
Species delimitations in taxonomically difficult fungi: the case of *Hymenogaster*

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DSMZ

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General challenges:

- Macromorphological variability of basidiomata
- Micromorphological variability of basidiospores
- Combination of both
- Different interpretations of morphological characters



Hymenogaster arenarius basidiospores and basidiomata

Great variety of species concepts:

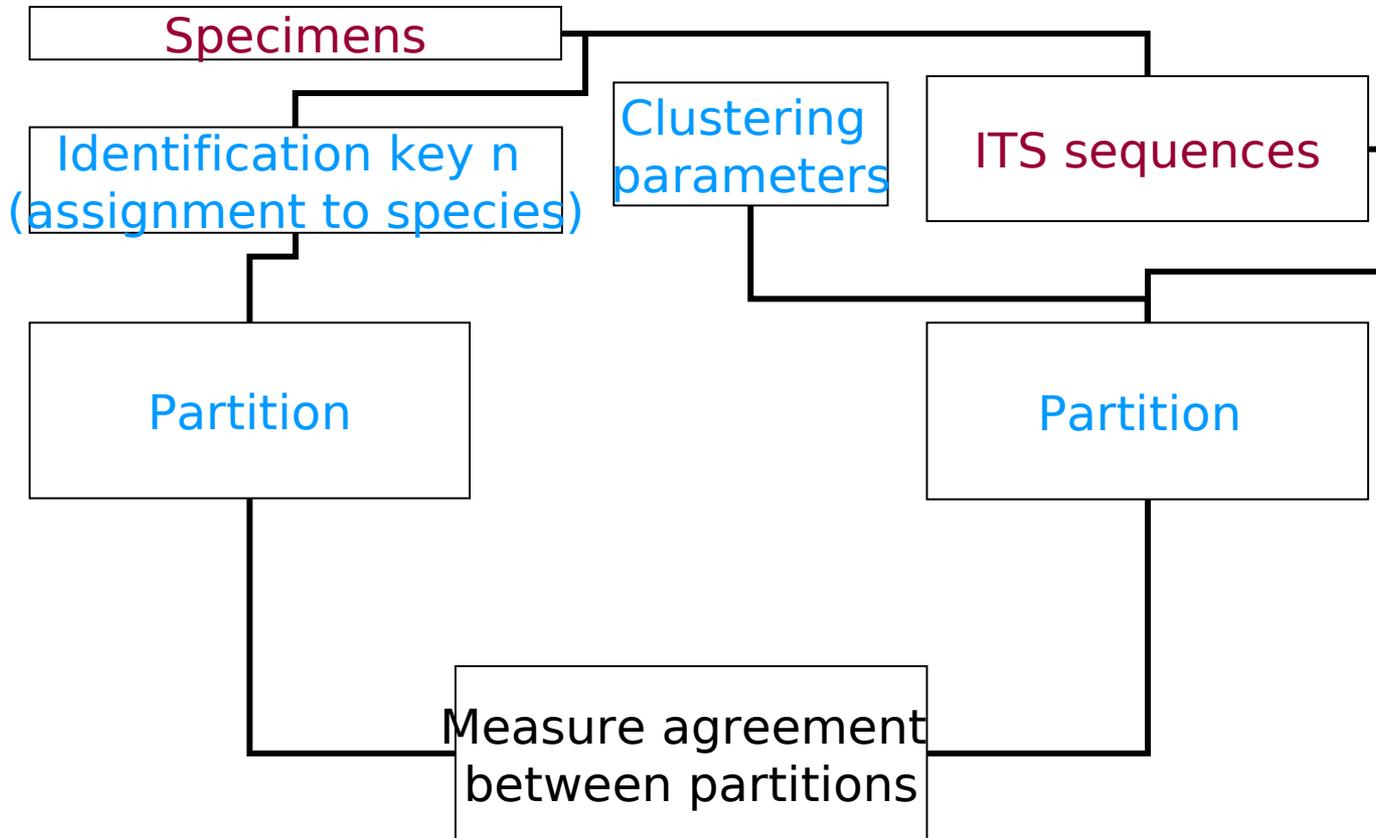
- Vittadini 1831
- Tulasne brothers 1843
- Hesse 1890
- Zeller & Dodge 1934
- Soehner 1960 (**narrow: 94 species**)
- Gross 1980
- Montecchi & Sarasini 2000 (**broad: 17 species**),



*Ert Soehner,
around 1940*

- How useful are these species concepts?
- **Question 1:** How to objectively compare different species concepts?
- **Question 2:** Once the best species concept is identified, how to revise the classification?

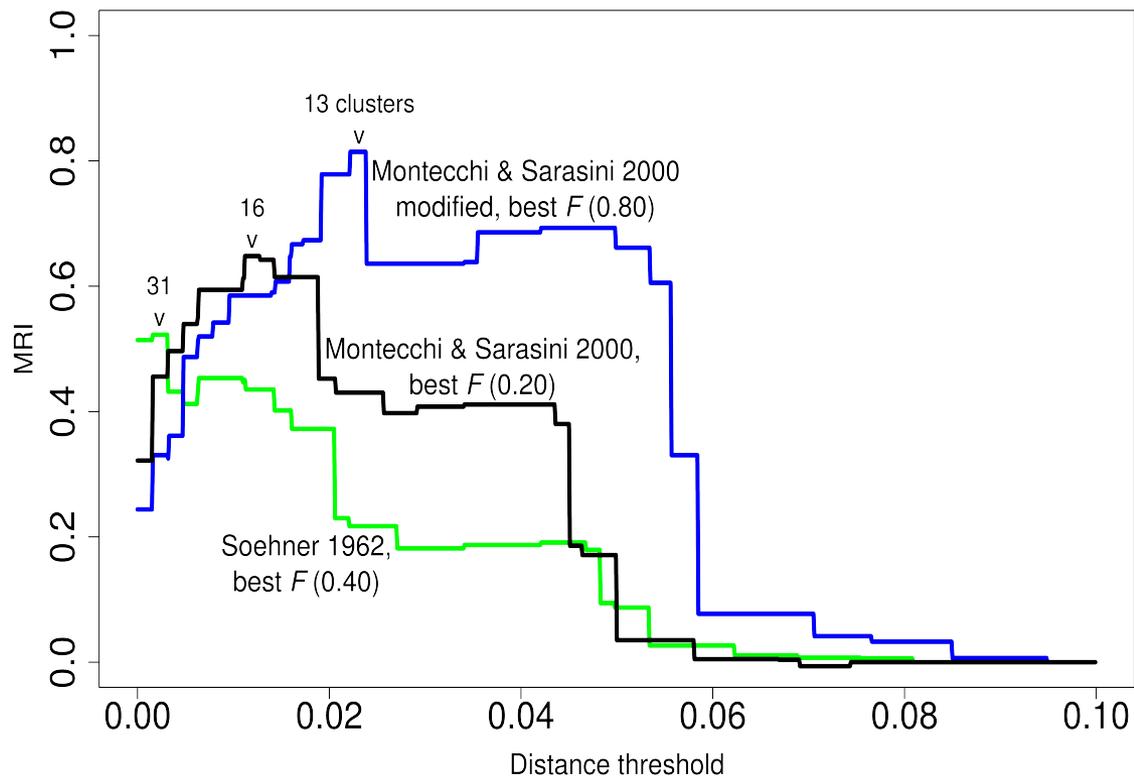
Clustering optimization to improve the congruency between traditional taxonomy and molecular systematics



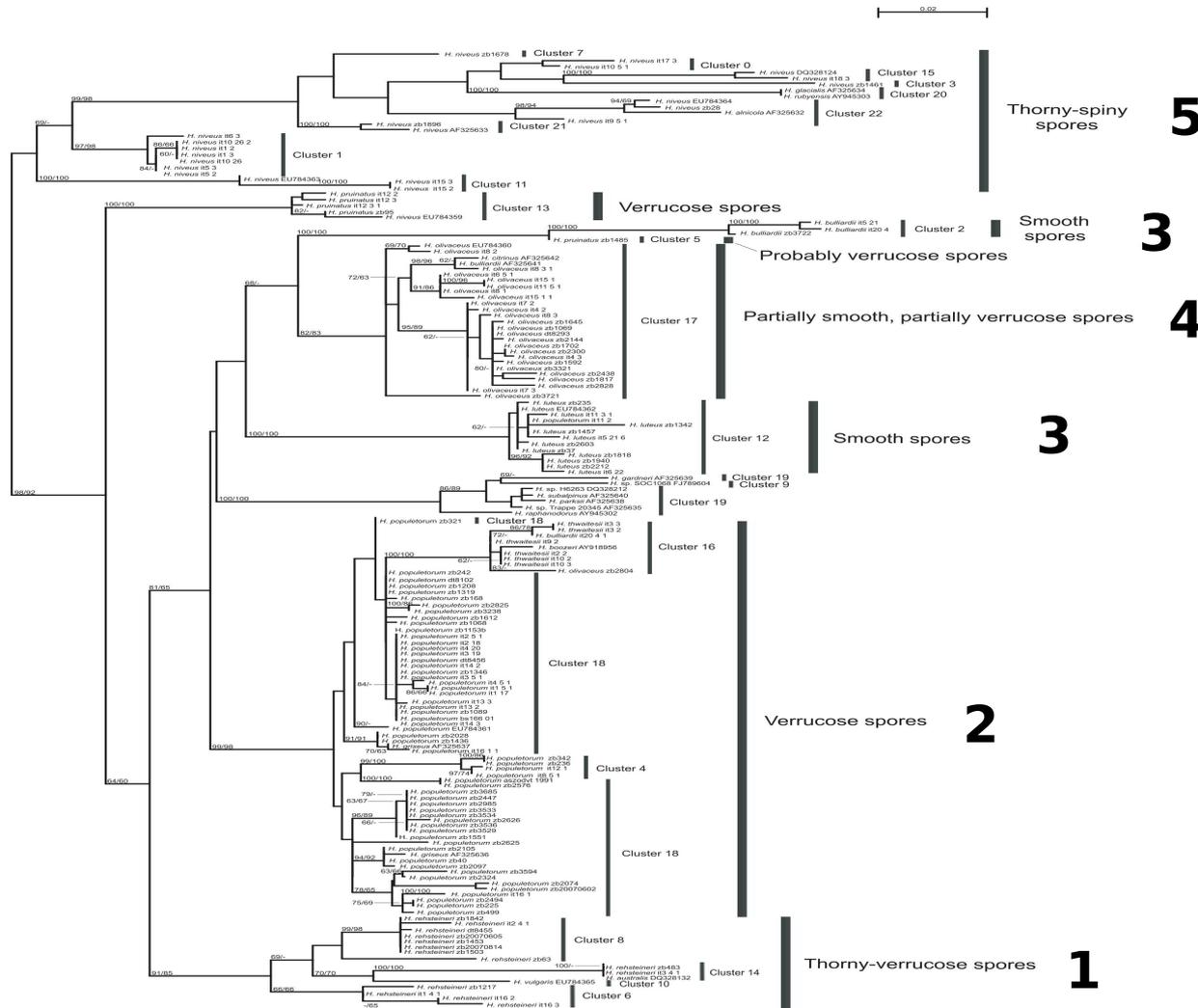
- Key 1: Soehner (**narrow**)
- Key 2: Montecchi & Sarasini (**broad**)
- Key 3: Modified Montecchi & Sarasini (**even broader**)
- See: www.goeker.org/mg/clustering

Clustering optimization plot

- ITS rDNA sequences obtained from 140 specimens from seven countries, mainly from Hungary and Germany
- Three keys examined (narrow vs. broad)
- Clustering optimization plot

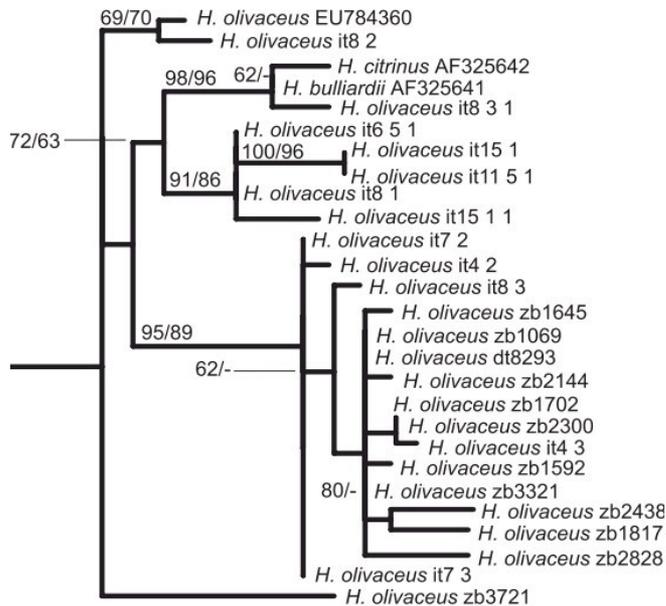


- Maximum likelihood tree (RAxML)



Example 1: Taxon merging

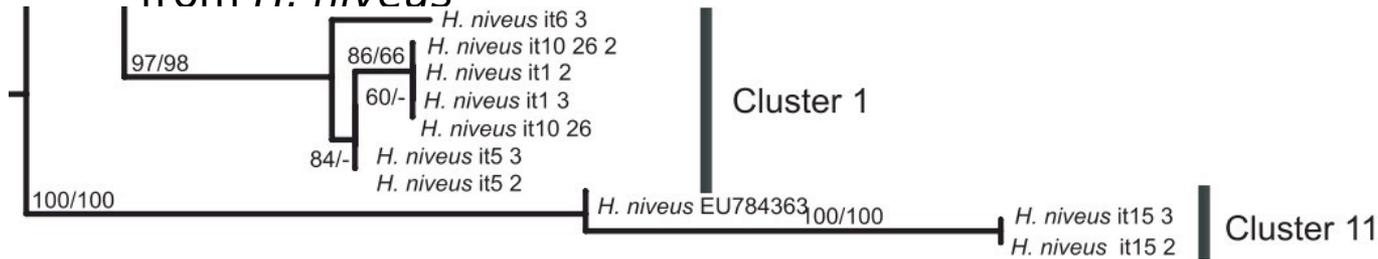
- Soehner: 4 species
- Montecchi & Sarasini: 2 species
- Modified Montecchi: 1 species
- Clustering optimization: 1 species



Hymenogaster citrinus

Example 2: Taxon splitting

- Soehner: 3 species
- Montecchi & Sarasini: 1 species
- Modified Montecchi & Sarasini : 1 species
- Clustering optimization: *H. arenarius* (Cluster 1) and *H. tener* (Cluster 11) must be separated from *H. niveus*



Hymenogaster tener arenarius



Hymenogaster niveus



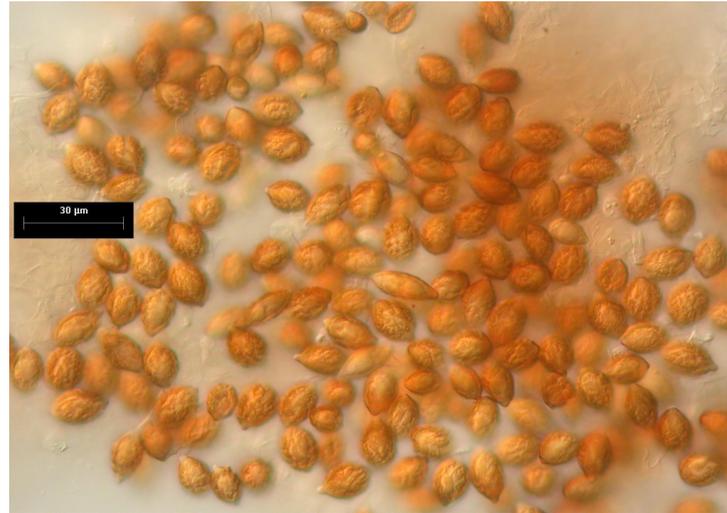
Hymenogaster

Example: *Hymenogasters* with spiny spores

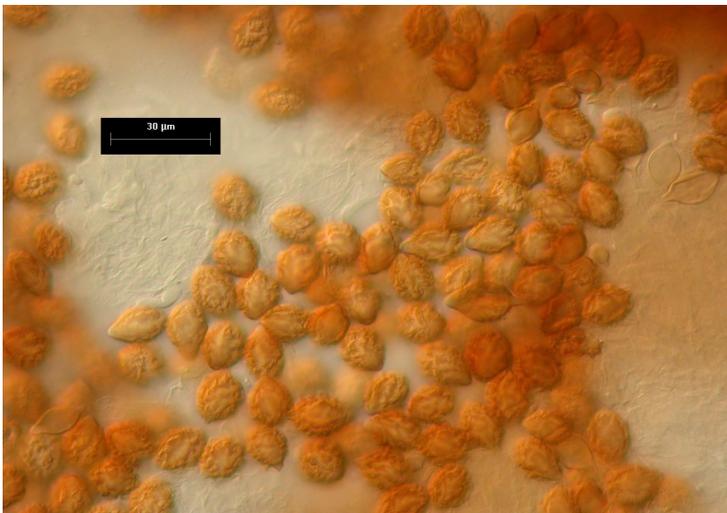
Hymenogaster tener



Hymenogaster arenarius



Hymenogaster niveus



Hymenogaster tener



Hymenogaster arenarius

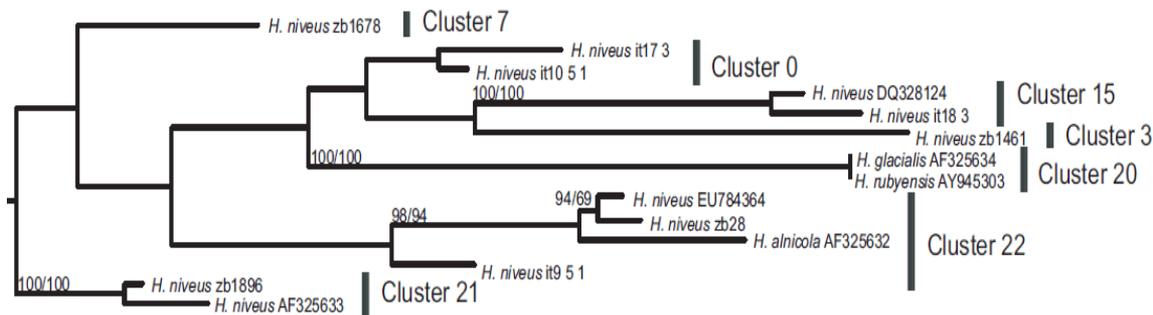


Hymenogaster niveus



Example 3: Cryptic taxa

- Soehner: 2 species
 - Montecchi & Sarasini: 1 species*
 - Modified Montecchi & Sarasini: 1 species*
 - Clustering optimization: 7 species
- (*including *H. tener* and *H. arenarius*)



Hymenogaster niveus

- Considerably macro- and micromorphological variability of *Hymenogaster* does not directly coincide with a large number of clusters
- The narrow species concept of Soehner does not adequately reflect the true number of species
- The modified broad species concept of Montecchi & Sarasini that combines conspecific taxa does more accurately reflect the number of species in the genus *Hymenogaster* (but we have considered some of Soehners taxa)
- Central European taxa with well distinguishable morphological characters are reduced from 25 (Soehner: 94) to 12 (including two novel species and 2 cryptic species complexes)
- Clustering optimization using OPTSIL is useful for complex and taxonomically difficult groups of fungi in general















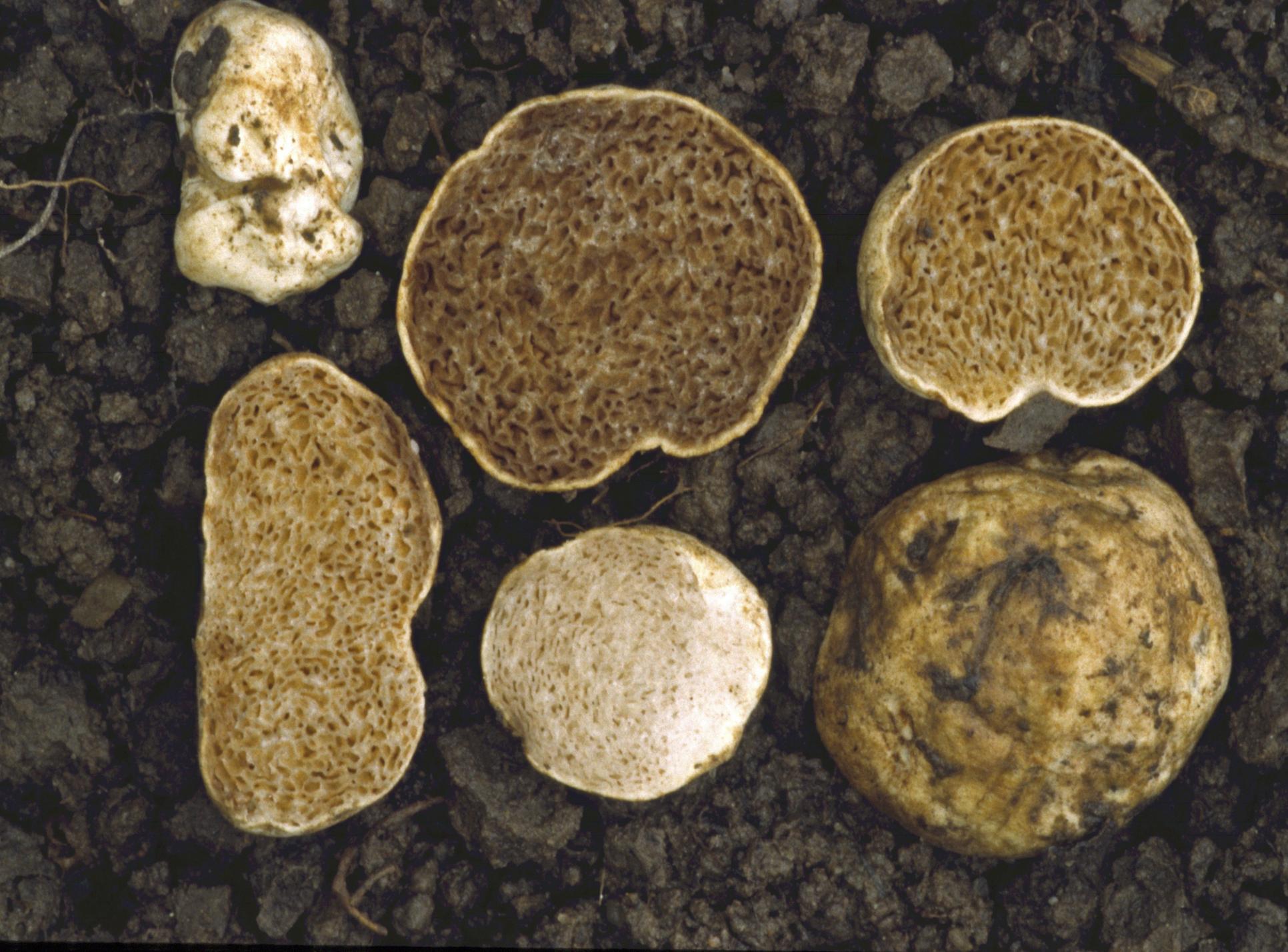


















Gunnar Hensel !!!

Zoltan Bratek and his team (ELTE; Budapest)

Thank you for your attention !

