm crassa episporio ruguloso vel verrucoso in nonnullis locis spinuloso, posteriorem partam corporis hospitis implent. In sporis materia hyalina indiferens. Mycelium et sporulatio conidialis desunt.*

In mortuo Pergamasus sp. (Acarina) in cuniculo Formicae polyctenae in silva conifera Potasze prope Posnaniam die 16 mense Martio anno 1964 coll. Typus numero 1533 in collectione designatus.

The distinctive features of this species are the colour, surface sculpture and dimensions of the resting spores.

***Tarichium obtusoangulatum* n. sp.**

Resting spores in outline irregularly circular or obtuse multiangular, light yellow, of the diameter (22.3)-26.8-28.6-(32.0) µm with the wall 3.2-5.5 µm thick; the episporium thickly and deeply ruffled with numerous obtuse conical convexities. The content formless, transparent. The resting spores fill the body cavity of a host.

In a dead mite *Uropoda minima* Kramer found under the Scotch pine bark in the moist coniferous forest Kosobudki, forest district Krosno Odrzańskie on 22 September 1982. The type signed with the number 1528 in the collection.

Diagnosis (Pl. III a-b). *Sporae perdurantes in lineamentis irregulariter circulares vel obtuso-multiangulae, pallido-flavae, diametro (22.3)-26.8-28.6-(32.0) µm cum membrana 3.2-5.5 µm crassa, episporio cum obtuso-conoideis convexitatibus valde et profunde sinuato. In sporis materia hyalina indiferens. Sporulatio conidialis et mycelium desunt.*

In mortuo Uropodis minimae sub cortice Pini in silva conifera Kosobudki prope Krosno Odrzańskie die 22 mense Septembri anno 1982 coll. Typus numero 1528 in collectione designatus.

This species differs from *T. acaricum* n. sp. by distinctly smaller resting spores and considerably stronger, irregular folding of their episporium.

***Tarichium pusillum* n. sp.**

Resting spores globose or subglobose (9.0)-10.6-11.0-(12.1) µm in diameter with grey-yellow wall 1.7-2.3 µm thick, covered by a very thin, finely rough, brownish episporium. The content coarse-grained and irregularly vacuolized. The spores very numerous fill the body cavity and basal parts of host's legs.

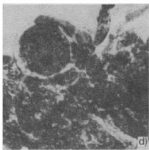
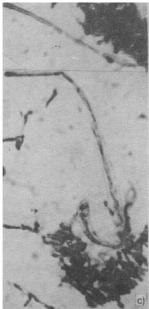
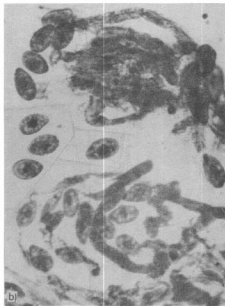
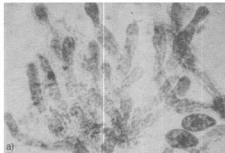


Plate I

Erynia phalangicida (Lagerh.) Rem. et Kell.

a – terminal branching of a conidiophore; *b* – external mycelium and conidia; *c* – pseudocystidia; *d* – internal mycelium with a resting spore

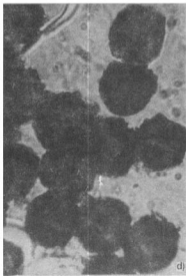
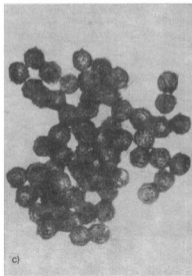
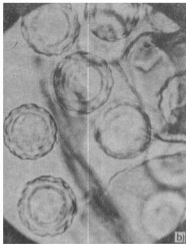
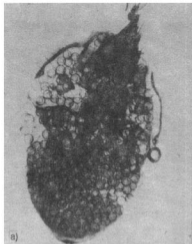


Plate II

a-b - *Tarichium acaricolum* n. sp. - resting spores; c-d - *T. fimosonigrum* n. sp. - resting spores

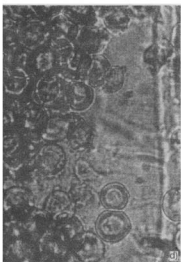
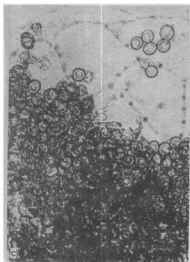
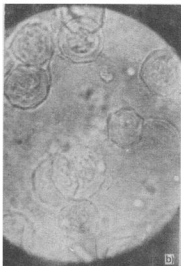
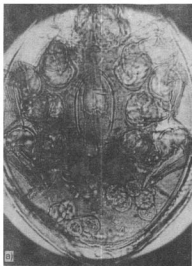


Plate III

a-b - *Tarichium obtusoangulatum* n. sp. - resting spores; c-d - *T. pusillum* n. sp. - resting spores

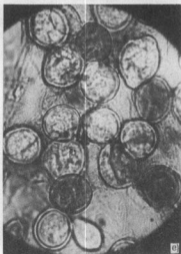
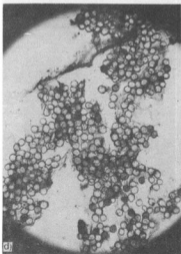
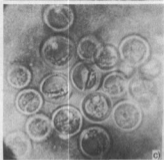
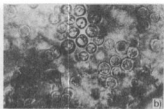


Plate IV

a-c - *Tarichium sphaericum* n. sp. - resting spores; d-e - *T. subglobosum* n. sp. - resting spores

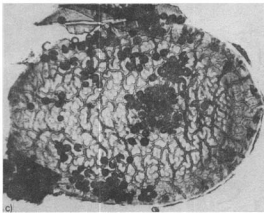
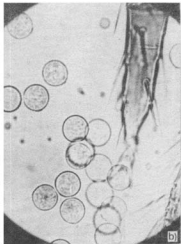
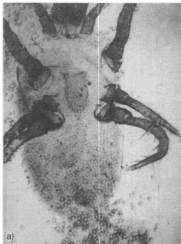


Plate V

a-b - *Torichlum tatricum* n. sp. - resting spores; c-d - *T. tenuiparietatum* n. sp. - resting spores

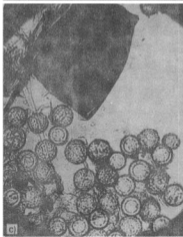
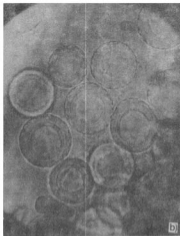
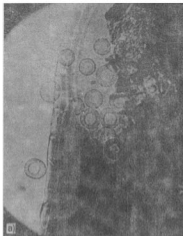


Plate VI

a-d - *Tarichium tenuisculpturatum* n. sp. - resting spores, a-b - specimen N°. 1477a, c-d - specimen N°. 1477b

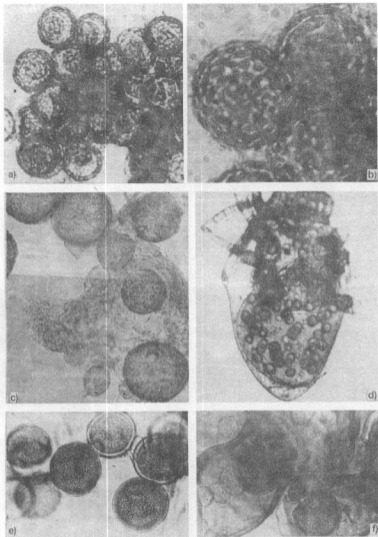


Plate VII

Tarichium tenuisculpturatum n. sp.

a-b — resting spores of the specimen, N^o. 1537 (magnif. incompar. with Plate VI)

Pythium-like mycelium with durable structures

c — elements of vegetative phase; d — thick-walled structures inside *Pergamasus* sp.; e — durable structures from the body cavity; f — thick-walled structures inside articles of eggs (note the presence of thin-walled outlines of degenerated cells)

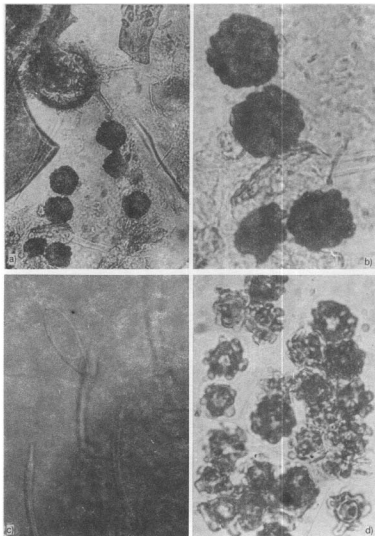


Plate VIII

Unidentified forms of fungi from mites

a-b — *Tarichium*-like structures from a dead *Oribatei*; c — a capillispore of *Neozygites* sp. (*Triplisporium* sp.) attached to a seta of *Parasitiformes*-deutonymph; d — zygospores of a species of *Zoosporales* from a dead *Pergamasus* sp.

In a dead mite *Pergamasus* sp. from the rotten ash wood, collected on 27 March 1983 in the park of the bee-hive Skansen museum in Swarzędz near Poznań. The type signed with the number 1534 in the collection.

Diagnosis (Pl. III c-d): *Sporae perdurantes globosae vel subglobosae diametro (9.0)-10.6-11.0-(12.1) μm, corpus hospitis cum basalibus extremitatum articulis complent. Membrana externa glauco-flava 1.7-2.3 μm crassa cum tenue ruguloso episporio brunneo. Materia interna irregulariter granulata.*

In mortuo Pergamasus specie (Acarina) ex ligno putrido Fraxini excelsioris in horto musei apidarii Swarzędz prope Posnaniam die 27 mense Martio anno 1983 coll. Typus numero 1534 in collectione designatus.

This species differs from all others described here as well as from the forms reported in references (T h o r 1930, M a c L e o d and M ü l l e r - K ö g l e r 1970) by small and very constant dimensions of the resting spores.

Tarichium sphaericum n. sp.

Resting spores smooth, colourless, globose, diameter (11.4)-17.2-18.8-(23.0) μm, seldom ellipsoid or pear-shaped 17.9-26.3 × 12.7-17.2 μm, with the wall 1.5-3.0 μm thick. The content transparent: the protoplasm surrounds a big central vacuole with thin, one-sided a little thicker layer. The resting spores fill the host's body cavity not coming into basal parts of legs. Vegetative mycelium unobserved.

In the dead mite *Trachyuropoda coccinea* (Michael) from the nest of *Formica polyctena* Först., found in the coniferous forest Potasze, forest district Zielonka, on 8 October 1981. The type signed with the N°. 1478 in the collection.

Diagnosis (Pl. IV a-c). *Sporae perdurantes leves hyalinae, globosae, diametro (11.4)-17.2-18.8-(23.0) μm, raro ellipsoides vel piriformes 17.9-26.3 × 12.7-17.2 μm, cum membrana 1.5-3.0 μm crassa in extremitatum articula non venientes, corpus hospitis implent. In sporis centralis vacuola tenui semilunoideoque plasmae strato continentur.*

In mortua Trachyuropoda coccinea (Acarina) in cuniculo Formicae polyctenae in silva conifera Potasze prope Posnaniam die 8 mense Octobri anno 1981 coll. Typus numero 1478 in collectione designatus.

The resting spores of this species occurring in mass resemble the illustrations given by T h o r (1930) for the species *Arctosporidium lucidum* ST., considered as belonging to *Haplosporidia*. As a result of comparisons of the features distinctive differences have been found particularly in the dimensions and protoplasmatic content of the resting spores. Thus, although according to the statements of L i n d q u i s t (1961), S a m š i ň á k (1962) and L i p a

(1962, 1971) Thor's species represent in reality a resting spore form of an entomopathogenic fungus, it cannot be considered as conspecific with the specimen found in *Trachyuropoda coccinea*.

***Tarichium subglobosum* n. sp.**

Resting spores smooth or finely rough, globose of the diameter (17.9)-23.5-25.3-(32.8) μm or ovoidal to broadly ellipsoid 21.0-30.5 \times 17.2-25.0 μm , often with a small papilliform convexity, sometimes one-sided stronger narrowed – somewhat pyriform, light brownish-yellow, with the wall 2.0-2.5 μm thick. The content granular, yellowish. The resting spores numerous both in the host's body cavity and in its legs. Conidial sporulation, pseudocystidia and rhizoids lacking.

In a dead mite *Pergamasus* sp. from a hill of *Formica rufa* found in the coniferous forest Piotrowo, forest district Oborniki on 20 Mai 1982. The type signed with N^o. 1477 c in the collection.

Diagnosis (Pl. IV d-e). *Sporae perdurantes leves vel tenui asperatae, globosae diametro (17.9)-23.5-25.3-(32.8) μm vel late-ellipsoideae 21.0-30.5 \times 17.2-25.0 μm , saepe cum parva papilliformi convexitate, nonnumquam ex una parte angustiores, paulo piriformes, pallide brunneo-fulvae, cum membrana 2.0-2.5 μm crassa, corpus hospitis una cum extremitatibus complent.*

In mortuo Pergamasus sp. in cuniculo Formicae rufae, in silva conifera Piotrowo prope Oborniki die 20 mense Maio anno 1982 coll. Typus numero 1477 c in collectione designatus.

The material was kept in the laboratory in living state but attempts at isolation of the fungus on media as well as efforts for obtaining its other morphological elements or developmental stages failed. The characteristics of this fungus do not correspond with any of so far described species.

***Tarichium svalbardense* (ST.) Bal. et Wiś.**

This species has been exactly described and discussed in a separate paper (Bałazy and Wiśniewski 1977). The same species was identified lately in a dead mite *Pergamasus* sp. collected under the bark of spruce trunk in the coniferous forest Rakownia, forest district Zielonka, on April 7, 1982.

Another specimen was found on March 30, 1983 in a dead oribatid mite taken out from the rotten wood of the hollow in *Robinia pseudacacia* L. in the Dendrological Garden of the Academy of Agriculture in Poznań-Sołacz. Its resting spores were of about 2 μm larger diameter (Table 1, N^o. 1535) and a little thinner walls – 1.5-1.9 μm . The authors consider these differences as insufficient for distinguishing a separate species or form. The features concerning all samples have been included into the Table 1.

Tarichium tatricum n. sp.

Resting spores smooth, regularly globose of the diameter (14.1)-15.5-15.9-(20.0) μm , transparent with finely granular content and with the walls about 0.5 μm thick, forming of irregularly globose, thin-walled hyphal bodies of the dimensions (14.1)-15.5-17.3-(18.7) \times 15.5-16.5 μm occurring inside the idiosoma of a host in the catenulate arrangement. In the basal joints of the legs there were only few resting spores. Hyphae and conidial sporulation lacking.

In the dead deutonymph of a mite of the sub-order *Parasitiformes* found in the mountain pasture in Dolina Miętuska, the Tatra National Park, on 9 September 1982. The type signed with the N°. 1477 d in the collection.

Diagnosis (Pl. V a-b). *Sporae perdurantes leves, regulariter globosae diametro (14.1)-15.5-15.9-(20.0) μm , hyalinae, tenue-granulosa plasma impletae, cum membrana circa 0.5 μm crassa, ex irregulariter globosis corporis hyphatis dimensionibus (14.1)-15.5-17.3-(18.7) \times 15.5-16 μm . in catenulato ordine intra hospitis idiosoma formantur. Sporulatio conidialis et hyphae absunt.*

In mortua deutonymphu acarorum subordine Parasitiformes in Dolina Miętuska (Tatra mons) die 9 mense Septembri anno 1982 coll. Typus numero 1477 d in collectione designatus.

This species is easily distinguishable among the forms with smooth-walled resting spores by their very constant, relatively small diameter and invariably globose shape.

Tarichium tenuiparietatum n. sp.

Resting spores colourless, smooth, globose of strongly differentiated dimensions — (9.0)-14.4-16.0-(23.4) μm in diameter — with the content formless, transparent, surrounded by the walls 0.5-1.0 μm thick. Conidial sporulation and hyphae unobserved.

In a dead mite of the group *Oribatei* form a nest of *Formica polyctena* Först., found in the coniferous forest Piotrowo, forest district Oborniki, on 1 June 1982. The type signed with the N°. 1530 in the collection.

Diagnosis (Pl. V c-d). *Sporae perdurantes leves, hyalinae, globosae, valde differentibus dimensionibus, diametro (9.0)-14.4-16.0-(23.4) μm , membrana 0.5-1.0 μm crassa contentae, corpus hospitis implent. Sporulatio conidialis et hyphae non inventae sunt.*

In mortuo acaro e subordine Oribatei in cuniculo Formicae polyctenae in silva conifera Piotrowo prope Oborniki die 1 mense Iunio anno 1982 coll. Typus numero 1530 in collectione designatus.

This species differs from *T. sphaericum* n. sp. by considerably thinner walls and from *T. tatricum* n. sp. — by strong differentiation of the dimensions and internal structure of the resting spores. It is entirely different from any other species.

Tarichium tenuisculpturatum n. sp.

Resting spores light yellow to golden-yellow in mass with formless, transparent content, globose of the diameter (23.0)-29.8-31.7-(37.4) μm , surrounded with thin walls 3.5-3.9 μm thick. The epispore with delicate and moderately dense yellow pits, appearing to be punctate with a fine rugosity. The resting spores fill the host's body cavity and basal joints of its legs and gnathosoma. Conidial ornamentation and hyphae lacking.

In dead mites *Pergamasus* sp.: N^o. 1477 a — collected under the Scotch pine bark in the coniferous forest Borek, forest district Wronki, on 7 April 1982; N^o. 1477 b — designed as the type — collected in the ant hill of *Formica rufa* L. in the coniferous forest Piotrowo, forest district Oborniki, on 20 May 1982; N^o. 1537 — collected in the rotten wood for the hollow in *Robinia pseudacacia* L. in the Dendrological Garden of the Academy of Agriculture in Poznań-Sołacz, on March 1983.

Diagnosis (Pl. VI a-d, VII a-b). *Spore perdurantes pallide-vel aureo-fulvae, bosae, diametro (23.0)-29.8-31.7-(37.4) μm , indifferente hyalina substantia intercum membrana 3.5-3.9 μm crassa, episporio tenue ruguloso et modernato dense lose sinuato, corpus hospitis una cum basalibus articulis extremitatum implet. ornamentatio conidialis et hyphae absunt.*

In mortuis acaribus Pergamasus sp.: N^o. 1477 a — sub cortice Pini silvestris in silva conifera Borek prope Wronki die 7 mense Aprili anno 1982 coll.; N^o. 1477 b — us designatus — in cuniculo Formicae rufae in silva Piotrowo prope Oborniki die mense Maio anno 1982 coll.; N^o. 1537 — in ligno putrido Robiniae pseudacacia in Horto Dendrologico Academiae Agriculturnarum in Posnania die 30 mense Martio anno 1983 coll.

This species differs from *T. acaricolum* n. sp. by the smaller resting spores and distinctly finer surface ornamentation of the epispore. In this respect it should be comparable with *T. subpunctulatum* Bałazy (1982 a), however, the rugosity of the resting spore surface (Pl. VII a-b) and lack of rhizoids in *T. tenuisculpturatum* n. sp. as well as too distant hosts do not allow to treat these fungi as identical.

Some unidentified forms

1. Black, entirely opaque, strongly warted on the surface structures were observed in a dead specimen of *Oribatei* found on 30 March 1983 in the rotten litter taken out from a hollow in *Robinia pseudacacia* in the Dendrological Garden in Poznań-Sołacz. The dimensions of these structures, resembling somewhat dark *Tarichium* resting spores, were (16.4)-21.9-23.6-(32.0) μm , with the arithmetic mean $22.7 \pm 3.11 \mu\text{m}$ (Pl. VIII a-b). For the reason of poor condition of the material the full characteristics and essential description were impossible.

2. In two cases capillispores of unidentified species of the genus *N. Witlaczil* [= *Triplosporium* (Thaxter) Batko] attached to the legs or setae of mites were found. They were first found on a deutonymph of a species of the order *Parasitiformes*, collected in the coat of a small rodent *Microtus arvalis* in the Wielkopolski National Park, protected area Wiry, on 2 February 1982. The capillispores were relatively big, $18.7-29.6 \times 8.5-12.5 \mu\text{m}$, strongly flattened at basal parts with the haptors $1-2 \mu\text{m}$ long. With regard to the shape and size they should be comparable with those of *N. tetranychi* (Weiser) Rem. et Kell., but there was no roughness on their surface. In the second case similar but smaller and more slender capillispores, $11.7-17.2 \times 3.5-5.6 \mu\text{m}$ were found on a deutonymph of *Lasioseius ometes* (Oudemans) collected under the pine bark in the forest district Rakownia, forest district Zielonka, on 7 April 1982. With regard to the size these spores were incomparable with any of the known species of *N. Witlaczil* from mites (Pl. VIII c).

3. The most common in dead specimens of *Pergamasus* sp. [in one specimen *P. septentrionalis* (Oud.) was determined] was the fungus forming relatively big globose or ovoidal durable structures (45)-65-82-(110) μm in diameter or $60-108 \times 39-75 \mu\text{m}$, covered with the yellow or light-brown smooth wall $2.5-6.0 \mu\text{m}$ thick (Pl. VII e-f). The content of these cells was finely granular, not transparent, staining well with aniline blue in lactophenol and with aceto-carmine, but the nuclei were not distinguishable (Fig. 1; Pl. VII d, f). If above described structures were formed in particular parts of legs or gnathosoma they assumed the shapes determined by the exoskeleton of these parts of the host body (Fig. VII g). Occurrence of this fungus was noted in the following collections: in *Pergamasus* sp. from an ant-hill of *Formica rufa* group in forest district Babki, forestry Łękno, on 21 May 1980; in *Pergamasus* sp. and two specimens of *P. septentrionalis* (Oud.) under the bark of a pine tree in the forest district Wronki, forestry Borek, on 7 April 1982; in 6 specimens of *Pergamasus* sp. collected in the hills of *Formica rufa* (L.) in forest district Oborniki, forestry Piotrowo, on 20 May 1982; in *Pergamasus* sp. under the bark of a pine tree in the Dendrological Garden of the Academy of Agriculture in Poznań on 23 March 1983; in *Pergamasus* sp. from rotten spruce wood and in *Trichoseius ovalis* (C. L. Koch) from that rotten pine trunk – both in the forest district Grodzisk, forestry Zwierzyniec, on 6 April 1983. Apart from the above mentioned collections similar structures were sometimes found among the remnant of unidentified mites and in one case in a small staphylinid beetle.

Several attempts to isolate and culture this fungus were made, but no growth in the dead mites in damp chamber conditions was successful. The mycelium was usually abundant, consisted of thread like, colourless, non-

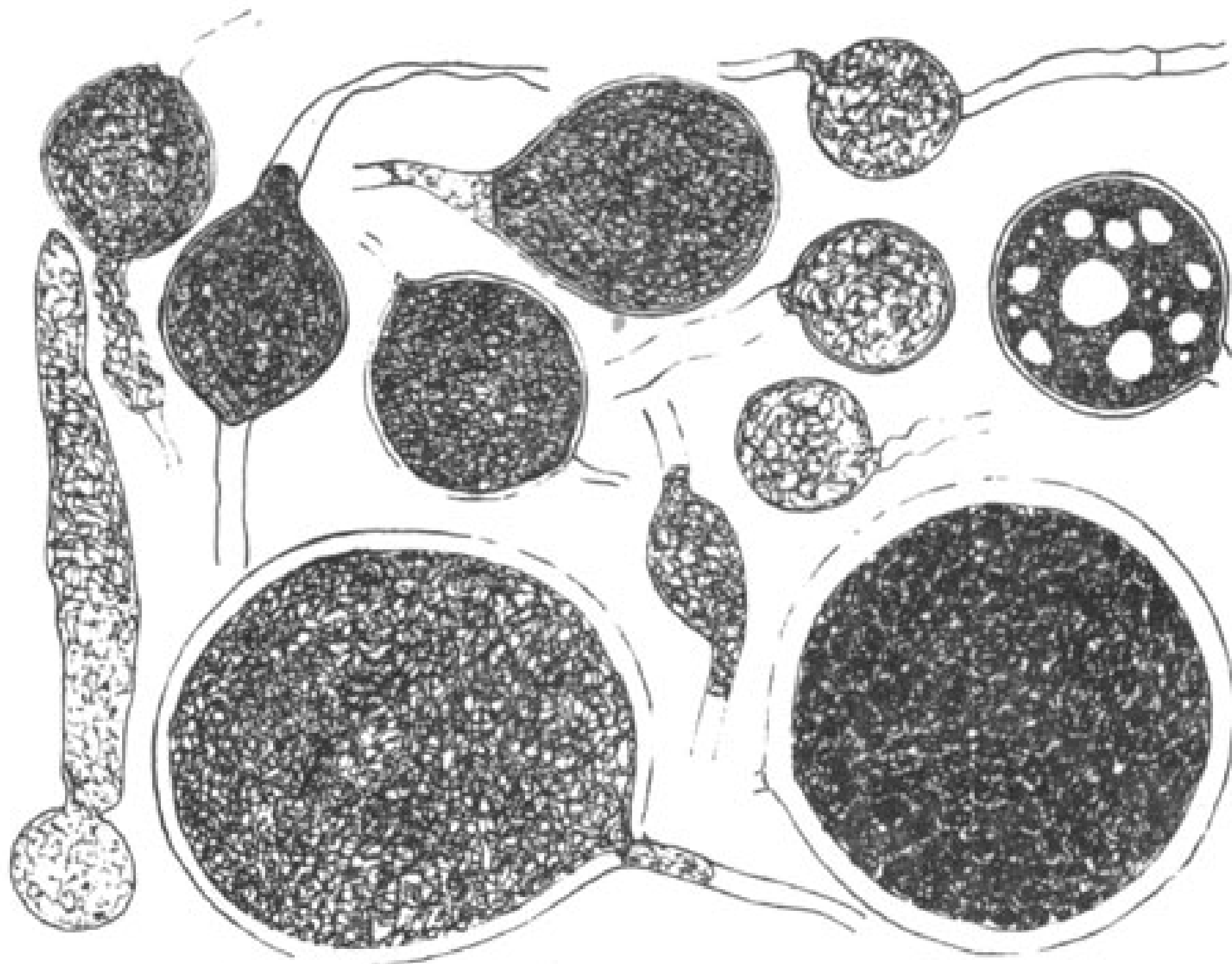


Fig. 1. *Pythium*-like mycelium with elements of vegetative phase

and poorly branched hyphae of uniform diameter (0.8)-3.1-4.4-(8.6) μm , with numerous intercalary and few terminal, at first thin-walled giant cells, spherical, ovoidal or elongated (Fig. 1; Pl. VII d), diameter 11-60 μm , with age partially degenerated or changing into thick walled structures described above. Both in the damp chambers and in hanging drops no new elements either of the fungus development or its morphology were obtained. Although the identification of the fungus on this basis is not possible it seems to be very close to the genus *Pythium* Pringsheim and in some respects resembles the structures described by Thor (1930) as *Hermanniasporidium magnum* ST. Hölldobler (1933) and Espadaler (1982) noticed the similarity of the latter to *Myrmicinosporidium durum* Hölld. — the parasite of some ant species. It would be interesting to determine the systematic position and ecological significance of this fungus which seems to be rather common in the biotic communities of the forest floor.

4. In one dead *Pergamasus* sp. collected together with the rotten wood from the hollow in *Robinia pseudacacia* in the Dendrological Garden in Poznań on 30 March 1983 there were found numerous thick walled structures irregularly star-shaped in outline, of the diameter 8.1-12.5 μm . The round central part 6.3-7.0 μm in diameter, contained a subglobose vacuole of the approximate size 4.7 μm

surrounded by 1.5-2.5 μm thick layer of the condensed protoplasm, was covered with a hyaline wall 1.5-2.5 μm thick having relatively long, obtuse warts and outgrowths up to 3 μm long on its epispore (Pl. VIII c). These structures have been surely the zygospores of a species of *Zoopagales*, however, neither invaded amoebae nor other vegetative elements of the fungus were observed.

CONCLUSIONS

On the basis of the data concerning the fungi parasitic for mites or dispersed by these arthropods one can state that the investigations on these problems are scarcely in the starting point. It seems, however, that the diversity of the forms and species of the fungi infecting mites is not lesser than in the case of the insect killing fungi. Unfortunately, the fungal diseases of the mites are usually either overlooked by acarologists or described imprecisely, precluding a correct identification of the pathogens. The most convenient form for elaboration of similar problems should be permanent and close co-operation and exchange of information between acarologists and invertebrate pathologists. The development of such comprehensive studies should cause reliable progress in invertebrate pathology on the whole. In the range of the mycology it should contribute to the fuller knowledge of the phylogenie of entomopathogenic fungi, in particular of *Entomophthoraceae*.

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O niektórych grzybach niższych występujących na roztoczach (*Acarina*) w Polsce

Streszczenie

W wyniku badań nad chorobami roztoczy występujących w mrowiskach, ściółce leśnej oraz w rowiskach owadów podkorowych i w częściowo rozłożonym drewnie autorzy – badając głównie schowane w martwych osobnikach zarodniki przetrwalnikowe – wyodrębnili 11 gatunków grzybów niższych, z których 9 stanowią nowo opisane taksony. Z wyjątkiem gatunku *Erynia talangicida* (Lagerh.) Rem. et Henneb., który wytworzył typowe zarodnikowanie konidialne, zostały zaliczone do rodzaju *Tarichium* Cohn, grupującego owadomorki (*Entomophthorales*) o niekompletnie poznanej morfologii i rozwoju.

Na podstawie obliczeń statystycznych materiałów uzyskanych w wyniku pomiarów oraz szczegółowych badań mikroskopowych sporządzono tablicę poglądową o stopniu zróżnicowania form zaliczanych do rodzaju *Tarichium*, poznanych dotychczas z roztoczy, oraz ułatwiającą ich oznaczenie.

Można przypuszczać, że choroby grzybowe wśród roztoczy występują nie rzadziej niż wśród owadów oraz, że w obu grupach powodowane są przez pokrewne gatunki patogenów.