Stropharia melanospermoides, spec. nova (*Strophariaceae*)

ANTON HAUSKNECHT
Sonndorferstraße 22
3712 Maissau, Austria
Email: ahausknecht.oemg@aon.at

IRMGARD KRISAI-GREILHUBER
Dept. für Botanik u. Biodiversitätsforschung der Universität Wien
Rennweg 14
1030 Wien, Österreich
E-Mail: irmgard.greilhuber@univie.ac.at

Accepted 4. August 2022 © Austrian Mycological Society, published online 7. January 2024

HAUSKNECHT, A., KRISAI-GREILHUBER, I., 2024: *Stropharia melanospermoides*, spec. nova (*Strophariaceae*). – Österr. Z. Pilzk. **30**: 145–150.

Key words: *Basidiomycota*, *Agaricales*, *Strophariaceae*, *Stropharia*. – New species, sp. nov. – Mycobiota of Austria, Funga of Austria. – 1 new species.

Abstract: *Stropharia melanospermoides*, found several times in East Austria, is described as a species new to science, which is also molecular genetically confirmed. Microscopical drawings and colour plates are given. The new species differs from its closest relative *S. melanosperma* macroscopically by slightly different colouration, and microscopically by having smaller spores and a gill edge composed of both leptocystidia and chrysocystidia.

Zusammenfassung: *Stropharia melanospermoides*, die mehrmals in Ostösterreich gefunden wurde, wird als neue Art beschrieben, die auch molekulargenetisch bestätigt ist. Mikroskopische Zeichnungen und Farbtafeln werden gegeben. Die neue Art unterscheidet sich von der nächst verwandten *S. melanosperma* makroskopisch durch etwas andere Farbgebung und mikroskopisch durch kleinere Sporen und eine aus Lepto- und Chrysocystiden aufgebaute Lamellenschneide.

Even in genera that include large and conspicuous mushrooms, new species can still be discovered in Europe. An example of this is the recently described *Stropharia flavida* from Catalonia (ARMADA & MOREAU 2022).

The taxon described in the present study was previously documented by HAUSKNECHT & KRISAI-GREILHUBER 2003: 101) as *Stropharia melanosperma* (BULL. ex PERS.) GILLET forma?, with detailed descriptions and colour illustration. This colour image was also used by NOORDELOOS (2011: 451 bottom) for *Stropharia melanosperma*. The distinguishing characters are outlined in HAUSKNECHT & KRISAI-GREILHUBER (2003). Subsequent molecular genetic investigations have revealed that it represents an independent taxon, requiring a new description.

Material and methods

The specimens are deposited in the herbarium WU-Mycologicum. Notes on ecology and macroscopic characteristics, as well as the microscopic examinations, were continuously recorded and conducted by the first author over the years. Colour designations follow KORNERUP & WANSCHER (1975).

DNA extraction from herbarium material, amplification of the ITS region and sequencing follow KLOFAC & GREILHUBER (2020). The newly generated sequences have been deposited in GenBank (www.ncbi.nlm.nih.gov), and an additional ITS sequence was downloaded from GenBank (Tab. 1). *Leratiomyces squamosus* and *L. laetissimus* were used as outgroup. The alignment was created using MAFFT Version 7 (www.ebi.ac.uk/Tools/mafft) (KATOH & al. 2019), manually checked, and edited with BioEdit v.7.2.6 (HALL 1999). Phylogenetic reconstruction was performed using PAUP* 4.0a.169 (SWOFFORD 2003) using the Parsimony Optimality Criterion, with 1000 bootstrap replicates of heuristic search with randomized addition of sequences and TBR branch swapping (mulTrees option active, steepest decent option not active). The entire matrix contained 697 equally weighted and unordered characters, with 542 being constant, 58 variable and parsimony-uninformative, and 97 parsimony-informative.

Taxonomy

***Stropharia melanospermoides* HAUSKN. & KRISAI, spec. nova** – (Figs. 1–2)
MycoBank no.: MB 851618

English diagnosis:

Apart from *Stropharia melanospermoides* differs in ITS sequence and macroscopically from the most similar *Stropharia melanosperma* (BULL.) GILLET by more whitish colours of pileus and stipe and a darker almost blackish-brown-olive spore print in mature specimens. Microscopically, the basidiospores are slightly smaller. The structure of the lamellar edge is entirely different, consisting of a mixture of chrysocystidia and leptocystidia in *S. melanospermoides*, while *S. melanosperma* has only cheilochrysocystidia.

Holotypus: Austria, Lower Austria, district Hollabrunn, community Maissau (MTB 7460/2), Grünhof, in newly established dry grassland, 9. August 2002, A. HAUSKNECHT, WU-Myc 22161.

Etymology: *melanospermoides*, because of the similarity to *S. melanosperma*. Derived from the name of the most similar taxon and the Greek composite ending – oides, meaning like or resembling.

Description

P i l e u s : 20–40 mm wide, 8–20 mm high, convex when young with a broad, obtuse umbo, soon applanate, not surface smooth, hygrophanous, not striate; young pure white, later milky white in the centre, yellowish to a maximum of pale yellow (KORNERUP & WANSCHER 1975: 3A1–2, 3A2, 3–4 A2).

L a m e l l a e : adnate, close, ventricose, young light grey-violet, later black-violet with a slightly lighter, smooth lamellar edge.

S t i p e : 32–55 mm long, 3–8 mm wide, cylindrical with a slightly thickened centre, tapering towards the base, entirely white, whitish, old with a very faint yellowish tint. Surface smooth, dry, not sticky, ring broad, double, white, with a slightly fringed-notched edge.

C o n t e x t : white, with a slightly fruity-sweetish smell.

B a s i d i o s p o r e s : 9–10.5 × 6.5–7.5 µm, on average 10.0 × 6.8 µm, Q = 1.4–1.6, ellipsoidal, thick-walled (wall ca. 0.5 µm), slightly lenticular, with ca. 1 µm wide germpore, dark brownish-olive in KOH, almost blackish-olive when old.

Fig. 1. *Stropharia melanospermoides,* WU-Myc 22161, holotype. Phot. A. HAUSKNECHT.

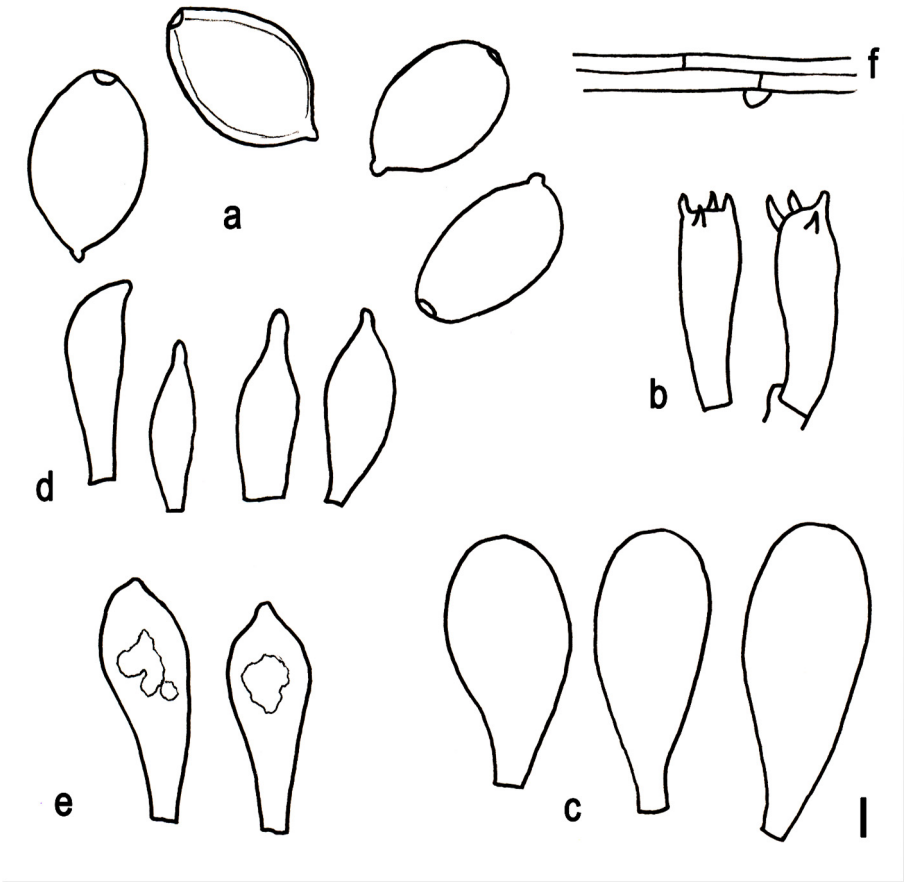

Fig. 2. *Stropharia melanospermoides*, holotype. *a* spores, *b* basidia, *c* cheiloleptocystidia, *d* cheilochrysocystidia, *e* pleurochrysocystidia, *f* hyphae of the ixocutis. Bar: *a* 2 µm, *b-f* 5 µm.

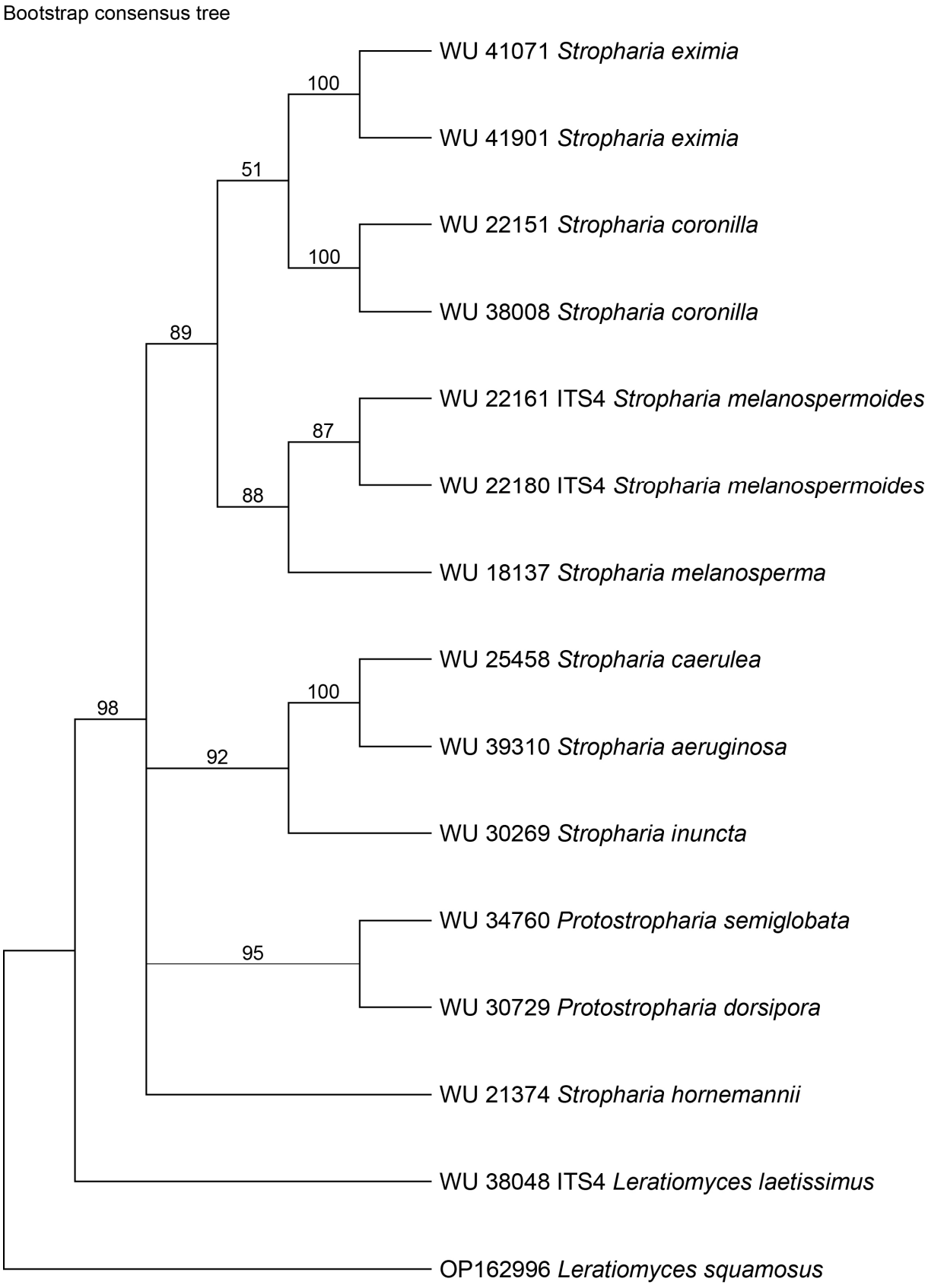

Fig. 3. Majority rule consensus tree of the investigated *Stropharia* species, with herbarium specimen or GenBank numbers. *Leratiomyces* used as outgroup.

Tab. 1. GenBank accession numbers, specimen numbers, country of origin, and reference of the taxa used for the phylogenetic analysis.

Taxon	Voucher no.	Country	GenBank ITS access. no.	Reference
Leratiomyces laetissimus (HAUSKN. & SINGER) BOROV., J. STŘÍBRNÝ, NOORDEL., GRYNDLER & OBORNÍK	WU-Myc 38048	Austria	PP085441	present study
L. squamosus (PERS.) BRIDGE & SPOONER	STU:SMNS-STU-F-0901307	Germany	OP162996	EBERHARDT & al. 2023
Protostropharia dorsipora (ESTEVE-RAV. & BARRASA) REDHEAD	WU-Myc 30729	Austria	PP085449	present study
Protostropharia semiglobata (BATSCH) REDHEAD, MONCALVO & VILGALYS	WU-Myc 34760	Austria	PP085440	present study
Stropharia aeruginosa (CURTIS) QUÉL.	WU-Myc 39310	Austria	PP085453	present study
S. caerulea KREISEL	WU-Myc 25458	Austria	PP085450	present study
S. coronilla (BULL.) W. SAUNDERS & W. G. SM.	WU-Myc 22151	Austria	PP085447	present study
S. coronilla	WU-Myc 38008	Austria	PP085448	present study
S. eximia BENEDIX	WU-Myc 41071	Austria	PP085445	present study
S. eximia	WU-Myc 41901	Austria	PP085446	present study
S. hornemannii (FR.) S. LUNDELL & NANNF.	WU-Myc 21374	Austria	PP085451	present study
S. inuncta (FR.) QUÉL.	WU-Myc 30269	Austria	PP085452	present study
S. melanosperma (BULL.) GILLET	WU-Myc 18137	Austria	PP085444	present study
S. melanospermoides HAUSKN. & KRISAI	WU-Myc 22180	Austria	PP085443	present study
S. melanospermoides	WU-Myc 22161	Austria	PP085442	present study

B a s i d i a : 4-spored, 21–32 × 8–9 µm, slender clavate with up to 5 µm long sterigmata.

C l a m p c o n n e c t i o n s : present at all septa.

C h e i l o c y s t i d i a : leptocystidia 25–50 × 12–20 µm, clavate-vesiculous, hyaline; chrysocystidia 25–32 × 6–10 µm, fusiform, often with rostellate extension and slightly yellowish, amorphous content; lamellar edge heteromorphic.

P l e u r o c y s t i d i a : formed as chrysocystidia, 25–40 × 9–14 µm, fusiform-clavate, with a small rostellate tip and yellowish content.

C a u l o c y s t i d i a : scattered at the tip of the stem, 20–30 × 11–20 µm, thin-walled, sphaerical, clavate, sphaerico-clavate, sometimes formed in chains.

P i l e i p e l l i s : a cutis to a light ixocutis consisting of ca. 2–4 µm thick hyphae.

Habitat: mostly in dry grasslands, along field and roadsides, also in gardens. At two localities on an exposed, sunny place in short grass (dry grassland), near last year's sheep dung.

Specimens examined (besides type): all from Austria. Niederösterreich, Pulkau, Großreipersdorf, Feldberg (7361/1), in dry grassland, 15. August 1984, A. HAUSKNECHT, WU-Myc 03606; - - in slightly deeper semi-dry grassland, 25. June 1989, A. HAUSKNECHT, WU-Myc 07656. - Maissau, Grünhof (MTB 7460/2), on roadside in grass, 26. May 1984, A. HAUSKNECHT, WU-Myc 03274; - - in dry grassland (type locality), 14. August 2002, A. HAUSKNECHT, WU-Myc 22180. - Schönberg am Kamp, Mollands (MTB 7460/3), in grass, 30. July 1989, A. HAUSKNECHT, WU-Myc 07836. - Marchegg, Breitensee (MTB 7767/1), on roadside, 21. August 1999, T. BARTA, WU-Myc 19482. - Hainfeld, Michelbach, (MTB 7860/4), in horse pasture, 25. June 1989, W. KLOFAC, WU-Myc 07518; - , Mayerhöfen (MTB 7860/4), in grass near *Thuja* and *Syringa*, 27. June 1989, W. KLOFAC, WU-Myc 19408. - Burgenland, Neusiedl am See, Spitalberg (MTB 7966/4), in dry grassland, 18. June 1995, T. BARTA, WU-Myc 13931.

Discussion

As evident from the diagnosis, the new species shows little macroscopic difference from *Stropharia melanosperma*. The u of the pileus and stipe are more whitish, and the spore print in mature specimens is darker, almost blackish-brown-olive. Additionally, the spores are slightly smaller. The structure of the lamellar edge is entirely different, consisting of a mixture of chrysocystidia and leptocystidia (see Fig. 2), while *S. melanosperma* has only cheilochrysocystidia.

In addition to the morphological differences, the NCBI Blast search provided initial indications of an independent taxon. The highest determined similarities were only 98 % with ITS sequences from *S. coronilla, S. rugosoannulata, S. ambigua*, and *S. melanosperma*. Of these, only the latter is also morphologically similar. Further, *S. ambigua* is an American species. The phylogenetic analysis placed the new taxon in a clade together with *S. melanosperma* with a bootstrap support of 88 %, where the two sequences of *S. melanospermoides* itself showed 87 % support (Fig. 3). Based on its morphological and molecular genetic features, the new species can be classified in *Stropharia* section *Mundae* according to SINGER (1986). This aligns well with the phylogeny presented by ARMADA & MOREAU (2022).

We would like to express our gratitude to KESIBAN ÖZDEMIR and DOMINIK METSCHINA for their technical assistance in sequencing as part of ABOL, the Austrian Barcode of Life project, subproject HRSFM, University of Vienna, supported by the Federal Ministry of Education, Science, and Research.

References

ARMADA, F., MOREAU, P.-A., 2022: Une strophaire nouvelle découverte en Catalogne *Stropharia flavida* sp. nov. – Bull. Soc. Mycol. France **138**(3–4): 231–247.

EBERHARDT, U., GRILLI, E., SCHUTZ, N., BARTLETT, P., BEKER, H. J, 2023: Old but not obsolete: a new life for some of MURRILL's (*Hebeloma*) names. – Mycologia **115**(3): 375–426.

HALL, T. A., 1999: BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. – Nucl. Acids Symp. Ser. **41**: 95–98.

HAUSKNECHT, A., KRISAI-GREILHUBER, I., 2003: Pilzbeobachtungen in einem neu geschaffenen Weidegebiet. – Österr. Z. Pilzk. **12**: 101–122.

KATOH, K., ROZEWICKI, J., YAMADA, K. D., 2019: MAFFT online service: multiple sequence alignment, interactive sequence choice and visualization. – Briefings in Bioinformatics **20**: 1160–1166.

KLOFAC, W., KRISAI-GREILHUBER, I., 2020: *Xerocomus ferrugineus* f. *aurantiiporus*, eine neue Form mit orangen Röhren aus Österreich. *Xerocomus ferrugineus* f. *aurantiiporus*, a new form with orange tubes from Austria. – Österr. Z. Pilzk. **28**: 9–12.

KORNERUP, A., WANSCHER, J. H., 1975: Taschenlexikon der Farben, 2. Aufl. – Zürich, Göttingen: Musterschmidt.

NOORDELOOS, M. E., 2011: *Strophariaceae* s.l. – Fungi Europaei **13**. – Alassio: Candusso.

SINGER, R., 1986: The *Agaricales* in modern taxonomy. 4th edn. – Königstein: Koeltz.