Choiromyces meandriformis and *Mattirolomyces terfezioides*: peculiar truffles with new perspectives

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Abstract

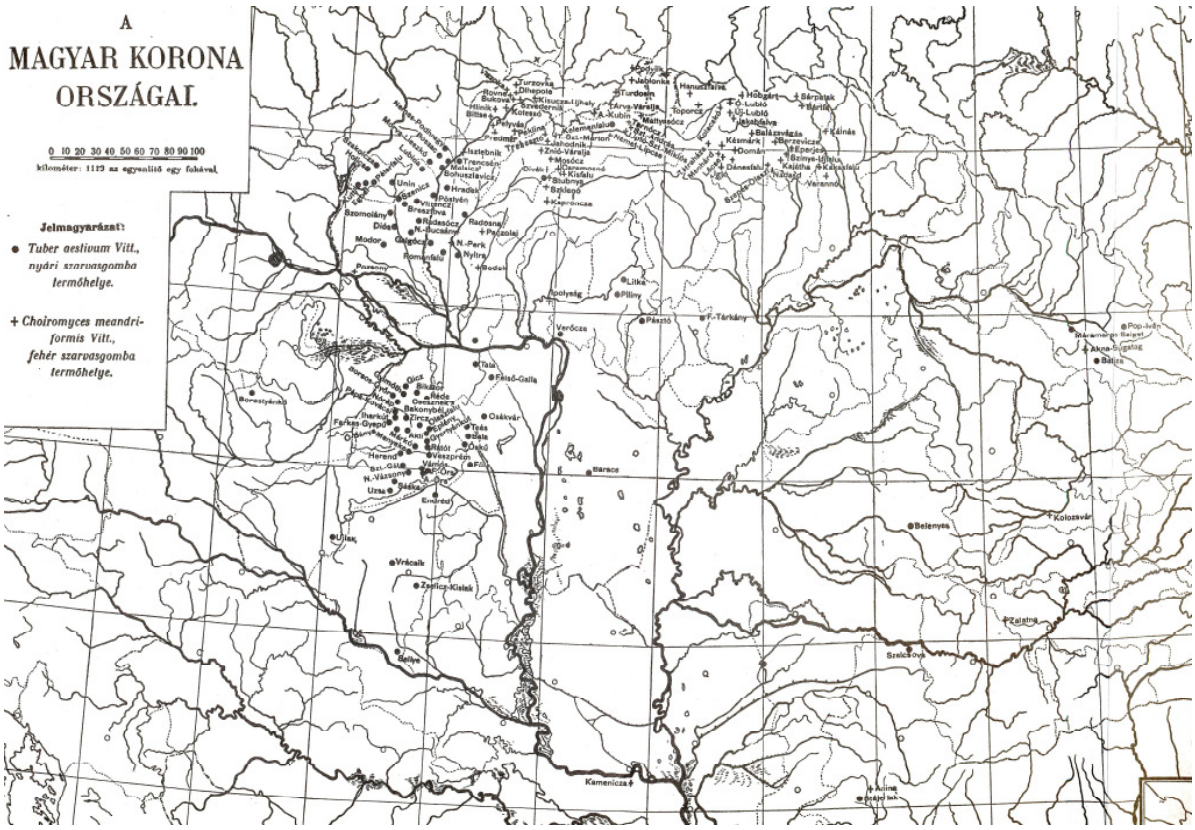
Science and market consider fungi called truffles belonging mainly to the *Tuber* genus; however, there are some symbiotic subterranean mushrooms which also have significant gastronomic value such as *Choiromyces meandriformis* and *Mattirolomyces terfezioides.* Previous studies of phytoindication on *Mattirolomyces terfezioides* revealed some submediterranean climate effect, semi-humid and intermediate moisture conditions and indicated slightly basic soils, disturbed, secondary and artificial *Robinietum cultum* habitats. Majority of habitats belongs to *Bromo sterilis-Robinietum* associations. Soil parameters of the habitats can be described as slightly alcalic or neutral with high humus, various phosphorous and medium or high potassium content. Lime can be detected in traces in all samples. *Choiromyces meandriformis* habitats can be characterized by acidic, mostly lime free, humus rich, heavy soils covered with hornbeam (*Carpinus betulus*) and spruce (*Picea abies*). It was mainly reported from mesophilic broadleaved forests (Syntaxonomic class: *Querco-Fagetea*), its derivatives with *Picea abies* and from different coniferous woods and plantations. Phytoindication reflects plants of semihumid-moderately wet habitats, mesotrophic plants which are mainly indifferent to soil pH and with medium light demand. These ecological results can contribute to the cultivation technology of the abovementioned species as gastronomic utilization of these new fungi recently came into prominence.

Introduction

Choiromyces meandriformis VITTAD.

Choiromyces meandriformis VITTAD. (syn. *Choiromyces venosus* (FR.) TH. FRIES) has a long history in the gastronomy of East-Central Europe, as the first occasion of mentioning truffles in the Carpathian basin in the 16th century was presumably white truffle (*Choiromyces meandriformis*). In this note the magistrate of Trencsen in 1588 ordered to protect a part of a forest producing Hungarian white truffles (Hollós, 1911). The book of Mátyus "Ó- és Új Dietetika" first informs us about the presence of Hungarian white truffle *(Choiromyces meandriformis)* in the Carpathian basin (Mátyus, 1787). Tradition on the consumption of truffles, including Hungarian white truffles can be detected during the period of Austro-Hungarian Empire since proliferating economy nourished truffle collection and commerce, resulting that tons of truffles collected from the Hungarian territory, mainly *Choiromyces meandriformis,* arrived to Vienna market of the period. World Wars discouraged truffle commerce and consumption, retention continued during the communist era as truffles, considered to be an exquisite symbol of aristocracy, were banned during that time (Gógán et al., 2007).

Scientific research on truffles started in the 19th century including as outstanding representatives of the period as László Hollós who created the first fungal map indicating the distribution of summer truffle (*Tuber aestivum* VITTAD.) and Hungarian white truffle (Map 1.)



Map 1. Truffle map of László Hollós (Hollós, 1911)

Choiromyces meandriformis carpophores can be described as irregular shape, weighing as heavy as 500 gr. The color of the peridium is whitish, then becomes light yellowish-brown, generally spotted by brown or reddish dots when mature. The gleba is composed, white then yellowish with pale veins. Asci contain 8 globose spores with the size of 18-22 μm, ornamented with truncate spines (Pázmány, 1998; Montecchi & Sarasini, 2000; Rimóczi et al., 1992; Babos, 1981, Hall, 2007).

It grows under beech (*Fagus sylvatica* L.), hornbeam (*Carpinus betulus* L.) and in coniferous forests, mainly in spruce (*Picea abies* L.) stands (Montecchi et Sarasini, 2000; Bratek, 2007). *Choiromyces meandriformis* has a variable presence in the European countries, it occurs in Great-Britain and in Austria, it is common in South Germany, Sweden, in Northeastern Poland and in the Baltic countries (Michael et al., 1978; Hennig, 1987; Wedén, 2007). *Choiromyces meandriformis* is considered to be rare in the current Hungarian territory, but widely spread in the surrounding Carpathian Mountains (Szemere, 1970). Fruiting period lasts from June to September (Bagi, 2000).

Gastronomic value of *Choiromyces meandriformis* considered differently through Europe as it is thought to be toxic in France and Italy (Montecchi & Sarasini 2000; Astier, 1998) but collected and used as valuable spice in Sweden, Germany, Russia and Hungary (Nilsson et al., 1978; Engel, 1971; Bratek, 2007; Wedén, 2007; Hagara, 1999; Svrček, 1985) being noted in some cases that fruit bodies should be cooked before eating (Bresinsky et al, 1985; Bon, 1987), or that overripe specimens can cause stomach irritation (Pázmány, 1998). However, Wedén (2007) has not found any incident of intoxication caused by this truffle. Moreover, young immature carpophores of the species are used to adulterate *Tuber magnatum* PICO (Ramsbottom, 1989).

Mattirolomyces terfezioides (MATTIR.) E. FISCHER

Mattirolomyces terfezioides has a shorter Hungarian history being discovered by Hollós in 1926 (Hollós, 1933). It is a unique mushroom for its fragrance and deliciousness, used to

create desserts, like sorbets, cakes because of its strong sweet flavor. Pázmány mentioned that this truffle has a fragrance similar to melon, but fruit bodies should be cooked (Pázmány, 1998).

Carpophores of *Mattirolomyces terfezioides* are regular globose shaped with the size between 1-20 cm, the color of the peridium changes with maturity from whitish, grayish to ochre-reddish. Surface can be smooth or roughed. The gleba is soft and marbled darkening from white to ochre-reddish. The ellipsoid shaped ascus measures 90-130 x 35-55 µm, contains 8 colorless or light-yellowish, globose, ornamented spores of a diameter of 15-19 µm in two rows (Szemere, 1970; Babos, 1981; Király et al., 1992; Rimóczi et al., 1992; Lawrinowitz et al., 1997; Montecchi et Sarasini, 2000).

It is mainly a species of the Carpathian basin, but presence has been reported from Serbia (Lawrinowitz et al., 1997) and some specimens from Italy (Montecchi-Lazzari, 1993; Brotzu, 1994). Literature mentions to be found not only in black locust forests but also under fruit trees (Pázmány, 1998).

In Hungary the host species is almost is black locust (*Robinia pseudo-acacia* L.), but this tree is not native in the country, being introduced only the years 1710-20s (Bratek et al., 2007). Hungarian sweet truffle grows mainly on the sandy soils deposited by the Danube (Bratek et al., 2007). Fruiting period lasts between August and November (Bagi et al, 2000).

Soil parameters of the habitats can be described as slightly alcalic or neutral ones with high humus, various phosphorous and medium or high potassium content. Lime can be detected in traces in all samples (Bratek et al, 2007).

Previous studies of phytoindication revealed some Submediterranean climate effect, semi-humid and intermediate moisture conditions and indicated slightly basic soils, disturbed, secondary and artificial *Robinietum cultum* habitats. Majority of habitats belongs to *Bromo sterilis-Robinietum* associations (Bratek et al, 2007).

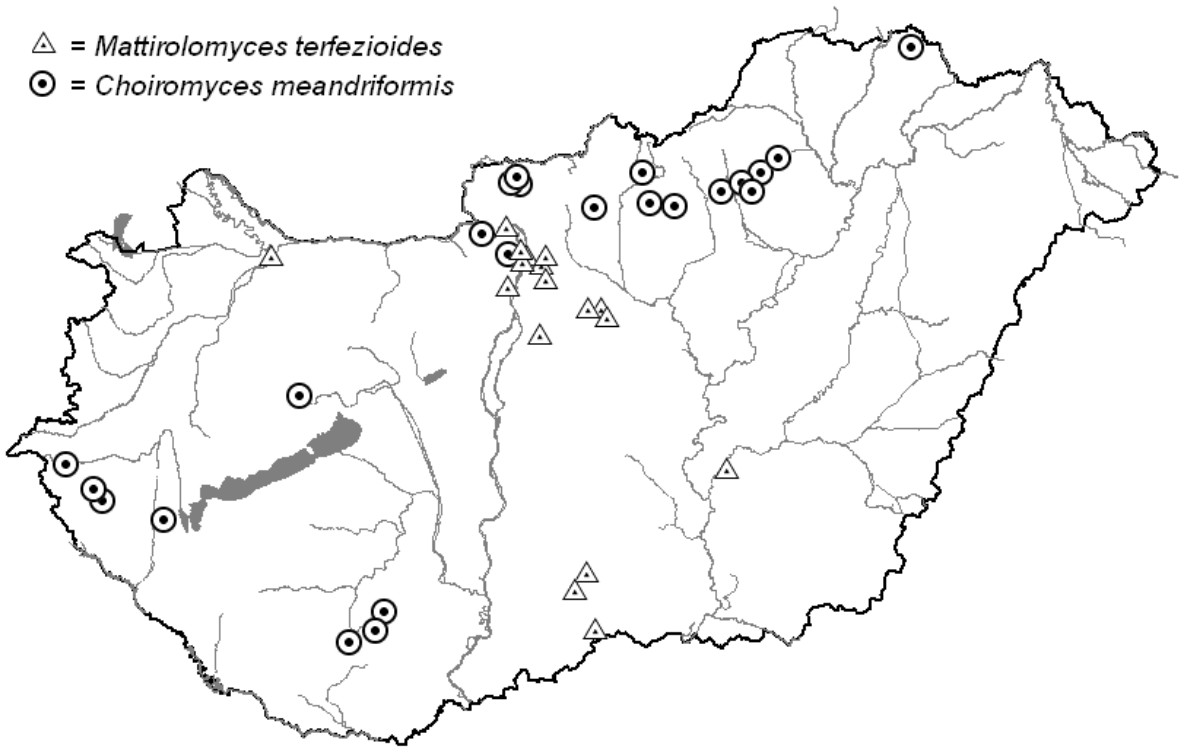
The species has a very good reputation in the Hungarian gastronomy; however, introduction to international market is still to wait for. Attempts on the cultivation of the species have been made (Bratek et al., 1998a, 1998b).

Materials and methods

28 soil samples have been collected in a depth of 2-20 cm in *Choiromyces meandriformis* nests. Analysis has been carried out by the Soil Conservation Laboratory of the Plant Health and Soil Conservation Station of Fejér County, Hungary. Phytoindication method of Ellenberg (1974 and 1991) adapted by Borhidi (2000) to Carpathian environmental conditions and method of Zólyomi (1992) was used for habitat characterization.

Results and discussion

After the scientific activity of Hollós (1911) and Szemere (1970) current mapping and habitat monitoring on both species reported many new habitats In Hungary (Map 2.).



Map 2. Current occurrence of *Choiromyces meandriformis* and *Mattirolomyces terfezioides* (I. Zoltán)

Choiromyces meandriformis habitats can be characterized by acidic-subacidic, mainly lime free, humus rich, mostly heavy soils. Macroelements (NO_3-NO_2-N, P_2O_5, K_2O) show high variability (Table 1.).

	Average (Stand. Dev.)	Max	Min
pH(H_2O)	5,3 (±0,7)	6,8	3,8
pH(KCl)	4,5 (±0,8)	6,7	3,4
SPA (Sticky point by Arany) (%)	56,8 (±10,4)	79,0	39,0
$CaCO_3$ (%)	0,12 (±0,46)	2,20	0,00
HUMUS (%)	5,43 (±1,93)	10,00	2,18
NO_3NO_2N (ppm)	6,66 (±10,19)	46,10	0,20
P_2O_5 (ppm)	87,98 (±58,08)	273,00	19,40
K_2O (ppm)	249,93 (±115,37)	528,00	87,50

Table 1. Soil characteristics of *Choiromyces meandriformis*

Habitats are covered with hornbeam (*Carpinus betulus*) and spruce (*Picea abies).* Habitat plant communities of the examined 21 *Choiromyces meandriformis* localities belong to two main groups: *Carpinion betuli* and *Melampyro bihariensi-Carpinetum*. Our results agree with the literature describing mesophilic broadleaved forests (Syntaxonomic class: *Querco-Fagetea*) and *Picea abies* stands or other coniferous woods as main habitats.
Phytoindocation on soil moisture and water condition shows slight differences according to the two methods as Borhidi ranges *Choiromyces meandriformis* habitats to the semihumid areas while Zólyomi method refers to moderately mild – mild – moderately wet habitats. The latter indication is proved by the presence and high coverage of typical forest-herbs of

humid areas as *Ajuga reptans* L., *Asarum europaeum* L., *Carex sylvatica* HUDS., *Galeobdolon luteum* HUDS. and *Sanicula europaea* L.

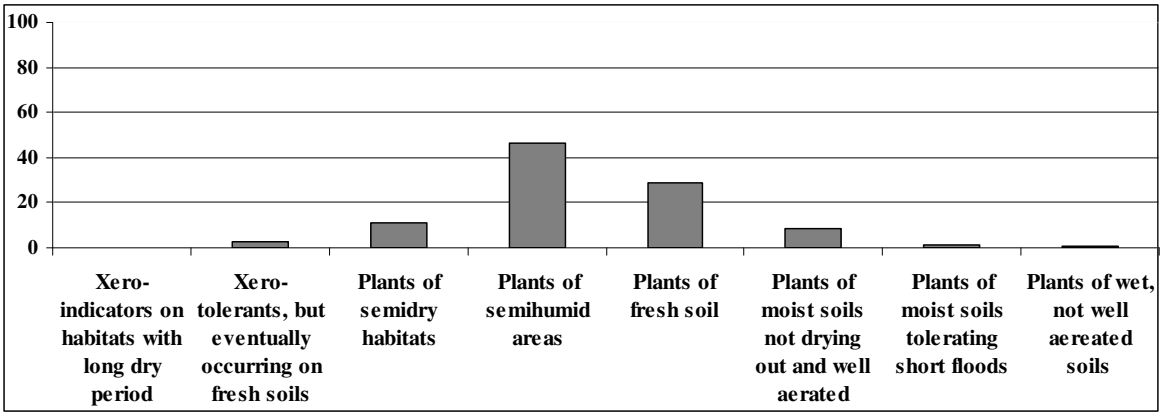


Fig 1. Relative soil moisture indication of habitats of *Choiromyces meandriformis* according to Borhidi

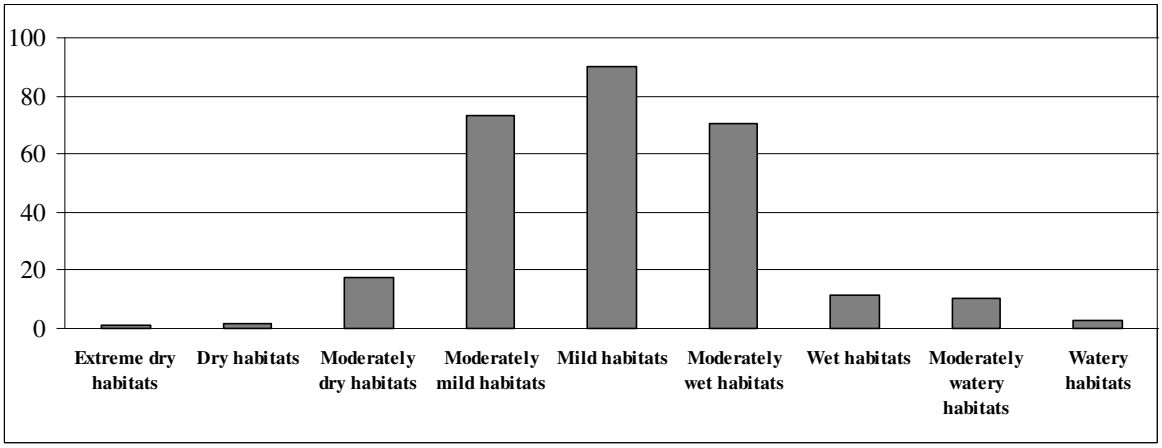


Fig 2. Relative soil moisture indication of habitats of *Choiromyces meandriformis* according to Zólyomi

Soil reaction (pH) indicates neutral or slightly acidic soils by both methods which could be an apparent paradox with the soil results (Table 1.) but soil could be very mosaic with local acidification, in addition, Borhidi ranges plants of slightly acidic or slightly basic soils and plants indifferent to pH together to the neutral category.
When examining nitrogen level of *Choiromyces meandriformis* habitats, Borhidi method refers them mesotrophic, while light has a considerable role in these sites as predominance of halfshadow-halflight plants can be noted. This indication is proved by the practice that *Choiromyces meandriformis* can be mainly found by the side of pathways, on the edges of forests or in small glades.
Herbaceous plants in habitats of both truffle species are mainly belong to generalist, disturbance tolerant groups. However, specialists described in *Choiromyces meandriformis* habitats as *Helleborus purpurascens* W. et K., *Lathyrus vernus* (L.) BERNH., *Ranunculus auricomus* L. and *Hepatica nobilis* MILL. clearly indicate semihumid mountain areas of Fagetalia flora associations, while plants around *Mattirolomyces terfezioides* nests refer to xerotherm steppe forests of *Quercus* and *Robinia pseudo-acacia*.

Choiromyces meandriformis and *Mattirolomyces terfezioides* are currently re-discovered in Hungarian gastronomy, either because the first is an easily adjustable material to wide-range of dishes, or, like the second one, a peculiar truffle with sweet flavor. Attempts to the

development of the cultivation technology of these species have already been made in Hungary, but comprehensive marketing strategy should also be built.
We believe that these efforts will raise these species on the sky of European truffling and cookery.

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