

On *Rosellinia mammaeformis* and other related species

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The taxon *Rosellinia mammaeformis* is redefined after a study of PERSOON's original material and recently collected specimens. Four similar species, *R. abscondita*, *R. etrusca*, *R. morthieri*, and *R. nectrioides* are redescribed and discussed; two species, *R. britannica* and *R. helvetica*, are described as new. A dichotomous key is presented for the seven species.

Rosellinia mammaeformis is considered to be a very common species of the genus, but careful studies of specimens identified as *R. mammaeformis* have shown that this name has been used for at least four different taxa.

In Great Britain a taxon with large ascospores and very distinctive ascus tips has been regularly identified as *R. mammaeformis*. In Scandinavia the species is interpreted quite differently. Some mycologists have followed the authoritative exsiccatum of FRIES, Scler. Suec. no. 387. However, the two examples of SS 387 which have been examined from UPS and K both contain the species *R. subsimilis* KARST., a large spored taxon not discussed in this paper. Other identifications of *R. mammaeformis* relate to *R. nectrioides* and occasionally *R. abscondita*. PERSOON's original material at L was examined and a taxon was found which differed from all those discussed above.

This study has been carried out to define *R. mammaeformis*, to identify the other taxa currently confused with the species, and to evaluate their morphological differences.

Morphological characters

The morphological characters which have been used to separate these taxa are the shape of the stromata, the presence or absence of the subiculum at maturity, the size, shape and colour of the ascospores, and the appearance of their germ slits. The stromata are

usually globose to semiglobose with a tapered or pointed apex but *R. mammaeformis*, *R. morthieri* and *R. britannica* differ in having a strongly flattened top. The ascospore shape is broadly similar for all the species treated and can be defined as asymmetrically ellipsoidal with one side flattened and the ends slightly pinched. The slimy caps and sheaths surrounding the spores are also more or less uniform; in some species, particularly in *R. helvetica* they are more developed, but with increasing age they become reduced or are even absent in all species. The taxonomic value of the asci is limited, as they soon disintegrate and only a few intact asci are usually present, thus not allowing careful analysis except in very young collections when the spores may not be fully mature. The ascus tips always turn blue in Melzer's reagent and their size, and to a lesser extent, their shape, can be used as a diagnostic character.

Only a few cultures were examined, mainly because of the difficulty encountered in germinating ascospores. Cultures derived from different species are well characterized macroscopically; the morphology of the anamorph formed in the subiculum and in culture, on the other hand, has no diagnostic value.

Material and Methods

Ninety-seven specimens were examined in this study and 57 of them were used for the statistical evaluation. Within each collection approx. 50 ascospores and some asci were chosen at random, mounted in water and their length and width measured at 1000 $\times$ magnification. Ascus tips were observed and measured in Melzer's reagent; spore appendages, especially the slimy caps and sheaths were studied by phase contrast microscopy and by mounting the spores in china ink diluted in water.

Culture inoculum was obtained from 2 month old single spore isolates obtained by the method of SAMUELS (1979). Transfers were made to 90 mm Petri dishes containing 2% malt extract agar. The plates were incubated at 18°–20° C in daylight alternating with darkness, and checked after 10, 25 and 50 days.

For the statistical analysis log-transformed data were used to rectify departure from normality. To test for normality distribution, probability plots were used (WILKINSON, 1986). For the graphical display of the ascospore length and width boxplots, a graphical analogue to one-way analysis of variance (TUKEY, 1977), were chosen. The Bartlett test (SOKAL & ROHLF, 1981) was used to test for homogeneity of group variances. A parametric one-way analysis of variance (ANOVA), combined with a multiple comparison testing by the Scheffé linear contrasts method (SOKAL & ROHLF, 1981) was also used.

A multivariate discriminant analysis was performed on the log-

transformed ascospore length and width to test the hypothesis that the seven species can be distinguished on the basis of these two variables.

No statistical analysis was performed on the measurements of the asci, perithecia and stromata as the sample size was not large enough. Thus, only median, mean, standard deviation and boxplots of ascus, perithecial and stromatal sizes were used for the exploratory data analysis.

The statistical analyses were computed using the statistical packages SYSTAT (WILKINSON, 1986) and STATVIEW 512+ (BRAINPOWER, INC., Calabasas CA, USA).

In the diagnoses of the species three values for the different measurements are given: minimum, median, maximum. In the key, however, the 95% confidence interval of the mean is given.

Herbarium abbreviations follow the Index herbariorum (HOLMGREN et al., 1981). The following abbreviations were used for private herbaria not cited in the Index: AJSW: A. J. S. WHALLEY, Liverpool, UK; FAB: HARMAS DE FABRE, Sérignan, France; GCC: G. C. CARROLL, Eugene, Oregon, USA. Specimens annotated with * were not used for the statistical evaluation.

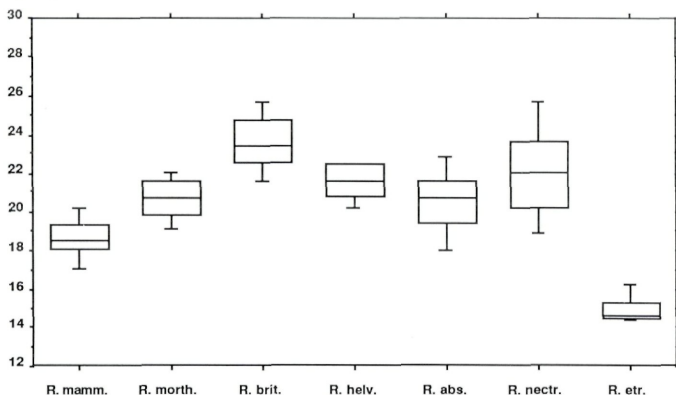
The cultures are deposited at CBS, Baarn, The Netherlands.

Results of the statistical analysis

Fig. 1 shows clearly that the seven taxa cannot be distinguished only on the basis of ascospore size. This is confirmed also by the ANOVA of spore length and width, as well as by the discriminant analysis (Tab. 1 and 2). Although both analyses do not allow particularly good discrimination between the seven sample groups on the basis of spore length and width only, they demonstrate that two groups are formed in which the ascospore sizes allow distinction of taxa (Fig. 2). Spore size is a good discriminator for the species *R. mammaeiformis*, *R. britannica*, *R. nectrioides*, and *R. etrusca*. For *R. etrusca*, however, the sample size is very small and analysis of larger samples would very likely reduce the prediction power of the analysis. *R. morthieri* and *R. abscondita*, on the other hand, can hardly be distinguished from the others by their ascospore size. The spore length is mainly responsible for the discrimination of the sample group (standardized canonical discriminant function coefficients for the first factor: 0.976 for length, 0.410 for width), an observation already made for *Hypoxyton fuscum* (PETRINI & al., 1987).

Tab. 3 summarizes the most important differences between the species as shown from the statistical and morphological analysis.

ascospore
length, μm



ascospore
width, μm

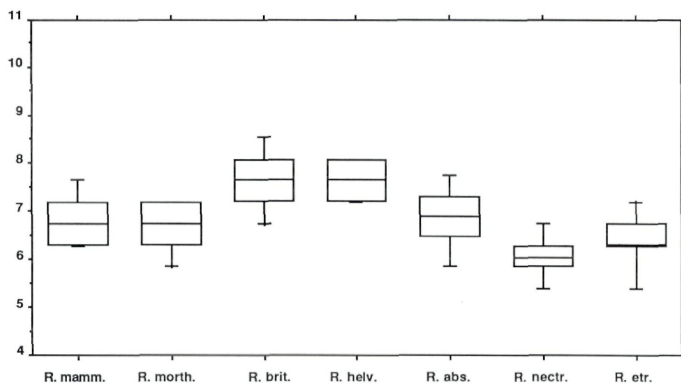
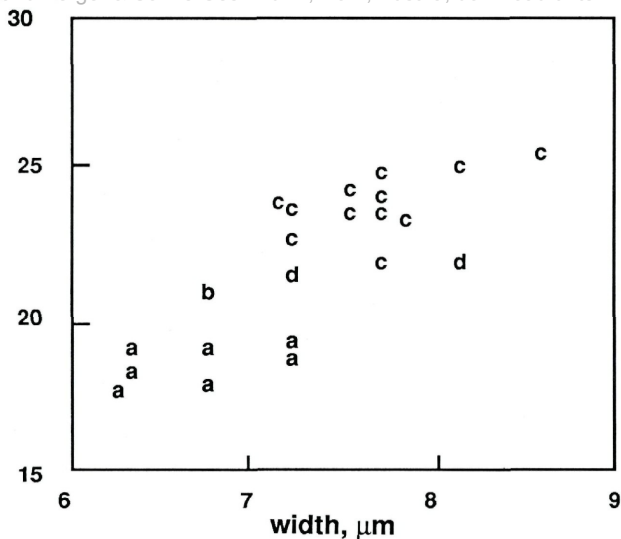


Fig. 1. Boxplots for ascospore sizes. Line within box: median; upper and lower lines: 75th, resp. 25th percentile. Length of vertical bar indicates the 80% confidence interval of the median. R.mamm.: *R. mammaeformis*; R.morth.: *R. morthieri*; R.brit.: *R. britannica*; R.helv.: *R. helvetica*; R.abs.: *R. abscondita*; R.nectr.: *R. nectrioides*; R. etr.: *R. etrusca*.

Length μm



Tab. 1. Multiple comparison testing of the differences in ascospore size of the seven species of *Rosellinia* studied. 1 *R. mammaeiformis*; 2 *R. morthieri*; 3. *R. britannica*; 4 *R. helvetica*; 5 *R. abscondita*; 6 *R. nectrioides*; 7 *R. etrusca*.

*) significant at 95%.

a) spore length

	1	2	3	4	5	6	7
1	—	*	*	*	—	—	*
2		—	*	*	—	—	*
3			—	*	*	*	*
4				—	*	*	*
5					—	—	*
6						—	*

b) spore width

	1	2	3	4	5	6	7
1	—	*	*	*	—	*	*
2		—	*	*	—	—	—
3			—	—	*	*	*
4				—	*	*	*
5					—	*	*
6						—	—

Tab. 2. Prediction results for discriminant analysis. Total percentage correctly classified: 60% (813 out of 1364 measurements). In brackets: percentage of correctly classified measurements for each species. 1 *R. mammaeiformis*; 2 *R. morthieri*; 3 *R. britannica*; 4 *R. helvetica*; 5 *R. abscondita*; 6 *R. nectrioides*; 7 *R. etrusca*.

	1	2	3	4	5	6	7	Total
1	174 (72)	21	2	20	16	2	5	240
2	6	9 (30)	1	3	4	6	1	30
3	0	11	237 (70)	55	16	19	0	338
4	0	2	11	38 (63)	9	0	0	60
5	56	31	31	51	41 (17)	28	5	243
6	32	68	21	2	14	285 (67)	1	423
7	1	0	0	0	0	0	29 (97)	30
Total	269	142	303	169	100	340	41	1364

Tab. 3. Main differences between the taxa studied. The factors allowing good discrimination of taxa are given. a: spore size; b: presence/ absence of subiculum; c: stromatal shape; d: stromatal size; e: ascus tip height; f: germ slit. 1 *R. mammaeiformis*; 2 *R. morthieri*; 3 *R. britannica*; 4 *R. helvetica*; 5 *R. abscondita*; 6 *R. nectrioides*; 7 *R. etrusca*.

	1	2	3	4	5	6	7
1	—	a	a, e	a, b, c	c, f	a, c, f	a, c
2		—	a, e	a, b, c	c, f	c, f	a, c
3			—	a, b, c	a, c, f	a, c, f	a, c
4				—	a, b, f	a, b, f	a, b
5					—	a	a, f
6						—	a, f

Key to the species described*

- 1 Subiculum strongly developed, and present in young, mature and old stages 4. *R. helvetica*
- 1* Subiculum scant, present only in young stages, absent in mature and old material 2
- 2 Stromata semiglobose with a flattened top, ascospores brown to dark brown 3
- 2* Stromata semiglobose to globose, top tapering to a point, not flattened; ascospores light brown to brown 4
- 3 Ascospores 16–23 µm long, ascal tip 2.5–4.5 µm high 5. *R. mammaeiformis* (incl. 6. *R. morthieri*)
- 3* Ascospores 20–27 µm long, ascal tip 5–8 µm high 2. *R. britannica*
- 4 Ascospores 14–17 µm long, brown, germ slit always straight 3. *R. etrusca*
- 4* Ascospores up to 30 µm long, light brown, germ slit straight to slightly diagonal 5
- 5 Ascospores 16–24 × 5.5–8.5 µm (median: 20.6 × 7), side walls curved 1. *R. abscondita*
- 5* Ascospores 17–27 × 5–7 µm (median: 22 × 6), side walls almost parallel 7. *R. nectrioides*

* Measurements in the key are based on the 95% confidence interval of the mean

Description of species

1. *Rosellinia abscondita* H. REHM. – Hedwigia 28: 356. 1889. – Fig. 3a–j.

Non TASSI. – Bull. Lab. Ort. Bot. Siena, p. 52. Tab. 5. Fig. 2. 1900.

Anamorph: *Geniculosporium*

Stromata 0.35–0.6–1 mm in diameter, 0.25–0.5–0.9 mm in height, semiglobose to nearly globose with papillate to pointed ostioles, young light brown to brown, darkening with age, at maturity dark brown, singly or in small groups, sometimes fused together into small clusters, especially when erumpent from bark. Subiculum in young stage covering the stromata, giving them a powdery appearance, appressed between the stromata and on the substrate, woolly to felted, cream coloured to light brown, disappearing and eventually absent in mature and old collections, where sometimes a distinctive, white, leathery area around the stromata can be observed. Ectostroma in cross section 25 µm thick, soft when fresh, cracking when old and dry, black. Entostroma white, cream coloured to dark brown in age, restricted to the sides and the bottom of the stromata or lacking at maturity. – Perithecia 325–538–700 µm in height, 300–500–700 µm in diameter. – Asci 133–154–167 × 8.5–

13–15 µm, spore-bearing part 87–103–114 µm, stipe 42–48–64 µm. – Ascus tip 3.6–4.5–4.5 high, upper width 3.2–3.6–4.5, lower width 3.2–3.6–3.6 µm. – Ascospores 16–20.5–25 × 5.2–6.9–10 µm, asymmetrically ellipsoidal with a flattened side, light brown, with a straight to diagonal germ slit over nearly the whole spore length on the flattened side, sidewalls, when spore symmetrical in optical section, always curved; ascospore ends surrounded by slimy caps, up to 2 µm in length and 4.5 µm in width, disappearing with age.

Anamorph in the subiculum with conidiophores up to 80 µm high and 4 µm wide, hyaline to light brown, with distinctive scars. – Conidia 4–6 (7) × 3.5–4.5 µm, ellipsoidal with a truncate base, hyaline to light brown.

Culture. – 10 days 1.5–4 cm diam.; 25 days 6–9 cm diam. The three isolates showed considerably different growth rates, aerial mycelium scarce, felted, appressed, white with a tinge of orange, some isolates forming in the centre brown discolorations and stromatic structures, reverse white to light orange, with a slightly undulated margin, after approximately 50 days two isolates (399, 3.102) showed brown stromatic structures strongly developed in sectors at the margin, while isolate no. 3.101 lacked any brown discoloration. All cultures were sterile.

Habitat: Betulaceae: *Alnus incana*, *A. viridis*, *Carpinus betulus*. Compositae: *Cirsium palustre*, *Hieracium umbellatum*. Rosaceae: *Sorbus aucuparia*. Salicaceae: *Salix appendiculata*. Saxifragaceae: *Ribes petraeum*.

Known distribution: Subalpine and alpine areas of Austria, Canada, Italy, Norway, Sweden, Switzerland.

Specimens examined. – HOLOTYPE. – AUSTRIA: Tyrol, Oetzthal, Hochjoch Glacier, on dry herbaceous stems; leg. Dr. Rehm, IX. 1888 (S).

CANADA: Prov. Québec, Parc de la Gaspésie, 2.parking, Mont de la Jacques Cartier, on unidentified wood; leg. L. PETRINI, 1.VIII.1987 (ZT 3.160). – ITALY: Trentino Alto Adige, Val di Sole, on stems of *Cirsium palustre*; leg. BRESADOLA, VIII.1896 (PAD). – NORWAY: Oslo, Sorkedalen, Finnerud, on stems of *Hieracium umbellatum*; leg. A. LEUCHTMANN, 20.VIII.1985 (ZT). – SWEDEN: Lycksele Lappmark: Tärna s.n, Umfors, multnande björkved; leg. L. HOLM, 6.IX.1961 (UPS, sub *R. mammaeformis*)*. – SWITZERLAND: Ct. Graubünden, Fuorns, Rhein da Medel, 1460 m.a.s., on *Salix appendiculata*; leg. L. PETRINI & F. CANDOUSSAU, 22.IX.1983 (ZT 3.106). Ct. Graubünden, Fuorns, Rhein da Medel, 1460 m.a.s., on *Salix appendiculata*; leg. L. PETRINI & F. CANDOUSSAU, 22.IX.1983 (ZT 3.105). Ct. Graubünden, Landschaft Davos, Teufli – Stillberg, on *Ribes petraeum*; leg. L. PETRINI, 2.IX.1981 (ZT 2.225A). Ct. Graubünden, Landschaft Davos, Zügenschlucht, 1300 m.a.s., on *Salix appendiculata*; leg. L. PETRINI, 4.IX.1982 (ZT 355B). Ct. Graubünden, Lower Engadin, Ramosch, Pradella, 1150 m.a.s., on *Alnus incana*; leg. L. & O. PETRINI, 4.IX.1983 (ZT 399). Ct. Graubünden, Lower Engadin, Val Tavrü, 1800 m.a.s., on *Sorbus aucuparia*; leg. L. & O. PETRINI, 6.IX.1983 (ZT 3.102, NP 83.102). Ct. Graubünden, Lower Engadin, Val Tavrü, 1800 m.a.s., on driftwood; leg. L. & O. PETRINI, 6.IX.1983 (ZT 3.101, NP 83.100). Ct. Graubünden, Lower Engadin, Val Tavrü, 1800 m.a.s., on *Ribes petraeum*; leg. L. & O. PETRINI, 6.IX.1983 (ZT 3.100, NP 83.99). Ct. Graubünden, Lower Engadin, Val Tavrü,

1800 m.a.s., on *Ribes petraeum*; leg. O. PETRINI, 8.IX.1982 (ZT 2.282, NP 82.51). Ct. Graubünden, San Bernardino, Lago Doss, 1500 m.a.s., on *Alnus viridis*; leg. L. PETRINI, 19.VIII.1981 (ZT 314). Ct. Ticino, Prato Leventina, Bedrina, on *Carpinus betulus*; leg. L. & O. PETRINI, 6.V.1981 (ZT 305). Ct. Uri, Andermatt, St. Anna, 1460 m.a.s., on *Alnus viridis*; leg. L. PETRINI, 22.IX.1983 (ZT 3.104A).

R. abscondita differs from *R. mammaeformis* mainly by the characters of its stromata, larger and lighter coloured ascospores. Moreover, *R. abscondita* has smaller slimy caps around the ends, while *R. mammaeformis* has a slimy sheath surrounding the spores.

2. *Rosellinia britannica* L. E. PETRINI, O. PETRINI & S. M. FRANCIS, sp. nov. – Fig. 3k–q.

Stromata 0.7–0.9–1.4 mm diam., 0.6–0.8–1 mm alta, paene semiglobosa, apice plano, angulis rotundatis, ostioliis papillatis, atribrunnea dum juvenia, nigra aetate provecta et maturitate completa. Subiculum in juvenibus speciminibus pallide brunneum ad brunneum, evanescens maturitate provecta, in maturis senectisque speciminibus absens. Perithecia 500–688–875 µm alta, 575–750–975 µm diam. Asci unitunicati, 182–218–265 × 7–11–20 µm, poro iodo tincto coerulescenti praediti, 5.4–6.3–8.1 µm alto. Ascosporae 19.8–23.4–27.5 × 5.1–7.7–10.4 µm, uniseriatae, asymmetrice ellipsoideae et unilateraliter applanatae, brunneae ad atribrunneae, fissura germinativa recta, in parte applanata sporae posita, aequilonga sporae praeditae; apices et pars applanata ascosporae vagina mucosa apicaliter ad 4 µm longa 6 µm lataque, aetate provecta deliquescenti praeditae.

Holotypus. – Francia, in regione dicta 'Pyrénées Occidentales', pago Lourdes, in silva Mouret, ad ramos Castaneae; leg. F. Candoussau, 11.X.1987 (ZT 3.157)

Anamorph: *Geniculosporium*

Stromata 0.7–0.9–1.4 mm in diameter, 0.6–0.8–1 mm high, semiglobose with a flattened top, with bluntly papillate ostioles, in young stage dark brown, black when mature, singly or in small groups, sometimes fused together. Subiculum limited to the base of the stromata, in young stage light brown to brown, felted, disappearing and eventually completely absent in mature and old specimens. Ectostroma in cross section 25–100 µm thick, soft when fresh, carbonaceous when dry and old, black. Entostroma cream coloured to brown or brown grey, restricted to the sides and to the bottom of the stroma, mostly lacking at maturity. – Perithecia 500–688–875 µm high, 575–750–975 µm in diameter. – Asci 182–218–265 × 7–11–20 µm, spore-bearing part 108–146–182 µm, stipe 50–71–96 µm. – Ascalt tip 5.4–6.3–8.1 µm high, upper width 3.6–4–5 µm, lower width 2.7–3.6–4.5 µm. – Ascospores 19.8–23.4–27.5 × 5.1–7.7–10.4 µm, asymmetrically ellipsoidal with a flattened side, brown to dark brown, with a straight germ slit, over nearly the whole spore length on the flattened side; ascospore ends and the flat side surrounded by a slimy sheath, up to 4 µm long at each end and 6 µm wide, disappearing with age.

Anamorph in the subiculum with conidiophores variable in length, up to 4 µm wide, light brown to brown. – Conidia 6–8 × 3–4.5 µm, ellipsoidal with truncate base, light brown.

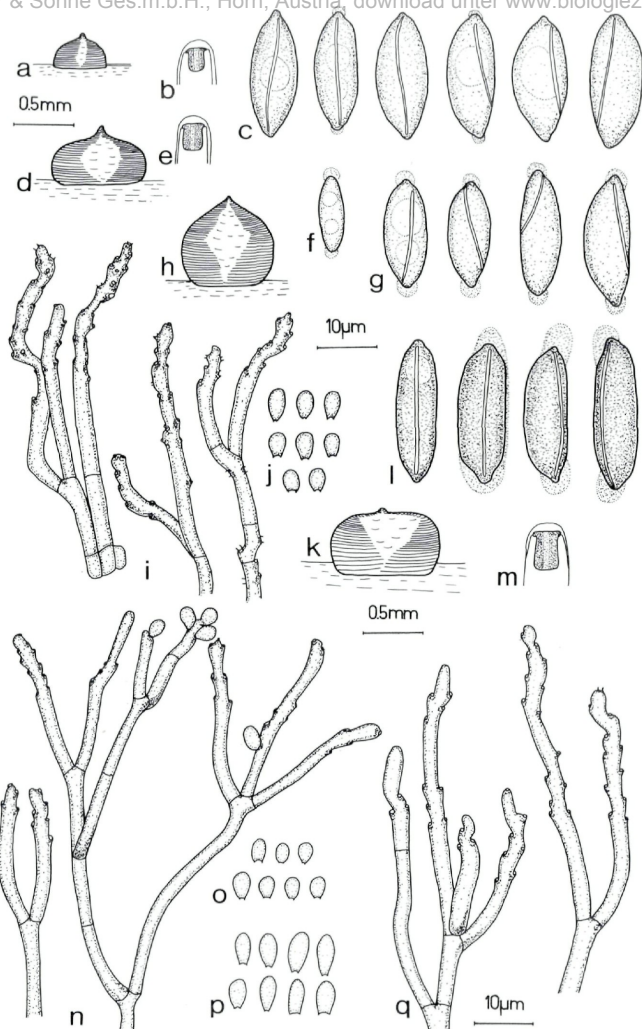


Fig. 3. a-j. *Rosellinia abscondita*. - a. stroma (holotype). - b. ascus tip (holotype). - c. ascospores (holotype). - d. stroma (3.102). - e. ascus tip (3.102). - f. immature ascospore (3.100). - g. ascospores (3.102). - h. stroma (2.282). - i, j. conidiophores and conidia in the subiculum (3.100). - k-q. *Rosellinia britannica*. - k. stroma (holotype). - l. ascospores (holotype). - m. ascus tip (holotype). - n, o. conidiophores and conidia in culture (318). - p, q. conidia and conidiophores in the subiculum (AJSW 1141).

Culture. – 10 days 1.5–2 cm diam.; 25 days 6–7.5 cm diam; aerial mycelium felted, appressed, white, turning light grey with age, reverse white to cream coloured, forming conidiophores in the centre after approximately 50 days, grey in macroscopical appearance. – Conidiophores variable in length, up to 3 µm wide, light brown. – Conidia 3.5–5 × 3–3.5 µm, ellipsoidal with truncate base, light brown.

Habitat: barked and unbarked branches of Araliaceae: *Hedera helix*. Betulaceae: *Corylus avellana*. Fagaceae: *Castanea*. Oleaceae: *Fraxinus excelsior*.

Known distribution: Denmark, Southern France, Italy, Great Britain, Southern Switzerland.

Specimens examined. – HOLOTYPE. – FRANCE: Pyrénées Occidentales, Lourdes, Bois du Mouret, on *Castanea* leg. F. CANDOUSSAU, 11.X.1987 (ZT 3.157).

DENMARK: Jonstrupvang, Bullerup, on *Fraxinus excelsior*; leg. D. HAMELEV, XII.1985 (AJSW 1141, sub *R. aquila*). – FRANCE: Les Landes, Tartas, Bord de la Midouze, on unidentified wood; leg. L. PETRINI, 29.III.1986 (ZT 3.136). Pyrénées Atlantiques, Nay, Saligues de Bourdettes, on *Fraxinus excelsior*; leg. F. CANDOUSSAU, 29.IX.1983 (ZT 3.117). Pyrénées Atlantiques, Nay, Saligues de Bourdettes, on unidentified wood; leg. F. CANDOUSSAU, 12.X.1981 (ZT 318, in culture). Pyrénées Atlantiques, Nay, Saligues de Bourdettes, on unidentified wood; leg. F. CANDOUSSAU, 30.III.1986 (ZT 3.140). Pyrénées Atlantiques, Nay, Saligues de Bourdettes, on unidentified wood; leg. L. PETRINI, 12.X.1981 (ZT 320). – GREAT BRITAIN: North Wales, Gwynedd, Bangor, Tretorlt, on *Hedera helix*; leg. A.J.S. WHALLEY, 14.IV.1982 (AJSW 832). North Wales, Gwynedd, Bangor, Llynwood, on *Fraxinus excelsior*; leg. A.J.S. WHALLEY, 6.IV.1980 (ZT, ex Herb. AJSW 748). North Wales, Clwyd, Llaneliden, near Ruthin, on *Corylus*; leg. L. PETRINI & A.J.S. WHALLEY (ZT 3.148). South Devon, Saplton Nature Reserve, Area J1, on *Hedera helix*; leg. D.L. HAWKSWORTH, 12.VIII.1973 (UPS ex IMI no. 178223)*. Sussex, Midhurst, Dunford House, on *Hedera helix*; leg. C. BOOTH, 25.V.1959 (BPI ex IMI no. 76770)*. – ITALY: Rome, Castel Gandolfo, on *Hedera helix*; leg. P.A. SACCARDO, VII.1904 (BPI MYCOTHECA ITALICA NO. 1477, sub *R. mastoidea* SACC.). – SWITZERLAND: Ct. Ticino, Sottoceneri, Comano, on *Fraxinus excelsior*; leg. L. PETRINI, 15.IV.1984 (ZT 3.123).

This species was regularly identified as *R. mammaeiformis* in Great Britain and elsewhere, but this taxon differs from true *R. mammaeiformis* by the much larger ascospores and ascal tips which are nearly twice as long. The appearance of the cultures also differs. *R. morthieri* was originally described on *Hedera helix*: this suggests some affinities with the “British *R. mammaeiformis*” which also frequently occurs on this host. *R. britannica*, however, has significantly larger ascospores and larger ascal tips than *R. morthieri*.

3. *Rosellinia etrusca* H. FABRE. – Ann. Sc. Nat. Bot. Ser.6 9:80. 1878. – Fig. 4a–b.

Stromata 0.5–0.6–0.7 mm in diameter, 0.5–0.55–0.6 mm high, nearly globose with indistinct papillate ostioles, dark brown to black, in small groups, sometimes fused together. Subiculum not

seen. – Ascospores $14\text{--}14.6\text{--}17 \times 5.4\text{--}6.3\text{--}7.2 \mu\text{m}$, asymmetrically ellipsoidal, brown, with straight germ slit over nearly the whole spore length; ascospore ends surrounded by slimy caps up to $1 \mu\text{m}$ long and $2 \mu\text{m}$ wide.

Habitat: Caprifoliaceae: *Lonicera etrusca*.

Known distribution: France

Specimen examined. – HOLOTYPE. – FRANCE: Vaucluse, Sérignan, on *Lonicera etrusca*; leg. H. FABRE, VI.1871 (FAB).

The type material is the only known specimen of this species. No asci could be found in the collection.

R. etrusca differs from *R. abscondita* and *R. nectrioides* by its smaller ascospores and germ slits that are always straight.

4. *Rosellinia helvetica* L. E. PETRINI, O. PETRINI & S. M. FRANCIS, sp. nov. – Fig. 4c–g.

Stromata $0.7\text{--}0.9\text{--}1.1 \text{ mm}$ diam., $0.6\text{--}0.8\text{--}1 \text{ mm}$ alta, paene semiglobosa ad pyriformia, ostiolis papillatis ad acutatis, atribrunnea, nigra circa ostiolum, dense gregaria ad connata. Subiculum valde evolutum, atribrunneum, maturitate provecta praesens. Perithecia $550\text{--}625\text{--}750 \mu\text{m}$ alta, $575\text{--}675\text{--}700 \mu\text{m}$ diam. Asci unitunicati, $198\text{--}219\text{--}240 \times 13\text{--}16\text{--}17 \mu\text{m}$, poro iodo tincto coerulescenti praediti, $4.5\text{--}5.4\text{--}6.3 \mu\text{m}$ alto. Ascosporae $19.8\text{--}21.6\text{--}24.3 \times 6.8\text{--}7.7\text{--}9 \mu\text{m}$, asymmetrically ellipsoideae et unilateraliter applanatae, brunneae ad atribrunneae, fissura germinativa recta, in parte applanata spora posita, aequilonga spora praedita; ascosporae nuper lectae totae vagina mucosa lateraliter ad $4.5 \mu\text{m}$ apicaliterque ad $6 \mu\text{m}$ lata, aetate provecta modo apicaliter et ad partem applanatam visibili circumdatae.

Holotypus. – Helvetia: Berna, in loco dicto "Brünigpass", 1900 m alt. s. m., in *Fago sylvatica*; leg. L. PETRINI, 18.X.1982 (ZT 348A).

Stromata $0.7\text{--}0.9\text{--}1.1 \text{ mm}$ in diameter, $0.6\text{--}0.8\text{--}1 \text{ mm}$ high, nearly semiglobose to somewhat pear-shaped with papillate to pointed ostioles, dark brown, black around the ostiolum, densely packed and often fused together, forming a dense cover on the substrate. Subiculum strongly developed, felted to woolly, dark brown, still present in old material. Ectostroma in cross section $50\text{--}75 \mu\text{m}$ thick, dark brown to black. Entostroma white, cream coloured to brown or dark brown, restricted to the sides and the bottom of the stromata. – Perithecia $550\text{--}625\text{--}750 \mu\text{m}$ high, $575\text{--}675\text{--}700 \mu\text{m}$ in diameter. – Asci $198\text{--}219\text{--}240 \times 13\text{--}16\text{--}17 \mu\text{m}$, spore-bearing part $127\text{--}150\text{--}164 \mu\text{m}$ and stipe $53\text{--}72\text{--}92 \mu\text{m}$. – Ascus tip $4.5\text{--}5.4\text{--}6.3 \mu\text{m}$ high, upper width $3.6\text{--}3.8\text{--}4.5 \mu\text{m}$, lower width $2.7\text{--}3.6\text{--}4.5 \mu\text{m}$. – Ascospores $19.8\text{--}21.6\text{--}24.3 \times 6.8\text{--}7.7\text{--}9 \mu\text{m}$, asymmetrically ellipsoidal with a flattened side, brown to dark brown, with a straight germ slit over the whole spore length on the flattened side, when freshly collected completely surrounded by a thick slimy sheath, up to $4.5 \mu\text{m}$ wide and up to $6 \mu\text{m}$ long at each end, later reduced to the ends and the flattened side of the spores, absent in old material.

Habitat: unbarked wood of Fagaceae: *Fagus sylvatica*.
Salicaceae: *Salix viminalis*.

Known distribution: Central Switzerland, mountain and subalpine area.

Specimens examined. – HOLOTYPE. – SWITZERLAND: Ct. Bern, Brünigpass, 1900 m.a.s., on *Fagus sylvatica*; leg. L. PETRINI, 18.X.1982 (ZT 348A).

SWITZERLAND: Ct. Glarus, Klöntal, Vorder Richisau, 1100 m.a.s., on *Salix viminalis*; leg. L. PETRINI, 4.VIII.1983 (ZT 381).

R. helvetica differs from the other species discussed here primarily by the subiculum which is present in both young and old material. It is distinguished from *R. mammaeformis* by its slightly longer ascospores and the shape and colour of the stromata. *R. helvetica* has larger stromata, darker ascospores and a much larger slimy sheath than *R. abscondita*, *R. etrusca* and *R. nectrioides*.

5. *Rosellinia mammaeformis* (PERS.: FR.) CES. & DE NOT. – Comm. Critt. It. 1: 227. 1863. – Fig. 4h–o.

BAS. – *Sphaeria mammaeformis* PERS.: FR. – Syn. Meth. Fung. p. 64. 1801

Anamorph: *Geniculosporium*

Stromata 0.6–0.9–1.2 mm in diameter, 0.4–0.6–0.9 mm high, nearly semiglobose with a flattened top, with bluntly papillate ostioles, young brown to dark brown, black at maturity, singly or in small groups, sometimes fused together. Subiculum in young stage covering the stromata, light brown to brown, between the stromata and on the substrate felted, dark brown, gradually disappearing during ripening and becoming reduced to the base of the stromata, eventually completely absent when mature and old. Ectostroma in cross section 50–75 μm thick, carbonaceous, black. Entostroma cream coloured, light to dark brown, restricted to the sides and to the bottom of the stroma, or lacking at maturity. – Perithecia 400–525–700 μm high, 475–612–750 μm in diameter. – Asci 113–148–173 $\times$ 8–9–9.5 μm , spore-bearing part 92–109–126 μm , stipe 20–38–57 μm . – Ascaltip 2.7–3.6–4.7 μm high, upper width 2.7–3–3.6 μm , lower width 1.8–2.7–3.2 μm . – Ascospores 14.4–18.5–24 $\times$ 5.8–6.8–8.5 μm , asymmetrically ellipsoidal with a flattened side, brown to dark brown, with a straight germ slit over nearly the whole spore length on the flattened side; ascospore ends and the flat side surrounded by a slimy sheath, up to 4 μm in length at each end and 6 μm wide, disappearing with age.

Culture. – 10 days 3 cm diam.; 25 days 8 cm diam. Aerial mycelium abundant, cottony, white, with age brown in the centre and forming radiate strands, reverse white to cream coloured, brown in the centre. Different single spore isolates inoculated onto the same dish formed dark brown stromatic lines, where after approxi-

mately 3 months conidiophores were formed: they were variable in length, up to 3 μ m wide, hyaline to light brown, grey in macroscopical appearance. – Conidia 4–5 $\times$ 2.5–3 μ m, ellipsoidal with truncate base, hyaline to light brown.

Habitat: on barked and unbarked wood of Oleaceae: *Fraxinus excelsior*. Salicaceae: *Salix* and other hardwoods.

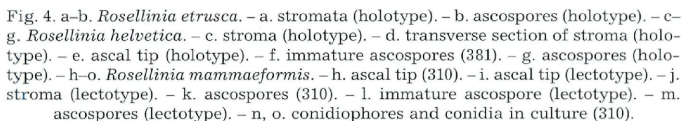
Known distribution: Denmark, France, Switzerland.

Specimens examined. – LECTOTYPE: on *Populus* or *Corylus*; leg. MOUGEOT (L 910.269.326, sub *Sphaeria mammaeformis*).

DENMARK: Sjaelland, Stevns Klinten, on unidentified wood; leg. G. C. CARROLL, 3.V.1963 (GCC 454). – FRANCE: Haute-Savoie, Thonon, Bois de Goudrée, on *Fraxinus excelsior*; leg. L. PETRINI, 4.VII.1981 (ZT 310, in culture). On *Salix*; leg. ROUSSEL (UPS (F-02371) 34147, sub *S. mammaeformis*)*. – SWITZERLAND: Ct. Zürich, Zürichberg, Tobelhofstrasse, on *Salix* ?; leg. A. VOLKART, 25.IX.1904 (ZT). Leg. WEGELIN, 9.XI.1889 (ZT). Tägelsbach, on Fäschinen; leg. WEGELIN, 8.V.1892 (ZT). – *Fungi Rhen.* No.1061 (G, printed standard label with handwritten name and number, without description, sub *R. aquila* var. *glabra* L. FÜCKEL, not the type material). – No further annotation, L. FÜCKEL, No. 557 (G, sub *Sphaeria mammaeformis*)*.

According to the nomenclatural rules (STAFLEU & al., 1981) a lectotype must be chosen among the specimens of *S. mammaeformis* mentioned or studied by PERSOON or FRIES and included in the protologue. We have studied the original material of *Sphaeria mammaeformis* of the FRIES and the PERSOON herbaria. In the FRIES herbarium. (UPS) seven collections exist: exsiccata 387, Scler. Suec. sub *S. mammaeformis* is *R. subsimilis* KARSTEN; collections no. (F 02372) 34148, (F 02373) 34149, and (F 02374) 34150 are immature or old and empty and judging by their stromatal shape and size they belong either to *R. abscondita*, *R. nectrioides* or *R. subsimilis*. Two specimens (F 02369) 34145 and (F 02370) 34146 have stromata suggesting typical *R. mammaeformis*, but the material is old and decayed. No. (F-02375) 34151 is from Mauritius and represents a different species.

In the PERSOON herbarium only five specimens can be found under the name *Sphaeria mammaeformis*. Nos. 910.263.1127, 910.263.1129, 910.269.316 are too old and cannot be identified. No. 910.269.325 is *Rosellinia aquila* (FR.: FR.) DE NOT.; only no. 910.269.326, containing material from MOUGEOT, consists of comparatively good material and fits the description of *R. mammaeformis*. This specimen is therefore chosen as the lectotype of *R. mammaeformis*. The exsiccata Stirpes Crypt. no. 380 by MOUGEOT, NESTLER & SCHIMPER, mentioned by FRIES (1823) in his description of *S. mammaeformis* and therefore a possible lectotype, is rejected, because the two exsiccata deposited in the herbarium of Geneva are *R. thelena* (FR.) RABENH. One, which is in excellent condition, also contains one small piece of *R. subsimilis*. The same exs. no. 380 deposited in IMI contains two species of *Rosellinia*, one similar to PERSOON'S *R. mammaeformis*, while the second is *R. subsimilis*.



WINTER (1887) cites *Hypoxyylon globulare* BULL., FÜCKEL's Fungi rhenani 1060, as a synonym of *R. mammaeformis*. However, the specimens in G and K are *R. desmazieresii* (BERK. & BR.) SACC. But exs. 1061 of FÜCKEL's Fungi rhenani, sub *H. globulariforme* FÜCKEL, deposited in K, is *R. mammaeformis*. Two additional specimens of it exist in G. One is also *R. mammaeformis*, sub *R. aquila* (FR.: FR.) DE NOT var. *glabra* FÜCKEL. The other, with a printed description, contains three twigs. Two are covered with *R. mammaeformis* (erroneously annotated as *R. morthieri*). The third, obviously removed from a sheet onto which it had been glued, has stromata of *R. aquila* var. *glabra* on it. *H. globulariforme* cannot be cited as a synonym of *R. mammaeformis* owing to the confusion of taxa found in the three samples of the exsiccata examined.

R. mastoidea SACC. is also listed as a synonym by WINTER (1887). However, no original material could be found in PAD. The five specimens present in PAD as well as two exsiccata in BPI (1476, 1477) have been collected after the date of publication and contain several species, thus not allowing a lectotype to be chosen: exs. 1476, Mycotheca italica is *R. aquila*. (PAD, empty in BPI); exs. 1477, Mycotheca italica, is *R. britannica* (BPI, immature in PAD); one specimen is *Hypoxyylon confluens* (Tode: Fr.) West. (PAD), another is an old *R. subsimilis* (PAD) and the fifth, also in PAD, is either an almost completely decayed *R. abscondita* or *R. nectrioides*. The drawings of *R. mastoidea* by SACCARDO in Fungi italici (SACCARDO, 1877–1886; Tab. 589, 1879,) do not allow one to draw any conclusion on the taxonomic position of this species. Therefore we do not cite *R. mastoidea* as a synonym of *R. mammaeformis* and have to consider it as a species incertae sedis.

In addition, SACCARDO (1882) cites *Sphaeria brachystoma* WALLR. as a synonym of *R. mammaeformis*. Original material is not deposited in STR and the species remains unknown at present.

There seems no good reason to follow SACCARDO (1882), who changed the epithet "*mammaeformis*" to "*mammiformis*": we prefer to use the etymologically and philologically more consistent "*mammaeformis*" in accordance with the rules of Latin grammar (see also the use of "*mammatus*" by PLINIUS, Nat. 35, 159).

6. *Rosellinia morthieri* L. FÜCKEL. – Symb. Myc. p. 148. 1869. – Fig. 5a–c.

Stromata 0.6–0.9–1.1 mm in diameter, 0.3–0.5–0.8 mm high, nearly semiglobose with a flattened top, with bluntly papillate ostioles, dark brown to black, in small groups. Remnants of a woolly, brown subiculum are present. – Ascus tip 3–3.8–4 µm high, upper width 3 – 3.3–4 µm, lower width 2–2.8–3 µm. – Ascospores 16.2–

20.7–22.5 × 5–6.8–7.7 µm, asymmetrically ellipsoidal with a flattened side, brown to dark brown, with a straight germ slit over nearly the whole spore length on the flattened side; ascospore ends and the flat side surrounded by a slimy sheath, up to 2 µm in length at each end and 5 µm wide, disappearing with age.

Habitat: branches of Araliaceae: *Hedera helix*.

Known distribution: France, Switzerland.

Specimen examined. – HOLOTYPE. – SWITZERLAND/France: Jura, on *Hedera helix*; leg. MORTIER, V.1863 (G).

The type material is the only specimen known at present. *R. morthieri* differs from *R. mammaeformis* only by its larger ascospores, although there is considerable overlap of the ascospore sizes (Fig. 1). It is tempting to merge the two taxa but we prefer to wait until more collections of *R. morthieri* can be examined. No cultural data are available.

7. *Rosellinia nectrioides* H. REHM. – Ann. Mycol. 6: 324. 1908. – Fig. 5d–n.

Anamorph: *Geniculosporium*

Stromata 0.4–0.7–1 mm in diameter, 0.3–0.6–0.9 mm in height, semiglobose to nearly globose with papillate to pointed ostioles, young light brown to brown, darkening with age, at maturity dark brown, singly or in small groups, sometimes fused together into small clusters, especially when erumpent from bark. Subiculum in young stage covering the stromata, giving them a powdery appearance, appressed between the stromata and on the substrate, woolly to felted, cream coloured to light brown, disappearing and eventually absent when mature and old. Ectostroma in cross section 25 µm thick, soft when fresh, cracking when old and dry, black. Entostroma white, cream coloured to dark brown in age, restricted to the sides and the bottom of the stromata or lacking at maturity. – Perithecia 375–550–675 µm in height, 400–563–675 µm in diameter. – Asci 108–200–266 × 8–10–15 µm, spore-bearing part 90–132–166 µm, stipe 18–69–125 µm. – Ascus tip 3.6–4.5–6.3 high, upper width 2.7–3.6–4.5, lower width 2.3–3–4.5 µm. – Ascospores 16.7–22–29.5 × 4.7–6–7.7 µm, asymmetrically ellipsoidal with a flattened side, light brown, with a straight to diagonal germ slit over nearly the whole spore length on the flattened side, sidewalls, when spore symmetrical in optical section, parallel; ascospore ends surrounded by slimy caps, up to 1.5 µm in length and 3 µm in width, disappearing with age.

Anamorph in the subiculum with conidiophores variable in length, light brown, with distinctive scars. – Conidia 3.5–6

(7.5) $\times$ 3.5–4.5 μ m, ellipsoidal with truncate base, hyaline to light brown.

Culture. – 10 days, 3–3.5 cm diam.; 25 days, covering the whole plate. Aerial mycelium felted, appressed, white, in the centre dark brown discolorations; reverse white with brown areas, after approximately 50 days surface covered with grey areas and brown black stromatic structures, forming conidiophores. – Conidiophores variable in length, up to 3 μ m wide, light brown. – Conidia 5–7 $\times$ 2–3 (4) μ m, ellipsoidal with truncate base, light brown.

Habitat: Betulaceae: *Alnus viridis*, *Alnus* spp., *Betula*. Compositae: *Tanacetum vulgare*, *Serratula tinctoria*, *Solidago canadensis*. Leguminosae: *Trifolium medium*. Onagraceae: *Epilobium angustifolium*. Oleaceae: *Fraxinus excelsior*. Poaceae: *Dactylis glomerata*. Rosaceae: *Crataegus sanguinea*, *Filipendula ulmaria*, *Rosa*, *Rubus idaeus*. Rubiaceae: *Galium* cf. *verum*. Salicaceae: *Salix nigricans* spp. *borealis*, *Salix* spp. Saxifragaceae: *Ribes petraeum*. Umbelliferae: *Angelica sylvestris*.

Known distribution: Alpine and subalpine areas of Canada, Finland, Norway, Sweden, Switzerland, USSR.

Specimens examined. – HOLOTYPE. – USSR: St. Petersburger Forstinstitut, on *Crataegus sanguinea*; leg. W. TRANZSCHEL, 4.IX.1895 (S 16/12.905).

CANADA: Québec, Mt. Laurier, Lac Castor, l'Ascension, on *Solidago canadensis*; leg. L. PETRINI, 19.VIII.1987 (ZT 3.161). – FINLAND: Konnevesi, Silkkakoski, on *Betula*; leg. S.A. ELBORNE, 19.VIII.1986 (C SAE-86,20SF). Mästälä; leg. K. STARBÄCK (UPS 1707, sub *R. mammaeiformis*)*. – NORWAY: Sör-Trøndelag: Oppdal, Kongsvoll, near R. Blesebekken, 975 m.a.s., on *Salix*; leg. K. & L. HOLM, 22.VIII.1973 (UPS 89A, sub *R. mammaeiformis*)*. Troms, Tromsø h:d, Tromsøya, Sandnes, on *Filipendula ulmaria*; leg. K. & L. HOLM, 22.VIII.1982 (UPS 2733A, sub *R. mammaeiformis*)*. Troms, Tromsø, Tromsøya, W. jor Hamma, on *Salix nigricans* ssp. *borealis*; leg. G. MATHIASSEN, 5.X.1981 (TROM 1134/81, 1135/81, 1137/81, 1138/81). – SWEDEN: Ad Åre Jemmlandia, on *Epilobium angustifolium*; leg. A. G. ELIASSON, IX.1911 (UPS, sub *R. mammaeiformis*)*. Ad Åre Jemmlandia, on *Rubus idaeus*; leg. A. G. ELIASSON, 31.VIII.1911 (BPI, UPS, sub *R. mammaeiformis*)*. Falun, Stadsparken, Gren av lönn på marken; leg. R. MORANDER, 11.V.1977 (UPS 2353, sub *R. mammaeiformis*)*. Gästrikland, Gävle, Lövudden; leg. J. A. NANNFELDT, 4.VIII.1947 (UPS, sub *R. mammaeiformis*)*. Gästrikland, Gävle, Lövudden, on *Dactylis*; leg. J. A. NANNFELDT, 11.VII.1953 (UPS 12894, sub *R. mammaeiformis*)*. Gästrikland, Gävle, Lövudden, on *Alnus*; leg. J. A. NANNFELDT, 15.VIII.1954 (UPS 13815, sub *R. mammaeiformis*)*. Härjedalen, Tännäs sn, Fjällnäs, on *Betula*; leg. J. A. NANNFELDT, 6.VIII.1933 (UPS 4906, sub *R. mammaeiformis*)*. Uppland, Dalby Par. ca 150 m S.W. of Jerusalem, on *Serratula tinctoria*, leg. K. & L. HOLM, 4.X.1984 (ZT 3.128, ex Herb. HOLM 3349b). Uppland, Dalby Par. Jerusalem, on *Fraxinus excelsior*; petioles, leg. K. & L. HOLM, 21.IX.1984 (ZT 3.121, ex Herb. HOLM 3340). Uppland, Dalby Par. Jerusalem, on *Trifolium medium*; leg. K. & L. HOLM, 21.IX.1984 (ZT 3.122, ex Herb. HOLM 3341, in culture). Uppland, Dalby Par. Jerusalem, on *Galium* cf. *verum*; leg. K. & L. HOLM, 21.IX.1984 (ZT 3.120, ex Herb. HOLM 3339). Uppland, Uppsala, on *Rosa*, leg. RUMELL, 25.V.1884 (BPI, sub *R. mammaeiformis*)*. Uppland, Uppsala, Bondkyrka Par., north of "Kvarnbo lund", on *Angelica sylvestris*; leg. O. ERIKSSON, 14.X.1962 (UPS 1828 BB, sub *R. mammaeiformis*)*. Uppland, Uppsala, Bondkyrka Par., north of "Kvarnbo

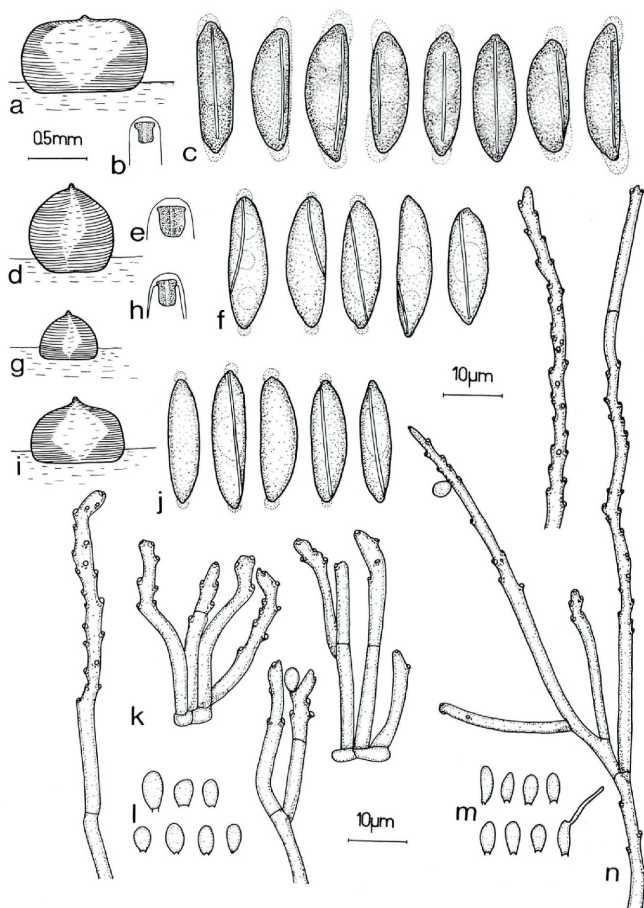


Fig. 5. a-c. *Rosellinia morthieri*. - a. stroma (holotype). - b. ascus tip (holotype). - c. ascospores (holotype). - d-n. *Rosellinia nectrioides*. - d. stroma (holotype). - e. ascus tip (holotype). - f. ascospores (holotype). - g. stroma (3.122). - h. ascus tip (3.122). - i. stroma (3.122). - j. ascospores (3.122). - k, l. conidiophores and conidia in the subiculum (294). - m, n. conidia and conidiophores in culture (3.122).

lund", on herbaceous stem; leg. O. ERIKSSON, 14.X.1962 (UPS 1828 AB, sub *R. mameaeformis*)*. Västerbotten, Sävarpar, Östnäs, on *Chrysanthemum* (= *Tanacetum*) *vulgare*, leg. K. & L. HOLM, 16.VIII.1986 (ZT 3.146 ex Herb. HOLM 4155b). – SWITZERLAND: Ct. Graubünden, Hinterrhein, Dürrenbüel, 1850 m.a.s., on *Alnus viridis*; leg. L. PETRINI, 19.VIII.1981 (ZT 315). Ct. Graubünden, Hinterrhein, Dürrenbüel, on *Ribes petraeum*; leg. L. PETRINI, 25.VIII.1982 (ZT 294). Ct. Graubünden, Klosters, Vereinal, on *Alnus viridis*; leg. L. PETRINI, 1.IX.1982 (ZT 349). Ct. Graubünden, Landschaft Davos, Teufi–Stillberg, 1790 m.a.s., on *Ribes petraeum*; leg. L. PETRINI, 2.IX.1982 (ZT 2.225). Ct. Graubünden, Landschaft Davos, Teufi–Stillberg, 1900 m.a.s., on *Alnus viridis*; leg. L. & O. PETRINI, 2.IX.1982 (ZT 352). Ct. Wallis, Furkapass, above Gletsch, 1850 m.a.s., on *Alnus viridis*; leg. L. PETRINI, 25.IX.1982 (ZT 359). Ct. Wallis, Furkapass, above Gletsch, 1850 m.a.s., on *Alnus viridis*; leg. L. PETRINI, 25.IX.1982 (ZT 361).

R. nectrioides differs from *R. abscondita* mainly by the narrower ascospores and by their shape.

Acknowledgments

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