

Kalmanago gen. nov. (*Microbotryaceae*) on *Commelina* and *Tinantia* (*Commelinaceae*)

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Received 16 June 2020 / Accepted 30 June 2020 / Published 2 July 2020

Denchev, T.T., Denchev, C.M., Kemler, M. & Begerow, D. 2020. *Kalmanago* gen. nov. (*Microbotryaceae*) on *Commelina* and *Tinantia* (*Commelinaceae*). – Mycobiota 10: 21–37. doi: 10.12664/mycobiota.2020.10.03

Abstract. *Bauerago* (with *B. abstrusa* on *Juncus* as the type species) is a small genus in the *Microbotryales*. Its species infect plants belonging to three, monocotyledonous families, *Commelinaceae* (*Commelina* and *Tinantia*), *Juncaceae* (*Juncus* and *Luzula*), and *Cyperaceae* (*Cyperus*). There are four *Bauerago* species on hosts in the *Commelinaceae* (three species on *Commelina* and one on *Tinantia*). *Bauerago commelinae* on *Commelina communis* was studied by molecular and morphological methods. Phylogenetic analyses using rDNA (ITS, LSU, and SSU) sequences indicate that *B. commelinae* does not cluster with other species of *Bauerago* on *Juncaceae*. For accommodation of this smut fungus in the *Microbotryaceae*, a new genus, *Kalmanago*, is introduced, with four new combinations: *Kalmanago commelinae* (Kom.) Denchev et al., *K. combensis* (Vánky) T. Denchev et al., *K. boliviana* (M. Piepenbr.) T. Denchev et al., and *K. tinantiae* (J.C. Lindq.) T. Denchev et al. A lectotype is designated for *K. commelinae*.

Key words: *Bauerago*, *Commelina benghalensis*, *Commelina communis*, *Commelinaceae*, *Kalmanago*, lectotypification, *Microbotryaceae*, *Microbotryales*, new combinations, new genus, phylogeny, smut fungi, taxonomy, *Tinantia*

Taxonomic novelties. New genus: *Kalmanago* T. Denchev, Denchev, Kemler & Begerow. New combinations: *Kalmanago boliviana* (M. Piepenbr.) T. Denchev, Denchev, Kemler & Begerow, *K. commelinae* (Kom.) Denchev, T. Denchev, Kemler & Begerow, *K. combensis* (Vánky) T. Denchev, Denchev, Kemler & Begerow, *K. tinantiae* (J.C. Lindq.) T. Denchev, Denchev, Kemler & Begerow.

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Introduction

In 1895–1897, the Russian botanist V.L. Komarov traveled to the Russian Far East, NE China, and Korea, and gathered an enormous number of herbarium specimens on which he described many new plant species (Komarov 1901, 1903–1904, 1905–1907). During these expeditions, Komarov collected a number of interesting plant parasitic fungi, including a smut fungus on *Commelina communis*, found on the border between China and Korea, near Yalu River, not far from Mao-erh-shan (currently Linjiang). Based on the gross morphological characteristics and spore shape, sizes, and ornamentation, but in the absence of information about the spore germination, Komarov placed this fungus into the genus *Tilletia*, with some uncertainty, and described it as ‘*Tilletia? commelinae*’ (Jaczewski et al. 1899a, b). Later, this smut fungus was recombined as *Ustilago commelinae* (Kom.) Zundel (Zundel 1953). Since in its modern circumscription the species of *Ustilago* are restricted only to host plants in the *Poaceae*, Denchev (2003) transferred the fungus on *Commelina communis* to *Bauerago*.

Bauerago was described by Vánky (1999) with *B. abstrusa* (Malençon) Vánky on *Juncus gerardi* Loisel. as the type species. It is a small genus in the *Microbotryales* comprising nine species on host plants belonging to three, monocotyledonous families, namely, *Commelinaceae* (on *Commelina* L. and *Tinantia* Scheidw.), *Juncaceae* (on *Juncus* L. and *Luzula* DC.), and *Cyperaceae* (on *Cyperus* L.). The genus was characterised by sori destroying seeds of infected plants and filling the capsules (achenes, in the case of *Cyperus*) with a powdery spore mass; solitary spores; absence of peridium and columellae in the sori; absence of sterile cells between the spores; host-parasite interaction by intercellular hyphae without interactions with deposits of fungal vesicles; and mature septa without pores (Vánky 2013; Begerow & McTaggart 2018; Denchev & Denchev 2018).

There are four *Bauerago* species on hosts in the *Commelinaceae*: *B. commelinae* (Kom.) Denchev, *B. combensis* (Vánky) Denchev, and *B. boliviana* M. Piepenbr. on *Commelina* spp., and *B. tinantiae* (J.C. Lindq.) Vánky on *Tinantia* spp. (Vánky 1994, 1999, 2008, 2011; Piepenbring 2002; Denchev 2003). The aim of the present study is to clarify the phylogenetic position of the smut fungi in *Bauerago* infecting hosts in the *Commelinaceae*. A combined approach, using molecular, morphological, and ecological data, was applied. Based on the revealed phylogenetic placement and affinities of this group of fungi in the *Microbotryales*, a new genus, *Kalmanago*, is proposed herein.

Material and methods

Morphological examination

Dried specimens from the herbarium of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (SOMF) were examined under a light microscope (LM). For LM observations and measurements, spores were mounted in lactoglycerol solution (w : la : gl = 1 : 1 : 2) on glass slides, gently heated to boiling point to rehydrate the spores, and then cooled. The measurements of spores are given in the form: min–max (extreme values) (mean \pm 1 standard deviation). The description below is based entirely on the specimens

examined (excl. the information about the spore germination pattern). The shapes of spores are arranged in descending order of frequency.

DNA extraction, PCR amplification, and sequencing

For DNA extraction, spore mass from infected specimens of *Commelina communis* was removed. The samples were milled in the Fastprep-24™ Sample Preparation Instrument (MP Biomedicals), using two steel beads. Genomic DNA was isolated using the my-Budget Plant DNA Kit™ (Bio-Budget Technologies GmbH, Germany), according to the manufacturer's protocol (protocol 1: "Isolation of DNA from plant material using lysis buffer SLS"). PCR was performed to amplify the entire ITS or part of the ITS and parts of the LSU and SSU rDNA regions, using GoTaq™ Master Mix (Promega, USA) with primer combinations ITS1-F/ITS4 (White et al. 1990; Gardes & Bruns 1993), 5.8S-R/ITS4 (Vilgalys & Hester 1990; White et al. 1990), NL1/NL4 (O'Donnell 1992, 1993), and NS1/SR7 (White et al. 1990). Standard thermal cycling conditions with annealing temperature of 52 °C were used for amplification. Five µl of PCR products were purified using ExoSAP (1:5 diluted in ddH₂O; New England Biolabs, USA). Amplicons were sequenced in both directions with the BigDye™ Terminator Cycle Sequencing Kit V3.1 (Applied Biosystems) on an ABI 3130xl Genetic Analyser at the Faculty of Chemistry and Biochemistry, Ruhr University Bochum, Germany. Subsequently, they were quality controlled and forward and reverse read were merged in Geneious 10.2.6 (Biomatters Ltd, Auckland). Sequences were deposited in the NCBI nucleotide database (see Table 1 for accession numbers).

Phylogenetic analyses

A multiple sequence alignment of the newly generated sequences (Table 1) and representative sequences downloaded from NCBI's GenBank (Table 2) was generated using the e-ins-i option in MAFFT v7.450 (Katoh & Standley 2013). Ambiguous regions, as well as leading and trailing sequences, were removed using GBLOCK (Castresana 2000) implemented in SeaView (Gouy et al. 2010), whereby smaller final blocks, gap positions, and less strict flanking positions were allowed. The ITS, LSU, and SSU rDNA regions were aligned separately using MAFFT v7.305b (Katoh et al. 2002; Katoh & Standley 2013) under the "linsi" option. The alignments were concatenated using Geneious 10.2.6 (Biomatters Ltd, Auckland). A Maximum Likelihood phylogeny was inferred by RAxML 7.3.5 (Stamatakis 2006) under the GTRGAMMA option and 1000 rapid bootstrap replicates. The resulting phylogeny was visualized in FigTree v1.4.3 (Rambaut 2012).

Results

Morphology

The results of the morphological examination by light microscopy are included in the species description and Figs 2–5.

Morphologically *Bauerago commelinae* can be distinguished from the type species of the genus *Bauerago*, *B. abstrusa*, by its spore germination pattern. The specific spore

Table 1. List of newly sequenced specimens used in the phylogenetic analyses

Species	Host	Fungarium no.	Country	Year	Collector	DNA isolation no.	GenBank accession numbers		
							ITS	LSU	SSU
<i>Aurantiosporium scleriae</i>	<i>Scleria flexuosa</i>	SOMF 30248	Malawi	2001	C., T. & K. Vánky	TD 575	MT636671	MT636661	MT636682
<i>Bauenago vuyekii</i>	<i>Luzula campestris</i>	GLM-F047394	Germany	2001	H. Jage	TD 518	MT636670	MT636660	MT636681
<i>Fulvisporium restifaciens</i>	<i>Austrostipa stiposa</i>	Triebel, Microf. Triebel, Microf. exs., no. 306 (B)	Australia	1996	D. Triebel	TD 615	MT636672	MT636663	MT636684
<i>Kalmanago commelinae</i>	<i>Commelina communis</i>	SOMF 30249	Japan	1999	C.M. Denchev	TD 272	MT636665	MT636655	MT636675
<i>Kalmanago commelinae</i>	<i>Commelina communis</i>	SOMF 30251	Japan	1999	C.M. Denchev & Y. Harada	TD 273	MT636666	MT636656	MT636676
<i>Kalmanago commelinae</i>	<i>Commelina communis</i>	SOMF 18825	Japan	1985	M. Kakishima et al.	TD 577	–	MT636662	MT636683
<i>Kalmanago commelinae</i>	<i>Commelina communis</i>	SOMF 20882	China	1991	Guo Lin	TD 294	MT636667	–	MT636677
<i>Microbotryum anomalum</i>	<i>Fallopia baldschuanica</i>	SOMF 30252	Bulgaria	1998	C.M. Denchev	TD 4	–	MT636653	MT636673
<i>Microbotryum bistortarum</i>	<i>Bistorta vivipara</i>	C-F-107750	Greenland	2017	S.A. Elborne	TD 401	–	MT636659	MT636680
<i>Microbotryum parlatoresi</i>	<i>Rumex maritimus</i>	S-F-22745	Austria	1988	H. Melzer	TD 386	MT636668	MT636657	MT636678
<i>Microbotryum reticulatum</i>	<i>Persicaria lapathifolia</i>	SOMF 30253	Bulgaria	2016	T.T. Denchev & C.M. Denchev	TD 75	MT636664	MT636654	MT636674
<i>Microbotryum stygium</i>	<i>Rumex acetosa</i>	K(N) 110086	UK	2002	R.G. Woods	TD 388	MT636669	MT636658	MT636679

Table 2. List of sequences downloaded from GenBank

Species	Voucher no.	GenBank accession numbers			Reference
		ITS	LSU	SSU	
<i>Aurantiosporium subnitens</i>	MP1173	–	AF009846	–	Begerow et al. 1998
<i>Bauerago abstrusa</i>	H.U.V. 18526	DQ238719	EF621955	–	Kemler et al. 2006, 2009
<i>Bauerago vuyckii</i>	MP2380	DQ238720	DQ363321	–	Bauer et al. 2006; Kemler et al. 2006
<i>Fulvisporium restifaciens</i>	H.U.V. 17637	–	AF009860	–	Begerow et al. 1998
<i>Leucosporidium golubevii</i>	CBS 9651	KJ708386	KY108283	KJ708386	Wang et al. 2015a
<i>Leucosporidium scottii</i>	CBS 5930	AF444495	AF131060	KF036682	Sampaio et al. 1999; Scorzetti et al. 2002; Liu et al. 2015
<i>Microbotryozyma collariae</i>	ATCC MYA-4666	JN849458	JN849460	–	Suh et al. 2012
<i>Microbotryozyma collariae</i>	ATCC MYA-4667	JN849459	JN849461	–	Suh et al. 2012
<i>Microbotryozyma swertiae</i>	CGMCC2.3533	MK050424	MK050424	MK050424	Li et al. 2020
<i>Microbotryum anomalum</i>	GLM-F059392	EF621921	EF621960	–	Kemler et al. 2009
<i>Microbotryum betonicae</i>	TUB 015851	EF621924	EF621964	–	Kemler et al. 2009
<i>Microbotryum bistortarum</i>	TUB 015860	EF621930	EF621973	–	Kemler et al. 2009
<i>Microbotryum dianthorum</i>	RUB042	JN942224	JN939361	JN938659	Schoch et al. 2012
<i>Microbotryum emodensis</i>	FO17516	DQ238743	AY512858	–	Bauer et al. 2006; Kemler et al. 2006
<i>Microbotryum intermedium</i>	M-0066091	DQ238724	EF621983	–	Kemler et al. 2009
<i>Microbotryum lychnidis-dioicae</i>	RUB050	JN942218	JN939369	JN938667	Schoch et al. 2012
<i>Microbotryum marginale</i>	TUB 015881	EF621940	EF621989	–	Kemler et al. 2009
<i>Microbotryum parlatorei</i>	B 70 0007574	DQ238736	EF621991	–	Kemler et al. 2006, 2009
<i>Microbotryum pustulatum</i>	TUB 015872	EF621947	EF621998	–	Kemler et al. 2009
<i>Microbotryum reticulatum</i>	CBS 101451	KJ778630	KJ708457	KJ708389	Wang et al. 2015a
<i>Microbotryum reticulatum</i>	M-0066067	DQ238730	EF621999	–	Kemler et al. 2006, 2009
<i>Microbotryum saponariae</i>	RUB041	JN942252	JN939360	JN938658	Schoch et al. 2012
<i>Microbotryum scabiosae</i>	CBS 176.24	KJ778631	KJ708458	KJ708391	Wang et al. 2015a
<i>Microbotryum scabiosae</i>	CBS 677.93	KJ778632	KJ708459	KJ708390	Wang et al. 2015a
<i>Microbotryum scabiosae</i>	TUB 015876	EF621951	EF622004	–	Kemler et al. 2009

Table 2. (continued)

Species	Voucher no.	GenBank accession numbers			Reference
		ITS	LSU	SSU	
<i>Microbotryum scorzonerae</i>	CBS 364.33	KJ778633	KJ708460	KJ708393	Wang et al. 2015a
<i>Microbotryum scorzonerae</i>	CBS 685.93	KJ778634	KJ708461	KJ708392	Wang et al. 2015a
<i>Microbotryum silenes-dioicae</i>	RUB053	JN942216	JN939372	JN938670	Schoch et al. 2012
<i>Microbotryum silenes-dioicae</i>	TUB 015864	EF621937	EF621985	–	Kemler et al. 2009
<i>Microbotryum silenes-inflatae</i>	RUB033	JN942230	JN939352	JN938650	Schoch et al. 2012
<i>Microbotryum stellariae</i>	RUB056	JN942214	JN939375	JN938673	Schoch et al. 2012
<i>Microbotryum violaceum</i>	GLM-F050283	DQ640065	DQ640070	–	Lutz et al. 2008
<i>Microbotryum violaceum s. lat.</i>	AFTOL-ID 1819	DQ789984	DQ789982	DQ789983	Lutzoni et al. 2004
<i>Sphacelotheca cf. koordersiana</i>	AFTOL-ID 1917	DQ832221	DQ832219	DQ832220	Lutzoni et al. 2004
<i>Sphacelotheca polygoni-persicariae</i>	MEL:2383469	KP311404	KP311344	–	Schuster et al. 2016
<i>Sphacelotheca polygoni-serrulati</i>	TUB F	–	AY512884	–	Bauer et al. 2006
<i>Ustilentyloma brefeldii</i>	TUB 012510	DQ238745	EF622016	–	Kemler et al. 2006, 2009
<i>Ustilentyloma fluitans</i>	K(M)	KC994460	KC994459	–	Smith et Lutz 2014
<i>Ustilentyloma fluitans</i>	RB900	AY212990	AF009882	AY124481	Sampaio et al. 2003
<i>Ustilentyloma graminis</i>	AFTOL-ID 674	DQ234557	AY631901	AY657013	Lutzoni et al. 2004
<i>Ustilentyloma graminis</i>	CBS 6403	AF444524	AF189933	NG_062670	Scorzetti et al. 2002; Lutzoni et al. 2004

germination in *Bauerago commelinae* (as '*Ustilago commelinae*') was first demonstrated by McLain (1960), later confirmed by Duran & Safeuulla (1968) and Ingold (1989b). In this species, the phragmobasidium is 2-celled. The basidium cells neither fuse nor form sporidia. Each cell produces a long, unbranched hypha: the lower cell produces a hypha near the septum, while the upper cell produces hyphae either in an apical position or just above the septum, but never in an intermediate position. The hyphae grow to a length of several hundred micrometres without branching (Duran & Safeuulla 1968; Ingold 1989b). The two-celled basidium with a single septum is rare in the smut fungi, for example, also observed in *Moesziomyces bullatus* (J. Schröt.) Vánky on *Echinochloa crus-galli* (L.) P. Beauv. (Ingold 1988). In these cases, the basidium is prostrate on the medium, while the two-celled basidium in *Anthracoidea*, a regular germination pattern in this genus, is an aerial structure (Ingold 1989a). The spore germination in *Bauerago abstrusa* results in a phragmobasidium on which sessile basidiospores are produced (Vánky 2013: Fig. 9F).

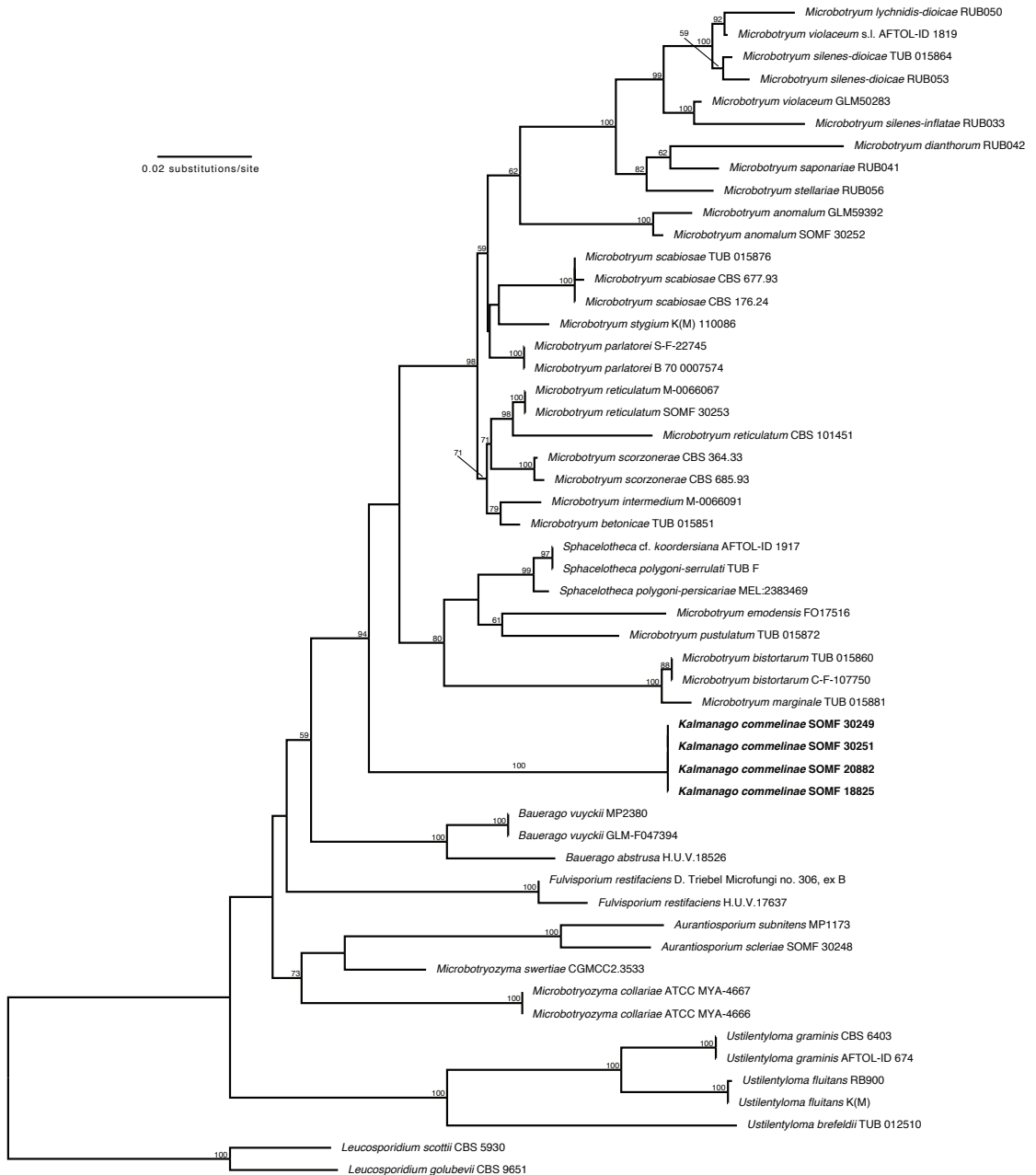


Fig. 1. Phylogenetic relationships in the *Microbotryales*, based on the RAxML analysis of concatenated MAFFT alignments of partial rDNA small subunit (SSU), partial rDNA large subunit (LSU), and complete rDNA internal transcribed spacer (ITS). *Kalmanago commelinae* is depicted in boldface. Bootstrap values of 1000 repetitions above 50 are shown above branches. The phylogeny was rooted with *Leucosporidium scottii* and *L. golubevii*.

Phylogeny

The molecular phylogenetic analyses (Fig. 1) partially confirms previous analyses, but also indicates phylogenetic relationship not inferred by previous studies. Phylogenetic relationships within the genus *Microbotryum* mirror those of previous analyses, with *Sphacelotheca* being nested within a clade of *Microbotryum* species on *Persicaria*. The newly proposed genus *Kalmanago* forms the highly-supported sister group to *Microbotryum* and together they form the sister clade to *Bauerago*. However, this later relationship only has low statistical support. As in previous studies (Wang et al. 2015b) species within the family *Ustilentylomataceae* occur paraphyletic in our analysis, but there is no statistical support for this.

Taxonomy

Phylogenetic analyses using ITS, LSU, and SSU rDNA sequences indicates that *Bauerago commelinae* forms a distinct lineage and does not cluster with other species of *Bauerago* on *Juncaceae*. For accommodation of this smut fungus in the *Microbotryaceae*, a new genus, *Kalmanago*, is proposed.

Kalmanago T. Denchev, Denchev, Kemler & Begerow, **gen. nov.**

Index Fungorum number: IF 557798

Etymology — The genus is named in honour of Dr Kálmán Vánky (1930–), in recognition of his outstanding contribution to the taxonomy of the smut fungi in general, and to the genus *Bauerago* in particular. The name is derived from *Kalman* and *Ustil-ago*.

Description — Members of the *Microbotryaceae* R.T. Moore. **Infection** systemic. **Sori** destroying seeds of infected plants in the *Commelinaceae* and filling the capsules with a powdery, reddish brown to very dark reddish brown spore mass; peridium and columellae absent. **Spores** solitary, mainly globose and subglobose, yellowish brown to dark reddish brown; spore wall reticulate. **Sterile cells** lacking between the spores. **Spore germination** (after Duran & Safeulla 1968; Ingold 1989b) results in two-celled phragmobasidium; basidium cells neither fuse nor form sporidia; each cell producing a long, unbranched hypha.

Type species — *Kalmanago commelinae* (Kom.) Denchev, T. Denchev, Kemler & Begerow.

Kalmanago commelinae (Kom.) Denchev, T. Denchev, Kemler & Begerow, **comb. nov.**

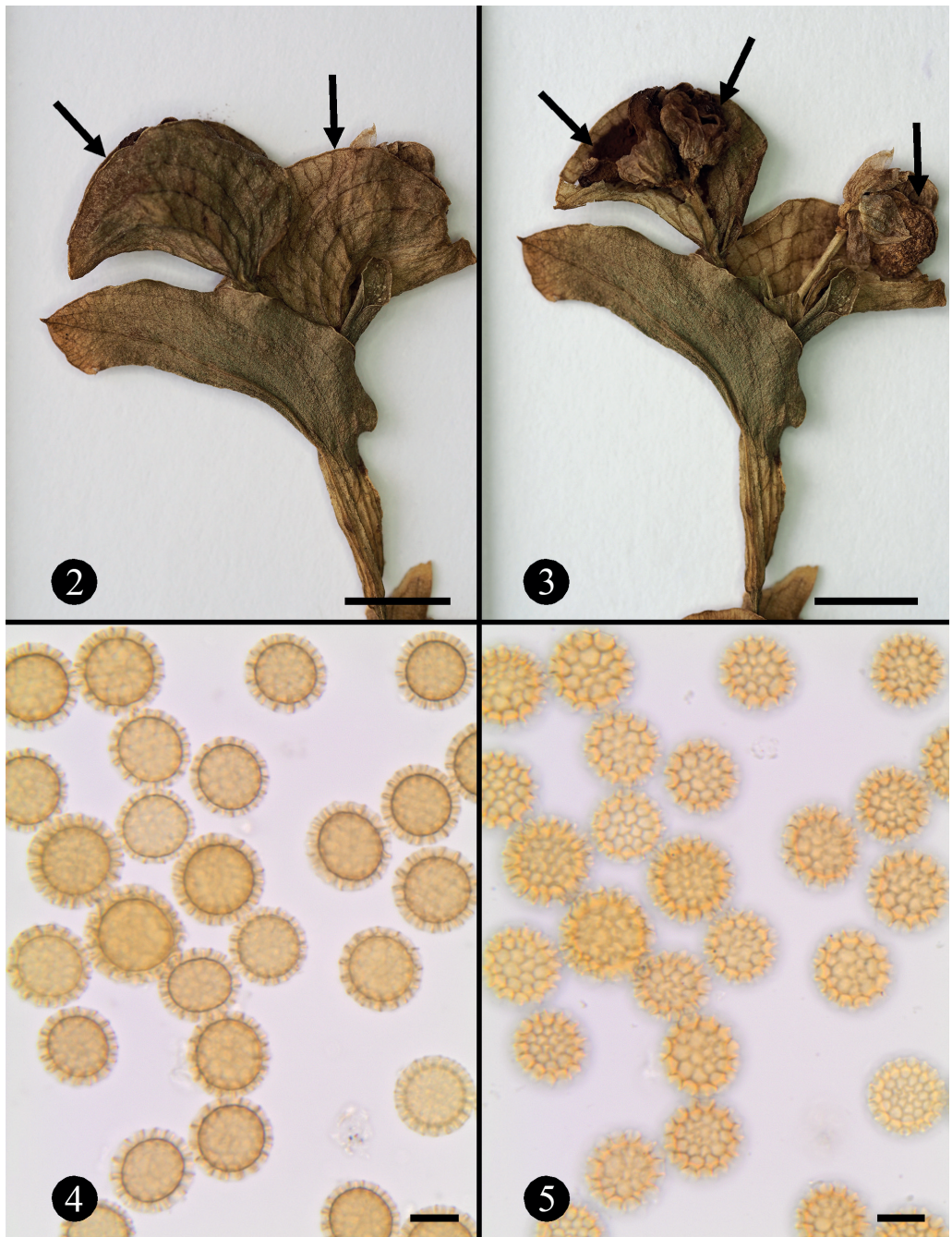
Index Fungorum number: IF 557799

Figs 2–5

Basionym: *Tilletia commelinae* Kom., in Jaczewski, Komarov & Tranzschel, *Fungi Rossiae* Exsicc.: no. 210, 1899.

≡ *Ustilago commelinae* (Kom.) Zundel, *Contr. Dept. Bot. School Agric. Pennsylvania State Coll.* 176: 151, 1953.

≡ *Bauerago commelinae* (Kom.) Denchev, *Mycotaxon* 87: 128 [in the journal, printed by error as ‘129’], 2003.



Figs 2–5. *Kalmanago commelinae* on *Commelina communis* (SOMF 30251). 2, 3. Habit (arrows in 2 show the spathae enclosing sori; arrows in 3 indicate infected capsules, visible after partial removal of the spathae). 4, 5. Spores in LM (in median and surface view, respectively). Scale bars: 2, 3 = 0.5 cm, 4, 5 = 10 μ m

Typification — On *Commelina communis*: CHINA, JILIN PROVINCE, near Yalu River, not far from Mao-erh-shan (currently Linjiang), 3 Sep 1897, leg. V. Komarov, s.n. (LE 43546, **lectotype, designated here**; IF 557800). Isolectotypes in Jaczewski, Komarov & Tranzschel, *Fungi Rossiae Exsiccati*, no. 210 (as '*Tilletia? commelinae*'). **Fig. 6**

Infection systemic. **Sori** destroying the seeds, filling the hypertrophied capsules with a powdery, umber (based on the Rayner's Colour Chart; Rayner 1970) spore mass; enclosed by the spatha. **Spores** subglobose, globose or broadly ellipsoidal, sometimes ellipsoidal, ovoid or slightly irregular, (14.5–)15.5–20.5(–21.5) × (13.5–)14.5–19(–20) (18.4 ± 1.0 × 16.8 ± 1.1) µm ($n/2 = 200$), medium yellowish brown to medium reddish brown, reticulate; spore wall (1.9–)2.2–3.3(–3.6) µm thick (including reticulum); meshes 4–7 per spore diameter, polyhedral or irregular, (0.7–)1.0–4.0(–4.5) µm long; muri 19–28 on equatorial circumference, in optical median view acute or subacute, (1.0–)1.2–2.3(–2.7) µm high. **Spore germination** (after Duran & Safeulla 1968; Ingold 1989b) results in two-celled phragmobasidium; basidium cells neither fuse nor form sporidia; each cell developing a long, unbranched hypha; lower cell producing a hypha near the septum, upper cell producing hyphae either in an apical position or just above the septum, but never in an intermediate position.

Specimens examined — On *Commelina communis* L.: JAPAN, AOMORI PREFECTURE, Hirosaki, Bunkyo-cho, Campus of Hirosaki University (Faculty of Agriculture and Life Science), 40°35'N 140°28'E, 26 Oct 1999, leg. C.M. Denchev & Y. Harada, s.n. (SOMF 30251); Hirosaki, 23 Oct 1999, leg. C.M. Denchev, s.n. (SOMF 30249).

Known hosts — On *Commelinaceae*: *Commelina communis*.

Distribution — Asia (Russian Far East, Japan, China), North America (U.S.A.).

Comments — *Commelina communis* is native to East and South East Asia, and introduced into East and South Europe and North America (Komarov 1901; Hong & DeFilipps 2000). *Kalmanago commelinae* is reported (as '*Tilletia commelinae*', '*Ustilago commelinae*' or '*Bauerago commelinae*') from the Russian Far East – Ussuri Region (Govorova 1990; Azbukina et al. 1995); Japan – Hokkaido (incl. Okushiri Island) and Honshu (Aomori, Akita, Iwate, Ibaraki, and Shizuoka prefectures) (Sydow & Sydow 1913; Ito 1936; Kakishima 1982; Harada 1983, 1984; Vánky 1986, 1987, 1994); China (Jaczewski et al. 1899b; Guo 1988, 2000; Vánky 1992, 1994); and North America (Durán & Fischer 1961; Vánky 1994; Farr & Rossman 2020).

Nomenclatural notes — The name of this smut fungus was published by Komarov as '*Tilletia? commelinae*', and the species was distributed in the exsiccate series *Jaczewski, Komarov & Tranzschel, Fungi Rossiae Exsiccati*, under no. 210 (Jaczewski et al. 1899a, b). Although assigned to *Tilletia* with a question mark, this species was accepted by Komarov and he provided it with a description. Therefore, *T. commelinae* is considered as a validly published name (Art. 36.1., Shenzhen Code).

In volume 87 of *Mycotaxon*, pages 128 & 129 were inverted by the journal printer, incorrectly numbered, and in the wrong page order. Both combinations published there, *B. commelinae* and *B. combensis*, are, for nomenclatural purposes, to be considered as having been published on page 128.

Jaczewski, Komarov, Tranzschel LE-43546.
Fungi Rossiae Exsiccati.

210. Tilletia? Commelinae Kom. nov. sp.

Soris laete castaneis, pulveraceis, fructus tegumentibus tectis, intra ovariiis ortis; sporis globosis, pallide castaneis vel olivaceis 10,4—18,2 μ . in diametro, areolis regularibus circiter 2—3,6 μ . altis reticulatis.

In ovariiis *Commelinae* communis *L.*

In valle fl. Jalu, non procul ab oppidulo Chinensium Mao-ell-schan.

3/14 IX. 1897.

Legit. Komarov.



Fig. 6. *Kalmanago commelinae* on *Commelina communis* (lectotypus)

Three other species on hosts in the *Commelinaceae*, hitherto placed in *Bauerago*, also need to be relocated to *Kalmanago*.

Kalmanago boliviana (M. Piepenbr.) T. Denchev, Denchev, Kemler & Begerow, **comb. nov.** Index Fungorum number: IF 557801

Basionym: *Bauerago boliviana* M. Piepenbr., Ecol. Bolivia 37: 52, 2002.

Typification — On *Commelina* sp., **BOLIVIA**, LA PAZ DEPARTMENT, Pongo de Quime, 12 Jul 1921, leg. White, no. 2256 (holotype BPI 159668; isotype BPI 159669).

For its description and illustrations, see Vánky (2011: 83–84).

Known hosts — On *Commelinaceae*: *Commelina* sp.

Distribution — South America (Bolivia). Known only from the type locality.

Kalmanago combensis (Vánky) T. Denchev, Denchev, Kemler & Begerow, **comb. nov.** Index Fungorum number: IF 557802

Basionym: *Ustilago combensis* Vánky, Mycoscience 35: 358, 1994.

≡ *Bauerago combensis* (Vánky) Denchev, Mycotaxon 87: 128 [in the journal, printed by error as ‘129’], 2003.

Typification — On *Commelina benghalensis* L., **PAKISTAN**, PUNJAB, Murree, August 1952, leg. S. Ahmad, s.n. (holotype HUV 8966).

For its description and illustrations, see Vánky (1994: 358, Figs 8–10).

Known hosts — On *Commelinaceae*: *Commelina benghalensis*.

Distribution — Asia (Pakistan). Known only from the type locality.

Kalmanago tinantiae (J.C. Lindq.) T. Denchev, Denchev, Kemler & Begerow, **comb. nov.** Index Fungorum number: IF 557803

Basionym: *Ustilago tinantiae* J.C. Lindq., Revista Fac. Agron. Univ. Nac. La Plata, ser. 3, 29: 253, 1953.

≡ *Bauerago tinantiae* (J.C. Lindq.) Vánky, Mycotaxon 106: 162, 2009[‘2008’].

Typification — On *Tinantia fugax* Scheidw., **ARGENTINA**, SALTA PROVINCE, Capital Department, Quebrada de San Lorenzo, alt. 1500 m, 19 Mar 1952, leg. H. Sleumer, s.n. (holotype LPS 22062; isotype HUV 13705).

For its description and illustrations, see Vánky (2011: 87–88).

Known hosts — On *Commelinaceae*: *Tinantia fugax*, *Tinantia* sp.

Distribution — South America (Argentina).

Acknowledgements. C.M. Denchev is much obliged to Prof. Yukio Harada (Hirosaki University, Hirosaki, Japan) for the facilities during his visit at the Hirosaki University, in 1999. The authors are grateful to Prof. Makoto Kakishima (University of Tsukuba, Tsukuba, Japan) for critically reading the manuscript.

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