DICHOTOMOUS KEY TO LACHNELLULA (worldwide)

(*Trichoscyphelloideae*, *Lachnaceae*, *Helotiales*, Ascomycetes),
with a synoptic table of characters
(H.O. Baral, Feb. 2000, with updates until 2008, unpublished)

The genus *Lachnellula* forms a rather natural group of macroscopically very similar species growing exclusively on bark, more rarely wood or resin of conifers. One of them, *L. willkommii*, is well-known as a possible cause of Larch canker. Species concepts in the genus are still in an nonsatisfying condition due to lack of adequate descriptions of several taxa, and little information on specimen from remote areas. The present key contains ca. 30 more or less accepted taxa (29 species and 1 variety), all growing on conifers. The list of species names contains further 3 unclear and 17 excluded taxa (on angiosperm substrates). These are not treated in the key.

The present key is the result of intense personal studies on mainly fresh living specimens. It takes care of some often neglected characters like croziers, iodine reaction in Lugol's solution, and ascospore guttulation in the living state. Many data and references of literature available to the author are incorporated. The idea is to continuously complete this key by additional information and results, and by further literature. The reader is encouraged to inform the author about errors or missing data. Ecological data (distribution, host range, phenology) need to be completed, as well as morphological data. No records from Africa (incl. Macaronesia) and S-America were available.

Abbreviations:

Reagents: CR = Congo Red in NH_4OH, **CB** = cotton blue in lactic acid or lactophenol, **H_2O** = tap water, **IKI** = strong Lugol's solution (≈1 % I_2, ≈2 % KI, in H_2O), **KOH** = potassium hydroxide ≈5 %, **MLZ** = Melzer's Reagent (≈1 % I_2, ≈2 % KI, 50% H_2O, 50 % chloral hydrate), **NH_4OH** = ammonium hydroxide
Lipid: LB = lipid body ("oil drop"), relative lipid content of ascospores (**LC**): **0** = without lipid (eguttulate), **1**= ≈3 % oil content, **2** = ≈10 %, **3** = ≈25 %, **4** = ≈50 %, **5** = ≈80 % (maximum possible lipid content)
Iodine reaction: BB = blue at any iodine concentration, **RB** = blue at low, red at high iodine concentration, **RR** = red at any iodine concentration

General remarks:

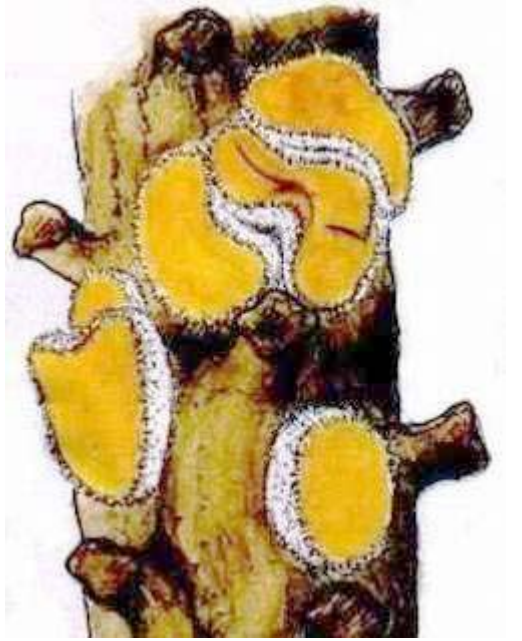
Apothecia:

Lachnellula abietis

Capitotricha bicolor	

L. subtilissima (inamyloid form)

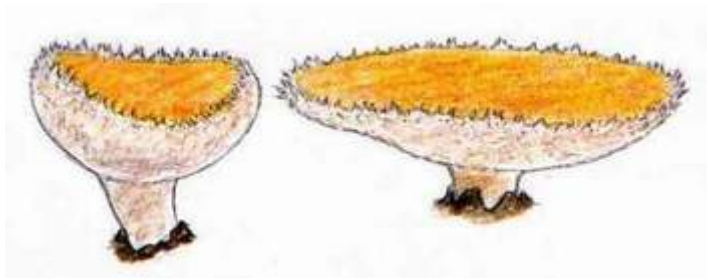
L. calyciformis



L. splendens

L. resinaria var. calycina

L- resinaria var. resinaria



L. mugonicola

L. mugonicola

L. laricis (Mongolia)

L. flavovirens

L. flavovirens

L. fuscosanguinea

L. arida (Mongolia)

L. fuscosanguinea (above: dry state, right: same group rehydrated)

Shrinking effect:

Dead cells (asci, spores, sterile elements) are often considerably smaller compared to living ones. This shrinkage can easily be demonstrated in fresh material when applying lethal media. In herbarium material, however, the sizes of the dead cells differ only slightly among the used media (H_2O, KOH, MLZ etc.). Whenever possible, microfeatures and cell sizes were evaluated in the living state in tap water (for vital taxonomy see BARAL, 1992). Cell sizes in lethal media like KOH or MLZ are often added in order to allow comparison with literature data which are mainly gained from dead material. Since in water mounts both living and dead cells use to occur side by side, simply citing "in H_2O" is insufficient.
- Observed approximate linear shrinkage in *Lachnellula*:
Ascus length: 10-20(-30?) %, width: dto.
Ascospore length: 5-10 %, width: 5-15 %

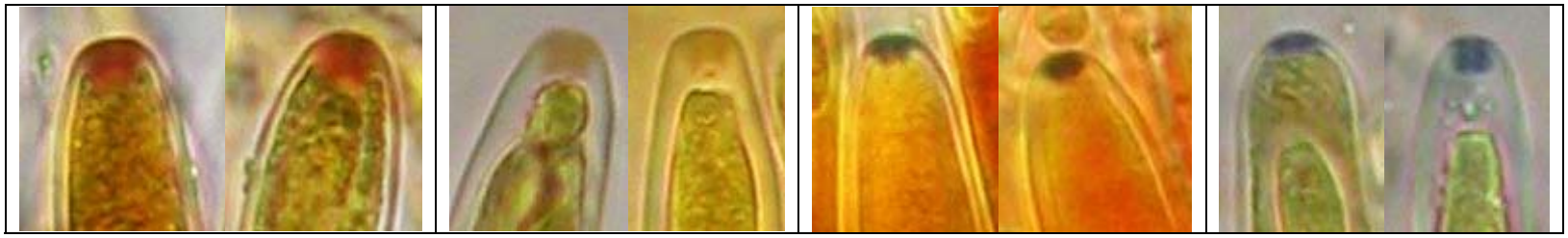
Iodine test:

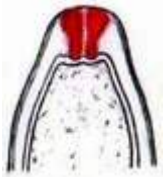
Phenomenon of hemiamyloidity: Diagnosing hemiamyloidity requires the use of Lugol's solution (= IKI). KOH-pretreatment is not necessary for diagnosing hemiamyloidity of apical rings of asci. Application of IKI to apical rings yields a brownish or purplish-red stain ("type RR"), or sometimes first a blue stain which changes to dirty reddish when the concentration of iodine increases ("type RB"). MLZ gives a negative or only faintly reddish reaction in type RR and RB, or sometimes a faintly blue in type RB, whereas KOH-pretreated material gives a very distinct blackish-blue reaction in both IKI as well as MLZ. KOH-pretreatment is done by applying a drop of 2-5 % KOH for 10 sec (heating not necessary, though recommended in critical cases), ample iodine directly added afterwards by removing as much KOH as possible beforehand. - A faint hemiamyloid reaction (IKI rose, KOH+IKI pale violet) occurs in the ectal excipulum of some species (*L. resinaria*, *L. calycina*, *L. laricis*).

	directly applied		KOH-pretreated	
	IKI	MLZ	IKI	MLZ
inamyloid-	-	-	-	
hemiamyloid	RR	-	BB	BB
	RB	(B)	BB	BB
euamyloid	BB	BB	BB	BB

Example: Hemiamyloid apical rings (type RR) in *Lachnellula laricis* (H.B. 7898)

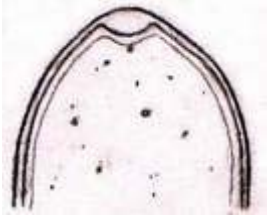
IKI without KOH	MLZ without KOH	IKI after KOH (unheated)	MLZ after KOH (heated)



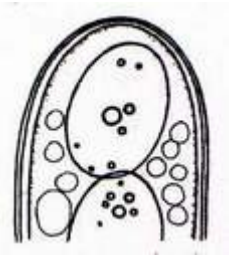


L. angustispora (hemiamyloid)

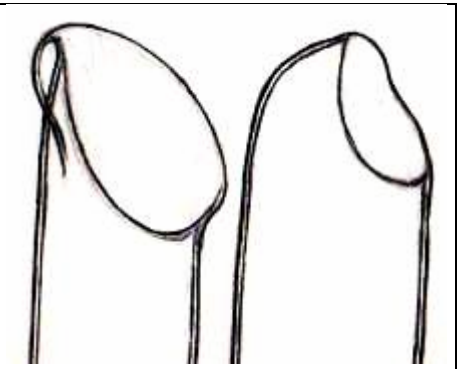
L. calyciformis



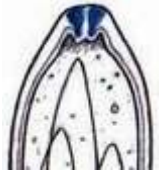
L. splendens



L. robusta

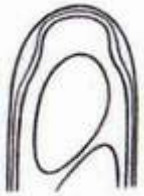


L. robusta, apices of discharged asci



L. ellisiana (euamyloid)

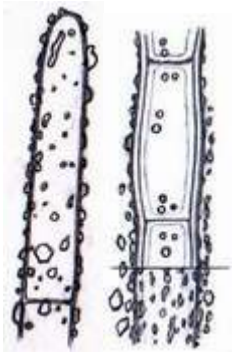
L. gallica,



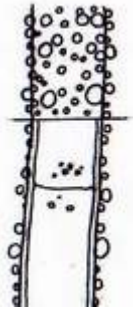
L. arida

Ascus types in Lachnellula (left: with amyloid ring, rest: inamyloid, with thin apical or subapical thickenings)

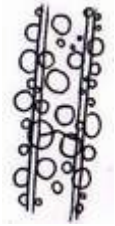
L. arida



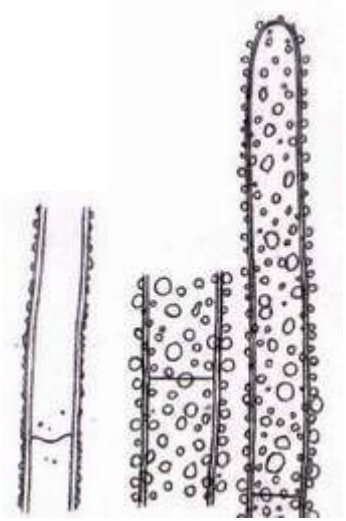
L. calycina, resinaria



L. gallica

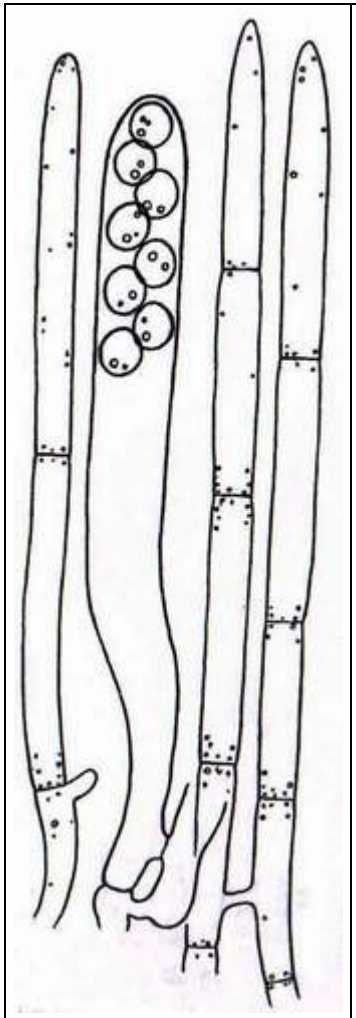


L. kamtschatica



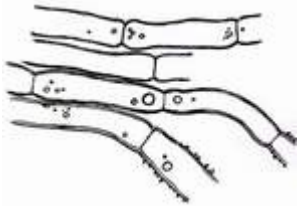
L. mugonicola

Hairs in Lachnellula: cell wall hyaline, rarely brown, warts globose, rarely angular-crystalloid

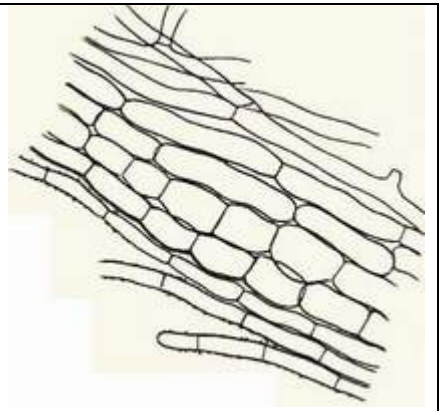


L. calycina

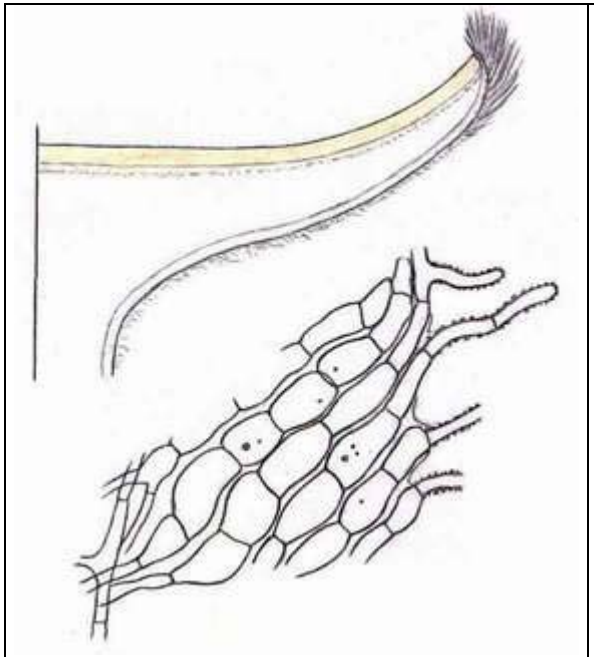
Asci and paraphyses in Lachnellula



L. resinaria (horizontal textura porrecta)



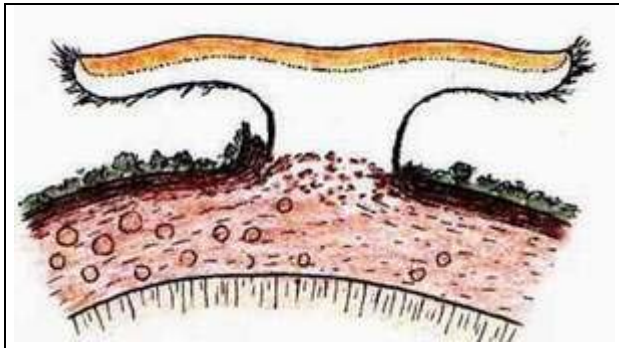
L. calyciformis (horizontal t. prismatica)



L. mugonicola (textura prismatica orientedat 45°)

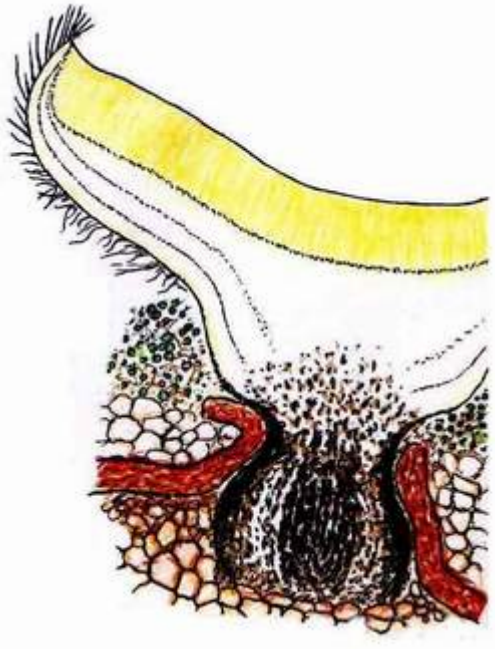
L. robusta (textura globulosa-oblita oriented at 45-90°)

Ectal excipulum in *Lachnellula*



L. robusta

Median section of apothecia showing erumpent growth from beneath outermost bark by pushing off the dark red-brown periderm.



L. splendens

Asci: Although sometimes variable in *Lachnellula*, the iodine test remains a highly useful tool in ascomycete taxonomy (Baral 1987). Most species of *Lachnellula* have permanently inamyloid asci (IKI, with or without KOH-pretreatment, always with only very slight apical wall thickenings). This is typical of xerotolerant discomycetes tending to grow as aerophytes. If an IKI-positive, ± thick apical ring is present, this is always of the *Calycina*-type. In most of these species the iodine reaction is hemiamyloid (type RR or RB, exception: *L. ellisiana*: BB).

In my paper on *Lachnellula* (1984) I reported the red reaction but was still unaware of the differences concerning the applied reagents, therefore erroneously wrote "Melzer" and "dextrinoid" instead of "Lugol" and "hemiamyloid". Literature reports of "negative" or "blue" reactions should be re-examined because, without indicating the method, both statements might refer to the same hemiamyloid type of reaction. In herbarium material older than ca. 50-100 years red (RR) reacting rings may have changed to react blue (RB or BB) without being KOH-pretreated.

Dharne (1965) or Dennis (1949) reported only blue versus negative reactions, since they probably used MLZ on KOH-pretreated material. Earlier authors often neglected the iodine test. The presence of an amyloid ring is faintly visible already in water (or KOH) mounts, and was indirectly reported as "enclosing membrane ... not following the contour of the ascus at the apex" (Bingham & Ehrlich, 1943: 106, *L. agassizii*) without applying iodine.

Variation in the iodine reaction was observed in complexes like *L. subtilissima* and *L. willkommii*/*occidentalis*. In *L. occidentalis* IKI-positive and IKI-negative mature asci occur often within a single apothecium. Rare deviations from the usual behaviour are known from e.g. *L. resinaria* (usually IKI-)and *L. suecica* (usually IKI+). Such variability is very rare in the Helotiales, and probably has, together with the difficult case of hemiamyloidity, caused workers like Cooke (1876) to completely abandon the iodine test. Huhtinen (1993: 194) indicated that 3 different reactions (blue, red, and negative) were reported for *L. subtilissima*; this is, however, mainly a result of the methods. These phenomena must have escaped Dharne's notice when constructing his key which starts with the iodine test almost at the beginning.

Tissue: A hemiamyloid reaction of the gelatinized intercellular matrix of the medullary and ectal excipulum of the apothecial stipes is observed in *L. resinaria* and *L. calycina*, slightly also in *L. laricis*, but so far not in other species of the genus. The same phenomenon is known from the whole ectal excipulum of different species of *Proliferodiscus* and *Perrotia* (see BARAL 1987: 423), a feature which illustrates the relationship of these genera. The observed rose-red IKI-reaction is absent in MLZ, and can be converted by KOH-pretreatment (few min unheated, or few sec heated) into a purplish-violet reaction (in IKI or MLZ) and a bright (greyish-)blue when rinsing the mount with water. Similar red MLZ-reactions reported as "dextrinoid" for the excipula of *Proliferodiscus* species by Haines & Dumont (1983) and Spooner (1987) should betested fro hemiamyloidity.

Carotenoids: The yellow LBs in the paraphyses and excipular cells yield a dirty blue-green iodine reaction (IKI or MLZ, independent of KOH-treatment) due to the presence of yellow carotenoids.

Glycogen: Glycogen depots in ascospores stain red-brown in both IKI and MLZ (with or without KOH-pretreatment).
Such invariably reddish reactions are termed dextrinoid.

Cell inclusions:

LBs in ascospores: Vital observation is essential when using oil drop patterns (lipid bodies, LBs) for taxonomy, since LBs in dead spores often coalesce to form variable patterns. Secondly, they gradually disappear in post-mature stages (even when the spores remain within the dead asci). A third source of errors is the applied medium: if only dead herbarium material is available, this must be studied in KOH (or NH_4OH) because lipids become nearly invisible (masked) when mounted in media like H_2O, MLZ or CB, but gain in KOH an immensely increased contrast against the surrounding plasma. Such effects of artificial variability influenced e.g. SPOONER (1987: 614) to state the completely unjustified opinion, that spore guttulation is inconsistent and therefore of doubtful taxonomic significance (SPOONER saw only in a few collections some guttulate spores). Not all drops are lipids: LBs are recognized by their strong refractivity in the living plasma (in tap water) und by their insolubility in KOH (BARAL 1992: 357).


Glycogen regions in spores of *L. laricis*

LBs in ascospores are nearly always ± small in *Lachnellula*, therefore reports of large drops should refer to artificial coalescence. The only exception known to me is *L. abietis* with 2-4 large LBs in each spore.

--- Bild multigutt. robusta -> 1 large LB---

LBs in paraphyses and excipular cells: Refractive guttules within sterile tissue of *Lachnellula* are always LBs and mostly yellow-orange due to carotenoids.

--- Bild Paraph. farbig ----

Glycogen: This forms one or two large, ± spherical bodies of very low refraction in the living sporoplasm. Glycogen bodies stain red-brown (dextrinoid) in iodine. They are typically surrounded by small LBs by forming a hollow sphere. In KOH they are completely invisible, and the LB-sphere usually becomes disordered.

--- Bild splendens in IKI, mit Nucleus ---

Nuclei: In one species (*L. splendens*) nuclei were observed in the living spores (in tap water, the contrast increases when adding small amounts of IKI). The nuclear plasma appears as a transparent unstructured region while the nucleolus is of medium refractivity and adhers to the nuclear membrane.

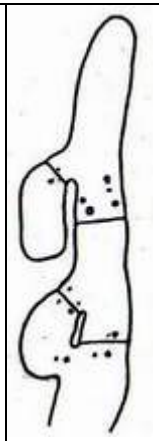
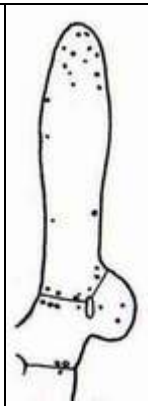
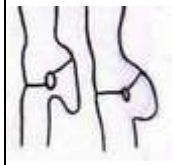
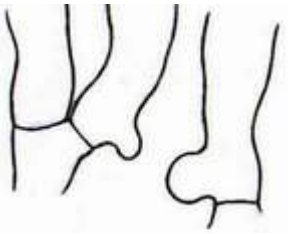
Drought-tolerance: Members of *Lachnellula* are drought-tolerant (xerotolerant), that means they produce their ascocarps on branches that protrude into the air (aerophytes), and dry down rapidly during periods of sunny or dry weather, while during wet times they immediately revive and continue maturation or sporulation. Nevertheless they are often collected on branches with close contact to the ground, as a result of the current method to neglect dry substrates, as a result of the fact that they partly or entirely close their bright yellow-orange hymenium in the faded, dry state (in contrast to a habitually similar basidiomycete growing in the same habitats, *Aleurodiscus amorphus*), thus become very inconspicuous. The mentioned height of the branches above ground level therefore depends on the method of collecting, and further usually neglects branches hanging higher than ca. 2.5-3 m. It is

only half of the truth that they grow as aerophytes "only in forests with especially moist air or rich in snow" (BARAL, 1984: 144), an error that comes from the common opinion that fungi need a permanently moist environment. Some species (e. g. *L. gallica*, *L. calyciformis*, *L. subtilissima*) appear in great number on previously cut larger parts of the crown now lying with only partial contact on the grownd, which indicates presence of mycelium within the living substrate (endophytic growth). Within *Lachnellula*, mature asci show the lowest tolerance to drought (min. 6 weeks), ascospores the highest (min. 6 months). Tests on drought tolerance were made according to BARAL (1992: 378).

--- evtl. Bild vom Standort ----

Phenology: The given data refer to the Northern hemisphere (mainly Central Europe).

Croziers: In many genera of the Helotiales the ascus base is a constant and important character. In *Lachnellula* this was introduced by BARAL (1984) as a valuable additional feature, but there is considerable variation in many of the included species: even when an ascus attains maturity, the lateral protuberance of a cell of the ascogenous hyphae often does not fuse with its cell below while others within an apothecium do so by forming a true crozier. The percentage of such septate or aseptate basal protuberances or "unfinished croziers" varies among the collections. Mainly unfinished croziers were seen in *L. abietis*. Variation between simple septa and croziers is found in species complexes like *L. arida*, *L. subtilissima*, *L. willkommii*, or *L. calyciformis*. Further material needs to be examined to prove whether or not different taxa should be separated. Constently present croziers were observed, e.g., in *L. gallica*, *L. robusta*, *L. resinaria* and *L. calycina*. In those species having croziers, nearly all of the croziers are provided with a perforation ("medaillon-shaped", the lateral protuberance forms an arch), and this type of crozier is also known from the closely related genera *Perrotia* and *Trichopeziza*, and also from "*Dasyscyphus*" *scabrovillosus* which is possibly a *Capitotricha*.

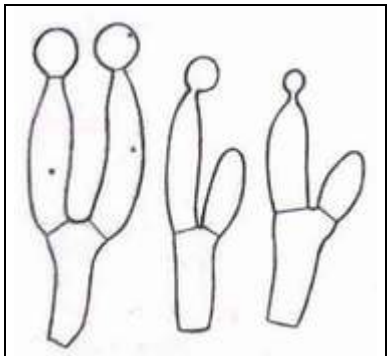
	 *L. angustispora*	 *L. kamtschaticam*	 *L. mugonicola*		 *L. plendens*
Croziers without perforation	**Croziers with perforation**			**Simple septate, with septate protuberance**	**Simple septate, with aseptate protuberance**

Croziers are generally neglected because of the apparent difficulty to see them. They are best studied in sections of living apothecia. With herbarium material the use of KOH or NH_4OH (best followed by a small drop of CR), and strong squeezing of the mount is recommended.

Paraphyses: are unbranched near apex, straight, cylindrical to subclavate or sublanceolate; in later stages they frequently form irregular subapical or lateral outgrowths; sometimes they may become ± moniliform. The yellow-orange color of the hymenial discs is due to the carotenoids in the LBs within the paraphyses.

--- Bild Paraphysenformen ----

Anamorph: Ascospore cultures in *Lachnellula* frequently develop an anamorph currently assigned to the genus *Naemospora* Roth ex Kuntze (or Naemaspora?). The microconidia (in the key termed "conidia") are produced in labyrinthiform cavities within small, erumpent, ± yellowish stromata which can sometimes also be found close to the apothecia on the branches.



Naemospora* anamorph of *L. resinaria

LACHNELLULA P. Karsten 1884

Type: *Lachnellula chrysophthalma* (= *L. suecica*)
= *Trichoscyphella* Nannf. (1932)
≡ *Trichoscypha* Boud. (1885) non Hook. (1869)
Type: *Trichoscyphella calycina* (= *L. subtilissima*)

The genus was for a long time restricted to a few globose-spored species. Those with elongate spores were mainly placed in *Dasyscypha* Fuck. and *Lachnella* Fr., and later in *Trichoscyphella* Nannf. Following Dharne (1965), Baral (1984) and Baral & Matheis (2000), the genus is here restricted to conifer-inhabiting species. Dharne's concept is enlarged to include also ± smooth-haired taxa (*L. abietis*, *L. ellisiana*, *L. pseudofarinacea*), and my previous concept is here enlarged to include also taxa with euamyloid apical rings (*L. ellisiana*). A larger number of species on angiosperm plants have been transferred to the genus (Dennis 1962; Kohn 1980, 1981; Spooner 1987) but these differ morphologically and are therefore here removed from the genus (some belong in *Proliferodiscus*, see list of excludued taxa).

Keys: Dharne (1965, world, 17 spp.), Raitviir (1970: world, 23 spp., partly in *Perrotia*; 1980, 1991: Russia), Breitenbach & Kränzlin (1981: pl. 229-237: Switzerland, colour plates), Spooner (1987: Australasia, ca. 6 spp., partly in *Perrotia*), Baral (1984: Europe, 22 spp.).

KEY TO WORLD SPECIES OF LACHNELLULA

1. Hairs or at least outer region of ectal excipulum with distinctly light ochre to dark brown wall pigmentation; apothecia therefore externally distinctly deep ochraceous to dark brown; restricted to subalpine-boreal regions (?*L. angustispora*) ..... 2 (**Brown-haired species of Lachnellula**)
1. Hairs completely hyaline; apothecia externally pure white-haired, sometimes translucent pale yellowish-reddish, stipe base sometimes dark brown; asci IKI- or IKI+; planar to subalpine-boreal ..... 10 (**White-haired species of Lachnellula**)

Brown-haired species of Lachnellula

2. Sp. spherical, 3.5 µm diam., asci 55-60 x 6-7 µm, apoth. externally rufo-cinereous, disc. fresh pale orange ..... ***L. microspora*** Ellis & Everh.

On bark of *Pinus*, *Abies sacchalinensis*, boreal, E-Canada, Japan. Imperfectly known species. Ref.: Saccardo (1895: 411), Seaver (1951; 283), Takahashi (1979: 101, pl. VIII).

2. Sp. elllipsoid-ciborioid-oblong 3

3 Asci IKI deep red (RR): see *L. angustispora* ..... (→ 34)
3 Asci IKI- 4

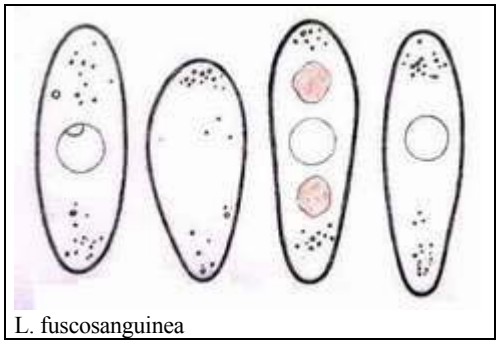
4. Spores *(10-)12-17-22 µm long 5
4. Spores *6.5-12(-13) µm long 7

5. Spores 13-22 x (4.4-)**5-7** µm, LBs?, overripe 1(-3)-septate, asci †**88-125** x 7-12 µm, hairs pale olive-buff, 3-4 µm wide, long hairs with slender apices (1-2 µm), disc bright orange, no anamorph; **parasitic** ..... ***L. pini*** (Brunch.) Dennis

On resinous cankers on branches of *Pinus sylvestris*, *P. mugo*, *P. pumila*, *P. sibirica*, *P. albicaulis*, *P. monticola*, *P. strobus*, montane-boreal, (V)VII-IX(XI), Scandinavia, rare in Russia (European part, Ural, Altai-region, Far East), Japan, USA (900-1800m, here only on 5-needled pines). Ref.: Raitviir (1980: 97, 1991: 322), Vaartaja (1953), Hahn & Ayers (1934: 487), Takahashi (1979, pl. IX, X). Saprophytic forms intermediate with *L. fuscosanguinea* occur in S-Finland (Vaartaja). *Dasyscypha bubakii* Klika (1922) on bark and cones of *Pinus mugo* from Slovakia (Tatra, 1500-1600m) seems to be a synonym.

5. Spores *(10-)12-17(-19) x (3.5-)**4-5.5(**-6.2) µm, without or with many minute LBs near each end (LC 0-2); asci *80-116 x 9-11.5(-12) µm, †**70-90** x 8-11 µm, with septate protuberance or croziers; hairs 140-250 x 3.5-5 µm, pale to light yellowish-reddish-ochre, apically not narrowed, wall †0.3-0.8(-1.3) µm thick; ectal excipulum of horizontal, hyaline, ± gelatinized, textura prismatica-angularis covered by a thin? fox-ochre t. porrecta(-oblita); disc bright egg-yellow-orange (lit.: also blood-red); **saprophytic to weakly parasitic** ..... ***L. fuscosanguinea*** (Rehm) Dennis

On undecayed bark of mostly hanging twigs and branches of *Pinus mugo*, more rarely *P. cembra*, *P. sylvestris*, subalpine-boreal, 0.3-1.8 m above ground, V-X, frequent in Central Europe (Alps, 1250-2000 m), Skandinavien, ?N-America. Ref.: Dharne (1965: 139), Kujala (1950: 26), Breitenbach & Kränzlin (1981: pl. 232), Baral (1984), Hahn & Ayers (1934: 484), Svrček (1962), Breitenbach & Kränzlin (1981: pl. 231, as *L. flavovirens*; 232), Galán et al. (1997: 140), Schmid-Heckel (1985: 61, 1988: 24), Schmid & Schmid (1991: pl. 69), Kahr et al. (2009).


L. fuscosanguinea

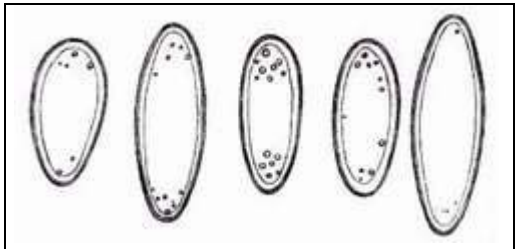
7. Spores †5.5-8 x 2.5-3.(-3.5) µm, fusoid-subclavate, with few small LBs; hairs -120 x **2-3.4** µm (Holm: -180 x 4), pale ochraceous, (?)thin-walled; disc deep yellow; asci IKI-, partly with croziers; ectal excipulum, pale ochraceous, texture? ..... ***L. juniperina*** (K. & L. Holm) Vesterholt (in Knudsen & Hansen 1996)

On bark of twigs of *Juniperus nana* and *J. communis* close to small wounds, subalpine-alpine, VIII, Scandinavia (1100 m). Ref.: Holm & Holm (1977: 13), Knudsen & Hansen (1996), Baral (in prep.).

7. Spores ***3.3-5.5** µm wide, ellipsoid, hairs more brown, with (olivaceous-)ochraceous large warts 8

8. Hairs 100-320 x **4-5** µm, pale to bright fox-ochre to greybrown, ???only sligtly tapering towards apex, wall **0.3-0.4** µm thick; spores †6.5-10(-13) x 3.5-5.2 µm with a few minute LBs at each end; asci with croziers or septate protuberances; ectal excipulum of ± strongly gelatinized textura prismatica-oblita (30-90°) partly covered by a fox-ochre text. porrecta-oblita; apoth. 1.5-4.5 mm diam., disc bright yellow-olivaceous-ochraceous; conidia 3 x 1.5 µm ..... ***L. flavovirens*** (Bres.) Dennis

On bark of ?hanging branches (rarely needles) of *Larix*, *Picea*, *Pinus* (*mugo*, *cembra*), *Juniperus*, *Abies*, fully developed when still covered by snow, V-IX, subalpine, infrequent in Europe (Alps, e.g. 1800-2000 m), Russia (Ural, Kasachstan, Altai-region, Far East), N-America (esp. NW regions). Very close to *L. fuscosanguinea*; ascus and spore size seem the only good characters (also fide Dharne). Colour of disc and hairs, also hair warts might be additional characters. Ref. Bresadola (1887, n.v,), Dharne (1965: 137), Müller (1977: 50), Raitviir (1980: 96, 1991: 321), Funk (1981: 87). Breitenbach & Kränzlin (1981: pl. 231) is possibly *L. fuscosanguinea*, Bresadola (1927: pl.


L. flavovirens (dead state)

MCCXXXIX) is *L. arida*!

8. Hairs 100-300 x **4-7(-8)** µm, light to deep ochre- or reddish-brown, gradually tapering towards the subhyaline apex, wall **0.2-0.8** µm thick; ectal excipulum text. angularis (prismatic near margin), slightly to strongly gelatinized, cortex deep fox-ochre to red-brown; apothecia 1.5-8 mm, disc bright to deep yellow-orange, dry hysterioid 9

9. Asci arising from **simple septa** (without or with aseptate protuberances); spores mature without or with a few minute LBs at each end (up to 0.4 µm, LC 0-1), *(7-)7.5-9.5(-10.3) x 4.2-5(–5.5) µm (†3.8-4.4 µm wide); paraphyses cylindrical-subclavate; [Lit.: conidia 2-4 x 1.3-1.8 µm]; apoth. 1-8 mm diam. ..... ***L. arida*** (W. Phillips) Dennis

On bark of twigs [rarely needles] of *Larix decidua*, *L. sibirica*, rarely on *Pinus cembra*, *P. mugo*, *Picea*, ± below snow, montane-subalpine, V-IX, Europe (Alps: Saas, Dachstein, Hochschwab, 1700-2000 m), Asia (Himalaya, Mongolia, Japan), N-America. Apparently a variable or collective species (see following lead). The characters croziers and spore guttulation are currently neglected and so far unexamined in the type material. The studied material is too scanty to decide whether these characters are variable, or indicative of different taxa. Ref.: Dharne (1965: 136), Müller (1977: 50), Breitenbach & Kränzlin (1981: pl. 229, Saas, *Larix*, possibly belongs to the form without croziers), Baral (1984: 152; in prep.), Bresadola (1927: pl. MCCXXXIX, as *D. flavovirens*), Oguchi (1981: 165), Kahr et al. (2009).

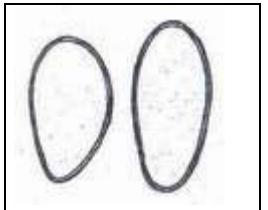
9. Asci arising from **croziers** (in collection from Alps often only with septate protuberances): two forms (?)

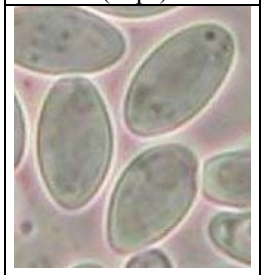
- spores mature with several LBs upto 1 µm diam. (LC (1-)2-3), *6-9 x 3.3-4.5 µm; asci with croziers; paraphyses slightly tapering at apex; apoth. 1.5-3.5 mm diam.; ..... ***L.*** aff. ***arida***

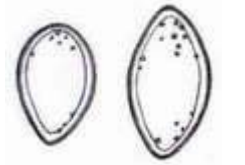
On bark and resin of dry hanging twigs of *Abies magnifica*, *Pseudotsuga*, ?*Pinus edulis* (?or *Juniperus*), Midwest of USA (Rocky Mts., 1900-2980 m). Ref.: Baral (in prep.), compare also reports of "*arida*" by Harkness (1877: 117, n.v.) and Smerlis (1973, n.v.).

- spores mature with a few to several minute LBs (LC 0-1, immature 2), *6-9(-10) x 3.5-5 µm; asci with croziers or septate protuberances; paraphyses cylindrical; apoth. 1-8 mm diam. ..... ***L.*** aff. ***arida***

On *Abies balsamea*, *Larix*, Canada (Alberta), Europe (Alps: Aletschwald). Perhaps only a variant of the preceeding.


L. arida (Alps)


L. arida (Mongolia)

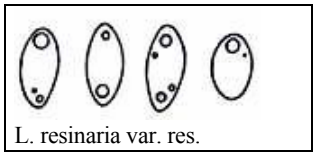

L. aff. arida (Canada, dead state)

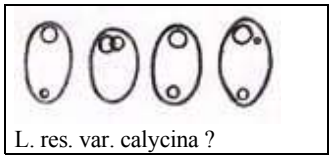
White-haired species of Lachnellula

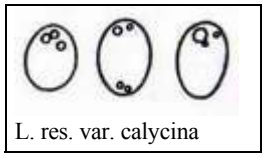
10. Spores *(2-)2.5-4(-4.5) µm long, basal excipular tissue of apothecia hemiamyloid (IKI reddish, KOH+IKI violaceous); asci IKI- (lit.: also J+), arising from croziers; ectal excipulum of ± gelatinized textura prismatica-porrecta; hairs 50-130 µm long, with ± round to mostly irregularly elongate-crystalloid, partly detaching warts; paraphyses consistently narrow-sublanceolate 12
10. Spores min. *(4-)4.5-6 µm long, basal excipular tissue of apothecia inamyloid (rarely faintly hemiamyloid: *L. laricis*) 13

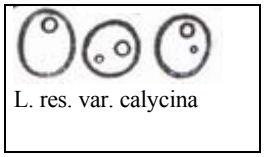
12. Spores (ovoid-)**ellipsoid-fusoid**, *(2.5-)3-4.7 x 1.6-2.4 (†2.5-4 x 1.5-2) µm, with **± symmetrical guttulation**: (0-)1-3 LBs in each end; asci *35-54 x 4.2-5.2 (†3.7-4.2) µm, IKI-; pycnidia hemispherical to flat-convex, white to pale orange, 0.25-0.7 mm diam., conidia ± globose, *2.2-3(-3.5) x 2-2.8(-3.3) µm, with 1-2 small excentric LBs ..... ***L. resinaria*** (Cooke & Phill.) Rehm ***var. resinaria***

On mainly recently killed twigs to stems, on bark or wood, mostly in blackened resinous wounds of cankers, mostly of *Picea*, also *Pinus*, *Abies*, *Larix*, ca. 1-2.5 m above ground, (colline-)montane(-subalpine), II-XI, not rare in Central & S-Europe (100-1800(-2000?) m), N-USA, Russia (Estland, Far East). Very close to *L. calycina*; spore width and L/W-ratio overlap between the two varieties. Dharne reported the asci as J+ "blue" while Galán and Baral & Matheis found a consistent negative IKI-reaction in totally 16 collections. Ref.: Cooke (1875), Ferdinandsen & Joergensen (1938: 191), Grelet (1951: 90), Dharne (1965: 123), Raitviir (1980: 89, 1991: 316), Hanso (1978: 4), Anderson (1902), Kujala (1950: 28), Galán (1985: 117), Ellis & Ellis (1985: 168), Sacconi (1985: 10), Baral & Matheis (2000), Kahr et al. (2009).


L. resinaria var. res.

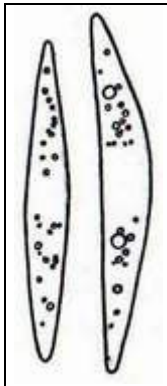

L. res. var. calycina ?

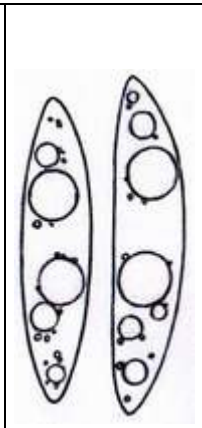

L. res. var. calycina

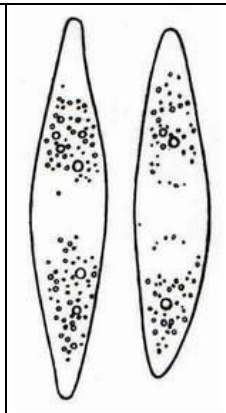

L. res. var. calycina

12. Spores **subglobose**(-ellipsoid-ovoid), *(2.3-)2.5-3(-3.5) x 2-2.5(-2.8) (†1.9-2.5) µm, with ca. 1-4 small, **nearly always ly asymmetrically arranged LBs**; asci *39-50 x 4.6-5.5 (†4.2-5) µm, IKI-; conidia ellipsoid-ovoid, 3.5-4.8 x ??? µm ..... ***L. resinaria var. calycina*** **(**Sacc.) Baral

On wood and bark of branches or stems of *Pinus contorta*, *P. sylvestris*, *P. mugo*, *P. pinaster*, *P. radiata*, *P. strobus*, rarely on *Picea*, *Cupressus*, 0-4 m above ground, sometimes associated with resin but mostly not so, never on cankers, planar-colline (XII-VI, apparently atlantic) or subalpine (VII-IX), rare in Europe (20-450 or 1725-2350 m), New Zealand (introduced). The isodiametrical cells treated by Raitviir as difference against *L. resinaria* are present in both varieties only at the apothecial base. The literature reports always globose spores and association with resin, only Kujala stresses the subglobose shape. In one collection a few asci with ellipsoid, partly biguttulate spores occurred among the subglobose-spored asci. Var. *calycinpa* differs from var. *resinaria* only in spore shape, and in the preference of more decayed, less resinous branches of *Pinus* without cankers. Ref.: Vuillemin (1888: LXX, "*Trichoscypha calycina* (Schum. pro parte ?)"; Saccardo (1889: 391), Kirschstein (1938: 398, *resinaria*), Ferdinandsen & Joergensen (1938: 191, *rehmii*), Kujala (1950: 28), Grelet (1951: 90), Gremmen (1960: 278), Raitv. (1980: 88), Spooner (1987: 430), Dennis (1961: 302), Stephan & Butin (1980), Baral & Matheis (2000), Kahr et al. (2009).


L. ellisiana


L. abietis


L. splendens

13. Spores long-filiform with tapered ends, †60-97 x 1.5-2.3 µm, ca. 7-septate; ascus apex conical, strongly hemiamyloid (RB), with croziers (with small perforation); hairs 100-300 x 3-5 µm, smooth, slightly tapering towards apex, with loose resinous granules and lumps; paraphyses sublanceolate ..... ***L. pseudofarinacea*** (P. & H. Crouan) Dennis

On bark of dead branches or stems of *Pinus maritima*, *P. sylvestris*, *P. brutia*, planar, IV, IX, XI-I, ozeanic Europe (near Atlantic, Baltic and Mediterranean see). Ref.: Le Gal (1953: 95), Raitv. (1980: 87), Hanso (1978: 4), Dennis (1949: 95, as Tax. sp. 3).

13. Spores globose, ellipsoid to fusoid, 4-35 µm long, max. 3-septate 14

14. Spores fusiform-naviculiform with distinctly attenuated, ± acute ends, 11.5-35 µm long, l/w-ratio min. 3.5-4; asci IKI- or blue (BB) 15
14. Spores ovoid, ellipsoid, oblong, with rounded ends (rarely one end acute), l/w-ratio max. 3.3, if fusoid: spores shorter 18

15. Spores †15-22(-28?) x **2-3** µm, with many small LBs (max. ≈1 µm, LC 3), remaining aseptate (?); asci †54-72 x 6.5-8.3 µm, **IKI deep blue (BB)**, with croziers; hairs 50-150(-200) µm long, **smooth** (but sometimes granulate on flanks), towards apex **not tapered and densely septate**; paraphyses distinctly sublanceolate; anamorph yellowish-green, conidia 5-5.8 x 0.9-1.2 µm, fusoid ..... ***L. ellisiana*** (Rehm) Baral comb. nov.

On bark of branches of *Pinus*, *Picea*, *Larix*, *Pseudotsuga*, saprobe (parasitic on introduced trees), planar-colline ("lowlands"), I-XII (anamorph: during summer), ?not rare in E- & S-USA (close to atlantic seabord). Spore shape and smooth hairs indicate close relationship to European *L. abietis*. The species was confused with *Lachnum lachnoderma* on angiosperm plants. If substrate angiosperm compare also *Dasyscyphus scabrovillosus* (Phill.) Sacc. (=*Lachnellula dabaensis* Zhuang). Ref.: Hahn & Ayers (1934: 169), Seaver (1951: 248), Baral (in prep.), Massee (1896/97: 503).

15. Spores * **min. 3.4** µm wide, becoming septate when overmature, asci **IKI-** 16

16. Spores ***(12.5-)14-19(-21) x (3.4-)3.8-4.3(-4.8)** µm, naviculiform, with 1-2 large (**2-3.2** µm) and some small LBs in each half (living mature state), no glycogen; asci ***(65-)72-95(-106) x 10.8-13(-14)** µm, opening by an operculum, always with a basal, mostly **septate** downward protuberance, sometimes forming a crozier; hairs 100-300 µm long, apical part **smooth**, **± tapered**, lower part slightly rough or nearly smooth, usually covered by **± low, easily detaching warts** (0.1-0.3 µm) of **irregular** (crystalloid) shape, hairs often agglutinated to form distinct teeth; paraphyses *2-3 µm wide, **sublanceolate** ..... ***L. abietis*** (P. Karst.) Dennis.

On bark of living or dead, broken or hanging twigs and branches of *Picea abies*, sometimes close to or on blackened resin, 0-2.5 m above ground (especially trees felled by storms but also on standing living trees), often associated with *Tryblidiopsis pinastri*, colline to subalpine-subboreal, I-XII, quite frequent in Central Europe (385-1660 m), Scandinavia, NE of USA (Farr et al. 1989). Very constant species being confined to *Picea*. Dharne mentions also *Abies alba* as host (possibly by misinterpreting the name *abietis*). A very sparse unpreserved collection on *Abies*-needles from Germany, with two rather small LBs in the spores, might belong here. Ref. Dharne (1965: 139), Raitviir (1970), Schmid-Heckel (1988: 24), Kujala (1950: 22), Baral & Matheis (2000), Kahr et al. (2009).

16. Spores *(**21,5-)23-30(-35) x (5,5-)5,8-6,5(-7,5)** µm, with many minute LBs (**0.2-1** µm, living state!); with 1 large non-refractive body of glycogen in each half (redbrown in IKI); asci ***115-140 x 13.5-17** µm, often with an always **non-septate** basal protuberance (never croziers); hairs **50-150** µm long, **not tapered** towards apex, **totally** densely covered by **globose warts** (0.3-1 µm), not forming teeth; paraphyses apically min. *3-5(-6.5) µm wide, **cylindrical to slightly clavate** ..... ***L. splendens*** (Schröter) Baral & Matheis

On bark of twigs of *Picea abies*, ≈0-0.5 m above ground, montane, VII-X, quite rare in Central Europe (Alps, Black Forest, Vosges, 500-1200 m). Ref.: Schröter (1893: 85), Jacquenoud (1984: 44), Breitenbach & Kränzlin (1981: pl. 234), Baral (1984: 150), Schmid-Heckel (1988: 24), Baral & Matheis (2000), Kahr et al. (2009).

18. Spores min. *4 µm wide (compare also undetermined collections in lead 18, below of *L. pseudotsugae*) 28
18. Spores max. *2-3(-3.5) µm wide (†1.5-3 µm) 19
18. Spores intermediate: †(5-)6-8(-9) x 2.6-4 µm, with several medium to small LBs in each half (LC (1)2-3); asci †47-63 x 4-6 µm, apex subconical, **strongly hemiamyloid**, **with croziers** (or septate protuberances); paraphyses cylindrical to subspathulate or sublanceolate; apothecia 1.5-7 mm diam., stipes exceptionally long (1-2 mm); conidia †1.5-4.5 x 0.5-3 µm, ellipsoid-ovate ..... ***L. agassizii*** (Berk. & Curt.) Dennis.

On bark of branches and trunks of *Abies* (mainly *A. balsamea*), *Pinus* (mainly *P. strobus*) , *Picea sitchensis*, *Tsuga heterophylla*, (?also *Larix*), saprobe (to weak parasite), subboreal, VII-XI, frequent from NE-USA to E-Canada, also Midwest of USA (Rocky Mts.). Confused with collections with asci IKI-, without croziers (*L.* aff. *pseudotsugae*). Close to *L. caylciformis* differing by amyloid asci and croziers. Ref.: Bingham & Ehrlich (1943: 106); Seaver (1951: 247), Dharne (1965: 126, giving ?erroneous spore width of 3-4.5 µm)), Raitviir (1970: 69, erroneously stating Europe & Asia), Funk (1981: 85), Baral (in prep).

- Similar species with spores ellipsoid(-fusoid), **biguttulate**, †3.8-7.5 x 1.8-4 µm; asci †47-60 x 3-5.5 µm, IKI?, croziers?; conidia †2.5-4 x 1.8-3 µm; on cankers and bark of living branches & stems (parasitic) on *Pseudotsuga taxifolia*, Pacific coast (California to W-Canada): ***L. pseudotsugae*** (Hahn) Dennis (1962: 184). Close to *L. calyciformis* but with much wider conidia. Ref.: Bingham & Ehrlich (1943: 301), Hahn & Ayers (1940: 138), Dennis (1949: fig. 103b), Seaver (1951: 246), Funk (1981: 89).

- ***L.* aff. *pseudotsugae*:** Two collections from Canada (Brit. Columbia & Quebec), on indet. conifer/*Abies balsamea*, VII-IX, T.R.Lohmeyer/E. Smerlis ("*agassizii*"), have spores †5-7.7 x (3.1-)3.3-4(-

4.4) µm with some minute peripheral LBs (**not biguttulate**), asci †50-65 x 5.3-7 µm, **IKI-**, **without croziers**, conidia †3.3-5.3 x 2-2.5 µm.

- A similar unpreserved collection [spores *6-9.2 x 3.5-5 µm, with numerous small LBs; asci *88-100 x 8-9 µm, with septate protuberances or croziers, IKI-; hairs *≈250 x 2-3 µm; on bark of *Pinus mugo*, 6.VIII.1988, Liechtenstein (1975 m)] resembles *L. gallica* or *L. kamtschatica* in the multiguttulate spores, but differs from this in too narrow spores and rather narrow hairs.

19. Spores †4.5-7.5 x 1.5 µm, narrowly fusoid; asci †30-40 µm long, J+ "blue"; ectal excipulum of text. globulosa; hairs 95 x 4-6 µm, strongly tapering towards apex; apothecia very small ..... ***L. minuta*** Dharne

On dead branches of *Larix*, montane, VI, Europe (Alps, known from 1 collection only). Similar to *L. subtilissima*, taxonomic value ambiguous. Ref.: Dharne (1965: 122).

19. Spores 5-10 µm long, min. 2 µm wide; asci (†) min. 43-50 µm long 20

20. Spores cylindric-fusoid, *(5-)6-10(-11) x 2-3.1 µm(-12 µm fide Dharne, -13 fide Kujala), eguttulate or with few **minute LBs** (LC 0-1(-2)), LBs **polar or not**; asci **IKI 2-3RR/Rb**, usually most asci with basal septate protuberance, some or many of these with true croziers, in some populations croziers and protuberances completely lacking; conidia *2.5-4 x 1.2-1.6 µm (Dharne: 3-4.5 x 1-1.3 µm), no or 1 minute (excentric?) LB ..... ***L. subtilissima*** (Cooke) Dennis (= *Trichoscyphella calycina* (Schum.: Fr.) Nannf.)

On bark (sometimes on resin, very rarely wood) of mostly dead twigs to trunks (rarely cones or needles) of mostly *Picea*, *Abies*, *Pinus*, *Pseudotsuga*, rarely *Sequoiadendron*, *Larix*, saprobe to parasite, 0-1.5 m above ground, colline to montane(-subalpine), (XI-)I-VI(-VIII), very common in Europe (100-1600 m), N-America, Japan, rare (?) in Asia (European part, Caucasus, Altai-region, Far East). Variable in the ascus base, possibly a collective species (specimens with IKI-negative asci or with upto 10-13 µm long allantoid spores should be excluded, see below). Ref.: Boudier (1910: pl. 518, as *calycina*), Dennis (1949: 92 as *calycina*), Raitviir (1980: 91, 1991: 318), Dharne (1965: 121), Kujala (1950: 30), Grelet (1951: 88), Baral (1984: 151), Breitenbach & Kränzlin (1981: pl. 235), Schwegler (1975), Schmid-Heckel (1988: 24), Kahr et al. (2009).

- Three collections differed by spores *7-11.7 x 2.5-3.3 µm (straight); asci IKI- (with partly open croziers); conidia *3.5-4.9/1.4-1.9 µm, LC 2-3 (*Pinus*: S-France, Luxembourg & Schwäbische Alb). These should be compared with the long-spored "parasitic" form on *Pinus sylvestris* and *P. murrayana* mentioned in Kujala (1950: 31) [spores 6-9(-13) x 2-2.5 µm, somewhat allantoid], also in Grelet [spores 10-12 x 2 µm, courbées, *Pinus* & *Abies*].
- *L. intricata* Spooner (1987: 436), on unidentified bark (not stated whether coniferous) from Australia, appears to be similar. It is said to be possibly close to *L. calyciformis* but clearly different in having slightly amyloid asci. It is further characterized by flexuous, often spirally coiled hairs [spores †6-7(-8) x 2-2.5(-3) µm, notes on spore guttulation and croziers lacking].

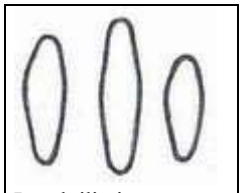
20. Spores consistently with 1(-2) **small LBs (0.3-1 µm diam.)** and 0-4 minute LBs **in each half** (not close to ends, LC (1-)2), asci **IKI-** (collections with smaller LBs might also belong to *calyciformis* rather to *subtilissima*) 21

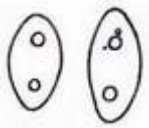
21. Spores ellipsoid to ovoid, of ± consistent size and shape, *(4.8-)5-6.5(-7.7) x 2.3-3.3(-3.5) µm, †4-6.8(?-7.5) x (1.8-)2.2-3(?-3.5) µm; asci *54-72 x 5.4-7 µm, **no croziers, no basal protuberances**; hairs 90-190 µm; conidia †2-4 x 1-1.5 µm, ± ellipsoid ..... ***L. calyciformis*** (Fr.) Dharne (= *L. minuscula* Raitv)

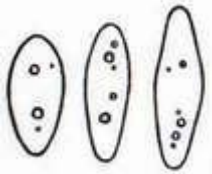
On bark of twigs to stems of mainly *Abies* spp., more rarely *Picea*, *Larix*, *Pinus*, *Pseudotsuga*, exceptionally close to resin, saprophyte (?rarely weak parasite), 0-2 m above ground, planar to montane(-subalpine), I-XII, common in Europe (Central E. 350-1500 m), Russia (European part, Ural, Caucasus, Kasachstan, Altai-region, East & Far East), Japan, rare in N-America, New Zealand. Rather constant species. The type of *L. minuscula* has spores †4.7-6.8 x 2.4-2.9 µm, i.e. distinctly wider than indicated by Raitviir. Ref.: Bingham & Ehrlich (1943: 98), Dennis (1949: fig. 103a, as Tax. sp. 2), Kujala (1950: 22), Grelet (1951: 87), Dharne (1965: 124), Raitviir (1980: 90, 1991: 316, 317), Oguchi (1981: 165), Baral (1984: 147), Breitenbach & Kränzlin (1981: pl. 230), Hanso (1978: 4), Funk (1981: 85), Kahr et al. (2009), Baral (in prep.).

21. Spores (ellipsoid-)fusoid, *(4.5-)5.5-7.5(-10) x (2.5-)2.7-3.2(-3.5) µm; asci *(50-)60-75(-79) x (5.3-)6-7(-7.5) µm, **with croziers (at least with basal protuberances)**; hairs 70-210 µm ..... ***L. aff. calyciformis*** ("***mugonicola***" nom. prov.)

On undecayed bark of branch of *Pinus mugo* (also other *Pinus* species: *P. strobus*, *P.* ?*uncinata*), 0.3-1.8 m above ground, partly associated with *Herpotrichia nigra*, III, VII-IX, ?399 or 1000-1910 m (**subalpine, rarely colline**), Europe (Alps, Pyrenees, Sudeten). Apparently constant species very close to *L. calyciformis*. Possibly the same species but with "eguttulate" spores (4.5-8.5 x 2-3 µm), asci ?IKI-, conidia 1-4 x 1-2 µm, was reported on bark of living branches of *Pinus mugo*, weak parasite/saprobe following *Cronartium ribicola* cankers, common in NW of N-America (Bingham & Ehrlich). Here probably also belongs a collection by Huhtinen from Svalbard (= Spitsbergen) on indet. conifer, on account of the presence of croziers, inamyloid asci, and spore guttulation; the guttules exclude *L. subtilissima* although spore shape is not distinctly fusoid. Ref.: (Bingham & Ehrlich 1943: 295, *Dasyscypha* spec.), Huhtinen (1993: 194, *L. calyciformis*), Schmid-Heckel (1985: 61, 1988: 24 p.pt., judging from the substrate, *L. calyciformis*), Baral (in prep.).


L. subtilissima


L. calyciformis


L. mugonicola

28. Spores †10-16 x **3-4 (?-4.5)**, µm, ellipsoid-oblong, l/w-ratio 3.2-3.3; asci †90-120 x 6.5-7.7 µm, J-; hairs distinctly tuberculate (with large warts formed by protruberances of the wall), 6 µm wide near base, gradually tapering towards apex; apothecia 3-5 mm diam.; conidia 3-6.5 x 0.8-1 µm ..... ***L. tuberculata*** Dharne

On *Larix decidua*, VI, subalpine, Europe (Alps, only known from 1 collection). The hair character should be restudied to clarify distinction from *L. occidentalis*. Ref.: Dharne (1965: 134).

28. Spores min. ***4-5** µm wide, hairs normally warted 29

29. Spores **oblong-ellipsoid(-clavate)**, **min. *11-15** µm long, l/w-ratio ≈**1.7-3**, with many minute LBs enclosing large glycogen bodies (LC ≈1-3), asci with or without croziers 30

29. Spores **globose, *4-7 µm long, or (ellipsoid-)ovoid**, ***6-15.7** µm long, l/w-ratio ≈**1-1.5**, multiguttulate (LC ≈3-4); asci with croziers 38

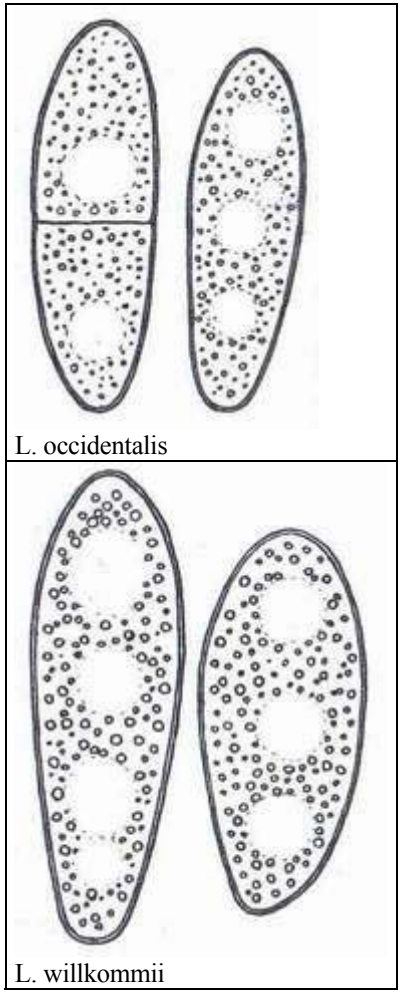
30. Spores *15-24 x (6.5-)7-8.5(-10.3) µm, ?exclusively on *Larix* 31
30. Spores *10-17.7 x (4-)5.5-7.5 µm 34

31. Spores *(14-)16-22(-24) x (6.2-)**7-8.5**(-9.5) µm, †(12-)15-19(-23) x **5-7(-**8.4) µm, narrowly ellipsoid-clavate-oblong, ends mostly obtuse; asci *150-190 x 12-15 µm, †(83-)100-130(-166) x (7-)8-12(-13) µm, with or without large IKI deep RR apical ring (mature asci!): 30-100% of asci of an apothecium IKI-red, but sometimes all asci IKI- with apical wall nearly unthickened), without or often with aseptate (rarely septate) basal protuberances, **no croziers**; apices of some to many paraphyses slightly to very strongly moniliform, *4-5(-6) µm wide; conidia †2-5 x 1.2-1.8 µm; apothecia 0.5-4 mm diam., **± saprophytic** ..... ***L. occidentalis*** (Hahn & Ayers) Dharne (= *Dasyscypha calycina* ss. Fuckel, = *L. hahniana* (Seaver) Dennis)

On bark (rarely resin) of dead, rarely living twigs and branches of *Larix decidua* (=*europaea*), *L. leptolepis*, *L. laricina*, *L. occidentalis*, *L. dahurica*, *L. rossica*, *L. sibirica*, very rarely *Abies*, *Picea*, *Pinus*, *Pseudotsuga*, 0-3 m above ground, planar to subalpine, I-XII, very common in Europe (25-2100 m), rare in Asia (European part, Altai-region, East & Far East), Japan, NE-USA, W-Canada. The iodine reaction of the asci is strongly variable in this otherwise constant species and therefore relatively useless for the distinction against *L. willkommii* (see also Cooke, 1876). Reported collections on *Pinus mugo* represent *L. fuckelii* (e.g. in Schmid-Heckel 1985: 61, teste H.B.). A collection from Canada, Ontario, indet. conifer, T.R. Lohmeyer (H.B. 5930, spores †16.5-21.3 x 4.8-6.2 µm, all asci IKI red) differs in having true croziers. Ref.: Cooke (1876, as *Peziza calycina*), Hahn & Ayers (1934), Seaver (1951: 244, incl. *hahniana*), Manners (1953), Kujala (1950: 24), Dharne (1965: 129), Dennis (1949: 94, as Tax. sp. 1), Raitviir (1980: 95, 1991: 321), Oguchi (1981: 166), Breitenbach & Kränzlin (1981: pl. 233, Asci J-), Baral (1984: 149), Takahashi (1979), Funk (1981: 88), Schmid & Schmid (1991: pl. 70), Kahr et al. (2009).

31. Spores *20-26.5 x **9-10.3** µm, †15.6-26(-28) x (6-)**7-9(-**9.4), one end often acute; asci †(126-)135-165(-173) x (9-)11-13(-14) µm, **always IKI-** (?), frequently with septate protuberance (?and croziers); paraphyses filiform or only apically inflated; conidia †2-8 x 1-2 µm; apothecia 3-6 mm diam., **parasitic** ..... ***L. willkommii*** (Hartig) Dennis

On resinous cankers of branches or stems of *Larix decidua*, rarely *L. dahurica*, *L. kurilensis*, *L. sibirica*, *L. sukaczewii*, ?never on *L. leptolepis*, colline to subalpine-boreal, I-IX, frequent in Central Europe (Alps 500-1840 m) & Asia (European part, Central Sibiria, Far East), Japan, introduced to S and SW of Scandinavia and to NE-/NW-USA & W-Canada. The species was accepted e.g. by Dharne and Kujala, but the morphological differences to *L. occidentalis* are slight and still deserve clarification. Misdeterminations are probably frequent: literature reports might often represent *L. occidentalis* (e.g. Breitenbach & Kränzlin, Raitviir, Schmid-Heckel). Dharne's clear distinction by the inamyloid asci of *L. willkommii* is relativised due to the variation in *L. occidentalis*. The main distinction is physiological. Ref.: Hahn & Ayers (1934), Seaver (1951: 243), Dharne (1965: 127), Kujala (1950: 31), Grelet (1951: 88, on *Larix* and *Pinus sylvestris*!), Müller (1977: 51), Raitviir (1980: 96, 1991: 321), Breitenbach & Kränzlin (1981: pl. 237, asci J+ reddish!), Butin (1983: 78-80), Baral (1984: 152 ff.), Manners (1953), Schmid-Heckel (1985: 61), Kahr et al. (2009). Oguchi's (1981: 166) treatise of "*L. occidentalis*" shows long and narrow conidia 5-8(-10) x 0.8-1.2 µm and non-moniliform paraphyses reminiscent of *L. willkommii*, but the spores are given smaller than in his "*L. hahniana*".

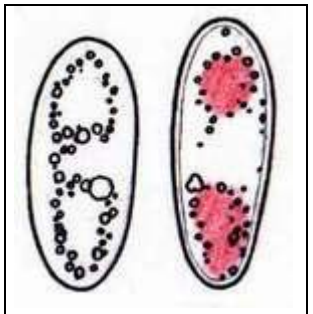

L. occidentalis

L. willkommii

34. Excipular cortical cells short, rectangular, very thick-walled, with **granular**, pale to light **yellow-ochraceous exudate** around each cell (incl. base of flank hairs), giving the externally apothecia a licht ochre colour, hairs 150-220 µm long, spores †12-16 x (4-)5-5.7 µm, with two large glycogen regions surrounded by many small LBs, asci †94-115 µm, ring IKI deep red (RR), with open croziers ..... ***L. angustispora*** Raitv.

On thin corticated twigs of *Larix sibirica***,** *L. daurica*, *Abies sibirica*, montane-boreal, VI-VIII, rare in Russia (from Ural to East & Far East). Apparently a good species. Ref.: Raitviir (1977: 3, 1980: 93, 1991: 319), Baral (in prep.).

34. Excipular cortical cells **without granular exudate, hyaline**, hairs 200-300(-400) µm long 35



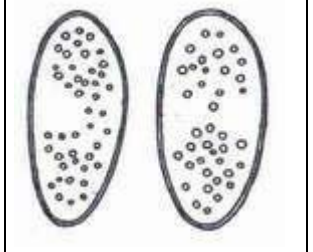
L. angustispora

35. Spores *(11-)12-15(-17.2) x (5-)5.5-6.7(-7.3) µm, with **many small LBs** in each half (**LC 3-4**), glycogen sparse; asci consistently IKI-, with basal septate protuberances or mostly with croziers, *93-148 x 12-14 µm, hair walls */†**0.2-0.5(-0.8)** µm thick, medulla without crystal druses, ectal excipulum inamyloid; conidia 6-10 x 0.8-1.2 µm ..... ***L. fuckelii*** (Bres. ex Rehm) Dharne

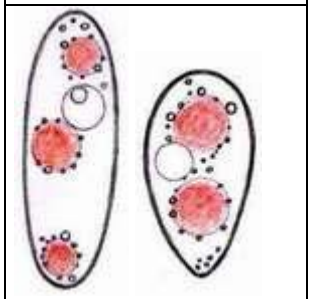
On bark of undecayed branches of *Pinus mugo*, *P. pumila,* rarely *Picea*, subalpine, VI-IX, 0.3-1.8 m above ground, not rare in Europe (Schwarzwald 1040 m; Alps 1000-1970 m [frequent], Dinarian Alps), rare in Russia (Ural, Far East). Apparently a constant species. Ref.: Dharne (1965: 131), Raitviir (1970, 1980: 93, 1991: 319), Baral (1984: 148), Schmid-Heckel (1985: 61, partly as *L. occidentalis*, teste H.B.), Kahr et al. (2009), Bemmann (2013).

35. Spores *(10-)12-16(-17.5) x (5.2-)5.5-7(-7.5) µm, with 2(-3) glycogen bodies surrounded by **some minute LBs** (**LC 1-2**), Dharne: †12-17.7 x 5.7-7.7 µm; asci IKI- or IKI deep red (RR), with croziers or basal protuberances, *105-132 x 10-11.6(-13.7) µm; hair walls ***0.4-0.8** µm (KOH **-1.2** µm), medulla with abundant crystal druses, ectal excipulum faintly hemiamyloid ..... ***L. laricis*** (Cooke) Dharne

On bark of dead, dry twigs of *Larix dahurica*, *L. sibirica*, *L. decidua*, montane-subalpine, VI-IX, possibly quite frequent in Europe (Alps, 500-1750 m, asci IKI-, no crystals?), Russia (European part, Ural, East & Far East, Mongolia, e.g. 2100 m, asci IKI+), and N-America. Possibly frequently confused with *L. occidentalis* [Cooke (1876) did not believe in different taxa]. Dharne reported the asci to be "J+ blue", but he included ***D. oblongospora*** Hahn & Ayers (1934) despite stating the asci as J-; however, the characters in the protologue of *D. oblongospora* would also suggest identity with *L. fuckelii*: spores 10-16 x 3.8-6 µm, cylindrical with obtuse ends; asci 68-115 x 7-9(-10) µm, IKI?; conidia 2-5 x 1-1.5 µm; apothecia 0.5-2 mm diam.; on dead branches of *Larix* spp., *Pinus* spp., *Picea*, *Pseudotsuga*, montane, NE-USA. Ref.: Seaver (1951: 247, *oblongospora*), Dharne (1965: 132), Müller (1977: 50), Raitviir (1980: 95, 1991: 320, 2008: 189), Zhuang (2002), Kahr et al. (2009), Baral (in prep.).



L. fuckelii



L. laricis

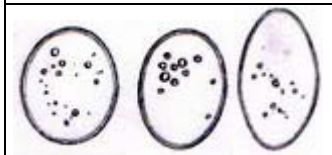
38. Asci IKI strongly red (RR), sometimes some asci IKI- 39

38. Asci constantly IKI- 40

39. Spores globose to subglobose (depending on collection), *4-7(-8) x 4-6 µm, LC 2-3: with one medium-sized or several small LBs; asci *70-94 x 6.5-9 µm, with croziers or with septate protuberances, ectal excipulum of gelatinized t. angularis to prismatica-porrecta; apothecia 1-8 mm diam., disc deep yellow-orange; conidia 3-5 x 0.8-1.2 µm ***L. suecica*** (de Bary ex Fuckel) N st., = *Pithya maloc*

On bark of dead twigs and branches (rarely cones) of *Larix* spp., *Picea*, *Pinus mugo*, *P. cembra*, *P. banksiana*, *Juniperus*, *Abies*, 0-0.5 m above ground, subalpine-boreal, V-IX, common in Europe (Alps: 1070-2000 m, Scandinavia: 550-700 m), Russia/Mongolia (European part incl. arctic region, Caucasus, Altai-region, East & Far East), Japan, Midwest of USA (Rocky Mts.), Canada. Close to *L. hyalina* (see there). A form with totally inamyloid asci but otherwise identical morphology occurrs in Sweden (Jämtland & Lapland, *Picea abies*, spores globose, H.B. 5928, 9371). In others variation between IKI RR and IKI- occurred between apothecia or asci (USA, Colorado, *Picea engelmannii*, spores broadly ellipsoid, H.B. 6334; Mongolia, *Larix sibirica*, spores globose, H.B. 7899c). The Colorado find might also belong to *L. kamtschatica*. Ref.: Raitviir (1980: 89, 1991: 315, 2008: 189), Seaver (1951: 283, *chrysophthalma*), Dharne (1965: 118), Müller (1977: 50), Holm & Holm (1977: 12), Baral (1984: 151), Breitenbach & Kränzlin (1981: pl. 236), Hosoya & Otani (1991: 27), Takahashi (1979, pl. X), Funk (1981: 89), Oguchi (1981: 168), Schmid-Heckel (1985: 61, 1988: 24), Kahr et al. (2009). *L. ikenoi* P. Henn. on *Juniperus chinensis* has larger spores and asci (iodine reaction unknown)

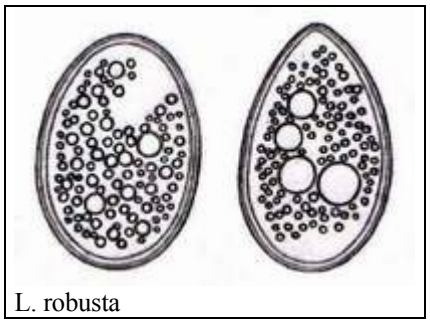
L. suecica



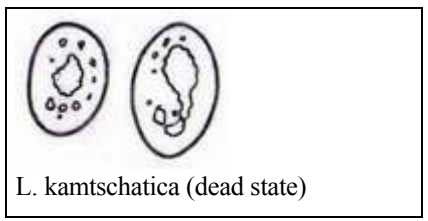
L. hyalina (ellipsoid-spored form of L. suecica?)

39. Spores subglobose to broadly ovoid, †4-7 x 2.6-3.5 µm (x 4.5-5 µm from Dharne's drawing!); conida 3 x 1.5 µm ***L. hyalina*** Dharne

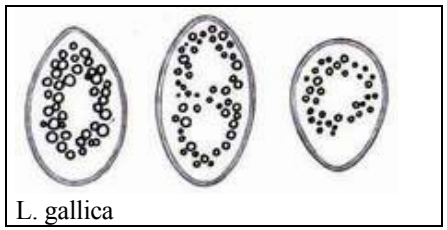
On dead branches of *Pinus mugo*, subalpine(-alpine), V-VII & XI, not rare in Central Europe (Alps, 1250-1800 m). Differing from *L. suecica* fide Dharne in shape of ascospores and conidia, also in the culture medium remaining hyaline (but becoming yellow-orange in *L. suecica*). Possibly a synonym of *L. suecica* since the ascospore shape is partly variable within a collection. Ref.: Dharne (1965: 119), Kahr et al. (2009).



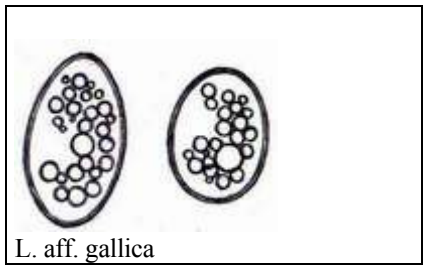
L. robusta



L. kamtschatica (dead state)



L. gallica



L. aff. gallica

40. Spores *(10.4-)**11.5-14**(-15.7) x **7.8-10**(-11) µm, with numerous small and few larger LBs; asci *122-153 x 14.5-16.2 µm ..... ***L. robusta*** Baral & Matheis (= *Perrotia robusta* Grelet ex Spooner)

On bark of twigs and branches of *Abies alba* & *A. pinsapo*, 0-1.5 m above ground, montane, II-V (X), Central (500-1000 m) and SW-Europe, Kaukasus (lit.???). Constant species. Ref. Baral (1984: 150), Malençon & Bertault (1976), Galán & Moreno (1985), Grelet (1951: 89), Berthet (1964a: 129; 1964b: 32), Eger (1995), Baral & Matheis (2000), Kahr et al. (2009).

40. Spores ***6-11.5** x **4.8-7** µm; asci *90-125 x 8-12.5 µm 41

40. Spores * ≈**4-7 x 4-5** µm .. see *L. suecica* ..... (→ 39, inamyloid form)

41. Spores †5.5-7.7(-8) x 4.3-5 µm, ectal excipulum of **± horizontal** highly gelatinized texture of strongly **elongated cells**, hairs 100-140 µm long ..... ***L. kamtschatica*** Raitv.

On dead twigs of *Pinus pumila*, VIII-IX, not rare in Far East of Russia (N-Sachalin, Kamtschatka). Very close to *L. gallica* differing mainly in the excipulum, and in slightly smaller spores. Ref. Raitviir (1970: 66, 1980: 92, 1991: 318), Baral (in prep.).

41. Spores †6-10.5 x 4-6 µm, ectal excipulum of **(irregularly) vertical**, ± gelatinized texture of **isodiametric to medium elogated cells**, hairs 100-300 µm long 42

42. Spores *(6.5-)8-10(-11.5) x (5-)5.5-6.5(-7) µm, ellipsoid-ovoid, rarely subglobose, LBs small (**0.2-0.6(-0.8)** µm, vital state!), forming **1-2 hollow spheres** enclosing large glycogen bodies; asci *90-125 x 9-11(-12.5) µm (†78-103 µm); hairs with obtuse, non-tapered ends ..... ***L. gallica*** (P. Karst. & Hariot) Dennis (= *Trichoscyphella carpatica* Svrček, = *L. phyllocladi* (Dennis) Dennis)

On bark of twigs and branches of *Abies alba*, *A. gracilis*, *A. nordmanniana*, *A. sacchalinensis*, *A. sibirica*, rarely on *Picea*, *Pinus sibirica*, *Larix sibirica*, 0-1 m above ground, (colline-)montane(-subalpine), (I-)III-IX, quite common in Europe ((?200) 380-1310 m), Asia (European part, Caucasus, Altai-region, East & Far East). The holotype was on *Abies*, not *Larix*. *L. phyllocladi* was distinguished by Dennis on account of its habitat (on *Phyllocladus* in New Zealand), but is morphologically identical fide Spooner who separated it at varietal level because of the geographic isolation and special substrate. Ref.: Karsten & Hariot (1890), Raitviir (1980: 92, 1991), Dharne (1965: 121), Dennis (1949: 94, fig. 103c; 1961: 302, *phyllocladi*), Grelet (1951: 89), Baral (1984: 148), Matheis (1985), Svrček (1962: 104), Spooner (1987: 616), Baral & Matheis (2000).

- ***L. ciliata*** (Hahn) Dennis is a very similar species or even a synomym having scarcely longer spores †8-12.4 x 4-6.6 µm (with one confluent large LB, the LB-pattern of living spores is unknown) and slightely shorter asci (†63-93 µm), hairs with subacute ends (!), saprobe on thin branches of *Pinus pumila*, *Pseudotsuga*, Far East of Russia (Chukotka, Magadan and Sachalin areas), Northern Pacific coast (USA, Canada). Ref.: Seaver (1951: 247), Raitviir (1980: 93, 2008: 189), Hahn (1940: 141), Spooner (1987: 614).

42. Spores * 7-9(-11) x 4.8-6.2 µm, LBs **0.6-1.3(-3)** µm diam., **not forming a hollow sphere** (living state!), glycogen absent or few; hairs with obtuse, non-tapered ends ..... ***L.*** aff. ***gallica***

On bark of thin branches of *Pinus sylvestris*, *Abies alba*, montane, Europe (Black Forest). Doubtfully different from *L. gallica*. Fresh collections on substrates other than *Abies* should be examined for spore guttulation. Ref. Baral & Matheis (2000).

Synoptic table to genus Lachnellula

* = living state, † = dead state (live measurements are entered whenever available). **LC:** 0 = no lipid, 5 = maximum lipid content. **IKI-reaction:** - = negative, 1-3 = weak to strong, RR/RB = hemiamyloid, BB = euamyloid. **Croziers:** - = simple septa, O = open croziers, M = medaillon-shaped croziers, C = normal croziers (without perforation). **Paraphyses:** l = sublanceolate (±only at apex), z = cylindrical, m = moniliform. **Warts:** - = smooth, g = globose, c = crystalloid, t = tuberculate. **Pigment of hairs**: - = hyaline, b = brown, y = yellow, r = reddish. **Phenology:** indicates number of collections per month; contains only personally studied material (except for rarely studied species). **Distribution:** Eu = Europe, Am = America, As = Asia.

	ASCOSPORES			ASCI				PAR	HAIRS				APOTHECIA		PHENOLOGY	SUBSTRATE	DISTRIB.
	length	width	LC	length	width	IKI	cr		length	width	warts	pigm.	diam.	stipe	jfmamjjasond		
	[µm]		[0-5]	[µm]					[µm]				[mm]				
L.abietis	*12.5-21.0	3.4-4.8	3.5-4	*65-106	9.2-14.0	--	Om	l	*100-300	2.5-5.0-	c	-	0.5-2.0	0.1-1.0	121221021100	Picea	Eu
L.agassiz	†5.2-8.7	2.6-3.4	2-3	†50-70	4.8-7.0	RB	M	l	†100-?	2.5-3.7	g	-	1.0-7.0	1.0-2.0	000000120110x	polyph.	Am
L.angusti	†12.0-16.0	4.0-5.7	2-2.5	†94-115	9.0-10.8	RR	OM	l	†150-200	2.8-3.3	g	-(y)	1.0-1.4	0.2-0.3		Larix, Abies	As
L.arida-1	*7.5-10.0	4.2-5.5	0-1	*82-96	7.5-9.5	--	--	z	*150-200	4.5-6.5	g	b	2.5-8.0	0.3-0.3	000010100000	Larix	Eu
L.arida-2	*6.5-9.0	3.5-5.0	1.5-2.5	†55-76	5.2-7.8	--	OM	l	†100-300	4.5-7.0	g	b	1.5-8.0	?		polyph.	EuAm
L.calycif	*5.0-6.8	2.3-3.3	2	*56-72	5.5-6.5	--	-	zl	*90-200	3.0-3.7	g-	-	1.0-5.0	0.3-1.5	303543323301	bes. Abies	EuAmAs
L.calycin	*2.3-3.5	2.0-2.8	1-3	*39-46	4.6-5.6	--	M	l	*50-145	2.5-4.5	c/g	--	0.5-2.4	0.0-0.4		esp. Pinus	EuAs
L.ellisiana	†15.0-22.0	2.3-3.0	2.5-3	†62-69	6.5-8.3	BB	M	l	†50-150	3.0-5.2	-/g	-	0.7-1.5	0.2-0.5		polyph.	Am
L.flavovir	†6.5-12.5	3.5-4.7	1-1.5	†60-94	5.0-8.0	--	OM	z	†200-300	4.0-5.0	g	b	1.5-2.5	?	000017111000x	polyph.	EuAmAs
L.fuckeli	*11.0-17.2	5.5-7.3	2-4	*93-130	12.5-14.0	--	OM	z	*100-300(-410)	2.7-3.8	g	-	1.0-4.0	0.2-0.3	000001114000	esp.Pinus mugo, pumila	EuAs
L.fuscosa	*11.5-19.0	3.5-5.8	0-1	*80-115	9.3-11.5	--	OM	zl	*150-250	3.5-6.0	g	b	1.0-5.0	0.3-0.5	000012411000x	Pinus	Eu?Am
L.gallica	*6.5-11.5	5.0-7.0	3-4	*89-125	8.0-12.5	--	M	zl	*100-300	2.5-5.8	g	-	1.0-4.0	0.0-0.7	002691000000	esp. Abies	EuAs
L.juniper	†6.5-9.0	2.8-3.2	1	†54-65	5.5-6.8	--	M	l	†120-?	2.0-3.4	g	(b)	0.6-1.3	0.1-0.2		Juniperus	Eu
L.laricis	*10.0-17.5	5.2-7.5	2	*105-132	10.0-13.7	--	M	z	*200-250	3.0-4.2	g	-	0.8-3.0	0.2	000000400000x	Larix	EuAmAs
L.kamtsch	†5.5-7.7	4.3-5.0	3	†64-77	7.0-7.5	--	M	zl	*100-200	2.2-3.5	g/(-)	-	0.8-1.8	?		Pinus pumila	As
L.microsp	†3.5-3.5	3.5-3.5	?	†55-60	6.0-7.0	??	?	?	?		?	r?	?			Abies	AmAs
L.minuta	†4.5-7.5	1.5-1.5	?	†30-40	4.0-4.6	†?	?	z	†95-?	4.0-6.0	g?		?		000001000000	Larix	Eu
L.mugonic	*5.0-9.8	2.4-3.4	1-2.5	*50-78	5.5-7.5	--	M	z	*90-210	3.0-4.5	g	-	0.5-4.5	0.1-0.5		Pinus mugo	Eu?As
L.occiden	*14.0-24.0	6.2-9.0	2-3	*150-190	12.0-15.0	-/RR	-O	zm	*70-120	3.0-4.0	g	-	0.5-4.0	0.2-0.8	549625214554	esp. Larix	EuAmAs
L.pini	†13.0-22.0	4.4-7.0	?	†88-125	7.2-11.8	--	?	z	?	3.0-4.0	g?	b	2.0-5.0	?	000010252110	Pinus	Eu
L.pseudof	†60.0-97.0	1.5-2.3	2-3	†65-120	8.0-12.0	RB	m	l	†100-300	2.0-5.0	-	-	0.2-1.5	?	100100001001x	Pinus	Eu
L.pseudot	†3.8-7.7	1.8-4.4	1-3	†47-65	3.4-7.0	--	-	zl	†100-220	3.5-4.2	g	-	1.0-2.0	0.2-0.4		Pseudotsuga, Abies	Am
L.resinar	*2.5-4.5	1.7-2.5	1-3	*35-54	4.2-5.2	--	m	zl	*50-125	2.5-4.5	c/g	-	0.5-2.0	0.2-0.5	012010101210	esp.Picea	EuAmAs
L.robusta	*10.4-15.7	7.8-11.0	4-5	*122-153	14.5-16.2	--	m	zl	*100-300	3.0-5.3	g	-	1.0-5.3	0.1-0.6	010210000100	Abies	Eu
L.splende	*21.0-35.0	5.0-7.5	2-3	*115-140	13.0-17.0	--	-O	z	*80-150	2.5-4.3	g	-	0.5-3.0	0.1-0.4	000000101200	Picea	Eu
L.subtili	*5.0-9.0	2.0-3.0	0-1	*50-70	3.0-6.2	RR/RB	-OM	zl	*85-210	3.04.5	g	-	1.0-4.5	0.3-0.8	869974120012	polyph.	EuAmAs
L.?subtil	*7.0-13.0	2.5-3.3	0-1?	*.....	.....	--	M	?					.....			Pinus	Eu
L.suecica	*4.0-8.0	4.0-6.0	2-3	*66-94	6.0-8.5	-/RR/RB	M	z	*100-200	2.7-3.7	g	-	1.0-8.0	0.1-1.3	000026519000x	polyph.	EuAmAs
L.tubercu	†10.0-16.0	3.0-4.0?	?	†90-120	6.5-7.7	--	?	zl	?	?-6.0	t	-	3.0-5.0	?	000001000000	Larix	Eu
L.willkom	*18.0-26.0	8.0-10.0	2	†135-165	11.0-13.0	--	M	z			g	-	2.0-3.0	?	100102130000	Larix	EuAmAs

List of taxa accepted in Lachnellula, with indication of their synonyms

L. arida-group (hairs pigmented, asci inamyloid)

Lachnellula angustispora Raitv. 1978

Lachnellula arida (W. Phillips) Dennis 1962
= Peziza arida W. Phillips, Grevillea 5:117 (1887)
= Lachnella arida (W. Phillips) Seaver 1951
= Trichoscyphella arida (W. Phillips) E. Müller & S. Ahmad 1962

Lachnellula flavovirens (Bres.) Dennis
= Trichoscyphella flavovirens (Bres.) Mos.
= Dasyscypha flavovirens Bres. 1887

Lachnellula fuscosanguinea (Rehm) Dennis 1962
= Trichoscyphella fuscosanguinea (Rehm) Svrček, Ceská Mykol. 16: 104 (1962)
= Dasyscypha fuscosanguinea Rehm 1872
= Trichopeziza fuscosanguinea (Rehm) Lamb. 1887
= Lachnella fuscosanguinea (Rehm) P. Karst. 1888

Lachnellula juniperina (K. & L. Holm) Vesterholt in Knudsen & Hansen, Nord. J. Bot. 16: 212 (1996)
= Dasyscypha juniperina K. & L. Holm, Symb. Bot. Upsal. 21: 12 (1977)

Lachnellula microspora Ellis & Everh. (1893)

Lachnellula pini (Brunch.) Dennis 1962
= Lachnella pini Brunch. 1911
= Dasyscypha pini (Brunch.) G.G. Hahn & Ayers, Mycologia 26: 487 (1934)

Doubtful taxon:
Lachnellula aeruginosa Oguchi (1980), Trans. mycol. Soc. Japan 21: 435 (non vidi).
An apparently interesting species on *Abies sacchalinsis* with green pigment. Possibly a good *Lachnellula* (no description available)!

L. resinaria-group (spores 2-4.5 µm long, excipulum hemiamyloid, asci inamyloid)

Lachnellula resinaria (Cooke & Phill. in Cooke) Rehm 1896 var. resinaria
= Trichoscyphella resinaria (Cooke & Phill.) Dennis 1949
= Trichoscypha resinaria (Cooke & Phill. in Cooke) Boud. 1907
= Peziza resinaria Cooke & Phill. in Cooke, Grevillea 3:185(1875)
= Dasyscypha resinaria (Cooke & Phill. in Cooke) Rehm 1883
= Lachnella resinaria (Cooke & Phill. in Cooke) W. Phillips 1887

Lachnellula resinaria var. calycina (Sacc.) Baral in Baral & Matheis 2000
= Lachnellula calycina Sacc. 1889
= Lachnellula rehmii Ferd. & Joerg. 1938 (nomenclat synonym)
= Lachnellula schumannii Rehm in Rabh. 1893 (nomenclat synonym)

= Trichoscypha vuillemini Boud. 1907 (?nomenclat synonym)
= Pithya microspora Velen.

L. subtilissima-group (spores 4.5-11 x 1.5-3.5 µm)
Lachnellula agassizii (Berk. & M.A. Curtis) Dennis 1962
= Dasyscypha agassizii (Berk. & M.A. Curtis) Sacc. 1889
= Peziza agassizii Berk. & M.A. Curtis 1872
= Lachnella agassizii (Berk. & M.A. Curtis) Seaver 1951

Lachnellula calyciformis (Willd. 1787 : Fr.) Dharne 1965
= Dasyscyphus calyciformis (Willd.) Rehm 1896
= Peziza calyciformis Willd.
= Trichoscypha calyciformis (Willd.) Grelet 1951
= Trichoscyphella calyciformis (Willd.) Nannf.
= Lachnellula minuscula Raitv. 1978

Lachnellula intricata Spooner, Spooner, B.M.; Bibl. Mycol. 116: 436 (1987)

Lachnellula minuta Dharne, Phytopath. Z. 53: 122 (1965)

Lachnellula pseutotsugae (G.G. Hahn 1940) Dennis 1962
= Dasyscyphus pseudotsugae G.G. Hahn, Mycologia 32:138(1940)

Lachnellula subtilissima (Cooke) Dennis 1962
= Trichoscypha subtilissima (Cooke) Boud. 1907
= Peziza subtilissima Cooke 1871
= Lachnella subtilissima (Cooke) W. Phillips 1887
= Dasyscypha subtilissima (Cooke) Sacc. 1889
= Trichoscyphella calycina (Schum.: Fr.) Nannf.

L. gallica -group (spores ± large, ends obtuse, l:w-ratio 1-1.5, asci inamyloid)
Lachnellula gallica (P. Karst. & Hariot) Dennis 1962
= Trichoscypha gallica (P. Karst. & Hariot) Boud. 1907
= Lachnella gallica P. Karst. & Hariot 1890
= Dasyscypha gallica (P. Karst. & Hariot) Sacc. 1892
= Trichoscyphella gallica (P. Karst. & Hariot) Berthet 1965
= Perrotia gallica (P. Karst. & Hariot) Spooner, Bibl. Mycol. 116: 612 (1987)
= Trichoscyphella carpatica Svrček 1962
?= Lachnellula phyllocladi (Dennis 1961) Dennis 1962
= Trichoscyphella phyllocladi Dennis 1961
= Perrotia gallica var. phyllocladi (Dennis 1961) Spooner, Bibl. Mycol. 116: 616 (1987)
?= Lachnellula ciliata (G.G. Hahn 1940) Dennis 1962
= Dasyscypha ciliata G.G. Hahn, Mycologia 32:141 (1940)

Lachnellula hyalina Dharne, Phytopath. Z. 53:119(1965)

Lachnellula kamtschatica Raitv. 1970

Lachnellula robusta Baral & Matheis in Baral 1984
= Perrotia robusta Grelet ex Spooner 1987
= Trichoscyphella gallica var. robusta (Grelet) Bertault & Malençon 1977
= Trichoscypha gallica var. robusta Grelet 1951

Lachnellula suecica (de Bary ex Fckl.) Nannf.
= Pithya suecica de Bary ex Fckl. 1876
= Lachnellula chrysophthalma (Pers. ex Wallr.) P. Karst. 1885
= Peziza chrysophthalma Pers.
= Trichoscyphella chrysophtalma (Pers.) Nannf.
= Pithya malochi Velen. (1934)

Doubtful taxon:
Lachnellula ikenoi Henn. 1902
The species grew on leaves of *Juniperus chinensis* in Japan and was described to have globose ascospores 8-10 µm diam., asci 100-120 x 10-12 µm (hairs not described). It was originally compared to *L. chrysophtalma* (= *L. suecica*), but appears to differ in larger asci and ascospores (iodine reaction not stated).

L. willkommii-group (spores large, ends obtuse, l:w-ratio 1.7-3)
Lachnellula fuckelii (Bres. in Rehm) Dharne 1965
= Dasyscyphus willkommii var. fuckelii Bres. in Rehm 1896
= Trichoscyphella fuckelii (Bres. in Rehm) Svrček 1962 (superfluous combination in: Moser, M. :66, 1963)
= Dasyscypha calycina var. minor Rehm 1896

Lachnellula laricis (Cooke) Dharne 1965
= Peziza laricis (Cooke) Rehm 1876
= Peziza calycina * laricis Cooke 1871
?= Dasyscyphus oblongospora G.G. Hahn & Ayers

Lachnellula occidentalis (G.G. Hahn & Ayers) Dharne 1965
= Dasyscypha occidentalis G.G. Hahn & Ayers, Mycologia 26: 90 (1934)
= Lachnellula hahniana (Seaver) Dennis 1962
= Dasyscypha calycina Fuckel 1951
= Trichoscyphella hahniana (Seaver) Manners 1953
= Lachnella hahniana Seaver 1951

Lachnellula tuberculata Dharne, Phytopath. Z. 53:134(1965)

Lachnellula willkommii (R. Hartig) Dennis 1962

= Trichoscyphella willkommii (R. Hartig) Nannf. 1932
= Dasyscyphus willkommii (R. Hartig) Rehm 1881
= Trichoscypha willkommii (R. Hartig) Boud. 1907
= Peziza willkommii R. Hartig 1874
= Helotium willkommii (R. Hartig) Wettst. 1881

Doubtful taxon:
Trichoscyphella tenuipilosa Cash in Cooke 1952
On dead twigs of *Pinus ponderosa*, USA. Reported as similar to *L. pseudotsugae* by Cash, but the diagnosis is insufficient, and the measurement of hair width ("1 µm") seems incredible.

L. pseudofarinacea-group (spores very long, filiform)
Lachnellula pseudofarinacea (P. Crouan & H. Crouan) Dennis 1962
= Trichoscyphella pseudofarinacea (P. Crouan & H. Crouan) Dennis 1960
= Peziza pseudofarinacea P. Crouan & H. Crouan 1867

L. splendens-group (spores large, fusiform)
Lachnellula abietis (P. Karst.) Dennis 1962
= Trichoscypha abietis (P. Karst.) Boud. 1907
= Helotium abietis P. Karst. 1867
= Lachnella abietis P. Karst. 1867
= Trichoscyphella abietis (P. Karst.) Nannf. 1953
= Perrotia abietis (P. Karst.) Raitv. 1970
= Dasyscypha abietis (P. Karst.) Sacc. 1889

Lachnellula ellisiana (Rehm) Baral in Baral & Matheis (2000)
= Dasyscypha ellisiana (Rehm) Sacc. 1889
= Peziza ellisiana Rehm 1876

Lachnellula splendens (J. Schröt.) Baral & Matheis 2000
= Dasyscypha splendens J. Schröt. 1908

Excluded species

Species belonging in Capitoticha and related genera

Lachnellula dabaensis Zhuang 1997
On angiosperm twig (?*Rubus*). A synonym of **"Dasyscyphus" scabrovillosus** (Phill.) Sacc.

Lachnellula himalayensis Kar & Pal 1970
On unidentified stem. The filiform spores (60-89 x 1.6-3 µm) and the presence of crystals suggest that the species could belong in the group around *Lachnum abnormis* (?*Capitotricha*).

Lachnellula cervina (Ellis & Everh. 1897) Dennis 1963

= Erinella cervina Ellis & Everh. 1897
= Erinellina cervina (Ellis & Everh. 1897) Seaver 1951
Unclear species, on *Betula*, spores long-filiform

Species belonging in Perrotia, Proliferodiscus, Hyphodiscus

Lachnellula phragmiticola (Henn. & Plöttn. 1899) Boud. 1907 - synonym of Perrotia distincta (Peck 1878) J.H. Haines 1989
= Dasyscypha phragmiticola P. Henn. & Ploett., Verh. Bot. Ver. Prov. Brandenb. 41: 97 (1899)
= Lachnella phragmiticola (Henn. & Plöttn. 1899) Kirschst. 1936
= Lachnellula phragmiticola (Henn. & Plöttn. 1899) Boud. 1907
= **Perrotia phragmiticola** (P. Henn. & Ploettn. in P.Henn. 1899) Dennis 1963

Lachnellula pulveracea (Alb. & Schwein. 1805) Dennis 1962
= Cenangium pulveraceum Alb. & Schwein. 1805
= Lachnellula pulveracea (Alb. & Schwein. 1805) Dennis 1962
= Dasyscyphus pulveraceus (Alb. & Schwein. 1805) Höhn. 1917
= Dermea pulveracea (Alb. & Schwein. 1805) Rehm 1912
= Farinodiscus pulveraceus (Alb. & Schwein. 1805) Svrček 1987
- **Proliferodiscus pulveraceus** (Alb. & Schwein. 1805) Baral in Baral & Krieglst. 1985 (superfluous combination in: Spooner, B.M.; Bibl. Mycol. 116: 646, 1987)

Lachnellula inspersa (Berk. & M.A. Curtis 1868) Dennis 1962
= Peziza inspersa Berk. & M.A. Curtis 1868
= Dasyscyphus inspersus (Berk. & M.A. Curtis 1868) Sacc. 1889
= Atractobolus inspersus (Berk. & M.A. Curtis 1868) O. Kuntze 1898
= **Proliferodiscus inspersus** (Berk. & M.A. Curtis 1868) J.H. Haines & Dumont 1983, Mycologia 75: 538 (1983)

Lachnellula tricolor (Sowerby: Fr.) Dennis 1962 (1963)
= Lachnella tricolor (Sowerby) W. Phillips 1887
= Peziza tricolor Sowerby: Fr. (1822)
= Dasyscyphus tricolor (Sowerby: Fr.) Massee 1895
= Erinella tricolor (Sowerby: Fr.) Quél. 1886
= **Proliferodiscus triclolor** (Sowerby: Fr.) Baral 2009
A rarely collected species confined to xeric bark of thick branches and trunks of *Quercus*m characterized by violet granules on hairs and excipulum giving a glaucous pigment to the apothecia. Asci euamyloid (rarely inamyloid), gelatinized excipulum hemiamyloid, ascospores guttulate, 9-17 x 2.6-3.7 µm.

Lachnellula pittospori L.M. Kohn 1981 var. pittospori
A synonym of **Proliferodiscus earoleucus** (Berk. & Broome 1875) J.H. Haines & Dumont 1983

Lachnellula pittospori var. azorica L.M. Kohn 1981
?A synonym of **Proliferodiscus earoleucus** (Berk. & Broome 1875) J.H. Haines & Dumont 1983

Lachnellula viridiglauca L.M. Kohn 1981
Probably a Proliferodiscus (or Hyphodiscus?)

Lachnellula theiodea (Cooke & Ellis 1878) Sacc. 1889
= Peziza theiodea Cooke & Ellis 1878
= Lachnella theiodea (Cooke & Ellis 1878) Sacc. in Seymour 1929
- **Hyphodiscus theiodeus** (Cooke & Ellis 1878) Zhuang, Mycotaxon 31: 414 (1988)

Lachnellula eucalypti Spooner, Bibl. Mycol. 116: 432 (1987)
On wood of *Eucalyptus*. Generic position unclear (?*Hyphodiscus*).

Lachnellula rattanicola J. Fröhl. & K.D. Hyde, Palm Microfungi, Fungal Diversity Press, Hong Kong, 393 pp. (2000)
On *Calamus* spp. & *Daemonorops margaritae* (monocotyledons). The hairs and also the medullary hyphae of this species are described as being covered by greenish-blue amorphous granules. This and the ectal excipulum of t. oblita refer the species to the genus *Hyphodiscus* or *Proliferodiscus*.

Lachnellula rhopalostylidis (Dennis) Korf 1977
On leaves of *Rhopalostylis sapida* (Arecales, New Zealand). Perhaps related to *Hyphodiscus*.

Species probably belonging in other genera

Lachnellula calva Rick 1906
A synonym of ?**Midotiopsis bambusicola** Henn. 1902

Lachnellula hysterigena (Berk. & Broome 1873) Sacc. 1889
= Peziza hysterigena Berk. & Broome 1873
= Lachnellula hysterigena (Berk. & Broome 1873) Sacc. 1889
= Unguiculariopsis hysterigena (Berk. & Broome 1873) Korf 1971
A synonym of **Unguiculariopsis ilicincola** (Berk. & Broome 1861) Rehm 1909

Trichoscypha distinguenda (P. Karst.) Boud. 1907
A synonym of **Dasyscyphella dryina** (P. Karst.) Raitv.

REFERENCES CITED

ANDERSON, A.P. (1902) - *Dasyscypha resinaria* causing canker growth on *Abies balsamea* in Minnesota. Bull. Torrey Bot. Club 29: 23-34, pl. 1-2.
BARAL, H.-O. (1984) - Taxonomische und ökologische Studien über die Koniferen bewohnenden europäischen Arten der Gattung *Lachnellula* Karsten. Beitr. Kenntn. Pilze Mitteleuropas I: 143-153.
BARAL, H.-O. (1987) - Lugol's solution/IKI versus Melzer's reagent: hemiamyloidity, a universal feature of the ascus wall. Mycotaxon 29: 399-450.
BARAL, H.-O. (1992) - Vital versus herbarium taxonomy: morphological differences between living and dead cells of Ascomycetes, and their taxonomic implications. Mycotaxon 44: 333-390.
BARAL, H.-O.; MATHEIS, W. (2000) - Über sechs selten berichtete weißhaarige Arten der Gattung *Lachnellula*. Z. Mykol. (in press).
BEMMANN, M. (2013) - *Lachnellula fuckelii* (Bres. ex Rehm) Dharne, ein in Baden-Württemberg kaum beobachteter Ascomyzet. Carolinea 71: 161-164.
BERTHET, P. (1964a) - Formes conidiennes de divers Discomycètes. Bull. trim. Soc. mycol. Fr. 80: 125-149.
BERTHET, P. (1964b) - Essai Biotaxonomique sur les Discomycètes. Dissert. Lyon, 158 pp.

BINGHAM, R.T. & J. EHRLICH (1943) - A *Dasyscypha* following *Cronartium ribicola* on *Pinus monticola* I. Mycologia 35: 95-111.
BINGHAM, R.T.; EHRLICH, J. (1943) - A *Dasyscypha* following *Cronartium ribicola* on *Pinus monticola* II. Mycologia 35: 294-311.
BOUDIER, E. (1907) - Histoire et classification naturelle des discomycètes d´Europe. Paris.
BOUDIER, E. (1905-1910) - Icones mycologicae. 4 vols. Paris.
BREITENBACH, J. & F. KRÄNZLIN (1981) - Pilze der Schweiz, Band 1: Ascomyceten.
BRESADOLA (1887) ....
BRESADOLA, G. (1927-1960). Iconographia mycologica. 28. Vols. Mailand.
BUTIN (1983) ....
CANTRELL, S. A. & R. T. HANLIN (1997) - Phylogenetic relationship in the family *Hyaloscyphaceae* inferred from sequences of ITS regions, 5.8S ribosomal DNA and morphological characters. Mycologia 89: 754-755.
COOKE, M.C. (1875) - British fungi. Grevillea 3: 177-186.
COOKE, M.C. (1876) - Observations on *Peziza calycina*. Grevillea 4: 169-172.
DENNIS, R.W.G. (1949) - A revision of the British *Hyaloscyphaceae*. Mycol. Papers 32: 1-97.
DENNIS, R.W.G. (1961) - Some inoperculate Discomycetes from New Zealand. Kew Bull. 15: 293-320.
DENNIS, R.W.G. (1962) - A reassessment of *Belonidium* Mont. & Dur. Persoonia 2: 171-191.
DHARNE, C.G. (1965) - Taxonomic investigations on the discomycetous genus *Lachnellula* Karst. Phythopath. Z. 53: 101-144.
EGER, A. (1995) - Schadpilze an Waldbäumen entlang des Höhenprofils am Schwerpunktstandort Wank unter besonderer Berücksichtigung der durch *Heterobasidium annosum* (Fr.) Bref. verursachten Rotfäule. Diplomarbeit Universität Regensburg.
ELLIS, M.B.; ELLIS, J.P. (1985) - Microfungi on land plants. An identification handbook. - London & Sydney.
FARR, D.F. et al. (1989) - Fungi on plants and plant products in the United States.
FELTGEN, J. (1903) - Vorstudien zu einer Pilzflora des Herzogtums Luxemburg. Nachträge II. ("1901"). Rec. Mem. Trav. Soc. Bot. Luxemb. 15: 1-243.
FERDINANDSEN, C.; JOERGENSEN, C.A. (1938) - Skovtraeernes Sygdomme. Kobenhavn.
FUNK, A. (1981) - Parasitic microfungi of western trees. Victoria, British Columbia.
GALÁN, R. (1985) - Contribución al estudio del orden Helotiales. (Ascomycotina) en España. Tesis Doctoral inéd. Univ. Alcalá Henares, 387 pp.
GALÁN, R.; MORENO, G. (1985) - Dos especies descritas por J. L. Grelet poco conocidas, *Calycellina albida* (Grelet & Crozals) Galan y Moreno comb. nov. y *Lachnellula robusta* Grelet ex Baral & Matheis, en España Peninsular. Cryptogamie, Mycol. 6: 21-28.
GALAN, R.; RAITVIIR, A.; VILA, J. (1997) - On some noteworthy alpine or subalpine *Hyaloscyphaceae* (*Leotiales*) found in the Pyrenees. Revista Catalana Micol. 20: 137-146
GRELET, L.-J. (1951) - Les Discomycètes de France 22. Rev. Myc. (Paris) N. S. 16: 80-100
GREMMEN, J. (1960) - A contribution to the mycoflora of pine forests in the Netherlands. Nova Hedwigia 1: 251-288, pl. 50-57.
HAHN, G.G.; AYERS, T.T. (1934) - Dasyscyphae on conifers in North America. I. The large-spored, white-excipled species. Mycologia 26: 73-101, pl. 8-12.
HAHN, G.G.; AYERS, T.T. (1934) - Dasyscyphae on conifers in North America II. *D. ellisiana*. Mycologia 26: 167-180.
HAHN, G.G.; AYERS, T.T. (1934) - Dasyscyphae on conifers in North America III. *D. pini*. Mycologia 26: 479-501.
HAHN, G.G. (1940) - Dasyscyphae on conifers in North America. IV. Two new species on Douglas fir from the pacific coast. Mycologia 32: 137-147.
HANSO, M. (1978) - Some materials to rhe mycoflora of conifers in Estonia I. Discomycetes. Folia Crypt. Eston. 10: 1-5.
HARKNESS (1877) - ....
HAINES, J.H.; DUMONT, K.P. (1983) - Studies in the *Hyaloscyphaceae* II: *Proliferodiscus*, a new genus of *Arachnopezizoideae*. Mycologia 75: 535-543.
HUHTINEN, S. (1993) - Some hyaloscyphaceous fungi from tundra and taiga. Sydowia 45: 188-198.
JAAP, O. (1906) - Verzeichnis zu meinem Exsiccatenwerk "Fungi selecti exsiccati", Serien I-IV (Nummern 1-100), nebst Bemerkungen. Verh. Bot. Ver. Prov. Brandenb. 47: 77-99.
JAQUENOUD, M. (1984) - "*Lachnellula* spec." Schweiz. Z. Pilzk. 62*:* 44.
[KARSTEN, P.A. (1871) - Mycologia Fennica I, Discomycetes. Bidr. Känned. Finlands Natur Folk 19: 1-263.]
KAHR, H.; MAURER, W.; SCHEUER, C.; FRIESACHER, D.; ARON, A. (2009) - Die Haarbecherchen (*Lachnellula*-Arten) der Steiermark. Joannea Bot. 7: 63-88
KARSTEN, P. A. & P. HARIOT (1890) - Ascomycetes novi. Rev. Mycol. 12: 169-173.
KIRSCHSTEIN, W. (1938) - Über neue, seltene und kritische Ascomyceten und Fungi imperfecti. Ann. Myc. 36: 367-400.

KLIKA, J. (1922) - Ein kleiner Beitrag zur Pilzflora der Czechoslovakei. Ann. Myc. 20: 290-292.
KNUDSEN, H.; HANSEN, L. (1996) - Nomenclatural notes to nordic ascomycetes. Nordic J. Bot. 16: 211-221.
KOHN L.M. (1980) - Additions to the fungus flora of Bermuda 1: A new species of *Lachnellula* on *Pittosporum* Mycotaxon 12: 278- 280.
KOHN L.M. (1981) - A preliminary discomycete flora of Macaronesia: part 3, *Hyamoscyphaceae* subf. *Trichoscyphelloideae*. Mycotaxon 13: 145-149.
LE GAL, M. (1953) - Les Discomycètes de l´herbier Crouan. Rev. Myc. 18: 73-132.
KUJALA, V. (1950) - Über die Kleinpilze der Koniferen in Finnland. Comm. inst. forest. Fenn. (Helsinki) 38: 1-121.
MALENÇON, G.; BERTAULT, R. (1976) - Champignons de la Péninsule Ibérique. Acta Phytotax. Barcinon. 19: 5-68.
MANNERS, J. G. (1953) - Studies on Larch canker I. The taxonomy and biology of *Trichoscyphella willkommii* (Hart.) Nannf. and related species. Trans. Br. Mycol. Soc. 36: 362-374.
MATHEIS, W. (1985) - Der Bannwald "Waldmoor-Torfstich". - In: Waldschutzgebiete (im Rahmen der Mitteilungen der Forstlichen Versuchs- und Forschungsanstalt Baden-Württemberg) 3: 125-136.
MASSEE, G. (1896) - Redescriptions of Berkeley's types of fungi (?1897). J. Linn. Soc. (Bot.) 31: 462-525, pl. 16-18.
MÜLLER, E. & ... AHMAD (1962). .....
MÜLLER, E. (1977). Zur Pilzflora des Aletschwaldreservats (Kt. Wallis, Schweiz). Beitr. Krypt. Fl. Schweiz / Mat. Fl. Crypt. Suisse 15 (1): 1-126.
NANNFELDT, J.A. (1932) - Studien über die Morphologie und Systematik der nicht-lichenisierten inoperculaten Discomyceten. Nova Acta Regiae Soc. Scient. Upsal., Ser. 4, 8 (2): 1-368.
OGUCHI, T. (1981) - Morphological and cultural studies on *Lachnellula* spp. in Hokkaido II. Species on *Larix*. Trans. mycol. Soc. Japan 22: 165-172.
RAITVIIR, A. (1977) - New taxa of the *Hyaloscyphaceae*. Folia Crypt. Eston. 9: 1-6
RAITVIIR, A. (1970) - Synopsis of the *Hyaloscyphaceae*. Scripta Myc. 1: 69
RAITVIIR, A. (1980) - A preliminary revision of the genus *Lachnellula* in the U.S.S.R. Metsanduslikud uurimused 16: 85-98.
RAITVIIR, A. (1991) - Ordnung Helotiales (in Russian). In: Plantae non vasculares, Fungi et Bryopsida Orientis extremis Sovietici, Fungi, Tomus 2 Ascomycetes. Leningrad.
RAITVIIR, A. (2008) - The Helotiales of the Magadan and Chukotka areas of the Russian Arctic. - Sommerfeltia 31: 179-190.
[REHM, H. (1896) - Ascomyceten: Hysteriaceen und Discomyceten. - In: Rabenhorst's Kryptogamenflora von Deutschland, Österreich und der Schweiz. Leipzig.]
SACCARDO, P.A. (1889) - Sylloge Fungorum 9: 1-1143, Patavii.
SACCARDO, P.A. (1895) - Sylloge Fungorum 11: 1-718, Patavii.
SACCONI, S. (1985) - Iniziazione allo studio dei discomiceti inoperculati II: Famiglia delle *Hyaloscyphaceae*. Boll. Gruppo Micol. Bresadola 78: 8-18.
SCHMID-HECKEL, H. (1985). Zur Kenntnis der Pilze in den Nördlichen Kalkalpen. Nationalpark Berchtesgaden, Forschungsberichte 8: 1-201.
SCHMID-HECKEL, H. (1988) - Pilze in den Berchtesgadener Alpen. Nationalpark Berchtesgaden, Forschungsberichte 15: 1-136.
SCHMID, I.; SCHMID, H. (1991) - Ascomyceten im Bild, 2. Serie, Tafel 51-100, IHW, Ehing.
SCHRÖTER, J. (1893) - Die Pilze Schlesiens. In F. Cohn, Kryptogamenflora von Schlesien, Bd. III, 2. Hälfte, - J. U. Kern, Breslau ("1908").
SEAVER, F.J. (1951). The North American cup fungi (inoperculates). New York, 428 p.
SMERLIS (1973) .....
SPOONER, B.M. (1987) - Helotiales of Australasia: *Geoglossaceae*, *Orbiliaceae*, *Sclerotiniaceae*, *Hyaloscyphaceae*. Bibl. Mycol. 116: 1-711.
STEPHAN, B.R.; BUTIN, H. (1980) - Krebsartige Erkrankungen an *Pinus contorta*-Herkünften. Europ. J. Forest Pathol. 10: 410-419.
SUKOVÁ, M. (2005) - A revision of selected material of lignicolous species of *Brunnipila*, *Capitotricha*, *Dasyscyphella* and *Neodasyscypha* from the Czech Republic. Czech Mycol. 57: 139-172.
SVRČEK, M. (1962) - Diskomycety z Nízkých Tater, nalezené behem posjezdové exkurze II. SEM. 1960. Ceska Mykol. 16: 87-114.
SVRČEK, M. (1976) - A taxonomic revision of Velenovsky's types of operculate discomycetes (Pezizales) preserved in National Museum, Prague. Acta Mus. Nat. Pragae B, 32: 115-194.
SVRČEK, M. (1978) - Diskomycéty jizníchech I, Dokoncení. Sb. J. muz. Cesky. Bud. prir. Vedy 18: 81-93.
TAKAHASHI, I. (1979). Studies on mycoflora and diseases of coniferous trees at the central part of Hokkaido, Japan. Bull. Tokyo Univ. Forest. 69: 1-143
VAARTAJA, O. (1953). Havanintoja puiden Dasyscypha-lajeista. Karstenia 2: 39-41
VELENOVSKY, J. (1934) - Monographia Discomycetum Bohemiae. Pragae.
VUILLEMIN, P. (1888) - Sur les Pézizes des chancres des conifères. Bull. Soc. Bot. Fr. 35: LXIV-LXXI.
ZHUANG, W.-y. (1997) - Fungal flora of the Daba Mountains: discomycetes. Mycotaxon 61: 3-12.
ZHUANG, W.-y. (2002) - Some new species and new records of discomycetes in China. X. Mycosystema 21: 475-479.