

Species identification and the detection of newly discovered taxa using character parsing and query-based searches based on digitized taxonomic literature

A pilot on arctic *Lactarius*

Fungi are still poorly understood and appreciated compared to plants and animals, despite being one of the most diverse groups of organisms with key ecological roles. Approximately 100,000 species of Eumycota (the true Fungi) have been described, while their true diversity was estimated to be 1.5 to 5 million species. Despite the differences among these estimates, it is clear that we currently know only a fraction of the total fungal biodiversity.

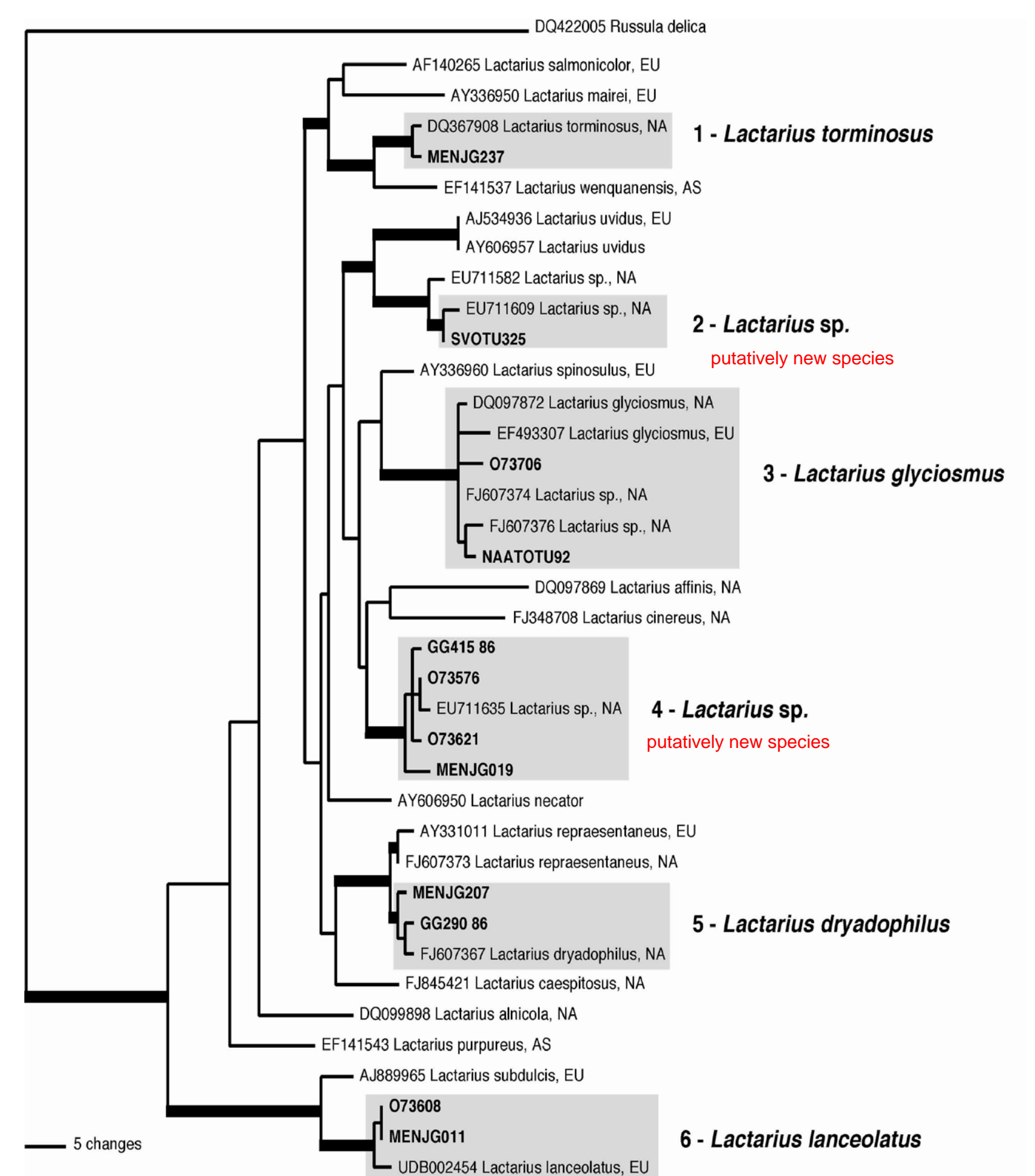
The goal of the fungi pilot is to provide tools that will facilitate taxonomic work by making comparisons of morphological and ecological data more efficient. For this purpose, we focus on the mark-up of the taxonomic literature of arctic *Lactarius* species. This genus works well as a study case, because of the manageable number of arctic species (ca. 20) and available monographs. Moreover, we have recently detected 2-3 putatively new species lineages in the Arctic using molecular phylogenetics and these can serve as a test case for the above comparisons.



L. lanceolatus with *Salix polaris* in the Siberian Arctic (photo: Geml)

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Methodology

1. Mark-up of scanned literature using GoldenGATE Editor



THE GENUS LACTARIUS

***Lactarius dryadophilus* Kühner**
Lactarius dryadophilus Kühner, 1975a: 68. Holotype: Norway, Hardanger (LY).
SYNONYM: *Lactarius dryadophilus* var. *salicicola* Bon & Jamoni in Jamoni & Bon, 1992b: 21.

A medium-sized to large, lilac staining *Lactarius* with a scream-coloured, viscid cap with a bearded margin; growing in arctic and alpine areas.

DESCRIPTION: Cap 30-100(-150) mm, at first convex with a slightly depressed centre and decurved or inrolled margin, sometimes slightly umbonate; surface sticky, viscid, at the margin bearded and tomentose with up to 2 mm long hairs, whitish chrome to pale cream or warm buff but more brownish in the centre, azonate or slightly zonate. Gills adnate, medium broad, crowded, often forked, whitish to pale cream, later pinkish buff. Stem 20-30 × 15-20 mm, typically curved and tapering downwards; surface whitish to pale cream, sometimes yellowish at the base, very finely pitted or with ochraceous spots, especially towards the base. Flesh firm, becoming hollow in the stem, white, changing to lilac; smell fruity, sweetish; taste mild, like cedar wood to very slightly acrid. Milk white, changing to lilac in contact with the flesh. Spore deposit cream.

Spores 9.3-11.8 × 7.2-9.2 μm, av. 10.2-10.3 × 8.1-8.4 μm, broadly ellipsoid to ellipsoid, Q = 1.15-1.40, av. 1.22-1.27; ornamentation up to 0.3 μm high, of rather fine and narrow ridges, often aligned but not forming a reticulum or at most a very incomplete one; isolated warts often elongate; plage inamyloid. Basidia 60-70 × 12-15 μm, subclavate, 4-spored. Pleuromacrocyttidia moderately abundant, 80-120 × 10-15 μm, α -fusiform, tapering to a mucronate apex. Gill edge sterile; cheilomacrocyttidia 40-60 × 7-9 μm, α -fusiform; paracystidia 10-25 × 4-6(-10) μm, cylindrical to tortuous or clavate. Pileipellis an ixocutis to an ixotrichoderm, 150-200 μm thick; hyphae 1-5 μm broad, very thin-walled and shrivelled, gelatinized, repent or ascending, some with conspicuous incrustations.

ECOLOGY AND DISTRIBUTION: Found in arctic and alpine vegetation types on rich, calcareous soils, often in *Dryas*-rich grasslands. Rather rare and known from Fennoscandia, the Alps, the Pyrenees and Greenland, and occurring from August to mid September.

DISCUSSION: The cap is tomentose only to a short distance from the margin, unlike in *L. repraesentaneus*, which also has more yellow colours, a longer stem and a different spore ornamentation.

The original description of *L. groenlandicus* was partly based on this species, but recently lectotypified as a synonym of *L. pubescens* (Knudsen & Lamoure, 1993). *Lactarius dryadophilus* var. *salicicola* Bon & Jamoni was described on a presumably

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2. Parsing trait data¹

Species	Spore length	Spore width	Q ratio	Ornamentation	Milk	Color change	Pileus
<i>L. aspidicus</i>	8.30	6.90	1.21	0.50	white	none	yellow
<i>L. brunneoviolaceus</i>	10.20	7.80	1.33	0.60	watery	none	vinaceous
<i>L. dryadophilus</i>	10.20	8.20	1.25	0.30	white	lilac	cream
<i>L. duplicatus</i>	7.90	6.40	1.25	0.90	white	yellow	orange
<i>L. glyciosmus</i>	7.30	5.60	1.27	0.70	white	none	grey
<i>L. hyssginoides</i>	7.50	5.90	1.24	0.70	white	none	brown
<i>L. lanceolatus</i>	8.90	7.00	1.30	0.60	white	none	orange
<i>L. nanus</i>	7.90	6.30	1.25	0.50	watery	none	vinaceous
<i>L. pseudouvidus</i>	9.20	7.30	1.26	0.30	watery	lilac	grey
<i>L. pubescens</i>	7.00	5.10	1.37	0.50	white	none	cream
<i>L. salicis-herbaceae</i>	9.80	7.60	1.29	0.25	white	none	cream
<i>L. salicis-reticulatae</i>	10.40	8.80	1.18	0.30	white	lilac	cream
<i>L. subcircellatus</i>	9.10	7.40	1.22	0.50	white	none	grey
<i>L. torminosus</i>	8.40	6.20	1.34	0.50	white	none	pink
<i>L. trivialis</i>	8.60	6.90	1.25	1.00	cream	green	vinaceous
<i>L. uvidus</i>	9.40	7.60	1.26	0.80	cream	lilac	grey

¹Parsing was done by hand for this table to show the required format, but it will be done in the future by CharaParser or similar methods.

3. Query-based search and filtering of quantitative and qualitative trait values using Shiny in R

