

Epitypification of *Naucoria bohémica* (*Agaricales, Hymenogastraceae*)

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The holotype of *Naucoria bohémica* Velen. has been revised. This collection corresponds to the most frequent interpretation of the taxon in modern literature. Since the condition of the material is not sufficient to determine microscopic and molecular characters, the authors designate a well-documented collection from the same area (central Bohemia) and corresponding in all aspects with the holotype as an epitype. Description and illustrations are provided for both collections.

Key words: Basidiomycota, *Alnicola bohémica*, taxonomy, typification.

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Revidovali jsme holotyp druhu *Naucoria bohémica* Velen. Tato položka odpovídá nejčastější interpretaci tohoto taxonu v moderní literatuře, avšak není v dostatečně dobrém stavu pro mikroskopické a molekulární studium. Autoři proto stanovují jako epityp dobře dokumentovaný sběr pocházející ze stejné oblasti (střední Čechy), který ve všech aspektech odpovídá holotypu. Obě položky jsou dokumentovány popisem a vyobrazením.

INTRODUCTION

Naucoria bohémica Velen., a species belonging to a small group of ectomyco-rhizal naucorioid fungi devoid of clamp connections [currently classified in the genus *Alnicola* Kühner, or alternatively *Naucoria* (Fr.: Fr.) P. Kumm.], is considered a widespread and well-documented species in Europe, although its original description (Velenovský 1921: 547) is brief and the fungus is not illustrated. The first documented interpretation is by Maire and Kühner (1935), who provide three separate descriptions: one of a 2-spored collection, and two of 4-spored collections which were later proved to belong to other species in this group (Kühner 1942, Kühner and Romagnesi 1957). Lange (1939: pl. 125A), under the misinterpreted name “*Naucoria scorpioides* Fr.”, gives an excellent illustration of the

same two-spored species, as accepted by Kühner (1942). Other species were separated from *N. bohémica* afterwards: *N. macrospora* (Lange 1938), *N. langei* (Kühner and Romagnesi 1957), *N. salicis* (Orton 1960), *N. spadicea* (Reid 1984), *N. badiolateritia*, *N. rubriceps*, and *N. saliceti* (Orton 1984). Despite of this splitting, the interpretation of *N. bohémica* as a two-spored species with typical lemon-shaped spores and well-developed universal veil remains relatively stable in literature. Most authors interpret it as a strictly two-spored species (Kühner and Romagnesi 1953, Orton 1960, Pegler and Young 1975, Singer 1977, Benkert 1980, Kühner 1981, Orton 1984, Reid 1984, Enderle and Krieglsteiner 1987, Bon 1992, Breitenbach and Kränzlin 2000, Ludwig 2000: pl. 53.5A, Ludwig 2001, Vesterholt and Heilmann-Clausen 2008, Henrici 2009, etc.). Other authors such as Moser (1978), following Maire and Kühner (1935), carefully separate their descriptions of 2- and 4-spored collections.

Nevertheless, even consensually restricted to 2-spored collections, *N. bohémica* shows a high morphological variability and an eclectic ecology: even though the type locality is a temperate deciduous forest, it has also been reported from Scandinavian birch forests (Moser 1978), Mediterranean evergreen oak forests (Moser 1978), swampy areas with *Salix* spp. (Einhellinger 1981: 197, Jamoni 2001: 46), and the alpine zone with *Salix herbacea* (Møller 1945: 213, Kühner 1981: 129, Breitenbach and Kränzlin 2000: 126, Roux 2006: 764).

Not revised by Moreau (2005) nor described by any previous author, the original material located at PRC herbarium was studied by J. B. The indications in the protologue (Velenovský 1921: 548) do not mention explicitly a single original collection (only locality, collector, month and year are indicated) as required by McNeill et al. (2006, art. 9.9) for definition of holotypes. However, as pointed out by Holec (1999: 18), and known from Czech mycological tradition (J. Holec and Z. Pouzar, pers. com.; see also Kotlaba 1975: 5), J. Velenovský only based his descriptions of new species in České houby on single collections.

However, the condition of the holotype is not sufficient to determine the microscopic and molecular characters of *N. bohémica*. Revision of this complex of species (Moreau et al., in prep.) is required to support a proper interpretation of this well-known name, therefore we designate an epitype, which can provide a full microscopic description as well as DNA sequences. This well-documented collection made by one of us (J. B.) corresponds to the usual interpretation of *N. bohémica* and to the holotype, and was found at a site relatively close to the type locality. The collection is described according to J. B.'s field notes and a microscopic analysis completed by P.-A. M.'s personal observations. Systematic position, comparison with related taxa, and placement in the new genus *Gardesiella* P.-A. Moreau et al. are the subject of a separate work (Moreau et al., Can. J. Bot., submitted).

MATERIAL AND METHODS

The only one basidiome (hymenium and stipe structure) of the holotype was revived and observed in 5 % KOH. Spore dimensions were measured in the hymenium from pictures taken with a Canon PowerShot A650 IS digital camera connected to a Zeiss Primostar microscope; measurements on screen and estimations were carried out using the AxioVision 4.8.1 software. Basidiomata of the epitype were described in fresh condition by J. B. Microscopic features were studied on exsiccata: spores were observed in water, 5 % KOH, and Melzer's reagent; basidia, cystidia, and pileipellis (radial and tangential cuts) were revived and observed in 5 % KOH. Spore dimensions were estimated on natural deposits on the stipe surface, from pictures taken on a Moticam1000 digital camera connected to a Nachet Andromede 0181 microscope; measurements on screen and estimations were carried out using the Mycomètre 2.02 software (Fannechère 2009). 1st and 9th deciles (D1,9) and average values (*italic*) are given according to Fannechère (2005, 2009).

RESULTS AND DISCUSSION

TAXONOMY

Naucoria bohémica Velen., České houby, part I, fasc. 3: 527 (1921).

Nomenclatural synonym: *Alnicola bohémica* (Velen.) Kühner, Encyclop. Mycol. 7: 12 (1935).

Taxonomic synonyms: *Naucoria macrospora* var. *borealis* F.H. Møller, Fungi Faeroes I: 213 (1945); *Alnicola bohémica* var. *borealis* (F.H. Møller) P.-A. Moreau et P. Roux in Roux, Doc. Mycol. 34(135–136): 41 (2008); *Alnicola bohémica* var. *gracilis* Jamoni, Fungi non Delineati 14: 46 (2001).

Misint.: *Naucoria scorpioides* (Fr.: Fr.) Quél. s. Lange (1938: 21, 1939: pl. 125A), non Fries (1821).

Revision of the original material

The only available collection (herb. J. Velenovský, PRC) is represented by a single basidiome, preserved in a conservation liquid in plastic bottle no. 170 with the indication: "*Naucoria bohémica*, Krč, May 1920". The bottle also contains basidiomata of *Boletus armeniacus* (Stromovka, May 1920), *Collybia lacerata* (Chuchle, May 1920), and *Inocybe pallescens* (Jevany, May 1920).

This is the only original material known for *N. bohémica*. It represents the holotype due to the agreement of data in the protologue and label of the collection (basidiome in bottle no. 170) in PRC.

H o l o t y p e: Czech Republic: Krč (near Prague), May 1920, herb. J. Velenovský (PRC), bottle no. 170.

The hymenium is not well preserved, but a few 2-spored basidia could be distinctly observed. Spores (Fig. 1a) are numerous, rather homogenous, most of them citriform with +/- papillate apex, $(9.7-12.0-13.33-14.7(-15.5) \times (7.0-7.3-8.35-9.2(-10.6)) \mu\text{m}$, $Q = 1.45-1.60-1.71$. Basidia (two distinctly observed) short, with 2 thick conical sterigmata (Fig. 1b). No other hymenium elements could be observed. Hyphae on the stipe cortex were distinctly devoid of clamps (Fig. 1c).

Despite of the approximations of the protologue, absence of clamp connections clearly prove that Maire and Kühner (1935) were right in attributing intuitively this name to clampless collections of *Alnicola*. Spore dimensions given by Velenovský (1921) suggested that the description was based on two-spored basidiomata; we are able to state that the spores are typically lemon-shaped, with a low ornamentation made up of irregular wart patches.

Description of the epitype

Epitype, designated here: Czech Republic: Central Bohemia, between the villages of Český Šternberk and Malovice, "Krvavá skála", in a young mixed forest plantation on gneissic bedrock, along a forest path under *Corylus*, *Picea*, *Betula*, and *Fagus*, $49^{\circ} 49' 13.66'' \text{N}$, $14^{\circ} 56' 41.49'' \text{E}$, 29. VIII. 2006 leg. J. Borovička (PRM 915256); isoeptype in herb. P.-A. Moreau (LIP: BORE2008-1).

Pileus 2–4 cm across, obtusely conical to broadly campanulate, in some specimens with irregular margin, striate when mature. Cap cuticle glazy when moist, slimy by imbibition, hygrophanous, deep brown in pileus centre, paler at margin, fading to brownish buff from the centre, in centre sometimes remaining deep brownish. Lamellae pale brownish (resembling *Hebeloma* spp.), margin paler and fimbriate. Stipe thin and rather fragile, 47×0.3 cm, cylindrical, hollow, very slightly broadened at base, irregular (not straight), densely covered by silky white fibrils with appressed bands of velar floccules, on brownish ground visible by detersion especially at base, pruinose at apex. Context dirty brownish, taste distinctly bitter, smell clearly of fresh green peas (legumes).

Spores $12.1-13.72-15.1 \times 7.1-7.70-8.3 \mu\text{m}$, $Q = 1.62-1.78-1.98$, yellow-brown in water, reddish ochre in KOH, distinctly dextrinoid in 1–2 minutes (3–4 on Vesterholt's scale; Vesterholt 2005) except at apex, typically widely amygdaliform (side view) to lemon-shaped (front view), with characteristic prominent rounded apex, occasionally more elongate with a fusiform tendency; myxosporium thick, $0.2-0.5 \mu\text{m}$, coarsely verrucose, usually typically made up of patches of coalescent warts; teratological spores not rare, rounded or bifurcate. Basidia $25-40 \times 9.5-12 \mu\text{m}$, mostly 2-spored (but also some 1-spored observed), club-shaped, hyaline, often with a dense granular content when mature, thin-walled and often collapsed after maturity; necrobasidia not observed.

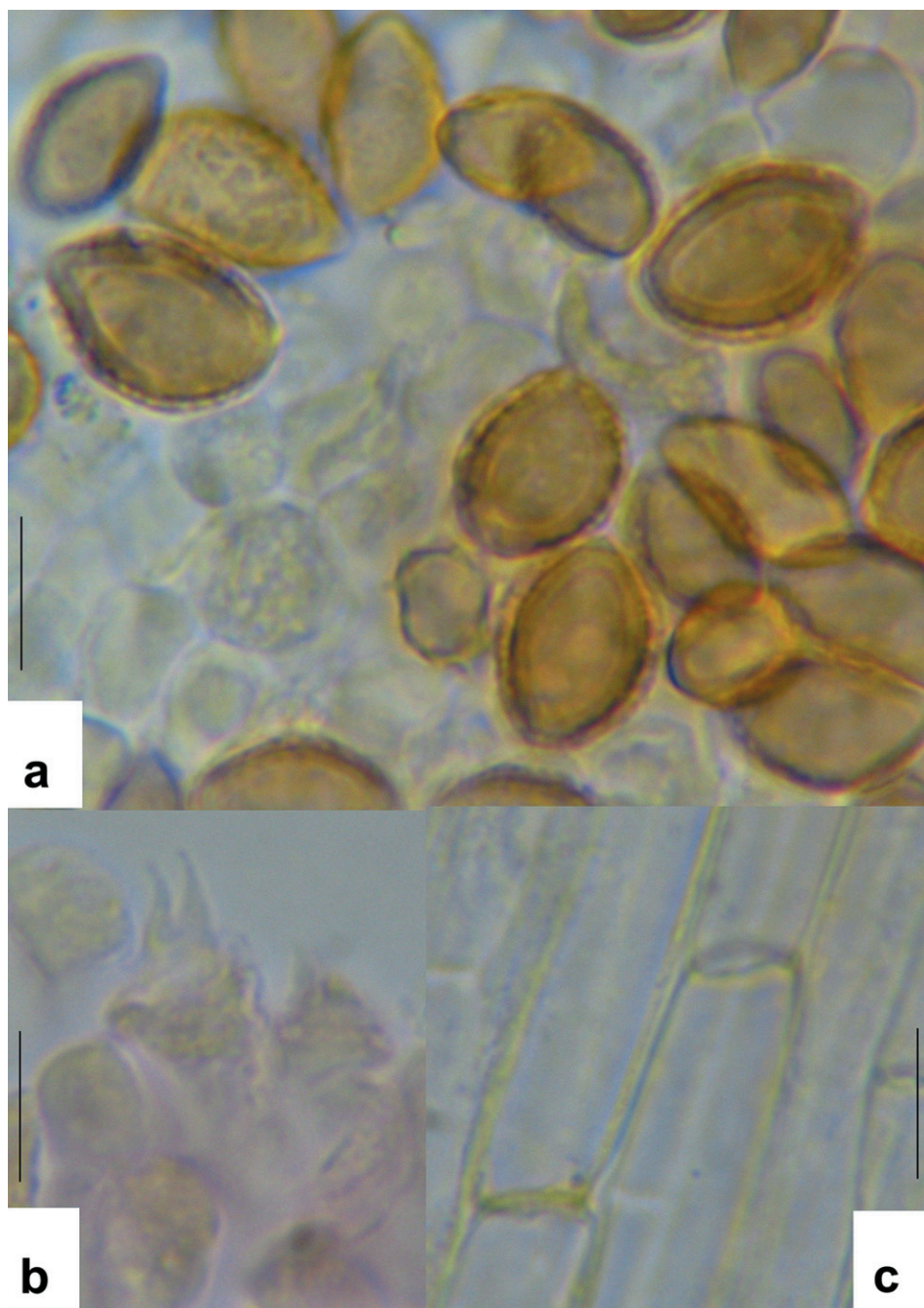


Fig. 1. *Naucoria bohemica* (holotype, PRC: herb. J. Velenovský, bottle no. 170): **a** – spores, **b** – basidia, **c** – clampless hyphae of stipe cortex. Scale bar = 10 μm . Photos by J. Borovička.

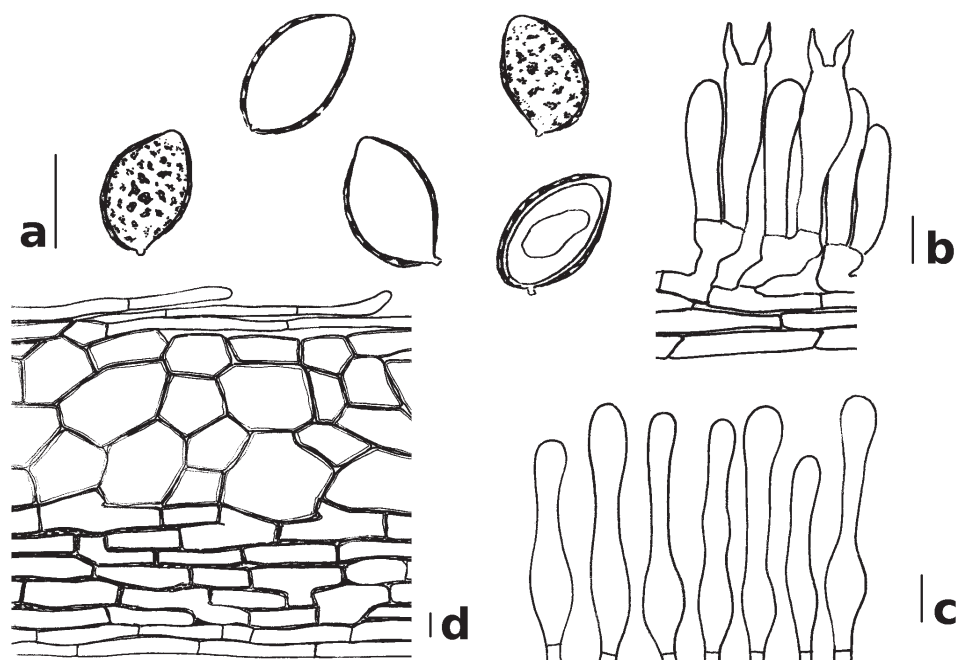


Fig. 2. *Naucoria bohémica* (isoepitype, LIP: BORE2008-1): **a** – spores, **b** – basidia and subhymenium, **c** – cheilocystidia, **d** – pileipellis (radial cut). Scale bar = 10 μ m. Drawings by P.-A. Moreau.

Lamellae edge sterile; cheilocystidia 28–45(–52) \times 4.5–7 μ m (base) / 4–6 μ m (apex), some uniseptate, cylindrical to narrowly lageniform, often with enlarged base and spatulate apex and flexuous neck, some vermiform to lageniform with an attenuate neck, not subcapitate, with slightly thickened wall up to 0.3 μ m thick in basal part, hyaline. Pleurocystidia absent.

Pileipellis distinctly 3-layered. Suprapellis 15–25 μ m thick, consisting of a dry cutis of filamentous, 4.5–6(–9) μ m thick hyphae with a slightly thickened yellowish wall, smooth to minutely incrustated, repent and possessing relatively few terminal articles towards margin, more erect and often with shorter, +/- catenulate hyphae towards centre with clavate to pyriform terminal elements and usually entirely covering the mediopellis. Mediopellis 45–60 μ m thick, consisting of a typical pseudoparenchymatic structure of jointed polyedric +/- isodiametric articles, more distinctly catenulate towards surface, 12–40 \times 9–25 μ m, coarsely incrustated. Subpellis filamentous, 30–50 μ m thick, made up of short, slender, 5–9 μ m thick and coarsely incrustated hyphae, otherwise of the same structure as context. Stipitipellis with numerous caulocystidia at apex, 18–65 \times 3–10 μ m, thin-walled, cylindrical, cylindro-clavate to vermiform or lobate with

slightly enlarged base. Superficial hyphae slender, 2.5–6 μm thick, smooth and colourless.

Clamp connections absent in all tissues.

NOTES

The original description of *Naucoria bohemica* by Velenovský (1921) was based on a collection found by O. Zvěřinová in a forest near Krč (“v lese Krčském”). It is likely that this refers to the former village of Krč, nowadays being a part of the city of Prague. The epitype collection was found in Central Bohemia between the villages of Český Šternberk and Malovice (“Krvavá skála”), a locality approx. 40 km from the original site. The basidiomata were growing nearby a forest path in a rather young mixed forest plantation under *Corylus* and *Picea* (in close vicinity also *Betula* and *Fagus*), on mossy soil on acid bedrock (gneiss). The collection originally constituted of 7 basidiomata (3 deposited at LIP, the others at PRM) collected by J. B., who photographed them in the field in humid conditions, and later ex situ while drying (Figs. 2–3).

Morphologically, the epitype specimens conform to traditional descriptions (in the most restrictive interpretation of the taxon) in the distinct universal veil on the stipe, forming zebra-like floccules (remining those of *Cortinarius decipiens*), on brownish ground only visible by detersion. Microscopically, except for some monosporic basidia (frequent in most collections studied by P.-A. M.), basidia are typically two-spored; spores (observed on natural deposits on stipe and pileus) are typically lemon-shaped in front view with a distinct apex, strongly dextrinoid (this character is variable but usually strong in most collections studied by P.-A. M., but not observable on the holotype due to preservation in liquid), and the cheilocystidia are slender with enlarged base and more or less enlarged apex, always < 7 μm wide (not observed on the holotype). The pileal structure, with a thick suprapellis entirely covering the mediopellis (made up of polygonal articles), is a characteristic of the species, unless this veil is thinned by erosion in old or washed specimens. The radish-like smell and mild raphanoid taste are other features of the species; here the taste was noted as “bitter” by J. B., only occasionally found on young collections by P.-A. M., but also strongly influenced by humidity and individual perceptions.

The collection designated here as epitype can therefore be considered to be unambiguous, and corresponds to the most frequent aspect and ecology of the species. It also corresponds to Velenovský's protologue (Velenovský 1921), although the description is imprecise and does not mention the presence of a veil on the stipe (possibly overlooked on too mature specimens) nor the characteristic raphanoid smell. Spore measurements made on the holotype by J. B. are perfectly comparable with measurements made on the epitype and other collections stud-



Fig. 3. *Naucoria bohemica* (isotype, LIP: BORE2008-1): fresh basidiomata in situ. Photo by J. Borovička.



Fig. 4. *Naucoria bohemica* (isotype, LIP: BORE2008-1): drying basidiomata. Photo by J. Borovička.

ied by P.-A. M. (Moreau et al., Can. J. Bot., submitted); width dimensions are somewhat larger on the holotype than on the epitype, whereas length dimensions are identical; the conservation in liquid may be responsible for this small variation by dilatation of the myxosporium.

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