

***Chaetomium* in the Czech Republic  
and notes to three new records**

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*Chaetomium* (Ascomycota, Sordariales, Chaetomiaceae) is a species-rich genus, with about 100 currently accepted species. Data on the occurrence of *Chaetomium* species in the Czech Republic were not yet summarised; this paper is the first attempt. So far, 14 *Chaetomium* species were published from the area of the Czech Republic. The author presents new records of three other *Chaetomium* (*C. aureum*, *C. madrasense*, and *C. robustum*) isolated from various substrates in the Czech Republic. Short descriptions and photographs are included.

**Key words:** Ascomycota, pyrenomycetes, Sordariales, *Chaetomium*, microfungi

Kubátová A. (2006): *Chaetomium* v České republice a poznámky ke třem novým nálezům. – Czech Mycol. 58(3–4): 155–171.

*Chaetomium* (Ascomycota, Sordariales, Chaetomiaceae) je druhově bohatý rod, zahrnující nyní okolo 80 uznávaných druhů. Údaje o výskytu druhů rodu *Chaetomium* v České republice nebyly dosud souhrnně zpracovány; tato práce představuje první souhrnný příspěvek k této problematice. Dosud byly z území České republiky publikovány údaje o výskytu 14 druhů rodu *Chaetomium*. Autorka prezentuje další tři druhy (*C. aureum*, *C. madrasense* a *C. robustum*) izolované z různých substrátů, které jsou považovány za nové nálezy pro Českou republiku. Krátké popisy druhů jsou doplněny fotografiemi.

INTRODUCTION

The genus *Chaetomium* represents ascomycetous fungi belonging to *Chaetomiaceae* (Sordariales). It is distinctive by its superficial ascomata (mostly ostiolate perithecia) covered with hairs of various types. Some *Chaetomium* spe-

cies are reported to be associated with *Acremonium*, *Botryotrichum*, *Humicola*, *Paecilomyces*, *Scopulariopsis* or *Trichocladium* anamorphs (CBS Anamorph-Teleomorph Database 2006). *Chaetomium* species are distributed worldwide and found on various substrates as saprotrophs. They are often coprophilous, cellulolytic; some of them are toxigenic, thermophilic and even pathogenic for man.

The genus was described by Gustav Kunze in 1817 based on the type species *Chaetomium globosum*. Kirk et al. (2001) reported that from 300 species described so far 81 are accepted. Since, many new species have been published. Now the genus comprises about 100 species. In CBS Filamentous Fungi Database (2006) even 413 records of all *Chaetomium* species names are mentioned.

The genus *Chaetomium* has been studied by many authors. Among the most important old works are those by Zopf (1881), Bainier (1910) and Chivers (1915). In the 1960s, several extensive studies of *Chaetomium* appeared (Udagawa 1960, Ames 1963, Mazzucchetti 1965, Novák 1966). Later monographs by Seth (1970), Arx et al. (1986) and Cherepanova (1989b) were published. Since that time many new species have been described, mostly not from Europe (e.g. Horie and Udagawa 1990, Abdullah and Zora 1993, Udagawa et al. 1994, Gené and Guarro 1996, Decock and Hennebert 1997, Rodriguez et al. 2002). While in the last century classical morphological characters were used in the taxonomy of *Chaetomium* (e.g. Arx et al. 1984, Cherepanova 1989a), at the end of the twentieth century molecular methods started to penetrate into this field (e.g. Lee and Hanlin 1999). In the GenBank database (2006) sequences of 27 identified and of 20 unidentified *Chaetomium* species are now deposited.

In the Czech lands, Corda was probably the first mycologist who studied *Chaetomium* in detail. He described eight new species (Corda 1837, 1840); two of them (*C. indicum* and *C. murorum*) are still accepted (according to Arx et al. 1986). Two of his species were found in Prague (*C. murorum* and *C. affine*), other species were described from material collected in East India; in some species the locality is not specified. A list of Corda's herbarium specimens deposited at the Herbarium of the National Museum in Prague (PRM) was later published by Pilát (1938).

In the 1970s, Hubálek published a series of papers on *Chaetomium* associated with free-living birds and small mammals. He found nine *Chaetomium* species on feathers and nests of free-living birds in the area of the former Czechoslovakia (e.g. Hubálek et al. 1973; Hubálek 1974a, 1974b). He considered epiornithochory as an important dispersal mechanism, especially for *Chaetomium* species with coiled or undulate terminal hairs and those with dichotomously branched hairs. They could be transferred by migratory birds over great distances (Hubálek 1975). Hubálek (1976c) and Hubálek et al. (1979) studied also fur of small wild mammals in the former Czechoslovakia and Yugoslavia. They isolated altogether ten *Chaetomium* species, however some of them were found only in Yugoslavia.

Finds of *Chaetomium* and *Botryotrichum* from soils in the former Czechoslovakia until 1988 were published by Řepová (1989a, 1989b) in her comprehensive list of soil fungi in Czechoslovakia. She cited altogether six species of *Chaetomium* found in the area of the Czech Republic. Later records of *Chaetomium* and records from different substrates are dispersed over many other papers.

The main aim of this study is to summarise published records of *Chaetomium* species from the Czech Republic and present three species new to this area.

#### MATERIALS AND METHODS

The species concept of *Chaetomium* is according to Arx et al. (1986). The identity of species previously published were not verified, due to absence of descriptions or illustrations in most of the records.

Five *Chaetomium* strains examined in this study were isolated during several surveys of micromycete diversity in the Czech Republic in 1993–2006. The surveys were focused on:

- fungi contaminating archive materials (1997): Neratovice, central Bohemia; isolation on soil extract agar with glucose and Bengal rose (SEA);
- air-borne fungi (1995–97): outdoor air in Prague, air samples were aspirated by an impactor, isolation on wort-beer agar (WBA);
- dried foods: Brno (as of 1999); isolation on yeast extract glucose chloramphenicol agar (YGC), see also Ostrý et al. (2002);
- microfungi of biological soil crusts (since 2005): Ralsko, northern Bohemia; isolation on soil extract agar with glucose and Bengal rose (SEA).

Isolated strains (see Tab. 1) were cultivated on malt extract agar (MEA: malt extract 20 g, peptone 1 g, glucose 20 g, agar 15 g, water 1000 ml), potato-carrot agar (PCA: potatoes 20 g, carrot 20 g, agar 15 g, water 1000 ml) and corn meal agar (CMA: cornmeal 60 g, agar 20 g, water 1000 ml) at 24–26 °C, 37 °C and 42 °C for 2–3 weeks in the dark. Measurements of colonies on each medium were made on three Petri dishes. Microscopic features were described from PCA after three weeks.

The *Chaetomium* strains were identified according to Arx et al. (1986). Photographs were taken on an Olympus BX-51 microscope using Nomarski contrast (DIC). Five living strains are maintained in the Culture Collection of Fungi (CCF), Dept. of Botany, Faculty of Science, Charles University, Prague, Czech Republic. Herbarium specimens (dried colonies) were deposited in the Herbarium of Dept. of Botany (PRC) at the same institute (see Tab. 1).

**Tab. 1.** Examined *Chaetomium* species.

Species	Strain no.	Herbarium specimen no.	Substrate, locality, date, isolated by
<i>C. aureum</i>	CCF 3252	PRC 295, PRC 296	fruit tea, Brno, Czech Republic, November 2001, V. Ostrý as No. 282A
	CCF 3624	PRC 297	surface soil crust, near former airport Ralsko, N Bohemia, Czech Republic, January 2006, A. Kubátová as No. 27/06
<i>C. madrasense</i>	CCF 3412	PRC 298, PRC 299, PRC 300	out-door air, Prague, Czech Republic, December 1996, A. Kubátová as No. 6/97
	CCF 3413	PRC 301, PRC 302, PRC 303	surface of book shelf in archive, Neratovice, N Bohemia, Czech Republic, June 1997, A. Kubátová as No. 79/97
<i>C. robustum</i>	CCF 3260	PRC 304, PRC 305, PRC 306	out-door air, Prague, Czech Republic, February 1996, A. Kubátová as No. 31/96

## RESULTS AND DISCUSSION

***Chaetomium* species – list of published records from the Czech Republic**

Notes:

Records under each species are arranged chronologically.

CCF = Culture Collection of Fungi, Prague.

SMF ISB = Collection of Microscopic Fungi of the Institute of Soil Biology, České Budějovice.

<sup>1</sup> More detailed data on locality not available.<sup>2</sup> Synonym according to Arx et al. (1986).<sup>3</sup> Nomen proposed by Arx et al. (1986) to be rejected; syn. of *C. globosum* according to CBS Filamentous Fungi Database.<sup>4</sup> Nomen designed by Arx et al. (1986) as a possible older name of *C. elatum*.*Botryotrichum piluliferum* Sacc. et Marchal (anamorph) – see *C. piluliferum* (teleomorph)*Chaetomium affine* Corda – see *C. elatum* <sup>2</sup> (*C. affine* is a synonym of *C. globosum* according to CBS Filamentous Fungi Database 2006)***Chaetomium aureum* Chivers**

Kubátová (this paper): CCF 3252, fruit tea, Brno, S Moravia;

Kubátová (this paper): CCF 3624, surface soil crust, Ralsko, N Bohemia.

*Chaetomium bainieri* Munk – see *C. globosum* <sup>2</sup>***Chaetomium bostrychodes* Zopf**Baudyš (1925)<sup>1</sup>;

Baudyš and Picbauer (1925): paper, Brno, S Moravia;

Hubálek (1974a): feathers of *Phasianus colchicus*, *Larus ridibundus*, *Passer domesticus*, *P. montanus*, former Czechoslovakia<sup>1</sup>;Hubálek (1974b): feather of four bird species, former Czechoslovakia<sup>1</sup>;Hubálek et al. (1979) as *C. microcephalum*: hair of small mammals, former Czechoslovakia or former Yugoslavia<sup>1</sup>;Urošević (1979) as *C. bostrychoides*: seeds of spruce and pine, Bohemia and Moravia.***Chaetomium circinatum* Chivers**

Fassatiová (1966): soil of steppe, Doutnáč hill, Bohemian Karst, central Bohemia.

*Chaetomium cochliodes* Palliser – see *C. globosum*<sup>2</sup>

*Chaetomium comatum* (Tode) Fr. – see *C. elatum*<sup>4</sup>

***Chaetomium crispatum* Fückel**

Baudyš (1925) as *C. streptothrix*;

Hubálek et al. (1979): hair of small mammals, former Czechoslovakia or former Yugoslavia<sup>1</sup>;

Kubátová and Váňová (2001): CCF 3184, soil, Šumava Mts., SW Bohemia.

*Chaetomium dolichotrichum* L. M. Ames – see *C. funicola*<sup>2</sup>

***Chaetomium elatum* Kunze: Fr.**

Corda (1837) as *C. lageniforme*: rotten paper, Reichenberg (Liberec), N Bohemia;

Corda (1840) as *C. affine*: leaves of *Quercus* sp., Prague, central Bohemia;

Opiz (1852)<sup>1</sup>, also as *C. affine* and *C. lageniforme*;

Thümen (1875): Teplice and Kačina („Kacin“), Bohemia;

Thümen (1875) as *C. comatum*: Kačina („Kacin“), Bohemia;

Baudyš (1925)<sup>1</sup> as *C. comatum*;

Baudyš and Picbauer (1925) as *C. comatum*: paper, Brno, S Moravia;

Picbauer (1927)<sup>1</sup> as *C. comatum*;

Picbauer (1929): moist wood, Brno, S Moravia;

Picbauer (1931): stems of *Dahlia variabilis*, Brno, S Moravia;

Picbauer (1938): dead stems of *Dahlia variabilis*, Velké Opatovice, Moravia;

Picbauer (1941): straw, Brno, S Moravia;

Svrček (1963) as *C. comatum*: excrements and soil under *Gymnocladus dioica* and *Liriodendron tulipifera*, Prague, central Bohemia;

Fassatiová (1966) as *C. affine*: soil of steppe, Doutnáč hill, Bohemian Karst, central Bohemia;

Hubálek et al. (1973): nest of *Passer montanus*, *Parus ater*, *Sturnus vulgaris*, S Moravia;

Hubálek (1974a, 1974b): feathers and nests of several bird species, former Czechoslovakia<sup>1</sup>;

Hubálek (1976a, 1976b): bird nests, S Moravia.

*Chaetomium fieberi* Corda – see *C. globosum*<sup>2</sup>

***Chaetomium funicola* Cooke**

Hubálek et al. (1973) as *C. funiculum*: nest of *Passer montanus*, *Phoenicurus phoenicurus*, S Moravia;

Hubálek (1974a, 1974b) as *C. funiculum*: feathers and nest of several bird species, former Czechoslovakia<sup>1</sup>;

Hubálek and Balát (1974) as *C. funiculum*: nests of *Passer montanus*, Bzenec, S Moravia;

Hubálek (1976a, 1976b): bird nests, S Moravia;

Hubálek et al. (1979) as *C. funiculum*: hair of small mammals, former Czechoslovakia or former Yugoslavia<sup>1</sup>;

Řepová (1988) as *C. dolichotrichum*, forest seeds, former Czechoslovakia<sup>1</sup>;

Kubátová et al. (2003): CCF 3004, arable soil, Prague, central Bohemia.

***Chaetomium* cf. *fusiforme* Chivers**

Řezáčová and Kubátová (2005): green tea (*Camellia sinensis*), Prague, central Bohemia.

***Chaetomium globosum* Kunze: Fr.**

Opiz (1852)<sup>1</sup>, also as *C. fieberi*;

Urošević (1961): seeds of oak, beech, pine, spruce, Czech Republic<sup>1</sup>;

Svrček (1963) as *C. bainieri*: soil under stem base of *Ginkgo biloba*, Prague, central Bohemia;

Fassatiová (1966): soil of forest and steppe, Doutnáč hill, Bohemian Karst, central Bohemia;

Tomšíková and Nováčková (1970): outdoor air, Plzeň, W Bohemia;

Hubálek et al. (1973): nests of *Passer montanus*, *Sturnus vulgaris*, S Moravia;

Hubálek et al. (1973) as *C. cochliodes*: nests of *Passer montanus*, *Parus ater*, S Moravia;

Hubálek (1974a), also as *C. olivaceum* and *C. cochliodes*: feathers and nests of several bird species, former Czechoslovakia<sup>1</sup>;

Hubálek (1974b): feathers of birds, former Czechoslovakia<sup>1</sup>;

- Hubálek (1974b), also as *C. olivaceum* and *C. cochliodes*: feathers and nests of several birds, former Czechoslovakia<sup>1</sup>;
- Hubálek and Balát (1974) as *C. cochliodes*: nests of *Passer montanus*, Bzenec, S Moravia;
- Hubálek (1976a, 1976b), also as *C. olivaceum* and *C. cochliodes*: bird nests, S Moravia;
- Hubálek et al. (1979): hair of small mammals, former Czechoslovakia or former Yugoslavia<sup>1</sup>;
- Hubálek et al. (1979) as *C. cochliodes*: hair of small mammals, former Czechoslovakia or former Yugoslavia<sup>1</sup>;
- Hubálek et al. (1979) as *C. olivaceum*: hair of small mammals, former Czechoslovakia or former Yugoslavia<sup>1</sup>;
- Urošević (1979): seeds of spruce and pine, Bohemia and Moravia;
- Urošević (1979) as *C. spirale*<sup>3</sup>: seeds of spruce and pine, Bohemia and Moravia;
- Čížková (1983), also as *C. spirale*<sup>3</sup>: seeds of *Picea abies*, *Pinus sylvestris*, Bohemia and Moravia<sup>1</sup>;
- Fassatiová et al. (1987): archive materials, Prague, central Bohemia;
- Kubátová (1987): phylloplane of *Syringa vulgaris*, *Lonicera* sp., Prague, central Bohemia;
- Řepová (1988): forest seeds, former Czechoslovakia<sup>1</sup>;
- Řepová (1988): soil, former Czechoslovakia<sup>1</sup>;
- Fassatiová (1995): archive materials, central Bohemia<sup>1</sup>;
- Nováková (1996): CMF ISB 117, apple orchard soil, Bavorov, S Bohemia;
- Nováková (1996): CMF ISB 430, mixed forest soil, Netolice, S Bohemia;
- Nováková (1996): CMF ISB 566, soil, Chelčice, S Bohemia;
- Nováková (1996): CMF ISB 940, gut content of *Lumbricus rubellus*, Chelčice, S Bohemia;
- Bečvář (1998): substrate of spoil-banks, near Kladno, central Bohemia;
- Novotný (1999): roots of *Quercus robur*; Dešov near Moravské Budějovice, S Moravia;
- Kubátová et al. (2000): imported Vietnamese tea, Prague, central Bohemia;
- Nováková and Blažková (2000): soil, Šumava Mts., SW Bohemia;
- Kubátová et al. (2003): CCF 1328, uranium mine, Příbram, central Bohemia;
- Kubátová et al. (2003): CCF 2733, esophagus of man, Brno, S Moravia;
- Kubátová et al. (2003): CCF 2785, painting, Trojský zámek castle, Prague, central Bohemia;
- Kubátová et al. (2003) as *C. cochliodes*: CCF 2792, hair of horse, Czech Republic<sup>1</sup>;
- Novotný (2003): roots of *Quercus robur*; Dešov near Moravské Budějovice, S Moravia;
- Řezáčová and Kubátová (2005): black tea (*Camellia sinensis*), Prague, central Bohemia.

#### ***Chaetomium indicum* Corda**

- Hubálek et al. (1973): nests of *Passer montanus*, *Phoenicurus phoenicurus*, S Moravia<sup>1</sup>;
- Hubálek (1974a, 1974b): feathers and nests of several bird species, former Czechoslovakia<sup>1</sup>;
- Hubálek and Balát (1974): nests of *Passer montanus*, Bzenec, S Moravia;
- Hubálek (1976a, 1976b): bird nests, S Moravia;
- Hubálek et al. (1979): hair of small mammals, former Czechoslovakia or former Yugoslavia<sup>1</sup>;
- Urošević (1979): seeds of spruce and pine, Bohemia and Moravia;
- Řepová (1986): indoor air in laboratory, České Budějovice, S Bohemia;
- Kubátová (1987): phylloplane of *Syringa vulgaris*, *Lonicera* sp., *Tilia cordata*, Prague, central Bohemia;
- Řepová (1988): forest seeds, former Czechoslovakia<sup>1</sup>;
- Řepová (1988): soil, former Czechoslovakia<sup>1</sup>;
- Nováková (1996): CMF ISB 164, apple orchard soil, Bavorov, S Bohemia;
- Nováková and Pižl (2002): vermiculture substrate, Sokolnice, S Moravia;
- Nováková and Pižl (2003): vermiculture substrate, Mikulčice, Sokolnice, Frýdek-Místek, NE Moravia;
- Nováková and Pižl (2003): intestine of *Eisenia andrei*, Frýdek-Místek, NE Moravia;
- Kubátová et al. (2003): CCF 2786, indoor air, Trojský zámek castle, Prague, central Bohemia;
- Kubátová et al. (2003): CCF 3258, substrate of ash-slag settlements pit, Opatovice, E Bohemia;
- Kubátová et al. (2003): CCF 3259, substrate of peat-bog, Krkonoše Mts., NE Bohemia.

*Chaetomium lageniforme* Corda – see *C. elatum*<sup>2</sup>

***Chaetomium madrasense*** Natarajan

Kubátová (this paper): CCF 3412, out-door air, Prague, and CCF 3413, archive materials, Neratovice, central Bohemia.

*Chaetomium microcephalum* L. M. Ames – see *C. bostrychodes*<sup>2</sup>

***Chaetomium murorum*** Corda

Corda (1837): wall, Prague, central Bohemia;

Svrček (1963): rotten wood in cavity of stem of *Aesculus hippocastanum*, soil under *Liriodendron tulipifera*, Prague, central Bohemia;

Fassatiová (1966): forest steppe soil, Doutnáč hill, Bohemian Karst, central Bohemia;

Hubálek et al. (1973): nests of *Passer montanus*, *Parus ater*, *Ficedulla albicollis*, *Sitta europaea*, *Sturnus vulgaris*, S Moravia;

Hubálek (1974a): feathers and nests of several bird species, former Czechoslovakia<sup>1</sup>;

Hubálek (1974b): feathers of birds, former Czechoslovakia<sup>1</sup>;

Hubálek (1976a, 1976b): bird nests, S Moravia;

Hubálek et al. (1979): hair of small mammals, former Czechoslovakia or former Yugoslavia<sup>1</sup>;

Kubátová (1987): phylloplane of *Tilia cordata*, Prague, central Bohemia;

Bečvář (1998): substrate of spoil-banks, near Kladno, central Bohemia;

Kubátová et al. (2003): CCF 2924, archive material, Prague, central Bohemia.

*Chaetomium olivaceum* Cooke et Ellis – see *C. globosum*<sup>2</sup>

***Chaetomium perlucidum*** Sergeeva

Řepová (1988): rhizosphere, former Czechoslovakia<sup>1</sup>.

***Chaetomium piluliferum*** J. Daniels

Fassatiová (1966) as *Botryotrichum piluliferum*: soil of steppe, Doutnáč hill, Bohemian Karst, central Bohemia;

Smrž and Hrnčířík (1981) as *B. piluliferum*: feed from plant substrata, former Czechoslovakia<sup>1</sup>;

Příhoda (1982): rotting plant matter of tobacco, Kostelec nad Č. L., central Bohemia;

Fassatiová et al. (1987) as *B. piluliferum*: indoor air of archive, Prague, central Bohemia;

Řepová (1988) as *B. piluliferum*: indoor air of archives, former Czechoslovakia<sup>1</sup>;

Řepová (1988) as *B. piluliferum*: soil, former Czechoslovakia<sup>1</sup>;

Hýsek (1993) as *B. piluliferum*: forest soils, Strouha and Vojířov near Temelín, S Bohemia;

Kubátová and Prášil (1995) as *B. piluliferum*: wall of flat, Ústí nad Labem, N Bohemia;

Nováková (1996) as *B. piluliferum*: CMF ISB 218, apple orchard soil, Bavorov, S Bohemia;

Nováková (1996) as *B. piluliferum*: CMF ISB 445, CMF ISB 537, CMF ISB 561, soil, Chelčice, S Bohemia;

Pazdziora (2000) as *B. piluliferum*: dwelling, Jičín district, NE Bohemia;

Nováková (2001) as *B. piluliferum*: forest soil, Šumava Mts., S Bohemia;

Kubátová et al. (2003) as *B. piluliferum*: CCF 1155, wellington boots, Vizovice, E Moravia;

Nováková and Pižl (2003) as *B. piluliferum*: vermiculture substrate, Frýdek-Místek, NE Moravia.

***Chaetomium reflexum*** Skolko et J. W. Groves

Hubálek (1974a): feathers of *Anser anser*, *Passer domesticus*, former Czechoslovakia<sup>1</sup>;

Hubálek (1974b): feathers and nests of several birds, former Czechoslovakia<sup>1</sup>;

Kubátová (1987): phylloplane of *Ulmus carpinifolia*, Prague, central Bohemia.

***Chaetomium robustum*** L. M. Ames

Kubátová (this paper): CCF 3260, out-door air, Prague, central Bohemia.

***Chaetomium spinosum*** Chivers

Nováková and Pižl (2003): vermiculture substrate, Mikulčice, Frýdek-Místek, NE Moravia.

*Chaetomium spirale* Zopf<sup>3</sup> – see *C. globosum*

***Chaetomium spirochaete*** Palliser

Svrček (1963): soil under *Juglans cinerea*, Prague, central Bohemia.



## Excluded records

*Chaetomium fiscicola* Petr. – current name *Zopfiella leucotricha* (Speg.) Malloch et Cain (according to Arx et al. 1986 and CBS Filamentous Fungi Database 2006)

Petrak (1915) as *C. fiscicolum*: rotten twigs of *Salix* sp., E Moravia.

*Chaetomium merdarium* – unknown name, probably a mistake

Konečný and Smrž (1979): storage space for eggs, former Czechoslovakia<sup>1</sup>.

In the above list, 17 currently accepted *Chaetomium* species known from the Czech Republic are given. They were isolated or found on many different substrates: excrements, bird feathers and nests, hair, soil, rhizosphere, roots, leaves, phylloplane, stems of herbs, straw, wood, seeds, tea, feed, paper, archive materials, clinical material, and air. Twenty-five strains of nine *Chaetomium* species are at present maintained in culture collections in the Czech Republic (see accession numbers in the list above).

The first published finds of *Chaetomium* from our area are probably *C. elatum*, *C. globosum* and *C. murorum* by Corda (1837). The most often recorded species are *C. globosum* (mentioned in 26 papers), *C. elatum* (18), *C. indicum* (15), *C. murorum* (12), *C. piluliferum* (12), and *C. funicola* (9). The author aimed to complete a list of *Chaetomium* records in the Czech Republic; nevertheless it is possible that some papers were neglected, thus the species list should be considered as preliminary.

Regarding this species-rich genus, the 17 species known from the Czech Republic is a somewhat low number. However, the numbers of *Chaetomium* species recorded in other countries are neither very high, whether dealing both small or large countries, or different substrates. For example, Lodha (1964) reported 12 species from dung in India. Novák (1966) recorded 15 *Chaetomium* species from soil and herbal material in Hungary. Robledo and Cifuentes (1986) recorded 16 *Chaetomium* species in Mexico. Smickaya et al. (1986) listed 18 species for the area of Ukraine. Cherepanova (1989b) reported 45 species from the large area of the former Soviet Union. Soyong (1990) reported 15 species of *Chaetomium* from soils in Thailand. Lorenzo (1993) cited 13 species from Argentina. Lizoň and Bacigálová (1998) mentioned ten species from various substrates in Slovakia. Bell (2005) reported 16 coprophilous species of *Chaetomium* from Australia.

Although *Chaetomium* did not belong to neglected genera, comprehensive data on occurrence and distribution of some known as well as newly described *Chaetomium* species in individual countries are somewhat poor. Many data on their occurrence are also hidden in herbaria. Thus it seems that a new monographic treatment of this striking genus would be very appreciated.



## Notes to three *Chaetomium* species isolated in the Czech Republic for the first time

### *Chaetomium aureum* Chivers 1912

Figs. 1 and 2

Syn. *Chaetomium trilaterale* Chivers 1912

*C. trilaterale* var. *diporum* J. C. Cooke 1973

and others (according to Arx et al. 1986)

Morphological characteristics of the studied strains (CCF 3252, CCF 3624)

Colonies on PCA after two weeks grey to grey-green due to formation of ascomata, the reverse is grey-violet, agar vinaceous. Colonies on CMA similar, differing only in rather weak sporulation and more intensive pigments. Colonies on MEA have an ochraceous mycelium; orange to vinaceous red pigments are produced into agar; the reverse is dark vinaceous; ascomata are not formed. Growth of colonies is better on CMA (see Tab. 2), sporulation is better on PCA, formation of pigments is most pronounced on MEA and CMA (Fig. 2a–b). Growth at 37 °C is better than at 24–26 °C (Tab. 2), however no sporulation was observed at 37 °C after 14 days. No growth was observed at 42 °C.

Ascomata (Fig. 1a) globose, c. 140 µm diam. Ascumatal hairs dark pigmented, septate, verrucose, arcuate, apically coiled, 4–6 µm wide near the base, up to 2 µm near the tip. Ascii (Fig. 1b) clavate, 8-spored, about 35 × 11 µm. Ascospores brown, in strain CCF 3252 (Fig. 1c) navicular, with germ pores at both ends, 8–9.5 × 5–6 µm, in strain CCF 3624 (Fig. 2c) inaequilaterally fusiform, with single germ pore, 9–12 × 5 µm.

Observations of microscopic and macroscopic features are in accordance with the broad concept of *C. aureum* by Arx et al. (1986). Strain CCF 3252 with its biporate ascospores fits to *C. trilaterale* var. *diporum* (= syn. of *C. aureum*). Its navicular to reniform ascospores also resemble the close species *C. cupreum* Ames. This species however differs by copper coloured hairs. Both isolated strains differ also slightly in colony diameters. It is not sure, if it is an isolate-typical feature or if the quality of the inoculum used (unequal size or different age) plays a role here.

Distinguishing features. Production of vinaceous red pigments, arcuate and apically coiled hairs, inaequilaterally fusiform or navicular ascospores, good growth at 37 °C.

Notes on habitat and distribution. The species is known from many countries and from various substrates. It was reported from seeds of *Capsicum annuum* and *Cucumis sativus* in USA (Skolko and Groves 1953), from *Avena sativa* in Canada (Connors 1967), from *Fragaria* sp. in Canada (Ginns 1986). Bernát et al. (1984) isolated *Chaetomium trilaterale* from agricultural soils in

Slovakia. Several records are mentioned in Arx et al. (1986) and in CBS Filamentous Fungi Database (2006): from tobacco, from *Arachis hypogaea* (USA), from soil (USA, Ecuador, Ivory Coast, South Africa), dung (Canada, East Africa), compost (Brazil). Soyong (1990) recorded this species from soils in Thailand. Zhdanova et al. (1995, 2001) considered this species a bioindicator of soils polluted with radionuclides near Chernobyl, Ukraine. They reported this species also from radioactive forest litter near Chernobyl (Zhdanova et al. 2005). *Chaetomium aureum* was also isolated from hypersaline water of the Dead Sea (Molitoris et al. 2000), from pineapple field soil and snap bean seed in Japan (Watanabe 2002), and it was reported to be associated with mangrove in Japan (Schmit and Shearer 2003). Zang et al. (2004) found this species associated with roots of *Cypripedium flavum* in China together with *Papulaspora byssina*.

***Chaetomium madrasense* Natarajan 1971**

Fig. 3

Morphological characteristics of the studied strains (CCF 3412, 3413)

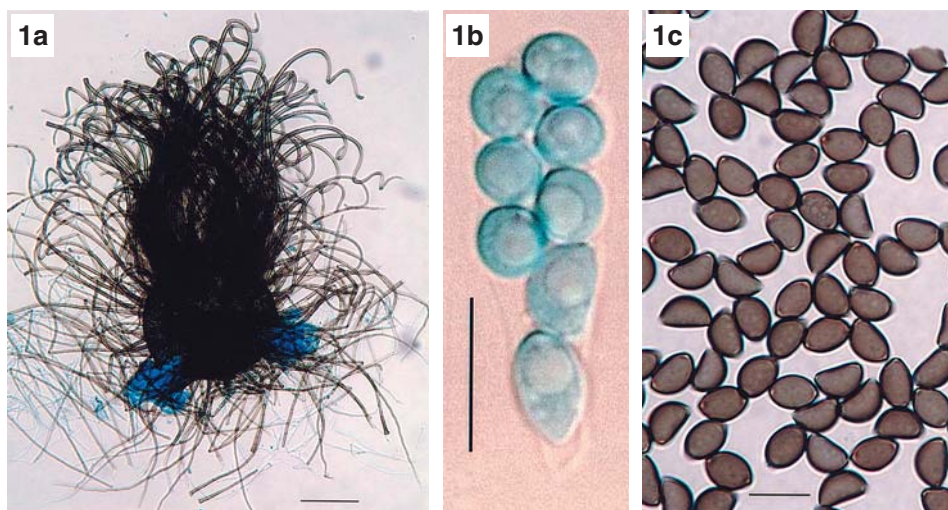
Colonies on PCA and CMA after two weeks dark grey due to formation of ascomata. No pigments produced into the agar medium. Colonies on MEA olive green. Sporulation is good on all three media. Growth of colonies is better on CMA. Growth at 37 °C is variable: 6–22 mm after 7 days on PCA (Tab. 2). At 42 °C no growth.

Ascomata (Fig. 3a) subglobose, c. 250–315 × 160–220 µm. Ascomatal hairs on PCA whitish, on MEA yellowish in reflected light, undulate or coiled, septate, finely verrucose, c. 2.5–3 µm thick. Asci (Fig. 3b) clavate, 8-spored, c. 60 × 18 µm. Ascospores (Fig. 3c) brown, smooth, broadly limoniform to subglobose in face view, slightly biapiculate, usually with a bulge (in lateral view), with an apical pore, 8–10 × 7 µm. Ascospores are pushed out of the ascoma in distorted bands.

Most of morphological features agree with those given by Arx et al. (1986), only the size of ascospores of our strain fit to the lower dimensions mentioned by Arx et al. and the ascomatal hairs of our strains are somewhat pale.

Distinguishing features. It is similar to *C. globosum* and *C. sphaerale*, however differs by ascospores which have a distinct bulge at one side. *C. citrinum* has similar ascospores of irregular shape, however its ascomatal hairs are hyphae-like.

Notes on habitat and distribution. *C. madrasense* is considered to be a rather common species (Arx et al. 1986). It is known from several types of substrate from various regions of the world: e.g. from the rhizosphere of *Pennisetum typhoides* and a leaf of *Triticum aestivum* (India), from seed of *Linum usitatissimum* and dung of goat (Israel), from soil (Kenya), from dung (France), and from *Gossypium humitectum* (Argentina) (CBS Filamentous Fungi Database 2006).

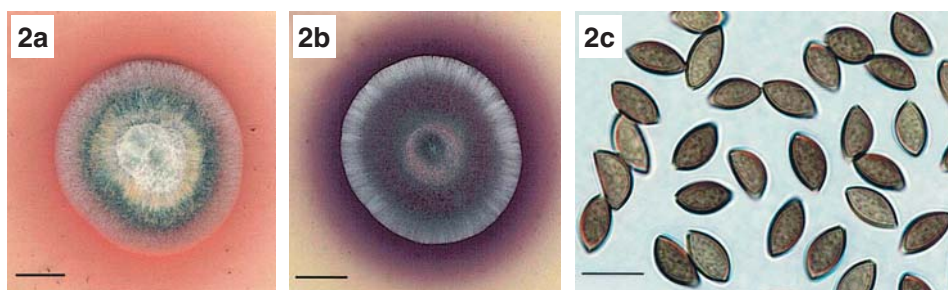


**Fig. 1.** *Chaetomium aureum* CCF 3252.

**1a** – ascoma, bar = 100  $\mu$ m;

**1b** – ascus with immature ascospores, bar = 10  $\mu$ m;

**1c** – ascospores, bar = 10  $\mu$ m.



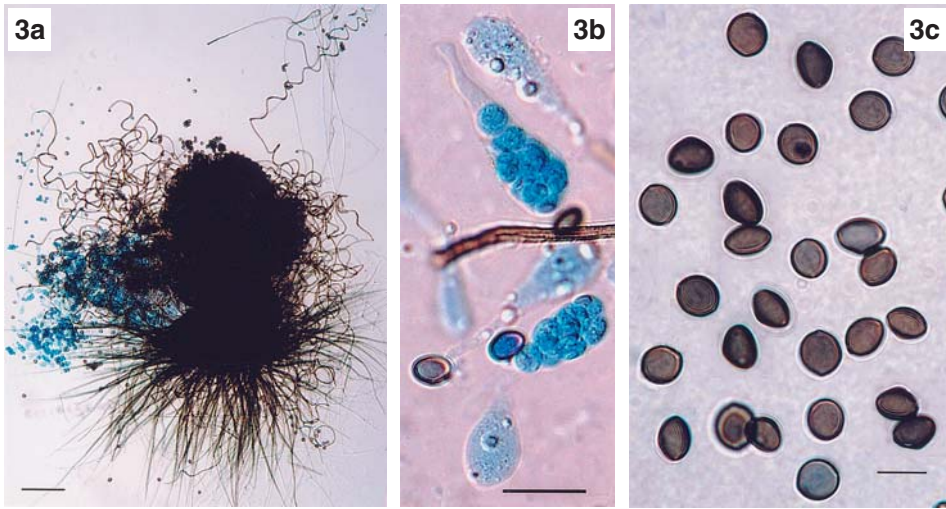
**Fig. 2.** *Chaetomium aureum* CCF 3624.

**2a** – colony on MEA, 8 days, 25 °C, bar = 10 mm;

**2b** – colony on CMA, 8 days, 25 °C, bar = 10 mm;

**2c** – ascospores, bar = 10  $\mu$ m.

Photo A. Kubátová

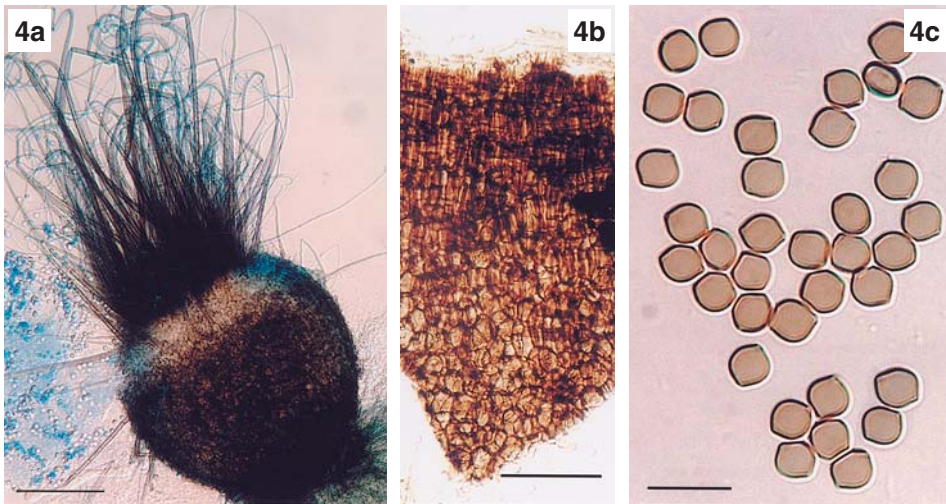


**Fig. 3.** *Chaetomium madrasense* CCF 3412.

**3a** – ascoma, bar = 100  $\mu$ m;

**3b** – asci with immature ascospores, bar = 20  $\mu$ m;

**3c** – ascospores, bar = 10  $\mu$ m.



**Fig. 4.** *Chaetomium robustum* CCF 3260

**4a** – ascoma, bar = 100  $\mu$ m;

**4b** – ascomatal wall cells near the ostiolum, bar = 50  $\mu$ m;

**4c** – ascospores, bar = 10  $\mu$ m.

Photo A. Kubátová



***Chaetomium robustum*** L. M. Ames 1963

Fig. 4

Morphological characteristics of the studied strain (CCF 3260)

Colonies on PCA have no aerial mycelium after two weeks; centre of colonies dark grey due to forming of ascomata, the reverse pale. Colonies on CMA similar, differing only in the formation of scarce mycelium, pale yellow pigments in agar and yellow-grey reverse. Colonies on MEA grow poorly, are yeast-like, with yellowish centre; ascomata not formed. Growth of colonies and sporulation better on PCA and CMA (see Tab. 2). No growth at 37 °C and 42 °C.

Ascomata (Fig. 4a) elongated, ampulliform, c. 300–500 × 180–310 µm. Ascomatal wall cells (Fig. 4b) near the ostiolum elongated and arranged in pallisade-like rows. Ascomatal hairs on CMA grey in reflected light, poorly branched, septate, verrucose, spirally coiled, 5–7.5 µm thick at lower part, tapered; lateral hairs seta-like, not coiled. Ascii clavate, 8-spored, c. 35–37 × 10–11 µm. Ascospores (Fig. 4c) brown pigmented, broadly limoniform, with an apical germ pore, 6 × 5.5 µm.

This observation is in accordance with Arx et al. (1986).

Distinguishing features. Two types of hairs (coiled and tapered), pallisade-like rows of elongated cells near the ostiolum, broadly limoniform ascospores with one germ pore.

Notes on habitat and distribution. Only scarce information exists on *C. robustum* finds. Arx et al. (1986) and CBS Filamentous Fungi Database (2006) mentioned strains isolated from soil in USA, Mexico, Jamaica and Israel and from litter in Jamaica. Bell (2005) recorded this species on dung in Australia.

**Tab. 2.** Colony diameters (mm) of three examined *Chaetomium* species on PCA, CMA and MEA at 24–26 °C, 37 °C and 42 °C.

Incubation temperature	Medium, days	<i>C. aureum</i> CCF 3252	<i>C. aureum</i> CCF 3624	<i>C. madrasense</i> CCF 3412	<i>C. madrasense</i> CCF 3413	<i>C. robustum</i> CCF 3260
24–26 °C	PCA 7	22–29	28–33	41–57	46–60	32–38
	PCA 10	36–43	43–45	68–whole dish	78–whole dish	48–56
	PCA 14	52–56	61–63	78–whole dish	82–whole dish	75–85
	CMA 7	25–35	28–30	48–66	57–67	31–35
	CMA 10	42–50	44–45	68–whole dish	whole dish	46–51
	CMA 14	59–65	66	whole dish	whole dish	67–75
	MEA 7	24–30	30–32	32–42	31–40	11–14
	MEA 10	33–38	47	58–70	58–whole dish	13–14
	MEA 14	40–52	66–67	whole dish	whole dish	15–17
37 °C	PCA 7	28–38	40–45	6–13	9–22	no growth
	PCA 10	48–54	55–60	10–25	15–36	no growth
	PCA 14	53–67	64–65	23–39	25–50	no growth
42 °C	PCA 7	no growth	no growth	no growth	no growth	no growth

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