

# Appendix I

## Alternatieve, verkorte *Scutellina*-sleutel tot de soorten.

N.B. Voor een juiste beoordeling van de sporenornamentatie dienen de sporen bekeken te worden in een oplossing van methyblauw in melkzuur (= MBM) met een 100x objectief (olie-immersie!).

Congorood als kleuringsmiddel en ook Melzer zijn **ongeschikt**, de ornamentatie wordt hierin te onduidelijk gekleurd en zwak geornamenteerde sporen kunnen glad lijken.

Dikgedrukte **namen** voor de in Nederland voorkomende soorten. De hier gebruikte namen komen niet in alle gevallen overeen met de namen in de Beknopte Standaardlijst en de Verspreidingsatlas (voor verschillen zie tabel onderaan de sleutel).

1. Sporen in MBM glad, ornamentatie ook met 100x olie-immersie niet zichtbaar.....**15)** *Sc. setosa* (niet in Nederland).
- 1\*. Sporen in MBM duidelijk geornamenteerd. .... 2
2. Sporen bolvormig of bijna bolvormig  $Qg < 1,25(-1,3)$ . .... **Groep I**
- 2\*. Sporen breed – tot smal ellipsoïde. .... 3
3. Buitenste sporenwand met ornamentatie loslatend in **warme** MBM. .... **Groep IV**  
[in deze groep wordt tevens **28)** *Sc. macrospora* “uitgesleuteld”; sporenwand van deze soort laat **niet** los in MBM (niet in Nederland)].
- 3\*. Buitenste sporenwand (epispodium) niet loslatend in warme MBM. .... 4
4. Ornamentatie bestaande uit geïsoleerde, circa ronde wratjes en wratten, waarvan er soms enkele samenvloeien. .... **Groep II**
- 4\*. Ornamentatie bestaande uit willekeurig gevormde wratjes en wratten die kunnen vervloeien tot gebogen richeltjes, onregelmatige plakjes en stukjes netwerk. .... **Groep III**

### Groep I.

1. Ornamentatie bestaande uit onderling verbonden richels, onvolledig netwerk. . *Sc. rotundisperma*.
- 1\*. Ornamentatie bestaande uit afgeronde wratten of stekels. .... 2
2. Sporen 24-30  $\mu\text{m}$ . .... **4)** *Sc. citrina*.
- 2\*. Sporen 15-23  $\mu\text{m}$ . .... 3
3. Ornamentatie bestaande uit stekels (scherp, stomp of afgeplat) vaak hoger dan breed..... 4
- 3\*. Ornamentatie bestaande uit afgeronde wratten of wratjes meestal breder dan hoog. .... 7
4. Ornamentatie bestaande uit spitse stekels. .... **1)** *Sc. legaliae*.
- 4\*. Ornamentatie bestaande uit stompe of afgeplatte stekels. .... 5
5. Ornamentatie bestaande uit stekels met afgeplatte of iets ingedeukte top tot 3  $\mu\text{m}$  hoog. .... 6
- 5\*. Ornamentatie bestaande uit kortere, stompe stekels tot 2  $\mu\text{m}$  hoog. .... **3)** *Sc. heterosphaera*.
6. Sporen 15,5-18,5  $\mu\text{m}$ . .... **2)** *Sc. trechispora* var. *trechispora*.
- 6\*. Sporen 19-22  $\mu\text{m}$ . .... **2a)** *Sc. trechispora* var. *AAA*.
7. Sporen met grote wratten tot 3  $\mu\text{m}$  hoog. .... *Sc. sinensis*.
- 7\*. Sporen met kleinere wratten. .... 8
8. Sporen rond  $Q \approx 1,0$  met afgeplatte en afgeronde wratten. .... **6)** *Sc. barlae*.

8*. Sporen niet zuiver rond $Q = 1,0-1,35$ .	9
9. Sporen bijna rond $Q = 1,0-1,15$ .	10
9*. Sporen breed ellipsoïde $Q = 1,1-1,35$ .	11
10. Ornamentatie bestaande uit wratten 1-2 $\mu\text{m}$ hoog.	5) <i>Sc. minor</i> .
10*. Ornamentatie fijnere wratten tot 1 $\mu\text{m}$ hoog.	7) <i>Sc. hyperborea</i> .
11. Randharen meestal tussen 200-1000 $\mu\text{m}$ lang.	8) <i>Sc. patagonica</i> .
11*. Randharen meestal tussen 100-500 $\mu\text{m}$ lang.	9) <i>Sc. peloponnesiaca</i> .

## Groep II.

1. Basis randharen niet of zelden 1x vertakt wortelend.	10) <i>Sc. nigrohirtula</i> .
1*. Basis randharen met 1-3 of meer wortels.	2
2. Meeste sporen met $Q > 1,6$ .	3
2*. Meeste sporen met $Q < 1,7$ .	4
3. Randharen tot 30 $\mu\text{m}$ breed, basis met (1-)2(-3) wortels.	11) <i>Sc. heterosculpturata</i> .
3*. Randharen tot 40 $\mu\text{m}$ breed, basis langste haren vaak met 3 of meer wortels. [indien randharen tot 30 $\mu\text{m}$ breed en sporen 24-28 x 12-14 $\mu\text{m}$ , vergelijk 28) <i>Sc. macrospora</i> ]	12) <i>Sc. cejpii</i> .
4. Sporen ellipsoïde, $Q = 1,4-1,7$ .	13) <i>Sc. subhirtella</i> .
4*. Sporen gemiddeld breder, $Q = 1,3-1,5$ . (zie opmerkingen onder deze soort).	14) <i>Sc. umbrorum</i> – complex.

## Groep III.

1. Ornamentatie lager dan 0,5 $\mu\text{m}$ .	2
1*. Ornamentatie 0,5-3 $\mu\text{m}$ hoog.	3
2. Sporen $Q = 1,2-1,5$ . (niet met zekerheid uit Nederland bekend).	16) <i>Sc. kerguelensis</i> .
2*. Sporen $Q = 1,5-1,8$ .	18) <i>Sc. pilatii</i> .
3. Ornamentatie 1-3 $\mu\text{m}$ hoog.	4
3*. Ornamentatie 0,5-1 $\mu\text{m}$ hoog.	5
4. Sporen 14-17 $\mu\text{m}$ breed.	21) <i>Sc. decipiens</i> .
4*. Sporen 11-14 $\mu\text{m}$ breed.	22) <i>Sc. pennsylvanica</i> .
5. Langste randharen zelden langer dan 1000 $\mu\text{m}$ .	6
5*. Langste randharen vaak langer dan 1000 $\mu\text{m}$ .	7
6. Sporen 16-20 x 10-13 $\mu\text{m}$ .	19) <i>Sc. vitreola</i> .
6*. Sporen 18,5-23 x 12,5-16,5 $\mu\text{m}$ .	17) <i>Sc. olivascens</i> .
7. Ornamentatie gevormd door willekeurig gevormde wratten tot 1 $\mu\text{m}$ hoog. ...	20*) <i>Sc. scutellata</i> .
7*. Ornamentatie gevormd door willekeurig gevormde wratten tot 0,5 $\mu\text{m}$ hoog. ... (lastige splitsing, zie opmerkingen onder 20) <i>Sc. scutellata</i> sl).	20a) <i>Sc. crinita</i> .

## Groep IV.

1. Ornamentatie bestaande uit een grof netwerk. .... 23) *Sc. pseudotrechispora*.  
1\*. Ornamentatie bestaande uit kleine wratjes en wratten die kunnen vervloeien tot gebogen richeltjes en stukjes netwerk. .... 2
2. Sporen tussen 8-10,5 µm breed. .... 3  
2\*. Sporen tussen 10-15 µm breed. .... 4
3. Ornamentatie soms vervloeiende wratjes circa 0,5 µm hoog. .... 24) *Sc. minutella*.  
3\*. Ornamentatie willekeurig gevormde wratten circa 1µm hoog. .... 24a) *Sc. species AAA*.
4. Sporen Q = 1,5-1,8. .... 5  
4\*. Sporen Q = 1,7-2,2. .... 6
5. Sporen 16,5-21,5 µm lang, ornamentatie circa 0,5 µm hoog. .... 25) *Sc. torrentis*.  
5\*. Sporen 20-25 µm lang, ornamentatie circa 1(-1,5) µm hoog. .... 26) *Sc. superba*.
6. Ornamentatie bestaande uit vervloeiende wratjes. .... 27) *Sc. mirabilis*.  
6\*. Ornamentatie geïsoleerde of zelden vervloeiend wratjes. .... 28) *Sc. macrospora*.

## Namen Verspreidingsatlas

*Scutellinia paludicola*  
*Scutellinia scutellata*

*Scutellinia subhirtella sensu* Kullman  
*Scutellinia subhirtella sensu* Svrček  
*Scutellinia superba sensu* Le Gal  
*Scutellinia superba sensu* Schumacher  
*Scutellinia trechisperma*  
*Scutellinia trechisperma* f. *trechisperma*  
*Scutellinia trechisperma* f. *macropilifera*

## Namen gebruikt in deze publicatie

*Scutellinia citrina*  
*Scutellinia scutellata* sl, opgesplits in  
*Scutellinia scutellata* ss en *Scutellinia crinita*  
*Scutellinia olivascens*  
*Scutellinia subhirtella*  
*Scutellinia pelopponesiaca*  
*Scutellinia superba*  
*Scutellinia trechispora*  
*Scutellinia trechispora*  
*Scutellinia heterosphaera*

## Appendix II

### Key to the Dutch species of *Scutellinia* (Cooke) Lamb.

#### Key to the groups.

N.B. Species in a group are not necessarily related; bold names for species found in the Netherlands.

1. Ascospores globose, subglobose to broadly ellipsoid,  $Q_{av} < 1.25(-1.3)$ . ..... **Group I**
- 1\*. Ascospores broadly ellipsoid, ellipsoid, narrow ellipsoid to fusiform,  $Q_{av} > 1.3$ ..... 2
2. Exosporium loosening (after some time) in hot lactic acid-cotton blue (= LACB), visible as an envelope floating around the spore (except *Sc. macrospora*). Ornamentation consisting of small warts and warts sometimes merged to curved ridges and pieces incomplete network (pseudoreticulate) or with a fully developed network (reticulate). Spores with  $Q_{av} > (1.4-)1.5$ . Marginal hairs shorter 400(-600)  $\mu\text{m}$  and diameter apothecia mostly less than 5 mm. On recently disturbed, moist soils, not on wood (sectie *Minutae*). ..... **Group IV**
- 2\*. Exosporium not loosening in hot LACB, with another combination of characteristics. .... 3
3. Spore ornamentation consisting of approximately round or weakly angular warts (hemispherical), mostly isolated, sometimes a few confluent (tuberculate, pustulo-cristate). Longest marginal hairs shorter than 800(-1000)  $\mu\text{m}$  (hairs from *Sc. umbrorum* exceptionally longer)..... **Group II**
- 3\*. Spore ornamentation consisting of randomly formed slices, amoeboid warts and curved ridges, sometimes confluent to pieces network (verrucose, tuberculo-reticulate) or spores smooth in LACB (optical light, 100x oil immersion). Longest marginal hairs often above 800  $\mu\text{m}$  (but not always, compare *Sc. kerguelensis*, *Sc. olivascens*, *Sc. setosa*, *Sc. vitreola*)..... **Group III**

#### Key to the species of Group I.

Species with globose, subglobose to broadly ellipsoid spores.

1. Spore ornamentation consisting of interconnected ridges (partial network) 2-4  $\mu\text{m}$  high. Spores 16-18.5  $\mu\text{m}$ , globose. Marginal hairs 500-1100 x 20-35  $\mu\text{m}$ , many septate, walls 3-7  $\mu\text{m}$  thick, base with 1-3 roots. Apothecia 3-8 mm. – Habitat: humus saprotroph. Not known in the Netherlands. .... *Sc. rotundisperma* Donadini (1983).
- 1\*. Spore ornamentation consisting of spines (spinulose, truncate, aculeolate) or hemispherical warts (= tuberculate), if with small confluent warts see 9\*. .... 2
2. Ornamentation spinulose, isolated, sharp spines 1.5-3.5(-4.5)  $\mu\text{m}$  long and 1-2(-2.5)  $\mu\text{m}$  broad. Spores 16.5-20.5 x 16-19.5  $\mu\text{m}$ , mostly not perfect globose,  $Q = 1.0-1.1(-1.15)$ . Marginal hairs 200-950 x 15-35  $\mu\text{m}$ , 3-13 septate, walls 2-6  $\mu\text{m}$  thick, base with 1-3(-4) roots, density along the edge 20-40 hairs per mm. Apothecia 1-7 mm. Habitat humus saprotroph on moist, rich often loamy or calcareous soils. .... **1) *Sc. legaliae*** Lohm. & Häffner (1983).
- 2\*. Ornamentation different. .... 3
3. Ornamentation aculeolate, truncate, isolated conical spines at the top flattened or slightly dented 1-3  $\mu\text{m}$  long and 1-2.5  $\mu\text{m}$  wide. Spores 15.5-18.5  $\mu\text{m}$ , globose. Marginal hairs 250-1800 x 20-45  $\mu\text{m}$ , (0-)5-15 septate, walls 3-10  $\mu\text{m}$  thick, base mostly with 2-7 roots, density along the edge 10-30(-40) per mm. Apothecia 2.5-12 mm. – Habitat: humus saprotroph on moist, rich often loamy or calcareous soils. .... **2) *Sc. trechispora*** (Berk. & Br) Lamb. (1887).  
N.B. Spores 19-22  $\mu\text{m}$ , see ..... **2a) *Sc. trechispora* var. AAA.**
- 3\*. Ornamentation different. .... 4
4. Ornamentation consisting of isolated, short spines and warts of different shape, often starting cylindrical or conical with rounded- or obliquely flattened top (rarely tended), also with some pointed

- elements, 0.5-2.5  $\mu\text{m}$  high and 0.5-2.0  $\mu\text{m}$  wide, at full maturity the bigger warts can be connected by thin, low ridges. Spores 16.5-21  $\mu\text{m}$ , globose. Marginal hairs 200-1545 x 15-40  $\mu\text{m}$ , (0-)5-20 septate, walls 2-6  $\mu\text{m}$  thick, base with 1-4(-5) roots, base longest hairs sometimes very complex, density 20-40 hairs per mm. Apothecia 2-7 mm. –Habitat: humus saprotroph on moist, calcareous, loamy or clayey soils. .... **3) *Sc. heterosphaera*** B. Jeannerot nom. prov.
- 4\*. Ornamentation different and marginal hairs shorter. .... 5
5. Ornamentation tuberculate, approximately hemispherical – or knob-shaped warts 1.0-3.0  $\mu\text{m}$  high and 1.5-3.0(-4.0)  $\mu\text{m}$  wide, of different size, the bigger warts sometimes connected by low ridges. Spores 24-30  $\mu\text{m}$ , globose. Marginal hairs 100-350 x 10-25  $\mu\text{m}$ , 2-5 septate, walls 2-5  $\mu\text{m}$  thick, base mostly unbranched, rare branched once, density large, 50-100 hairs per mm. Apothecia 2-8 mm. – Habitat: humus saprotroph on moist, calcareous soil, especially grassy vegetation.  
 ..... **4) *Sc. citrina*** (Masse & Crossl.) Y.J. Yao & Spooner (1995).  
 = *Sc. paludicola* (Boud.) Le Gal (1966).  
 N.B. Spores also with big warts but 17-19.5  $\mu\text{m}$ , marginal hairs 120-650(-840) x 20-45  $\mu\text{m}$ , longest hair complex rooting, see *Sc. sinensis* M.H. Liu (1996), not in the Netherlands, described from China and already found in some European countries (also as *Sc. tuberculosa*) N. Matočec (2000).  
 5\*. Ornamentation lower and spores smaller. .... 6
6. Ornamentation truncate-tuberculate, isolated, flattened – or rounded – approximately conical – knob-shaped – hemispherical warts of different size, mostly 0.5-2  $\mu\text{m}$  high and 0.7-2  $\mu\text{m}$  wide sometimes with some strikingly large warts 2-3  $\mu\text{m}$  high and up to 4  $\mu\text{m}$  wide. Spores 16.5-20.5 x 15.5-19.5  $\mu\text{m}$ , globose-subglobose  $Q = 1.0-1.15(-1.2)$ . Marginal hairs 100-500(-650) x 12-30(-36)  $\mu\text{m}$ , (0-)2-10 septate, walls 2-6.5  $\mu\text{m}$  thick, base with 1-2 - rarer with 3(-4) roots, density 30-75(-100) hairs per mm. Apothecia 2-11 mm. – Habitat: humus saprotroph on moist, often calcareous soils (bare places between grassy vegetation). .... **5) *Sc. minor*** (Velen.) Svrček (1971).  
 N.B. compare **8) *Sc. patagonica*** with  $Q = 1.1-1.3$  and longer hairs or **9) *Sc. peloponnesiaca*** with more confluent, smaller warts and  $Q = 1.15-1.3$ .  
 6\*. With another combination of characteristics. .... 7
7. Ornamentation tuberculate-aculeolate, isolated hemispherical – or cylindrical, slightly tapered, flattened warts 0.5-1.5(-2)  $\mu\text{m}$  high and 0.5-2.0(-2.5)  $\mu\text{m}$  wide. Spores 17-21.5  $\mu\text{m}$ , globose. Marginal hairs 100-365(-550) x 10-25(-30)  $\mu\text{m}$ , 0-7 septate, walls 2-6  $\mu\text{m}$  thick, base with 1-2(-3) roots, density high 40-80(-100) hairs per mm. Apothecia 2-11 mm. – Habitat: humus saprotroph on calcareous, loamy soils (bare places in grassy vegetation). .... **6) *Sc. barlae*** (Boud.) Maire (1933).  
 7\*. Ornamentation different, spores not perfect globose, broad ellipsoid, marginal hairs longer. .... 8
8. Ornamentation tuberculate, isolated low hemispherical warts (rarely some confluent) 0.5-1.5(-2.0)  $\mu\text{m}$  wide and 0.2-1.0  $\mu\text{m}$  high. Spores 19-22 x 18-21  $\mu\text{m}$ , mostly not perfect globose,  $Q = 1.0-1.1$ . Marginal hairs 150-700 x 13-26(-30)  $\mu\text{m}$ , (0-)2-11 septate, walls 2-5.5  $\mu\text{m}$  thick, base with 1-2(-3) roots, density high 45-100 per mm. Apothecia 2-9 mm. – Habitat: humus saprotroph on moist, mostly calcareous soils (grassy places). Not in the Netherlands (northern and alpine areas).  
 ..... **7) *Sc. hyperborea*** T. Schum. (1990).  
 8\*. Spores subglobose to broadly ellipsoid 18-23.5 x 15-18.5  $\mu\text{m}$ ,  $Q = 1.1-1.3(-1.35)$ . .... 9
9. Ornamentation tuberculate, isolated hemispherical – in outline sometimes lightly angular warts of different size, distributed fairly heterogeneously over the surface (sometimes in groups) 0.5-1.5  $\mu\text{m}$  high and 0.5-2  $\mu\text{m}$  wide. Spores 18-22 x 15-18  $\mu\text{m}$ ,  $Q = 1.1-1.3$ . Marginal hairs 200-1100(-1400) x 15-45  $\mu\text{m}$ , 3-28 septate, walls 2.5-6.5  $\mu\text{m}$  thick, base with 1-3 roots, longest hairs often rooting more complex, density 10-40 per mm. Apothecia 3-13(-20) mm. – Habitat: humus saprotroph on moist sandy soils, mostly grassy vegetation. .... **8) *Sc. patagonica*** (Rehm) Gammundi (1975).  
 N.B. If spores 19-23 x 14-17  $\mu\text{m}$  and  $Q = 1.3-1.5$ , see **14) *Sc. umbrorum*** (Fr.) Lamb.  
 9\*. Ornamentation verrucose, small confluent warts 0.2-0.8(-1.0)  $\mu\text{m}$  high and 0.2-1.0  $\mu\text{m}$  wide, sometimes mixed with some bigger ones (2-3  $\mu\text{m}$ ). Spores 18-23 x 15-18.5  $\mu\text{m}$ ,  $Q = 1.15-1.30$ .

Marginal hairs (60-)100-500(-650) x 11-27(-30)  $\mu\text{m}$ , 1-10(-14) septate, walls 1.5-6  $\mu\text{m}$ , base with 1-3 roots, rarely more complex, density 20-60 hairs per mm. Apothecia 1-9 mm. – Habitat: saprotroph on humus-rich mud, often in grassy vegetation. .... **9) *Sc. peloponnesiaca*** J. Moravec (1974). = *Sc. superba* (Vel.) Le Gal sensu Le Gal (1966), sensu Kullman (1982).

## Key to the species of group II.

Species with marginal hairs not longer than 800(-1000)  $\mu\text{m}$  (*Sc. umbrorum* sporadically longer) and with an ornamentation of approximately hemispherical, mostly isolated- or barely confluent warts (except *Sc. cejpii*).

1. Marginal hairs (100-)150-400 x 10-25  $\mu\text{m}$ , (0-)1-8 septate, walls (1.5-)2-5  $\mu\text{m}$  thick, base not forked, rarely with two roots, density high 50-100 per mm. Spores 21-24 x 14-16  $\mu\text{m}$ , ellipsoid, Q = 1.3-1.7; ornamentation consisting of isolated, sometimes confluent, approximately round warts (0.5-)1-1.5(-2)  $\mu\text{m}$  wide and 0.2-0.6(-1)  $\mu\text{m}$  high. Apothecia 2-10 mm. – Habitat: saprotroph on rather bare, moist, calcareous, loamy soils mixed with humus and wood, also on wet wood and paper.

..... **10) *Sc. nigrohirtula*** (Svr.) Le Gal (1964).  
N.B. According to Matočec (1995) *Sc. nigrohirtula* is hardly distinguishable from *Sc. kerguelensis*, in his opinion there are transitions between the two species.

1\*. Marginal hairs more robust and more complex rooting, spores different. .... 2

2. Marginal hairs (140-)200-550(-750) x (10,5-)12-31  $\mu\text{m}$ , 1-10 septate, walls (1.5-)2-5  $\mu\text{m}$  thick, base with 1-2(-3) roots, density 25-40 per mm. Spores 20-24 x 11.5-13.5  $\mu\text{m}$ , ellipsoid, sometimes little flattened on one side, Q = 1.5-2.0; ornamentation consisting of isolated, approximately round or slightly angular warts, normally 0.2-1.5  $\mu\text{m}$  wide and 0.2-0.8  $\mu\text{m}$  high, sometimes heterogeneous, warts of uneven size, many little warts mixed with few large warts (up to 3.5  $\mu\text{m}$  wide and 2  $\mu\text{m}$  high). Apothecia (3-)5-20(-25) mm. – Habitat: saprotroph in unfertilized, wet grassland.

..... **11) *Sc. heterosculpturata*** Kullman & Raitv. (1977).

2\*. Marginal hairs on average wider, rooting more complex, ornamentation different.

3. Marginal hairs (150-)200-700 x 20-45  $\mu\text{m}$ , 1-9 septate, walls 2.5-10  $\mu\text{m}$  thick, base often wide and complex rooting, density 15-30 per mm. Spores 21-25 x 11-13  $\mu\text{m}$ , ellipsoid, sometimes flattened on one side, Q = 1.7-2.15; ornamentation pustulo-cristate to tuberculate, round or slightly irregularly shaped warts (0.3-)0.5-1.5(-2)  $\mu\text{m}$  wide and 0.5-1.5(-2)  $\mu\text{m}$  high, usually the highest at the poles. Apothecia 2-10 mm. – Habitat: saprotroph on damp wood, also on (mostly calcareous) soils mixed with humus and wood. .... **12) *Sc. cejpii*** (Velen.) Svrček (1971).

N.B. In Le Gal (1966), Kullman (1981) and Yao & Spooner (1996) as *Sc. hirta*.

3\*. Spores wider, Q smaller or ornamentation different..... 4

4. Spores 20-24 x (12-)13-15.5  $\mu\text{m}$ , ellipsoid Q = 1.4-1.7; ornamentation tuberculate, mostly isolated, hemispherical sometimes slightly angular warts, up to 1  $\mu\text{m}$  high and 1.5(-2)  $\mu\text{m}$  wide. Marginal hairs 200-1000 x 17-38  $\mu\text{m}$ , (1-)3-23(-30) septate, walls 2.5-6.7  $\mu\text{m}$  thick, base with 1-3 roots, rarely more complex, density 20-40 per mm. Apothecia 3-9 mm. – Habitat: saprotroph on moist, loamy soils mixed with humus, also on wet, rotten wood. .... **13) *Sc. subhirtella*** Svrček (1971).

4\*. Spores 19-23.5 x 14-17  $\mu\text{m}$ , ellipsoid to broad ellipsoid Q = 1.3-1.5; ornamentation tuberculate, mainly hemispherical, sometimes slightly angular or crater-shaped warts 0.5-2(-3)  $\mu\text{m}$  wide and 0.5-1.5(-2)  $\mu\text{m}$  high. Marginal hairs 200-1050(-1350) x 15-40(-42)  $\mu\text{m}$ , 2-25(-29) septate, walls 2-6.5(-8)  $\mu\text{m}$  thick, base longest hairs often complex rooting with three or more roots, density 15-35(-45) per mm. Apothecia (2,5-)5-15(-20) mm. – Habitat: saprotroph mostly on the ground, black mud, reed land, moist not fertilized grassland. .... **14) *Sc. umbrorum*** (Fr.) Lamb. (1887).

N.B. If spores 18-22 x 13-16,5  $\mu\text{m}$ , Q = 1.3-1.5; ornamentation tuberculate, warts 0.5-1.5  $\mu\text{m}$  wide and 0.3-1  $\mu\text{m}$  high, sometimes mixed with some warts and very short ridges of about 2  $\mu\text{m}$ . Marginal hairs 200-800(-950) x 15-35(-38)  $\mu\text{m}$ , (0-)2-22 septate, walls (1-)2-6(-7)  $\mu\text{m}$  thick, base with to 3

roots, sometimes more complex, density 18-45 per mm. Apothecia 3-12 mm. Saprotroph on black, calcareous mud mixed with humus and pieces of wood. .... **14a) *Sc. parvispora*** J. Moravec (1974). N.B. If spores 18-22 x 13-17  $\mu\text{m}$ ,  $Q = 1.25-1.45$ ; ornamentation consisting of about hemispherical or randomly shaped warts and very short ridges of different size 0.5-2  $\mu\text{m}$  wide and 0.8(-1) high, sometimes also mixed with "blobs" up to 3(-4)  $\mu\text{m}$  wide and 1.5(-2)  $\mu\text{m}$  high (heterogeneous tuberculate). Marginal hairs 150-700 x 15-35  $\mu\text{m}$ , (0-)2-12(-14) septate, walls (1-)1.5-5  $\mu\text{m}$  thick, base with 1-3 roots, rare more complex rooting, density 17-53 per mm. Apothecia 3-10(-15) mm. – Habitat: saprotroph on moist bare sandy or loamy soils, sparingly overgrown with moss and germinating herbs. .... **14b) *Sc. umbrorum*** var. **BBB**. N.B. The question remains is *Sc. umbrorum* only a very variable species or a complex of a few species that are difficult to separate from each other? Molecular research seems necessary to solve this question.

## Key to the species of Group III.

Species with smooth spores or with spore ornamentation consisting of randomly shaped, confluent little warts and warts; a number of species with marginal hairs some of which are often longer than 1000  $\mu\text{m}$  (except *Sc. kerguelensis* and most collections of *Sc. olivascens*, sometimes also *Sc. setosa* and *Sc. vitreola*).

1. Spores 18.5-21.5(-23) x 11-13(-13.5)  $\mu\text{m}$ , ellipsoid  $Q = 1.5-1.85$ , smooth; ornamentation (also in LACB) not visible. Marginal hairs (250-)350-900 x (15-)19-40  $\mu\text{m}$ , 1-13 septate, walls 3-8  $\mu\text{m}$  thick, base often complex rooting, density 16-28 hairs per mm. Apothecia 1-4 mm, (brown)orange. – Habitat: remnants of moist or wet wood. .... **15) *Sc. setosa*** (Nees) Kuntze (1891). Not known from the Netherlands.

1\*. Spores in LACB with clear ornamentation, apothecia mostly larger on average. .... 2

2. Spores 20-26 x 14-19  $\mu\text{m}$ , broadly ellipsoid to ellipsoid  $Q = 1.2-1.5(-1.6)$ ; ornamentation verrucose, tiny warts that can confluent into randomly shaped lines, slices and sometimes pieces of incomplete network, mostly lower than 0.3(-0.5)  $\mu\text{m}$ , in optical section (100x oil immersion) poorly visible. Marginal hairs (80-)100-500 x (11-)15-35  $\mu\text{m}$ , 1-10 septate, walls 2-6.5  $\mu\text{m}$  thick, base with 1-3 roots (often 2), density 40-70 hairs per mm. Apothecia 2-10(-15) mm. – Habitat: saprotroph on wet, fairly bare often calcareous soils with liverwort, moss and germinating plants, also on wet wood. .... **16) *Sc. kerguelensis*** (Berk.) Kuntze (1891). Occurrence in the Netherlands very doubtful, a species of northern and alpine regions.

2\*. Marginal hairs on average longer, wider and more complex rooting or with other spores. .... 3

3. Spores 18-23.5 x 12.5-16.5  $\mu\text{m}$ , ellipsoid  $Q = 1.3-1.6$ ; ornamentation verrucose, small warts 0.2-1(-1.5)  $\mu\text{m}$  wide and 0.5(-1)  $\mu\text{m}$  high, confluent forming curved ridges and amoeboid shaped crusts. Marginal hairs 200-800(-1000) x 15-35  $\mu\text{m}$ , (0-)3-25(-31) septate, walls 1.5-6.5  $\mu\text{m}$  thick, base with (1-)2-3 roots, the longest hairs often root more complex, density 15-60 hairs per mm. Apothecia 3-15(-18) mm. – Habitat: saprotroph on wet wood (*Salix*, *Alnus*, *Betula*, *Populus*, *Fraxinus*) and surrounding black mud, also in wet unfertilized meadow. .... **17) *Sc. olivascens*** (Cooke) Kuntze (1891).

N.B. *Sc. olivascens* turned out to be a variable species, possibly a species-complex. Bogacheva & Kullman (2006) describe a variety *minutospora* with smaller spores 18.8-21.8 x 12-13.7  $\mu\text{m}$ , but almost completely within the boundaries given here.

3\*. With another combination of characteristics. .... 4

4. Spores 22-26 x 13-16  $\mu\text{m}$ , ellipsoid  $Q = 1.5-1.8$ ; ornamentation verrucose, tiny warts 0.2-1.6  $\mu\text{m}$  wide and up to 0.5  $\mu\text{m}$  high, confluent forming curved ridges, randomly shaped slices and sometimes pieces of network, in optical section (100x oil immersion) poorly visible. Marginal hairs 300-2000 x 25-50  $\mu\text{m}$ , 6-21 septate, walls 5-10  $\mu\text{m}$  thick, density 10-15 per mm. – Habitat: saprotroph on wet wood lying in water. Not in the Netherlands. .... **18) *Sc. pilatii*** (Velen.) Svrček (1971).

4\*. Spores smaller or ornamentation different. .... 5

5. Spores 16-20 x 10-13  $\mu\text{m}$ , ellipsoid  $Q = 1.4-1.7$ ; ornamentation verrucose, mostly isolated small, irregular warts, sometimes confluent, 0.4-1.5  $\mu\text{m}$  wide and 0.3-0.8(-1.2)  $\mu\text{m}$  high. Marginal hairs 200-1000(-1150) x 25-45(-50)  $\mu\text{m}$ , (0-)3-20(-25) septate, walls 2-9  $\mu\text{m}$ , base longer hairs often complex rooting. Apothecia 2-6 mm. – Habitat: saprotroph on moist wood and paper waste.

..... **19) *Sc. vitreola*** Kullman (1982).  
 5\*. Spores and/or marginal hairs different. ....6

6. Ornamentation (verrucose) consisting of irregular warts of different sizes and short curved or branched ridges, up to 1.0  $\mu\text{m}$  high, spores 17.5-22.5 x 11-14.5  $\mu\text{m}$ , ellipsoid  $Q = 1.4-1.8$ . Marginal hairs 300-1800(-2450) x 20-50  $\mu\text{m}$ , (0-)5-35(-60) septate, walls (2-)4-10(-13)  $\mu\text{m}$  thick, base of longest hairs complex rooting, density 10-25(-35). Apothecia 3-12(-17) mm. – Habitat: saprotroph on moist remains of wood and humus, also on wet paper. .... **20) *Sc. scutellata*** s.l.

N.B. *Sc. scutellata* here is understood in a broad sense including *Sc. crinita* (Bull.) Lamb. sensu T. Schumacher (1990). According to this author *Sc. crinita* can be distinguished from **20\*) *Sc. scutellata*** s.s. by another spore shape, lower spore ornamentation (0.2-0.6  $\mu\text{m}$ ) and a different behavior of the mycelium in culture. Yao & Spooner (1996) who also studied both (neo)types were unable to establish any clear boundary between these two collections. Research on own collections with an ornamentation lower than 0.6  $\mu\text{m}$  [**20a) *Sc. crinita*** (Bull.) Lamb. (1887)] gave the following results: spores (17.2-)18-21.5(-22) x (11.2-)12-14  $\mu\text{m}$ ,  $Lav \times Bav = 19.66 \times 12.92 \mu\text{m}$ ,  $Q = (1.3-)1.4-1.65(-1.72)$ ,  $Q_{av} = 1.52$ , average spore volume  $V_{av} = 1.73 \times 10^3 \mu\text{m}^3$ . Most collections on moist wood and soils mixed with humus and wood. Results for collections with an ornamentation up to 1.0  $\mu\text{m}$  (cf *Sc. scutellata* ss): spores (18-)19-22(-22.8) x (11.2-)11.5-14  $\mu\text{m}$ ,  $Lav \times Bav = 20.45 \times 12.71 \mu\text{m}$ ,  $Q = (1.36-)1.5-1.75(-1.87)$ ,  $Q_{av} = 1.61$ ,  $V_{av} = 1.73 \times 10^3 \mu\text{m}^3$ . Most collections from wet or moist unfertilized grassland. The question is, are these small differences caused by genetic differences or by environmental factors. Molecular research strongly suggests that *Sc. crinita* and *Sc. scutellata* are separate species.

N.B. Some collections with a spore ornamentation lower than 0.6  $\mu\text{m}$  showed more than others barely confluent small warts. These collections correspond well with **20aa) *Sc. scutellata*** var. *discreta* as described by Kullman (1982); var. *discreta* is probably not more than a form of *Sc. crinita*. See also T. Schumacher (1990) and Matočec & al. (2005).

6\*. Spores and/or ornamentation different. ....7

7. Spores 19-23 x 14-17  $\mu\text{m}$ , ellipsoid  $Q = 1.2-1.5(-1.6)$ ; ornamentation formed by irregular often curved, truncate warts or crusts 0.5-3  $\mu\text{m}$  wide and 1-3.5(-4.5)  $\mu\text{m}$  high touching each other or interconnected with ridges, sometimes confluent to a very incomplete network (tuberculo-reticulate). Marginal hairs 300-1000(-1500) x 15-40(-45)  $\mu\text{m}$ , (3-)5-18(-22) septate, walls (2.5-)4-7  $\mu\text{m}$  thick, base of longest hairs complex rooting. Apothecia 4-8 mm. – Habitat: saprotroph on moist remnants of wood and surrounding soil. Not in the Netherlands. .... **21) *Sc. decipiens*** Le Gal (1966).

7\*. Spores 16-21 x 11-14  $\mu\text{m}$ , ellipsoid  $Q = (1.35-)1.4-1.6$ ; ornamentation formed by irregular warts and crusts up to 3  $\mu\text{m}$  wide and 0.8-2.5  $\mu\text{m}$  high, often interconnected by small ridges or confluent into a heavy, very incomplete network. Marginal hairs (200-)300-1800(-2300) x (15-) 20-45(-55)  $\mu\text{m}$ , (0-)5-25(-30) septate, walls 3-8  $\mu\text{m}$  thick, base of longest hairs often very complex rooting, density about 15 per mm. Apothecia 4-20(-25) mm. – Habitat: saprotroph on moist wood and surrounding soil. Not in the Netherlands. .... **22) *Sc. pennsylvanica*** (Seaver) Denison (1961).

## Key to the species of Group IV.

Species with exosporium loosening in warm LACB (except *Sc. macrospora*).

1. Ornamentation reticulate, up to 3.5(-4.5)  $\mu\text{m}$  high coarse network. Spores 18-23 x 11.5-14.5  $\mu\text{m}$ , ellipsoid  $Q = 1.4-1.75$ . Marginal hairs (65-)90-395 x 10-27  $\mu\text{m}$ , 0-8 septate, walls (2-)3-7  $\mu\text{m}$  thick, base with 1-3(-4) roots, density 20-80 per mm. Apothecia 1-7(-10) mm. – Habitat: saprotroph on moist moderately rich soils. .... **23) *Sc. pseudotrechispora*** (J. Schröt.) Le Gal (1945).

1\*. Ornamentation consisting of small warts, warts and curved ridges sometimes confluent to an incomplete network (pseudoreticulate). .... 2

2. Spores 13-17 x 8-10  $\mu\text{m}$ , ellipsoid  $Q = 1.5-1.8$ ; ornamentation consisting of small warts (lower than 0.5  $\mu\text{m}$ ) that sometimes can confluent into curved ridges and pieces incomplete network. Marginal hairs 60-300 x 10-25  $\mu\text{m}$ , (0-)2-6(-8) septate, walls 0.8-3  $\mu\text{m}$ , base with 1-3 roots, density 30-60 hairs per mm. Apothecia 1-4 mm. – Habitat: saprotroph on rather bare, moist loamy soils, partly moss-covered. .... **24) *Sc. minutella*** Svrček & J. Moravec (1969).  
 N.B. Spores 15-18.5 x 8-10.5  $\mu\text{m}$ ,  $Q = 1,6-2,0$  with coarser ornamentation (up to 1  $\mu\text{m}$  high) consisting of irregular warts. Marginal hairs 70-200 x 10-20  $\mu\text{m}$ , 0-6 septate, walls 1.5-3  $\mu\text{m}$  thick, base with 1(-2) roots, density 40-50 hairs per mm. Apothecia 2-5 mm. – Habitat: saprotroph on rather bare sandy-loamy soils, partly moss-covered. .... **24a) *Sc. species AAA***.  
 2\*. Spores bigger. .... 3
3. Spores 16.5-21.5 x 10-13  $\mu\text{m}$ , ellipsoid  $Q = 1.5-1.8$ ; ornamentation consisting of small warts that sometimes confluent into curved ridges and pieces of incomplete network (compare *Sc. minutella*). Marginal hairs (50-)80-400(-470) x 10-27  $\mu\text{m}$ , (0-)2-7(-9) septate, walls 1.5-4.5  $\mu\text{m}$  thick, base with 1-3 roots, density 20-60 hairs per mm. Apothecia 1-6 mm. – Habitat: saprotroph on moist, bare sandy or loamy, somewhat enriched soils. .... **25) *Sc. torrentis*** (Rehm) T. Schumacher (1990).  
 3\*. Spores bigger, ornamentation different. .... 4
4. Spores 19-25 x 12-15  $\mu\text{m}$ , ellipsoid  $Q = 1.5-1.85$ ; ornamentation formed by small warts and warts that can confluent to short ridges, irregular crusts and an incomplete network (pseudoreticulate), 1(-1.5)  $\mu\text{m}$  high. Marginal hairs (60-)100-370 x 13-26  $\mu\text{m}$ , (0-)2-8(-11) septate, walls 1.7-5  $\mu\text{m}$ , base with 1-3 roots, density about 40 hairs per mm. Apothecia 2-6 mm. – Habitat: saprotroph on moist, bare sandy or loamy soils, partly moss-covered. .... **26) *Sc. superba*** (Velen.) Le Gal (1964).  
 4\*. Spores 24-30 x 11.5-15  $\mu\text{m}$ , narrow ellipsoid  $Q = 1.8-2.2$ ; ornamentation consisting of small warts that can confluent to ridges, irregular somewhat stretched warts that eventually results in pieces of an incomplete reticulum (up to 1  $\mu\text{m}$  high, pseudoreticulate). Marginal hairs 120-500 x 12-31  $\mu\text{m}$ , 0-7 septate, walls 2.5-5.5  $\mu\text{m}$ , base with 1-3 roots, density about 35-45 hairs per mm. Apothecia 2-6(-8) mm. – Habitat: saprotroph on moist, bare, enriched soils. Only found once in the Netherlands. .... **27) *Sc. mirabilis*** Diss. & Siv. (1983).  
 N.B. If exosporium not loosening in LACB and warts not or less confluent, see **Figuur 36(4)** compare **28) *Sc. macrospora*** (Svrček) Le Gal (1964).