Taxonomic Manual of the Erysiphales (Powdery Mildews)

1 Key to the genera (and sections) based on teleomorph and anamorph data

This key can be used to identify powdery mildew holomorph genera, based un fruiting bodies and, if present, anamorphs, by means of light microscopy. Concerning the descriptions of conidial germination, the *longitubus* pattern is only mentioned in species where it commonly occurs, although it can occur to a varying extent with any powdery mildew (see section 9.7.1). For type of conidial germination and pattern of conidial appressoria, see section 9.7.1.1. Conidial surface patterns seen by SEM are included in brackets (details of the terminology of patterns are presented and discussed in section 9.8). N.B. This key does not include taxa where no teleomorph is known. However, the anamorph genus *Microidium* is included in the Key based on anamorphs (section 13.2).

1. Chasmothecia always very large, more than 180 µm diam., with penicillate cells in the apical portion that become mucilaginous, appendages equatorial, with a bulbous base turning into a subulate upper part with obtuse to subacute apex; mycelium partly endophytic; anamorphs belonging to the hyphomycete genus *Ovulariopsis* (conidiophores arising from the ectophytic mycelium, long and slender, straight, occasionally spirally twisted; conidia formed singly, large, usually longer than 30 µm, mostly more or less clavate, in some species rhomboid to angular in outline, dumbbell-like, pinhead-like or broadly ellipsoid-ovoid to subcylindrical, shape usually uniform, in some species distinctly dimorphic; conidial germ tubes subterminal or lateral, appressoria alobate to multilobate to coralloid never club-shaped = *Ovulariopsis* type (Figs. 12I-J, 13M-N). (SEM: apex smooth or slightly verrucose, basal end wall densely warty; outer (side) wall with some warts in obvious groups, ofen in a helix and becoming denser towards the base (Fig. 13G-J); usually parasitic on trees and shrubs, Figs 199-296) ..... *Phyllactinia*

1. Appendages different, without bulbous base and subulate terminal part 2

2. Chasmothecia with a single ascus; anamorph with catenescent conidia (gradually maturing in a chain) with fibrosin bodies (see sect. 9.6.1), appressoria on mycelium (see sect. 9.3) indistinct to nipple-shaped; conidial appressoria alobate often club-shaped = *Fibroidium* type, *orthotubus* subtype (Fig. 7H), [SEM: end walls whorled; outer wall ± smooth (Fig. 14A-C)] 3

2. Chasmothecia with two to many asci [rarely with 1(-2) asci, but then with lobed appressoria on mycelium, anamorph lacking, on fruits and sepals of *Styrax japonica*, see *Erysiphe monascogera*]; anamorph absent or with solitary or catenescent conidia, with or without fibrosin bodies, if fibrosin bodies present, then conidiophores and conidia dimorphic (with large macro-conidiophores and very small micro-conidiophores, respectively, producing macro- and micro-conidia, both often somewhat octagonal in outline, see *Sawadaea*) 4

3. Wall of the chasmothecium differentiated, composed of two layers, which are easily separated from each other, appendages almost absent or mycelioid; anamorph with mycelium bearing special pigmented aerial hyphae, falcate to filiform; outline of the conidial chains sinuate; on hosts belonging to the *Fagaceae* (Figs. 23-29) ..... *Cystotheca*

3. Wall of the chasmothecium simple, layers firmly connected; appendages mycelioid (*Podosphaera* sect. *Sphaerotheca*) or stiff, setiform and terminally dichotomously branched (*P.* sect. *Podosphaera*), anamorph without special aerial hyphae; outline of the conidial chains crenate [if conidial germ tubes consistently short and/or forked = *Fibroidium* type, *brevitubus* subtype of *S.* subsect. *Magnicellulatae*, Figs. 7J-K, 12E-H] ..... *Podosphaera* emend. (incl. *Sphaerotheca*)

4. True appendages absent, but with gelatinous cells in the upper half of the chasmothecium which are clavate to subcylindrical; anamorphs unknown (Figs. 656-660) ..... *Erysiphe* sect. *Typhulochaeta*

4. Gelatinous cells absent; true appendages present or almost absent 5

5. Chasmothecium with thin peridium, composed of a single layer, semi-transparent, yellowish to light brown; appendages poorly developed. often almost absent; anamorphs usually not formed 6

5. Chasmothecia with thick, multilayered, non-transparent peridium with or without a differentiated epicortex forming a dark brown to black rind; appendages usually well-developed; anamorphs mostly present 7

6. On various tropical-subtropical host species [*Fabaceae*, *Malvaceae*, *Sapindaceae*] (Figs. 846-849) ..... *Brasiliomyces*

6. Confined to hosts of the *Fagaceae* (Figs 491-495) ..... *Erysiphe* sect. *Californiomyces*

7. Chasmothecia large, usually more than 150 µm in diam., appendages mycelioid. asci usually 2-spored; mycelium partly endophytic, partly ectophytic, usually forming dense whitish patches or layers, persistent, often tomentose; anamorphs belonging to *Oidiopsis* (conidiophores usually arising from internal hyphae, emerging through stomata, straight; conidia formed singly, large, about 40-80 µm long, dimorphic, i.e. with morphologically differentiated primary and secondary conidia); conidial germination *Ovulariopsis* type (Fig. 7L) [SEM: basal end wall smooth to slightly verrucose; apical septum of secondary conidia moderately verrucose; outer wall with evenly and more or less singly distributed warts, Fig. 13D-F] (Figs. 153-192) ..... *Leveillula*

7. Chasmothecia either smaller or appendages not mycelioid; anamorphs not belonging to *Oidiopsis* (mycelium either exclusively external, with an *Oidium* anamorph = *Blumeria*), (if mycelium internal as well as external, with an *Ovulariopsis* anamorph = *Phyllactinia*, *Pleochaeta*) 8

8. Chasmothecia always large, peridium without differentiated epicortex; appendages short, mycelioid; anamorph with pigmented secondary mycelium with thick-walled, straight to falcate, long, bristle-like hyphae; foot-cells of the conidiophores with bulbous swelling; conidia catenescent; haustoria digitate; conidial germination distinctive *Blumeria* type with two types of germ tube (Fig. 7F) [SEM: end walls protuberant, with a smooth annulus around a minutely verrucose centre; outer wall echinulate, Fig. 13A-C]; confined to *Poaceae* (Fig. 22) ..... *Blumeria*

8. Epicortex of chasmothecia present; thick-walled; anamorph with bristle-like hyphae not developed and conidiophores without a bulbous base; haustoria not digitate; conidia produce only one type of germ tube [SEM: septa of the conidia non-protuberant; outer wall non-echinulate]; not on *Poaceae* 9

9. Appendages mycelioid, flexuous, unbranched to irregularly branched, tips more or less straight, appendages rarely setiform, but neither regularly branched nor apically uncinate-circinate; conidia without fibrosin bodies [SEM: end walls fibrillar; outer wall ± ornamented never very smooth] 10

9. Appendages non-mycelioid, relatively short, stiff and setiform to long and flexuous, apex either dichotomously branched with straight, curved or circinate tips or, if unbranched, mature tips always uncinate to circinate-helicoid (or with stiff, setiform, unbranched appendages in the upper half, tips mostly straight, but then macro- and micro-conidiophores and conidia with fibrosin bodies present [on *Koelreuteria*], see *Sawadaea*) 12

10. Asci always immature in the current season, without any ascospores, ascospore development only after overwintering, overwintered asci 2-8-spored [rarely with 2-4 ascospores developed before overwintering, on *Rubia*, see *N. rubiae*]; anamorph characterised by a combination of lobed appressoria on the mycelium and on conidial germ tubes (*Striatoidium* type, Fig. 12A-C) and catenescent conidia (conidia mature in chains) [SEM: outer wall of the conidium with striate, delicate striping or ribbing, Fig. 15G-I] (Figs. 378-388) ..... *Neoërysiphe*

10. Ascospores mature in the current season before overwintering, asci 2(-4)-spored or 3-8-spored; anamorph either with lobed appressoria on both mycelium and conidial germ tubes and conidia formed singly, or with almost indistinct to usually nipple-shaped appressoria on the mycelium, alobate conidial germ tubes and catenescent conidia (rarely with nipple-shaped to lobed appressoria on the mycelium) 11

11. Asci 2(-4)-spored; anamorph with appressoria more or less nipple-shaped, rarely nipple-shaped to lobed on the mycelium, but alobate on conidial germ tubes (*Euoidium* type, Fig. 7D) and catenescent conidia (if conidia broad, length/width ratio < 2.0, usually 1.2-1.8, and germ tubes mainly *longitubus* pattern

= *Golovinomyces* sect. *Depressi*, Fig. 7E) [SEM: end walls fibrillar without papillae or ear-like lobes in centre; outer wall of the conidium more or less roughcast-like, Fig. 15D-F] (Figs. 318-363) ..... *Golovinomyces*

11. Asci (2-)3-8-spored; anamorph with more or less lobed appressoria on the mycelium and on conidial germ tubes (*Pseudoidium* type), lobatus/multilobatus patterns (Fig. 9G, I, J) conidia formed singly [SEM: end walls fibrillar zigzag, often with papillae or ear-like lobes in centre; outer wall rugose, similar to *E.* sects. *Microsphaera* and *Uncinula*, Fig. 16A-F] (Figs. 394-490) ..... *Erysiphe* sect. *Erysiphe*

12. Chasmothecial appendages attached to the upper half of the fruiting body, dichotomously to trichotomously branched, in a single species uniformly unbranched, tips uncinate-circinate; anamorph with catenescent conidia with fibrosin bodies, conidiophores and conidia dimorphic, with small micro-conidiophores forming micro-conidia (ca. 7-18 x 5-12 µm) and large macro-conidiophores forming macro-conidia (ca. 19-35 x 13-18 µm), conidia with fibrosin bodies, conidial germ tubes alobate (*Fibroidium* type, *orthotubus* subtype, Fig. 71) [SEM: end walls whorled; outer wall with vein-like embossed strips, Fig. 14D-F]; mainly on *Acer* and *Aesculus* (Figs. 143-151) ..... *Sawadaea*

12. Appendages either unbranched with uncinate to circinate-subhelicoid tips or dichotomously branched, but then equatorially attached; anamorph without micro-conidiophores and micro-conidia and without fibrosin bodies [SEM: end walls fibrillar, Fig. 16A,D (if smooth and outer wall verrucose = *Pleochaeta*/*Querozia*); ornamentation of the outer wall different]; or appendages unbranched, with uncinate-circinate apex, but arising from the lower half of the fruiting body, anamorph lacking (on Acer in North America) 13

13. Chasmothecial appendages dichotomously branched 14

13. Chasmothecial appendages unbranched, tips uncinate to circinate-subhelicoid 15

14. Appendages setiform, stiff, dichotomously branched, first branching point near the base or middle of the stalk, tips straight; anamorph with more or less short-cylindrical conidia, forming chains with a crenate outline, appressoria on mycelium more or less nipple-shaped, conidial germ tubes alobate (*Graciloidium* similar to *Euoidium* type) [SEM: end walls fibrillar, fibrils may be arranged randomly without papillae or ear-like lobes in centre; outer wall more or less smooth, Fig. 15A-C] on *Lycium* (Fig. 393) *Arthrocladiella*

14. Appendages relatively short, setiform, stiff to long and flexuous, but only apically branched (from the middle upwards); anamorph with ellipsoid-ovoid, doliiform to long-cylindrical conidia, formed singly, appressoria on mycelium more or less lobed, conidial germ tubes usually lobate (*Pseudoidium* type, alobate to multilobate patterns, Fig. 9C,E) [SEM: end walls fibrillar zigzag pattern often with papillae or ear-like lobes in centre; outer wall rugose Fig. 16A-C, E-F]; not on *Lycium* (Figs. 496-655) ..... *Erysiphe* sect. *Microsphaera*

15. Large chasmothecia, 115-250 µm diam., with numerous appendages, 70-200, arising from the lower half; anamorph lacking; on *Acer*, North America (Fig. 152) ..... *Takamatsuella*

15. Appendages equatorially arising or from the upper half; anamorphs usually present 16

16. Chasmothecia very large, about 150-450 µm diam., usually more or less turbinate, appendages apically uncinate-circinate; mycelium both endophytic and ectophytic 17

16. Chasmothecia usually smaller, less than 150 µm diam., non-turbinate, subglobose to somewhat flattened at the base; mycelium only ectophytic 18

17. Anamorph characterised by having external mycelium with special aerial hyphae, rigid, simple to dichotomously branched, and pigmented conidiophores and conidia; upper half of the chasmothecia with a few appendages, asci 2-spored; on *Platycyamus* in South America (Fig. 301) ..... *Queirozia*

17. Anamorph without special aerial hyphae, belonging in the hyphomycete genus *Ovulariopsis* (all structures colourless, conidiophores arising from external hyphae, long and slender, foot-cells usually spirally twisted, conidia large, more than 30 µm long, dimorphic, primary and secondary conidia more or less morphologically differentiated; conidial germination *Ovulariopsis* type (Fig. 70), both end walls smooth; outer wall verrucose, warts not obviously grouped, but often in a helix]; chasmothecia with numerous appendages, attached around the equatorial zone or somewhat in the upper half, asci 2-5-spored (Figs. 284-288) ..... *Pleochaeta*

18. Chasmothecia large, about 150-230 µm diam., with numerous pluriseptate appendages in the upper half, but appendages radiating, not in apical tufts; anamorph lacking; on *Fagus* and *Quercus* in China and Japan (Fig. 20) ..... *Parauncinula*

18. Chasmothecia mostly smaller, less than 150 µm diam., appendages with a single or only few basal septa, if multiseptate appendages more or less equatorial or very long, in apical tufts; anamorphs present . 19

19. Appendages of the chasmothecia equatorially inserted, rarely somewhat in the upper half, but never forming a distinct apical tuft; anamorph belonging to *Pseudoidium* (appressoria on mycelium lobed, conidia formed singly, conidial germ tubes usually very short or sessile, with multilobate appressoria (*Pseudoidium* type, often with *extensitubus* pattern, Figs. 9L, 11A-C) [SEM: end walls fibrillar zigzag often with papillae or ear-like lobes in centre similar to *E.* sect. *Microsphaera*; outer wall rugose Fig. 16D, or rarely fluted, specifically with *Erysiphe australiana*, Fig. 16G-H] (Figs 661-777) .... *Erysiphe* sect. *Uncinula*

19. Appendages in distinct apical tufts, very long, up to ten times as long as the chasmothecial diam., with a few remote septa; anamorph with corral-like appressoria on mycelium, secondary mycelium composed of thick-walled hyphae giving rise to thin-walled special aerial hyphae and catenescent conidia; on *Schinopsis* spp. in South America (Fig. 21) ..... *Caespitotheca*

2 Key to the genera (and sections) just based anamorphs

Includes conidial germination patterns, see sect. 9.7 (with conidial surface patterns seen by SEM, see sect. 9.8, in square brackets). Genera without any conidial states are not included.

1. Mycelium partly internal; anamorphs belonging to the hyphomycete genera *Oidiopsis* and *Ovulariopsis* (conidiophores usually long and slender, arising from external hyphae or emerging through stomata, conidia formed singly, usually large, about 40-80 µm long; conidial appressoria alobate to multilobate to coralloid never club-shaped = *Ovulariopsis* type (Figs. 7L-O, 6I-J) [SEM: end walls smooth or slightly verrucose; outer (side) wall with some warts single or in obvious groups (Fig. 13G-J)] 2

1. Mycelium exclusively external, superficial; anamorphs belonging in the hyphomycete genus *Oidium* and its segregates, i.e. former subgenera (conidiophores always arising from external hyphae, conidia mostly smaller, about 20-60 µm long, micro-conidia, if developed, even smaller; germ tube tips with various patterns including club shapes) 4

2. Conidiophores and conidia pigmented; mycelium with special aerial hyphae, rigid, thick-walled, simple or dichotomously branched; on *Platycyamus* in South America (Fig. 301) ..... *Queirozia*

2. Conidiophores and conidia colourless; mycelium mostly without any special aerial hyphae 3

3. Conidiophores mostly arising from internal hyphae, emerging through stomata, occasionally also formed on external hyphae; conidia usually dimorphic, with distinct differences in the shape of primary and secondary conidia [SEM: outer wall with evenly and more or less singly distributed warts, Fig. 13D-F], usually parasitic on herbaceous plants (Fig. 188) ..... *Leveillula* (*Oidiopsis*)

3. Conidiophores always arising from superficial hyphae, foot-cells straight, sometimes spirally twisted; conidia uniform or dimorphic; germ tubes usually terminal or subterminal but often lateral or twisted in *Phyllactinia* [*Ovulariopsis*] (Fig. 7M,N); [SEM: outer wall with some warts in obvious groups, often in a helix and becoming denser towards the base (Fig. 13G-J)]; usually parasitic on trees and shrubs (Fig. 252) ..... *Phyllactinia* and *Pleochaeta*

4. Fresh conidia with distinct fibrosin bodies, always catenescent; germ tubes long, alobate, unbranched or short and sometimes lateral and branched (Fig. 7H-K) [SEM: end walls whorled; outer wall smooth or lightly embossed, Fig. 14A-F] = *Fibroidium* type 5

4. Fresh conidia without fibrosin bodies, catenescent or maturing singly; two quite different types of germ tube on the same conidium: at least one broad appressorial tube and one or more shorter and thinner tubes 8

5. Conidiophores and conidia dimorphic, with small micro-conidiophores and micro-conidia and large macro-conidiophores and macro-conidia; germ tubes long, unbranched sometimes lateral (Fig 71) = *Fibroidium* type, *orthotubus* subtype [SEM: end walls whorled; outer wall with vein-like faintly embossed strips, Fig. 14D-F]; mainly on *Acer*, *Aesculus* and *Koelreuteria* (*Octagoidium*) (Figs. 144, 151) ..... *Sawadaea*

5. Conidiophores and conidia uniform, not dimorphic, without small micro-conidiophores and micro-conidia 6

6. Anamorph with mycelium bearing special pigmented aerial hyphae, falcate to filiform; outline of the conidial chains sinuate; germ tubes long, unbranched, sometimes lateral = *Fibroidium* type, *orthotubus* subtype; on hosts belonging to the *Fagaceae* (*Setoidium*) (Figs. 25, 29) ..... *Cystotheca*

6. Anamorph without special aerial hyphae; outline of the conidial chains crenate (*Fibroidium*) = *Podosphaera* emend. [identification of sections within this taxon is possible using conidial germination patterns as indicated below] 7

7. Germ tubes long, unbranched, sometimes lateral (Fig. 7H) = *Fibroidium* type, *orthotubus* subtype ... . *Podosphaera* sect. *Podosphaera* or *P.* sect. *Sphaerotheca* subsect. *Sphaerotheca*

7. Germ tubes short and branched, often lateral (Fig. 7J-K) = *Fibroidium* type, *brevitubus* subtype ....*P.* sect. *Sphaerotheca* subsect. *Magnicellulatae*

8. Anamorph with pigmented secondary mycelium with special thick-walled, straight to falcate, long, bristle-like aerial hyphae; foot-cells of the conidiophores with bulbous swelling; conidia catenate; haustoria digitate; germ tubes of two distinct types on the same conidium: at least one broad club-shaped appressorial tube and one or more shorter and thinner tubes arising anywhere, but from different sites (Fig. 7F) = *Blumeria* type [SEM: end walls protuberant, with a smooth annulus around a minutely verrucose centre; outer wall echinulate, Fig. 13A-C]; confined to *Poaceae* (*Oidium* s. str.) (Fig. 22) . ..... *Blumeria*

8. Without special aerial hyphae or, if present, shape distinct; foot-cells of the conidiophores non-bulbose; haustoria non-digitate; on dicots 9

9. Conidia very small, above all narrow, about 20-30 x 6-12 µm; appressoria on the mycelium at least partly slightly lobed to multilobed; conidia catenescent; germ tubes similar to *Blumeria* except both tubes arise only from end and are sometimes adjacent; appressorial tube cigar-shaped (Fig. 7G) [Figs. 782-784] . ..... *Microidium*

9. Conidia larger, above all wider 10

10. Conidia formed singly; appressoria on the mycelium more or less lobed; germ tubes short to very long, mainly subterminal, sometimes terminal, rarely lateral, length/conidial width ratio 0-2 (Fig. 7A-B) = *Pseudoidium* type [SEM: end walls fibrillar; outer wall rugose, Fig. 16A-F (but fluted in *Erysiphe australiana*, Figs. G-H)] = *Erysiphe* emend. (*Pseudoidium*) [a rough guide to identification of sections within this taxon is attempted using conidial germination patterns as indicated below] 11

10. Conidia catenescent; germ tubes short to long, sometimes lateral 14

11. Germ tube tips nearly always simple, straight or curved, alobate, sometimes swollen, club-shaped, rarely some irregular (non-dichotomous) branching. Some species with 100 or near 100% form an alobate pattem within *Pseudoidium* type. e.g.: *E. lonicerae* (Fig. 9C), *E. magnifica*, *E. symphoricarpi* .... *E.* sect. *Microsphaera*
NB. This closely resembles the *Euoidium* tvpe, but is distinguished by a lack of lateral germination and somewhat longer germ tube averaging 1.0 times the conidial width compared to an average of 0.75 with the *Euoidium* type

11. At least some germ tube tips often obviously bent, even uncinulate or branched 12

12. Germ tube tips mostly alobate, but some branching may form 2, rarely 5 lobes, e.g. in *E. heraclei*; tips may be strongly uncinate or reflexed (Fig. 9D), even circinate forming a crozier (Fig. 7B); this is a weakly lobate pattern within *Pseudoidium* type [a high proportion may show the *longitubus* pattern, e.g. in *E. trifoliorum* and *E. pisi* (Fig. 9A)] .....some species in *E.* sects. *Erysiphe* and *Microsphaera*

12. Tips of primary branches on germ tubes branching to produce at least 3 ± distinct lobes, often reflexed but not strongly uncinate or circinate, branching initially at an angle of 120° (Fig. 8A-D), angle sometimes appearing greater due to later reflexing (Fig. 151), consecutive branching resulting in a helicoid cyme with a curved false axis (Fig. 9G-H) and forming a symmetrical structure if both limbs of the primary dichotomy develop fully, sometimes after 36 h lobes proliferate and/or elongate to form a toasting fork pattern and even tiered appressoria in *extensitubus* patterns (Fig. 11A-C) [the branching pattern may be observed more clearly through the reverse of a Petri dish lid] (see section 9.7.3) ... 13

13. Germ tubes very short to long, but rarely sessile, tips with mostly 3-5 ± distinct lobes, after 36 h lobe proliferation (Fig. 9G) and *extensitubus* patterns may occur (Fig. 9K) and a secondary appressorium may form (Fig. 9M) = *Pseudoidium* type, *lobatus* pattern, typical of most species in ..... *E.* sects. *Erysiphe* and *Microsphaera*

13. Germ tubes mainly short, often sessile/subsessile, tips multilobate (with mostly 4 or more conspicuous lobes), often proliferating after 36 h to form extra lobes (and one or two lobes sometimes extending to form extensitubus patterns bearing further lobed appressoria in one or more tiers (Fig. 11 A-C) typical of many species in ..... *E.* sect. *Uncinula*

14. Secondary mycelium composed of thick-walled hyphae giving rise to special thin-walled aerial hyphae; appressoria on the mycelium coral-like:; on *Schinopsis* spp., South America (Fig. 21) ... *Caespitotheca*

14. Mycelium without special aerial hyphae, appressoria on the mycelium indistinct to lobed, but not coral-like; on other hosts 15

15. Appressoria on the mycelium conspicuously lobed [SEM: end walls fibrillar with fibrils almost whorled, outer wall of the conidium with striate, delicate striping or ribbing, Fig. 15G-I], striate surface structure of the conidial wall also visible by LM in older, shrivelled conidia; germ tubes: sessile to mainly short, averaging 0.6 times conidial width, tips with *lobatus* pattern mostly 2-3-lobed, averaging 2.5 lobes, shape may appear irregular due to compressed lobing (Fig. 12A-C) = *Striatoidium*, type (*Striatoidium*) ..... *Neoërysiphe*
NB. If appressoria sessile, this can sometimes resemble germination in *Erysiphe* sect. *Uncinula* but is distinguished by presence of lateral germ tubes and less prominent and extensive lobing.

15. Appressoria on the mycelium almost indistinct to nipple-shaped, rarely nipple-shaped to lobed [SEM: end walls fibrillar with fibrils in zigzag or random pattern, outer wall roughcast or smooth], conidial surface without delicate striping or ribbing in fresh as well as shrivelled conidia; germ tubes: mostly terminal or subterminal, of medium length (averaging 0.75 times conidial width), apex club-shaped or somewhat swollen, never lobed (Fig. 7D) = *Euoidium*/*Graciloidium* types 16
NB. Distinguish this pattern from the *longitubus* pattern (Fig. 7E) in other taxa (germ tubes not in contact with substrate) and from species in the *Pseudoidium* type, with 100% *alobatus* pattern (see section 9.7.1.1, Table 1). In the latter germ tubes are mostly longer averaging 1.0 times conidial width.

16. Conidia more or less short-cylindrical, forming chains with a crenate outline [SEM: end walls fibrillar with fibrils in random pattern, outer wall more or less smooth, Fig. 15A-C, 393]; on *Lycium* (*Graciloidium*) ..... *Arthrocladiella*

16. Conidia ellipsoid-ovoid, doliiform, limoniform, subcylindrical, forming chains with sinuate outline [SEM: end walls fibrillar with fibrils in zigzag pattern, outer wall of the conidium more or less roughcast-like, Fig. 15D-F); on other hosts = *Golovinomyces* 17

17. Conidia broad, median length/breadth ratio often less than 1.6; germ tubes often very long, up to 10 times conidial width, often lateral (Fig. 7E) = *longitubus* pattern within *Euoidium* type ..... *Golovinomyces* sect. *Depressi*

17. Conidia narrower, median length/breadth ratio 1.6 or more; germ tubes: mainly shorter (0.5-2, average 0.75. times conidial width), terminal/subterminal (Fig. 7D) = typical *Euoidium* type ..... *Golovinomyces* sect. *Golovinomyces*

3 Key to the species based on host families

3.1 Acanthaceae

- *Erysiphe* sect. *Uncinula* - a single species (on *Peristrophe*) .....(730) *E. peristrophes*

- *Golovinomyces* - a single species (on *Thunbergia*) ..... (315) *G. orontii* (as *Euoidium violae*)
- *Neoërysiphe* - a single species (on *Acanthus*) ..... (374) *N. galeopsidis*
- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Dicliptera*) ..... (55) *P. dicliptera*
- *Pseudoidium* - a single species (on *Elytraria*) ..... (791) *Ps. elytrariae*

3.2 Actinidiaceae

- *Erysiphe* sect. *Uncinula*

  1. Chasmothecial appendages straight or flexuous, but not mycelioid, usually unbranched; on *Actinidia* ..... (650) *E. actinidiae* var. *actinidiae*
  1. Chasmothecial appendages mycelioid, geniculate-sinuous, occasionally branched; on *Actinidia* ... . (650) *E. actinidiae* var. *argutae*

- *Phyllactinia* - see key to the species of *Phyllactinia*

3.3 Adoxaceae (incl. Sambucaceae, = Caprifoliaceae s. lat.)

- *Erysiphe* sect. *Erysiphe*

  1. Chasmothecial appendages dimorphic, with short bristle-like "appendages" (anchor hyphae) the upper half and long mycelioid appendages in the lower half; on *Sambucus*, India .... (437) *E. kashmiriensis*
  1. Chasmothecial appendages uniform, mycelioid, in the lower half; on *Sambucus* 2
  2. Asci thick-walled, appendages with chain-like swellings in the upper part .... (469) *E. sambuci* var. *crassitunicatae*
  2. Asci thin-walled, without swellings ..... (469) *E. sambuci* var. *sambuci*

- *Erysiphe* sect. *Microsphaera*

  1. Chasmothecia hemiglobose, base somewhat concave, with 5-8 appendages arising from the lower half; on *Viburnum sargentii*, Far East of Russia ..... (582) *E. miranda*
  1. Chasmothecia not concave at the base, appendages ± equatorial; on other hosts 2
  2. Tips of ultimate branchlets of appendages straight 3
  2. Tips of ultimate branchlets recurved 5
  3. Chasmothecia small, 70-100 µm diam., apices of appendages loosely branched, asci always 3 in number, 8-spored; on *Viburnum opulus*, Japan ..... (621) *E. shinanoensis*
  3. Chasmothecia larger, up to 160 µm diam., apices of the appendages regularly branched, asci about 3-8, 3-6-spored; on *Sambucus* dotfill 4
  4. Chasmothecia (65-)80-130(-145) µm diam., about 5-18 appendages; on *Sambucus*, North America, Asia ..... (639) *E. vanbruntiana* var. *vanbruntiana*
  4. Chasmothecia 85-160 µm diam., (10-)15-25(-45) appendages; on *Sambucus nigra* and *S. racemosa* s. lat., Asia, Europe ..... (639) *E. vanbruntiana* var. *sambuci-racemosae*
  5. Chasmothecia 65-90(-105) µm diam., average < 90 µm, about 3-8 appendages; on *Viburnum* (*burejaeticum*, *foetidum* var. *rectangulatum*, *lantana*, *tinus*, sp.), Europe, Armenia, Siberia .... (554) E. hedwigii
  5. Chasmothecia 70-125 µm diam., average > 90 µm, 4-16 appendages; on Viburnum spp., Europe, Asia, North America, New Zealand ..... (642) *E. viburni*

- *Erysiphe* sect. *Uncinula* - a single species (on *Viburnum*) ..... (759) *E. viburnicola*
- *Podosphaera* sect. *Podosphaera* - a single species (on *Viburnum*) ..... (33) *P. viburni*

3.4 Alliaceae

- *Leveillula* - a single species (on *Allium*) ..... (135) *L. allii*

3.5 Altingiaceae (Hamamelidaceae p.p.)

- *Erysiphe* sect. *Erysiphe* - a single species (on *Altingia*) ..... (396) *E. altingiae*
- *Erysiphe* sect. *Uncinula* [subsect. *Uncinuliella*]

  1. Chasmothecial appendages thin-walled; on *Liquidambar* ..... (756) *E. variabilis*
  1. Appendages thick-walled, at least below 2
  2. Appendages thick-walled below and thin-walled towards the apex, 1-2 times as long as the chasmothecial diam., chasmothecia (85-)140-170(-195) µm diam.; on *Liquidambar* ..... (735) *E. praelonga*
  2. Appendages thick-walled throughout, appendages 1-1.5 times the chasmothecial diam., chasmothecia smaller or larger 3
  3. Chasmothecia (90-)115-145(-170) µm diam.; on Liquidambar ..... (711) *E. liquidambaris* var. *liquidambaris*
  3. Chasmothecia 160-200 µm diam.; on Liquidambar ..... (711) *E. liquidambaris* var. *guiyangensis*

3.6 Amaranthaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Amaranthus* and *Celosia*) ..... (411) *E. celosiae*
- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

3.7 Anacardiaceae

- *Caespitotheca* - a single species (on *Schinopsis*, South America) ..... (3) *C. forestalis*
- *Erysiphe* sect. *Microsphaera*

  1. Mycelium hypophyllous; conidia 30-40 x 12-14 µm; asci 4-6-spored: on Cotinus .. (527) *E. cotini*
  1. Mycelium amphigenous, mainly epiphyllous; conidia much wider, asci (6-)8-spored; on *Anacardium*, *Cotinus* and *Magnifera* ..... see (495) *E. alphitoides* and (607) *E. quercicola*

- *Erysiphe* sect. *Uncinula*

  1. Chasmothecial appendages dimorphic, with 18-50 ± equatorial appendages, 1-2 times as long as the chasmothecial diam., apex coiled, and 14-32 short bristle-like "appendages" (anchor hyphae) in the upper half (subsect. *Uncinuliella*); on *Pistacia* ..... (733) *E. pistaciae*
  1. Appendages uniform, anchor hyphae in the upper half lacking 2
  2. Chasmothecia with 3-5(-8) appendages, width ± equal throughout; on *Toxicodendron* ..... (753) *E. toxicodendricola*
  2. Chasmothecia with (4-)8-40(-50) appendages, width increasing from base to top or variable ... 3
  3. Width of the appendages increasing towards the tip, up to the circinate part, appendages thin-walled, only slightly thicker below; on Toxicodendron, Japan ..... (719) *E. matsunamiana*
  3. Width almost equal throughout or somewhat increasing (up to 3/4-4/5 of the stalk), but then narrowing towards the tip, sometimes even narrowing from base to top, wall obviously thick below; on numerous hosts of *Rhus*, *Cotinus*, *Pistacia*, *Toxicodendron*, Asia ..... (757) *E. verniciferae*

- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Podosphaera* - a single species (on *Rhus*) ..... (92) *P. pruinosa*

  Anamorphs

- *Pseudoidium*

  On *Anacardium* ..... (606) *Ps. anacardii* (*Erysiphe quercicola*)
  On *Magnifera* ..... see (495) *E. alphitoides* and (607) *E. quercicola*
  On *Lannea* ..... (804) *Ps. lamneae*

3.8 Annonaceae

- *Oidium* sp. on *Asimina* (Amamo 1986)
- *Phyllactinia* sp. on *Rollina* (Amamo 1986)

3.9 Apiaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on hosts of many genera) ..... (431) *E. heraclei*
- Leveillula

  1. Conidia ± cylindrical, with cingulum-like rings (swellings) near the ends, not obviously dimorphic ..... (156) *L. lanuginosa*

  1. Conidia without any cingulum-like swellings, more obviously dimorphic, primary conidia ± lanceolate, secondary conidia ellipsoid-cylindrical 2

  2. Primary conidia usually lanceolate, maximum width in the lower half, only occasionally in the middle; on various hosts of the Apiaceae ..... (138) *L. braunii*

  2. Primary conidia ellipsoid-subcylindrical or somewhat wider in the upper half, maximum width in the middle or upper half, on *Carum carvi* ..... (149) *L. golovinii*

3.10 Apocynaceae (incl. Asclepiadaceae)

- *Erysiphe* sect. *Erysiphe*

  1. Chasmothecial appendages numerous, 0.5-2 times as long as the chasmotheciaö diam.; conidial germ tubes with up to two septa; on *Asclepias* ..... (398) *E. asclepiadis*

  1. Chasmothecial appendages few, only 4-17, longer, 1.5-4 times the chasmothecial diam.; conidial germ tubes aseptate; on *Pachypodium* ..... (432) *E. pachypodii*

- *Golovinomyces* - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Leveillula* - a single species ..... (169) *L. taurica*
- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Asclepias*, *Metaplexis*, *Tylophora*) (99) *P. sparsa*

Anamorphs

- *Ovulariopsis* - a single species (on *Asclepias curassavica*) ..... (292) *O. asclepiadis-curassavicae*
- *Oidium* s. lat. (generic affinity unclear)

  On *Hemidesmus* ..... (855) *O. hemidesmi*
  On *Obea* ..... (871) *O. stapeliae*
  On *Telosma* ..... (862) *O. pergulariae*

- *Pseudoidium*

  On *Cryptolepis* ..... (788) *Ps. cryptolepidis*
  On *Leptadenia* ..... (806) *Ps. leptadeniae*
  On *Pentatropis* ..... (821) *Ps. pentatropidis*
  On *Rauvolfia* ..... (825) *Ps. rauvolfiae*
  On *Vinca* ..... (835) *Ps. vincae*

3.11 Aquifoliaceae

- *Erysiphe* sect. *Microsphaera* - a single species (on Nemopanthus) ..... (589) *E. nemopanthi*
- *Phyllactinia* - a single species ..... (296) *Ph. guttata* s. lat.

3.12 Araliaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Panax*) ..... (454) *E. panacis*
- *Phyllactinia* - a single species (on Kalopanax) ..... (246) *Ph. kalopanacis*

  Anamorph
- *Pseudoidium* - a single species (on *Raukaua*) ..... (771) *Ps. araliacearum*

3.13 Aristolochiaceae

- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.
- *Erysiphe* sect. *Microsphaera* - a single species (on *Aristolochia*) ..... (496) *E. aristolochiae*

  Anamorph
- *Pseudoidium* as *Oidium* sp. ("*Erysiphe communis*"); on *Asarum canadense*, North America (see Hirata 1966, Anamo 1986)

3.14 Asteraceae (Compositae)

- *Erysiphe* sect. *Erysiphe*

  1. Chasmothecia 100-220 µm diam., 20-40 asci, (3-)4-6(-8)-spored; on *Ericameria*, North America (471) *E. sepulta*

  1. Chasmothecia smaller, with fewer asci 2
  2. Asci 2-3-spored; on *Saussurea*, Japan ..... (404) *E. braunii*
  2. Asci 4-8-spored (*E. mayorii* s. lat.) 3
  3. Asci (5-)6-8-spored, frequently 8-spored; on *Cirsium*, Europe to Kazakhstan ..... (449) *E. mayorii* var. *mayorii*
  3. Asci 4-7-spored 4
  4. On *Cicerbita*, Europe ..... (449) *E. mayorii* var. *cicerbitae*
  4. On *Cirsium*, Japan, Far East of Russia ..... (449) *E. mayorii* var. *japonica*

- *Erysiphe* sect. *Microsphaera* - a single species (on *Atractylodes*, Japan) ..... (563) *E. itoana*
- *Erysiphe* sect. *Uncinula* - a single species (on *Vernonanthura phosphorica*), South America ..... (758) *E. vernoniae*
- *Golovinomyces*

  1. Conidiophores very long, foot-cells (or sometimes following cells) very long, about 80-250 µm, width conspicuously increasing from base to top, or foot-cells about 40-80 µm long, subcylindrical, followed by a following cell about as long as the foot-cell or longer; conidia large, 25-50(-70) x 16-30 µm, especially wide, mostly > 20 µm, length/width ratio usually less than 2, broadly ellipsoid-ovoid to doliiform, conidia often with slightly constricted ends (limoniform); conidial germination mainly the *longitubus* pattern within the *Euoidium* type - on *Ambrosia ambrosioides* [= *Franseria ambrosioides*], *Arctium*, *Centaurea montana* and some other species of this genus, *Echinops*, *Onopordum*; or foot-cells subcylindrical, 35-120 x 9-18 µm, followed by 1-3 shorter cells, but conidia broadly ellipsoid-ovoid, doliiform to limoniform, about 25-45 x 15-27 µm, length/width ratio usually <2 (1.3-2.1, mostly 1.4-1.6) and conidial germination mainly the *longitubus* pattern - on hosts of the *Anthemideae* (*Artemisia*, rarely *Achillea*) and *Heliantheae* (*Ambrosia*, *Helianthus*, *Rudbeckia*, *Zinnia angustifolia*); [*Golovinomyces* sect. *Depressi*] 2
  1. Conidiophores shorter, foot-cells about 40-140 µm long, mostly 40-80 µm, cylindrical, usually followed by 1-3 shorter cells; conidia usually narrower, about 14-22 µm wide, seldom wider, ellipsoid-ovoid to doliiform, sometimes subcylindrical, conidial germination of the common *Euoidium* type; [*Golovinomyces* sect. *Golovinomyces*] 6

2. Chasmothecia mostly 95-150 µm diam.; appendages usually very short, shorter than the chasmothecial diam., often rudimentary, 3-9 µm wide, hyaline or faintly pigmented; on hosts of the *Anthemideae* (*Artemisia*, rarely *Achillea*) ..... (316) *G. artemisiae*

2. Either with chasmothecia larger, often larger than 150 µm diam., or appendages well developed, wider, brown when mature; on other genera of *Asteraceae* 3

3. Conidiophores with short or long foot-cells followed by shorter cells; on *Arctium*, some *Centaurea* spp. including *C. montana*, *Onopordum* and various plants of the *Heliantheae* (*Ambrosia*, *Helianthus*, *Rudbeckia*, *Zinnia angustifolia*) 4

3. Conidiophores with a long foot-cell followed by shorter cells or often with a short or moderately long foot cell followed by a cell of about the same length or much longer, sometimes very long; on *Echinops* or *Ambrosia* 5

4. Foot-cells of the conidiophores cylindrical, 35-80 x 9-15 µm; chasmothecia subglobose; on various plants of the *Heliantheae* (*Ambrosia*, *Helianthus*, *Rudbeckia*, *Zinnia angustifolia*) ..... (312) *G. ambrosiae*

4. Foot-cells of the conidiophores 80-190 µm long, mostly somewhat increasing in width from base to top; chasmothecia usually depressed-lentiform when mature; on *Arctium*, some *Centaurea* spp. including *C. montana*, *Onopordum* ..... (327) *G. depressus*

5. Foot-cells of the conidiophores subcylindrical, 40-80 x 7-14 µm, followed by 2-4 cells, the first following cell about as long as the foot-cell or longer; on *Ambrosia ambrosioides* [= *Franseria ambrosioides*], USA ..... (331) *G. franseriae*

5. Foot-cells increasing in width from base to top, straight, about 40-100(-150) x 10-20 µm, followed by some shorter cells or by a longer first following cell, about 100-170 µm, and a second cell about 40-100 µm, often followed by a further 1-2 short cells about 20-30 µm long, (the lengths of the first and second cells may be exchanged); on *Echinops*, Asia, Caucasus, Europe ..... (328) *G. echinopis*

6. Chasmothecia with short appendages, usually shorter than the chasmothecial diam., often very short 7

6. Chasmothecia with well developed appendages, about 0.5-4 times the chasmothecial diam., mostly about as long as the diameter or longer 8

7. Conidia small, about 20-32 x 10-15 um, cylindrical-doliiform (-ovoid); on *Chrysothamnus*, *Ericameria*, *Grindelia*, *Lorandersonia*, western USA ..... (345) *G. pseudosepultus*

7. Conidia larger, about 16-26 µm wide; on *Artemisia*, rarely on *Achillea* ..... (316) *G. artemisiae*

8. Conidia 25-45 x 15-27 µm (when fresh), broadly ellipsoid-ovoid to doliform-limoniform, length/width ratio 1.3-1.9, mostly 1.4-1.6; conidial germination mainly of the *longitubus* pattern within the *Euoidium* type; on *Ambrosia*, *Iva*, *Helianthus*, *Rudbeckia*, *Zinnia* [*Asteraceae*, *Heliantheae*) ..... (312) G. ambrosiae

8. Conidia narrower, more slender, length/width ratio about 1.3-2.6; conidial germination of the normal Euoidium type 9

9. Developing conidia usually not distinctly swollen, forming relatively short chains; mature conidia (10-)15-23(-25) µm wide; conidiophores erect, foot-cells straight or often curved, especially at the base; hyphal appressoria nipple-shaped or often poorly developed; germ tubes short, often somewhat twisted, broadened or bent, rarely forked; ascomata seldom developed; asci often 3- or 4-spored; on numerous host species of various plant families, including some cultivated hosts of the *Asteraceae*, e.g. *Chrysanthemum*, *Dahlia*, *Helianthus*, *Matricaria*, *Scorzonera*, but usually only in inoculation experiments and greenhouses, not under field conditions ..... (342) *G. orontii*

9. Developing conidia usually conspicuously swollen, often in long chains; conidiophores erect, straight, cylindrical to distinctly curved; hyphal appressoria conspicuously nipple-shaped, sometimes with a crenulate surface or lobed; germ tubes short to moderately long, simple; ascomata frequently developed, asci usually consistently 2-spored or only occasionally 3-spored; on various hosts of the *Asteraceae* (*G. cichoracearum* s. lat.) 10

10. Conidia small, about 20-30 x 10-15 µm; ascospores small and subglobose, about 14-19 x 10-13 µm; on *Goniocaulon indicum*, India ..... (343) *G. poonaensis*

10. Conidia larger; ascospores larger, usually not subglobose; on other hosts 11

11. Foot-cells of the conidiophores curved; conidia broadly ellipsoid-doliiform, 20-35 x 15-22 µm, length/width ratio (1-)1.2-2; chasmothecia large, about (100-)120-160 µm diam.; appendages usually shorter than the chasmothecial diam.; on species of *Senecio* sect. *Senecio*, above all *S. sylvaticus*, *S. viscosus* and *S. vulgaris*, but also *S. jacobaea* ..... (330) *G. fischeri*

11. Foot-cells of the conidiophores not curved, and/or conidia with a length/width ratio of about 1.5-2.3; and/or chasmothecia smaller; and/or appendages longer; on other hosts 12

12. Conidia narrow, 25-38 x 10-18 µm, width on average < 15 µm; On *Prenanthes* ..... (344) *G. prenanthis*

12. Conidia broader, width on average > 15 µm: on other hosts 13

13. Chasmothecia mainly caulicolous, immersed in a dense mycelial felt, 70-120 µm diam.; ascus wall very thin, about 1 µm thick; on *Lygodesmia*, USA ..... (322) *G. caulicola*

13. Chasmothecia mainly foliicolous and/or larger; ascus wall 1-2 µm thick: on other hosts 14

14. Chasmothecia relatively small, 85-115 µm diam., appendages 1-2 times as long as the chasmothecial diam.; foot-cells of the conidiophores 90-120 x 12-16 µm, conidia up to 55 µm long; on *Leuceria thermarum*, Argentina ..... (338) *G. leuceriae*

14. Chasmothecia larger or appendages shorter, mostly shorter than, or about as long as the chasmothecial diam. or foot-cells usually 30-80 x 9-14 µm, conidia usually up to 40 µm long 15

15. Foot cells of the conidiophores arising somewhat laterally from the hyphal mother cells, often curved, even sinuous throughout or only at the base 16

15. Foot cells arising from the upper surface of the mother cells, always straight 20

16. All foot cells curved at the base, often strongly so or even sinuous; hyphal appressoria frequently lobed; confined to *Sonchus* spp. [*Cichorioideae*, *Sonchinae*) ..... (350) *G. sonchicola*

16. Shape of foot-cells variable, straight to curved, and/or most or all hyphal appressoria nipple-shaped, only occasionally slightly lobed; on other hosts 17

17. Hyphal appressoria variable, nipple-shaped to lobed; on various plants of the *Cichorioideae* ..... (323) *G. cichoracearum* s. str

17. Hyphal appressoria completely or almost completely nipple-shaped; on other hosts (*Asteroideae*) 18

18. Shape of foot-cells variable, straight to curved; appendages 0.5-4 times as long as the chasmothecial diam.; on *Eupatorieae* (*Ageratina*, *Conoclinium*, *Eupatorium*, *Eutrochium*, *Praxelis*) ..... (324) *G. circumfusus*

18. All or almost all foot-cells curved; on *Astereae* 19

19. Chasmothecial appendages uniformly short, mostly shorter than the chasmothecial diam.; on *Aster* s. lat. (*Galatella*, *Symphyotrichum*) ..... (317) *G. asterum* var. *moroczkovskii*

19. Appendages variable in length, 0.5-2.5 times the chasmothecial diam.; on *Solidago* spp. ..... (317) *G. asterum* var. *solidaginis*

20. Mature chasmothecia usually depressed at the base or somewhat lentiform; on *Carduoideae*, *Inuleae* and *Senecioneae* 21

20. Mature chasmothecia usually subglobose; on other hosts 23

21. On *Inula*, *Inuleae* ..... (336) *G. inulae*

21. On *Carduoideae* or *Senecioneae* 22

22. On *Carduoideae* ..... (341) *G. montagnei*

22. On *Senecioneae* ..... (349) *G. senecionis*

23. Appendages about 0.5-4 times as long as the chasmothecial diam.; on *Cichorioideae* or *Eupatorieae* 24

23. Appendages uniformly short, usually about as long as the chasmothecial diam. or shorter; on other hosts 25

24. Hyphal appressoria nipple-shaped to somewhat lobed; on *Cichorioideae* ..... (323) *G. cichoracearum* s. str.

24. Hyphal appressoria consistently nipple-shaped; on *Eupatorieae* ..... (324) *G. circumfusus*

25. On *Heliantheae* (*Coreopsis*, *Dahlia*, *Melampodium*, *Tithonia*, *Xanthium*, *Zinnia*, etc.) ..... (352) *G. spadiceus*

25. On *Anthemideae* or *Astereae* 26

26. Or *Anthemideae* ..... (339) *G. macropus*

26. On *Astereae* (*Aster* s. lat.) ..... (317) *G. asterum* var. *asterum*

- *Leveillula*

1. Conidial surface with very conspicuous, large, dense warts, i.e. strongly verrucose-squamulose (warts very conspicuous, even when viewed by means of light microscopy); on *Thevenotia* ..... (170) *L. thevenotiae*

1. Conidia not verrucose-squamulose, warts if visible at all by light microscopy, fine, not very conspicuous; on other hosts 2

2. Primary conidia ± cylindrical or ellipsoid-ovoid to cylindrical, sides mostly ± parallel to each other or somewhat wider in the upper half, conidia sometimes partly or always somewhat narrowed in the middle, ends rounded, truncate or ± narrowed towards the apex, conical, tips usually obtuse 3

2. Primary conidia neither cylindrical nor ellipsoid-cylindrical, but ± lanceolate, ovoid-lanceolate, ovoid or ellipsoid-ovoid, apex ± pointed 5

3. Conidia large, about 40-80 µm long, apex of primary conidia mostly distinctly conical, not distinctly narrowed in the middle, at most slightly so; on *Picris* and other composites ..... (164) *L. picridis*

3. Conidia relatively small, about (35-)40-55(-60) µm long, apex of primary conidia rounded to short conical, occasionally or always narrowed in the middle; on *Chondrilla*, *Hexinia* or *Lactuca* 4

4. Conidia clearly differentiated in primary and secondary conidia, cylindrical primary conidia with short conical apex; on *Chondrilla*, *Hexinia* or Lactuca ..... (154) *L. lactucarum*

4. Conidia uniformly subcylindrical, usually somewhat narrowed in the middle, ends always rounded: on *Chondrilla*, Iran ..... (150) *L. guilanensis*

5. Primary conidia broadly ellipsoid-obovoid, apex rounded, length/width ratio 2.2-3.2, secondary conidia subcylindrical-doliiform, subclavate; chasmothecia relatively small, 130-180(-200) µm diam.; on *Helichrysum* ..... (151) *L. helichrysi*

5. Primary conidia lanceolate or ellipsoid-ovoid, but usually distinctly narrowed towards the tip, secondary conidia cylindrical or somewhat wider in the upper half; chasmothecia larger, mostly about 150-250 µm diam. 6

6. Maximum width of primary conidia mostly distinctly in the lower half (shape ± lanceolate) 7

6. Maximum width of primary conidia mostly ± in the middle or only slightly below (shape not distinctly lanceolate) 8

7. On a wide range of hosts ..... (169) *L. taurica* s. lat

7. On *Lactuca serriola* (genetically clearly distinct from *L. taurica*) ..... (153) *L. lactucae-serriolae*

8. Length/width ratio of primary conidia on average > 3; on *Carlina* or *Odontospermum* 9

8. Length/width ratio of primary conidia usually < 3 [1.8-3(-4.1)] 10

9. Primary conidia with abruptly constricted tips; On *Odontospermum* ..... (136) *L. asterisci*

9. Primary conidia, with tips not abruptly constricted, but gradually narrowed up to the apex; on *Carlina* ..... (171) *L. wasseri*

10. Primary conidia ellipsoid-ovoid, rather short, about 40-50 x 16-20 µm long, length/width ratio 2.2-2.8, conidial surface (SEM) with papillae on secondary conidia in groups of 6-15, spherical, 0.3-0.6 µm diam.; on *Osteospermum* ..... (161) *L. osteospermi*

10. Primary conidia longer, 50-65 µm, conidial surface (SEM) with evenly spread papillae or in smaller groups of only 3-5; on *Cynara* and other hosts of the *Asteraceae* ..... (157) *L. lappae*

- *Neoërysiphe* - see "Key to the species" of this genus

- *Podosphaera* sect. *Sphaerotheca*

1. Ascospores maturing rather late, but rather large, 18-28 x 14-19 µm, often faintly pigmented, yellowish to pale golden-brown; chasmothecia large, 80-120 µm diam.; terminal oculus of the ascus large, (15-)20-25(-30) µm diam.; mycelium persistent, but without dark, thick-walled secondary mycelium; on *Pericallis* × *hybrida* ..... (86) *P. pericallidis*

1. Either ascospores maturing late but small, average length < 20 µm, or ascospores maturing early and large, average length > 20 µm: and/or chasmothecia smaller or oculus of the ascus smaller; ascospores colourless; on other hosts 2

2. Ascospores maturing early (easily visible in usually mature ascus), mycelium persistent, with hyphae up to 12 µm wide; forming secondary mycelium, at least in old infections, secondary hyphae turning brown and thick-walled; oculus of the ascus (10-)15-20(-25) µm diam.; chasmothecial appendages well developed, coarse, up to 4 times as long as the chasmothecial diam.; on *Ainsliaea* (Asia) or on *Senecio* in northern hemisphere 3

2. Ascospores usually maturing late (ascus often immature); mycelium evanescent to persistent, secondary mycelium absent, but if present, then ascus with larger oculus, up to 30 µm diam.; on other hosts, or on *Senecio* in southern hemisphere 4

3. Persistent secondary mycelium and long chasmothecial appendages often forming conspicuous brown patches on leaves (in old infections); on *Senecio*, northern hemisphere ..(95) *P. senecionis*

3. Persistent secondary mycelium inconspicuous, thin, not forming brown patches on leaves; On *Ainsliaea*, Asia ..... (36) *P. ainsliaeae*

4. Ascus with large terminal oculus (thin apical portion of the wall), 15-30 µm diam. 5

4. Ascus with small terminal oculus, 8-15 µm diam. (average about 12 µm) 7

5. With thick-walled secondary mycelium; chasmothecia small, 70-90 µm, on average < 85 µm; oculus of the ascus large, 20-30 µm diam., on average about 25 µm; on *Adenocaulon himalaicum*, Japan ..... (35) *P. adenocauli*

5. Without thick-walled secondary mycelium; chasmothecia larger, 70-110 µm diam., on average > 85 µm; oculus of the ascus smaller, 15-25 µm diam. (on average about 18-20 µm) 6

6. On a wide range of hosts of the *Asteraceae*; conidial germ tubes short, often curved and/or forked (*Fibroidium* type, *brevitubus* subtype of subsect. *Magnicellulatae*) ..... (107) *P. xanthii*

6. On *Carpesium*, Japan, endemic (morphologically close to but genetically clearly distinct from *P. xanthii*) ..... (464) *P. carpesiicola*

7. Ascomata large, 75-100 µm diam., average > 85 µm; on *Aster* (incl. *Kalimeris*), Japan ..... (39) *P. astericola*

7. Ascomata smaller 55-90 µm diam., average < 85 µm 8

8. Chasmothecia with relatively short appendages, up to about 3 times as long as the chasmothecial diam.; on various other hosts ..... (60) *P. erigerontis-canadensis*

8. Chasmothecia with longer appendages, up to 6 times the chasmothecial diam.; with brown, thick-walled secondary mycelium; On *Bidens* or *Doronicum* 9

9. On *Bidens cernua*, North America ..... (43) *P. bidenticola*

9. On *Doronicum* spp., Europe to Caucasus and Central Asia ..... (69) *P. fusca*

Anamorphs

- *Euoidium*

  On *Ageratum* ..... (357) *Eu. agerati*

  On *Chrysanthemum* ..... (358) *Eu. chrysanthemi*

  On *Helichrysum* ..... (360) *Eu. helichrysi*

  On *Ixodia* (Australia) ..... (361) *Eu. ixodiae*

  On *Mutisia* (South America)

  1. Conidia 30-40 µm long; on *Mutisia spinosa* ..... (364) *Eu. mutisiae*

  1. Conidia longer, (32-)35-46(-62) µm; on *Mutisia decurrens* ..... (366) *Eu. reginae*

  On *Vernonia* ..... (370) *Eu. vernoniicola*

- *Fibroidium* - a single species (on *Emilia sonchifolia*; conidia up to 50 µm long) ..... (114) *F. emiliae-sonchifoliae*
- *Oidiopsis* - a single species (on *Tagetes erecta*) ..... (180) *Os. tagetidis*
- *Oidium* s. lat.

  On *Blainvillea acmella* ..... (869) *O. spilanthedis*
  On *Lagascea* ..... (856) *O. lagasceae*
  On *Launaea* ..... (858) *O. launaeae*
  On *Vernonia* ..... (872) *O. vernoniae*
- *Striatoidium* - a single species (on *Baccharis*) ..... (384) *St. baccharidis*

3.15 Balsaminaceae

- *Leveillula* - a single species ..... (169) *L. taurica*
- *Podosphaera*

  1. On *Impatiens noli-tangere* ..... (42) *P. balsaminae*
  1. On *Impatiens balsamina*, *I. textori* and other species ..... (107) *P. xanthii*

  Anamorphs

- *Fibroidium* a single species (on *Impatiens balsamina*, *I. textori* and other species, but not on *I. noli-tangere*) ..... (111) *F. balsaminae*
- *Oidiopsis* - a single species (on *Impatiens balsamina*) ..... (175) *O. balsaminae*

3.16 Basellaceae

- *Golovinomyces* - "*E. cichoracearum*" on *Basella*, India (see Hirata 1966, Amano 1986)

3.17 Begoniaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Begonia* in Chima) ..... (402) *E. begoniae*
- *Erysiphe* sect. *Microsphaera* - a single species (on *Begonia*) ..... (502) *E. begoniicola*
- *Golovinomyces* - a single species (on *Begonia*) ..... (342) *G. orontii* [as *Euoidium violae*]

  Anamorphs

- Euoidium - a single species (on *Begonia*) ..... (342) *G. orontii* [as *Euoidium violae*]
- *Pseudoidium*

  1. Conidia very long, usually 35-60 µm ..... *Ps. macrosporum* (see (502) *Erysiphe begoniicola*)
  1. Conidia much shorter, see *Erysiphe begoniae*

3.18 Berberidiaceae

- *Erysiphe* sect. *Erysiphe*

  1. Appendages aseptate, yellowish, only brownish near the base, ascospores of regwar shape, ellipsoid; on *Epimedium* in China ..... (422) *E. epimedii* var. *epimedii*
  1. Appendages septate, brown, ascospores of variable shape; on same host ..... (422) *E. epimedii* var. *brinnea*

- *Erysiphe* sect. *Microsphaera*

  1. Chasmothecial appendages very long and flexuous, up to 950 µm in length, apex simple or sometimes 1-3 times branched; on *Berberis* sp., Central Asia ..... (551) *E. golovinii*

1. Appendages shorter, length less than 400 µm, apex always richly branched, 3-6 times 2
2. Tips of ultimate branchlets of appendages always straight, not recurved 3
2. Tips at least partly recurved when mature 4
3. Appendages 1-3, mostly 1.5-2 times as long as the chasmothecial diam., branching very loose, diffuse; on *Berberis vulgaris* and other hosts, Europe to Central Asia, Turkey, Iran ..... (505) *E. berberidis* var. *berberidis*
3. Appendages 1-2, mostly 1-1.5 times the chasmothecial diam., branchings rather dense and compact; on *Berberis amurensis* and other hosts, China to Japan ..... (505) *E. berberidis* var. *asiatica*
4. Apex of appendages regularly and tightly branched, compact (on *Berberis* in South America or *B. heteropoda* in Asia) 5
4. Apex of appendages rather loosely branched, primary branches often elongated 6
5. Appendages about 1-2 times as long as the chasmothecial diam.; on *Berberis heteropoda*, Asia (534) *E. dimorpha*
5. Appendages 2-4 times the chasmothecial diam.; on *Berberis*, South America ... (632) *E. thaxteri*
6. Chasmothecia small, 70-100 µm diam., 4-15 appendages, apex 3-4(-6) times branched, primary branches elongated, often somewhat recurved; on *Berberis dasystachya* and *B. thunbergii* ..... (504) *E. berberidicola*
6. Chasmothecia 70-115 µm diam., 5-35 appendages, apex 4-6 times branched, a different mode of branching; on other hosts 7
7. Appendages (1-)1.5-2.5(-3) times as long as the chasmothecial diam., rather stiff, basal part usually pigmented, brown, rough-walled, thick-walled throughout or thick below and thin above, ascospores 16-30 x 8-15 µm; on *Berberis amurensis*, China, Japan ..... (585) *E. multappendicis*
7. Appendages 1.5-3.5, mostly 2-3 times the chasmothecial diam., flexuous, hyaline or only pigmented at the very base, smooth, thinwalled, ascospores 16-20 x 9-13 µm; on *Berberis diaphana*, China ..... (622) *E. sichuanica*

- *Phyllactinia* - a single species (on *Berberis*) ..... (203) *P. berberidis*

3.19 Betulaceae subfam. Betuloideae (*Alnus* and *Betula*)

- *Erysiphe* sect. *Erysiphe*

1. Chasmothecia 70-130 µm diam.; on *Alnus*, Japan ..... see (658) *E. amanoi*
1. Chasmothecia larger, 120-230 µm 2
2. Chasmothecia 130-230 µm diam., 15-30 asci, appendages mostly about 0.5-2 times as long as the chasmothecial diam.; on female catkins of *Alnus*, North America ..... (394) *E. aggregata*
2. Chasmothecia 120-160 µm diam., 8-15 asci, appendages 2-5 times the chasmothecial diam.; on *Alnus* in Europe ..... (483) *E. vernalis*

- *Erysiphe* sect. *Microsphaera*

1. Apex of the appendages very densely and regularly branched, asci 6-8-, mostly 8-spored; on *Alnus* ..... (598) *E. penicillata*
1. Apex rather loosely branched, sometimes somewhat irregular, asci 4-8-, mostly 5-7-spored; on *Betula* (*E. ornata* s. lat.) 2
2. Appendages 6-22, mostly 1-1.5 times as long as the chasmothecial diam.; on *Betula* in North America, Asia, rare in Europe ..... (594) *E. ornata* var. *ornata*
2. Appendages fewer, mostly about 4-10, shorter, mostly somewhat shorter than the chasmothecial diam.; on *Betula* in Europe ..... (594) *E. ornata* var. *europaea*

- *Erysiphe* sect. *Uncinula*

1. Appendages dimorphic, long, 1-4 times as long as the chasmothecial diam., either mycelioid, geniculate-sinuous, apex simple or with loosely to tightly circinate to spirally twisted apex; on *Alnus*, Japan ..... (658) *E. amanoi*

1. Appendages uniform, not dimorphic, not mycelioid, apex always uncinate-circinate 2
2. Width of the chasmothecial appendages almost equal throughout or somewhat irregular, asci 4-8-, usually 6-8-spored; on *Alnus* and *Betula*, Asia ..... (666) *E. betulina*
2. Width almost equal throughout or often increasing towards the tip, but then narrowing into a circinate apex, appendages often abruptly bent in the upper half, asci (4-)5-6(-7)-spored; on *Alnus*, Asia ..... (720) *E. miyabei*

- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Podosphaera* sect. *Podosphaera* - a single species (on *Betula*) ..... (19) *P. erineophila*

3.20 Betulaceae subfam. Coryloideae [=*Corylaceae*] (*Carpinus*, *Corylus* and *Ostrya*)

- *Erysiphe* sect. *Erysiphe*

1. Chasmothecia 200-250 µm diam., appendages arising from the upper half, pointing upwards, usually 4-8 times as long as the chasmothecial diam., (17-)20-50 in number; on *Carpinus laxiflora*, Japan ..... (426) *E. fimbriata*
1. Chasmothecia much smaller, appendages arising from the lower half, horizontally spread, much shorter; on *Corylus*, North America ..... (475) *Erysiphe* sp.

- *Erysiphe* sect. *Microsphaera*

1. Appendages 0.5-1.5 times as long as the chasmothecial diam. 2
1. Appendages (1-)1.5-2.5(-3.5) times the chasmothecial diam, ... 3
2. Appendages 0.5-1.5 times as long as the chasmothecial diam., mostly about as long as the diam., tips of ultimate branchlets distinctly recurved, asci (6-)8-spored, ascospores 14-20 µm long; on *Corylus*, North America, Asia ..... (524) *E. corylacearum*
2. Appendages always shorter then the chasmothecial diam., tips not recurved, asci 5-8-spored, ascospores 16-24 µm long; on *Corylus yunnanensis*, China ..... (641) *E. verruculosa*
3. Appendages often geniculate, septate, with 1-5 septa, pigmented, loosely and often irregularly branched or apex denser and regular; on *Corylus*, Japan ..... (525) *E. corylicola*
3. Appendages long and flexuous, but not geniculate, 0-1(-3)-septate, hyaline or only pigmented at the very base, branchings uniformly tight and regular; on *Carpinus*, *Corylus*, *Ostrya*, North America ..... (539) *E. ellisii*

- *Erysiphe* sect. *Uncinula*

1. Appendages 6-12 times as long as the chasmothecial diam., 7-11 in number, apex uncinate, ultimate tips very short bi- to trifid, with recurved or uncinate branchlets; on *Carpinus londoniana*, China ..... (762) *E. wuyiensis*
1. Appendages shorter, 1-2.5 times the chasmothecial diam., apex simply circinate (*E. carpinicola* s. lat.) 2
2. Chasmothecia with few appendages, 8-15, width variable, short bristle-like "appendages" (anchor hyphae) in the upper part lacking; on *Carpinus cordatus* ..... (673) *E. carpini-cordatae*
2. Chasmothecia with numerous appendages, about 10-40, sometimes with short bristle-like "appendages" (anchor hyphae) in the upper half 3
3. Conidia relatively large, 25-45 x 10-19 µm; chasmothecia with (6-)10-20(-25) appendages, up to 360 µm long, mostly curved throughout (arched), a few anchor hyphae in the upper part, 7-12; asci 2-6-spored; ascospores 15-28 x 10-19 µm; on *Carpinus betulus* and *C. tschonoskii* ..... (661) *E. arcuata*
3. Conidia relatively small, 20-30 x 9-14 µm; chasmothecia with numerous appendages, 15-40, shorter, up to 300 µm, straight to flexuous, somewhat curved-sinuous, but not typically arched; anchor hyphae numerous, usually more than 15 (subsect. *Uncinuliella*); asci (4-)6-8-spored; ascospores smaller, 13-20 x 7-12 um; on other hosts 4

4. Foot-cells of the conidiophores straight to slightly sinuous-curved at the base; chasmothecial appendages 90-220 µm long, width within the apical coil slightly decreasing; on *Carpinus japonica*, Japan ..... (672) *E. carpinicola*

4. Foot-cells of the conidiophores distinctly curved at the base; appendages up to 300 µm long, width within the apical coil ± uniform to slightly increasing; on *Carpinus laxiflora*, Japan, Korea ..... (675) *E. carpini-laxiflorae*

- *Phyllactinia* - see key to the species of *Phyllactinia*

3.21 Bignoniaceae

- *Erysiphe* sect. *Erysiphe*

1. Conidial germ tubes moderately long (median value 1.0 times the conidial width); on *Catalpa* ... .(409) *E. catalpae*

1. Conidial germ tubes shorter; on *Incarvillea* .....(470) *E. scholzii*

- *Erysiphe* sect. *Microsphaera*

1. Chasmothecial appendages long and flaccid, 1-6 times as long as the chasmothecial diam., 2-4 times branched; on *Catalpa*, North America, introduced in Europe ..... (538) *E. elevata*

1. Appendages 1-1.5 times the chasmothecial diam., rather stiff, apex 4-6 times branched; on *Campsis*, USA .....(597) *E. peckii*

- *Erysiphe* sect. *Uncinula*

1. Chasmothecia 95-125 µm diam., 40-100 appendages, width equal throughout, 6-8 um; on *Tecoma* and *Tabebuia*, South America ..... (730) *E. peruviana*

1. Chasmothecia 140-180 µm diam., 35-65 appendages, 4.5-5 µm wide and expanding to 6.5-8.5 µm above, but then abruptly narrowing to the circinate part; on *Stereospermum*, Africa ..... (748) *E. sibiliae*

- *Golovinomyces* - a single species .....(342) *G. orontii* [as *Euoidium violae*]
- *Leveillula* - a single species (on *Catalpa*) .....(140) *L. catalpae*
- *Neoërysiphe* - a single species (on *Catalpa*) ..... (374) *N. galeopsidis*
- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Catalpa*) .....(48) *P. catalpae*

Anamorphs

- *Fibroidium* - a single species (on *Catalpa*) .....(117) *F. hiratae*
- *Ovulariopsis*

1. Mycelium forming special aerial hyhae, lateral, long, up to 500 µm, setiform-filiform, wall thickened, at least below, conidiophores relatively short, up to 200 µm, conidia relatively narrow, 12-22 µm; on *Tabebuia aurea*, Brazil .....(308) *Ov. tabebuiae-aureae*

1. Special aerial hyphae lacking, conidiophores much longer, up to about 500 µm, conidia wider, usually 18-25 µm 2

2. Basal septum of the conidiophores strongly elevated 20-70 µm above junction with supporting hyphal mother cell, conidiophores walls somewhat thickened, 1-2 µm thick, at least below; on *Spathodea campanulata* .....(307) *Ov. spathodeae*

2. Basal septum of the conidiophores moderately elevated, 10-35 µm, conidiophores thin-walled, up to 1 µm below and 0.5 µm above; on various Tabebuia spp. ..... (304) *Ov. obclavata*

- *Pseudoidium* - a single species (on *Jacaranda*) .....(799) *Ps. jacarandigena*

3.22 Bixaceae

- *Pseudoidium* - a single species (on *Bixa*) ..... *P. anacardii* (see (606) *E. quercicola*)

3.23 Boraginaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on various genera) .....(444) *E. lycopsidis*
- *Erysiphe* sect. *Uncinula*

  1. Chasmothecia (55-)70-100(-110) µm diam., 3-16 appendages, shorter than the chasmothecial diam.; on *Ehretia* (*E. ehretiae* s. lat.) 2
  1. Chasmothecia 80-150 µm diam., 20-100 appendages, 0.75-3 times as long as the chasmothecial diam. 3
  2. Chasmothecia with 3-7 asci, 4-7-spored; on *Ehretia corylifolia*, China ..... (689) *E. ehretiae* var. *ehretiae*
  2. Chasmothecia with (2-)3 asci, 2-4-spored; on *Ehretia acuminata*, Taiwan ..... (689) *E. ehretiae* var. *taiwanensis*
  3. Chasmothecia with 40-100 appendages, asci 4-6-spored; on *Cordia*, India ..(754) *E. udaipurensis*
  3. Chasmothecia with 20-80 appendages, asci 3-spored; on *Ehretia*, South Africa (736) *E. praeterita*

- *Golovinomyces* - a single species (on various hosts) ..... (328) *G. cynoglossi*
- *Leveillula* - a single species (on various) .....(169) *L. taurica*
- *Phyllactinia* - see key to the species of *Phyllactinia*

Anamorphs

- *Fibroidium* - a single species (on *Heliotropium*) .....(116) *F. heliotropii-indici*
- *Pseudoidium* - a single species (on *Heliotropium*) .....(795) *Ps. heliotropii-strigosi*

3.24 Brassicaceae (Cruciferae)

- *Erysiphe* sect. *Erysiphe*

  1. Appendages of the chasmothecia mostly enlarged at the apex, clavate, thin-walled, but thicker at the base, asci 2-4-spored, spores about (20-)25.5-33 x (12-)14-18 µm; on *Rorippa cantoniensis* ..... (467) *E. rorippae*
  1. Appendages not clavate at the apex, thin-walled throughout, ascospores usually shorter ..... (417) *E. cruciferarum*

- *Golovinomyces*

  1. On *Arabis*, Asia; chasmothecia frequently produced .....(315) *G. arabidis*
  1. On other hosts, occasional infections; chasmothecia rarely developed, usually immature ..... (342) *G. orontii*

- *Leveillula* - a single species (on various hosts) ..... (169) *L. taurica*
- *Podosphaera*

  1. Chasmothecia usually 70-90 µm diam., appendages short, mostly shorter than the chasmothecial diam., ascospores large, 15-30.5 µm long; on various hosts of the *Brassicaceae* ...(57) *P. drabae*
  1. Chasmothecia 80-105 µm diam., appendages longer, 0.5-2.5 times the diam., ascospores small, 12.5-18.5 µm long; on *Cardamine*, Japan .....(45) *P. cardamines*

3.25 Burseraceae

- *Erysiphe* sect. *Uncinula* - a single species (on *Garuga*) ..... (700) *E. garungae*
- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

  Anamorph
- *Oidium* s. lat. - *Oidium* sp. on *Balsamodendron*, South Africa (Hirata 1966, Amano 1986)

3.26 Buxaceae

- *Phyllactinia* - a single species (on Buxus) ..... (236) *Ph. guttata* s. lat.

3.27 Calycanthaceae

- *Phyllactinia* - a single species (on Calycanthus) ..... (206) *Ph. calycanthi*

3.28 Calyceraceae

- *Oidium* s. lat. - *Oidium* sp. on *Acicarpha* (Hirata 1966)

3.29 Campanulaceae

- *Golovinomyces*

  1. Chasmothecia (110-)130-150(-170) µm diam., appendages usually shorter than the chasmothecial diam.; on *Adenophora* ..... (311) *G. adenophorae*
  1. Chasmothecia smaller, rarely formed, appendages longer; on other hosts ..... (342) *G. orontii*
- *Leveillula* - a single spectes (on Michauxia) ..... (160) *L. mindii*

  [*L. taurica* s. lat. has been recorded from several hosts of the *Campanulaceae*]
- *Podosphaera* sect. *Sphaerotheca* - a single species (on Codonopsis) ..... (51) *P. codonopsidis*

3.30 Cannabaceae

- *Erysiphe* sect. *Uncinula*

  1. Chasmothecia with about 50-150 appendages, width uniform throughout, thick-walled throughout; on *Celtis*, North America ..... (727) *E. parvula*
  1. Appendages less than 30, width increasing upwards, thin-walled above, thicker towards the base; on hosts in Asia 2
  2. Appendages distinctly verrucose, especially in the lower half, about 4.5-6.5 µm wide in the lower part, about 2/3-3/4 of the stalk ± equal in width or even somewhat decreasing upwards, but then gradually increasing to 8-11 µm beneath the circinate part; on *Celtis caucasica*, Asia ..... (678) *E. celtidis*
  2. Appendages smooth or only faintly rough-walled, width gradually increasing from base to top ..3
  3. Chasmothecia small, 75-100 µm diam.; on *Aphananthe*, Japan ..... (660) *E. aphananthes*
  3. Chasmothecia larger; on other hosts 4
  4. Circinate part of appendages only slightly enlarged, and usually only slightly to moderately enlarged in the upper half; on *Celtis* and *Hemiptelea* ..... (708) *E. kusanoi*
  4. Circinate part always strongly and abruptly enlarged; on *Zelkowa* ..... (765) *E. zelkowae*
- *Golovinomyces* - a single species ..... (342) *Euoidium violae* [as *G. orontii*]
- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Pleochaeta*

  1. Asci 2-spored; on *Celtis*, North and South America ..... (286) *Pl. polychaeta*

1. Asci(2-)3-4-spored 2
2. On *Aphananthe* and various *Celtis* spp., Asia, South Africa ..... (289) *Pl. shiraiana*
2. On *Celtis australis*, North India ..... (285) *Pl. indica*

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Celtis*, North America) .. (89) *P. phytoptophila* Anamorph
- *Pseudoidium* - a single species (on *Trema*) ..... (833) *Ps. udaiyanii*

3.31 Capparidaceae

- *Erysiphe* - a single species (on numerous species) ..... (417) *E. cruciferarum*
- *Golovinomyces* - a single species (on numerous species) ..... (342) *G. orontii* [as *Euoidium violae*]
- *Leveillula* - a single species (on numerous species) ..... (169) *L. taurica*

3.32 Caprifoliaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on Abelia) ..... (388) *E. abeliae*
- *Erysiphe* sect. *Microsphaera*

1. Chasmothecial appendages very long, 2-10 times the chasmothecial diam., apex 2-5 times branched, ultimate tips recurved when mature; on *Lonicera*, Europe, Asia ..... (579) *E. magnusii*
1. Appendages shorter, and/or tips straight 2
2. Appendages 1.5-5(-7) times as long as the chasmothecial diam., flexuous 3
2. Appendages shorter, about 0.5-2(-2.5) times the diam. 7
3. Tips of the ultimate branchlets recurved when fully mature (on *Abelia*, Japan) or apex 3-6 times densely and regularly branched, tips at first straight, but recurved when fully mature (on *Lonicera*, North America) 4
3. Tips always straight; on *Symphoricarpos* (North America) or *Lonicera* (Europe, Asia, apex loosely branched, diffuse) 5
4. Apex of the appendages densely and regularly branched, asci 3-10; on *Lonicera*, North America ..... (511) E. *caprifoliacearum* var. *flexuosa*
4. Apex loosely branched, asci 2-5; on *Abelia*, Japan ..... (492) *E. abeliicola*
5. Conidia ellipsoid-doliiform; chasmothecial appendages (1.5-)2-5(-7) times as long as the chasmothecial diam.; on *Symphoricarpos*, North America ..... (628) *E. symphoricarpi*
5. Conidia cylindrical; appendages (1-)1.5-2.5(-3) times the chasmothecial diam. 6
6. Chasmothecia 70-85 µm diam., appendages with a septum near the middle, asci usually 3; on *Lonicera ramosissima*, Japan ..... (574) *E. lonicerae-ramosissimae*
6. Chasmothecia 70-110 µm diam., appendages aseptate or with 1-3 basal septa, asci 2-8; on *Lonicera*, Europe to Asia ..... (573) *E. lonicerae* var. *lonicerae*
7. Tips of the ultimate branchlets always straight, seldom few tips slightly recurved 8
7. Tips always distinctly recurved when mature 10
8. Appendages densely and regularly branched, primary and secondary branches short, appearance of the branchings digitate; on *Abelia* ..... (517) *E. chifengensis*
8. Appendages loosely branched, branchings diffuse, primary and secondary branches often elongated, appearance not digitate; on *Lonicera* (*E. lonicerae* s. lat.) 9
9. Appendages 6-12, 1-3 times as long as the chasmothecial diam.; on various hosts of the genus *Lonicera*, Europe, Asia ..... (573) *E. lonicerae* var. *lonicerae* [appendages with a single septum near the middle; on *Lonicera ramosissima*, Japan, see *E. lonicerae-ramosissima*]

9. Appendages mostly 10-20, 1-2 times the chasmothecial diam.; on *Lonicera tatarica*, Europe, Asia introduced in North America ..... (573) *E. lonicerae* var. *ehrenbergii*

10. Appendages, 1-2.5 times as long as the chasmothecial diam., 3-20 in number, apex 4-6 times densely and regularly branched, compact, with 2-5-spored asci; on *Lonicera*, North America ..... (511) *E. caprifoliacearum* var. *caprifoliacearum*

10. Appendages either shorter or apex loosely branched, primary branches often elongated, or asci with more spores 11

11. Appendages 1-2 times as long as the chasmothecial diam.; on *Lonicera*, Asia ... (583) *E. miurae*

11. Appendages shorter, 0.5-1.25 times the chasmothecial diam., usually somewhat shorter than the diam.; on *Lonicera* or *Dipelta*, Asia 12

12. On *Lonicera* ..... (542) *E. erlangshanensis*

12. On *Dipelta* ..... (534) *E. dipeltae*

- *Phyllactinia* - a single species ..... (236) *Ph. guttata* s. lat.

3.33 Caricaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Carica*) ..... (407) *E. caricae*
- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.
- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Carica*) ..... (107) *P. xanthii*

Anamorphs

- *Ovulariopsis*/*Phyllactinia* (on *Carica papaya*)

1. Conidia dimorphic, primary conidia lanceolate, secondary conidia clavate; South America ..... (208) *Ph. caricifolia* [*Ov. caricicola*]

1. Conidia uniformly clavate 2

2. Cnmidia apiculate; Asia ..... (293) *Ov. caricae*

2. Cnmidia non-apiculate; Africa ..... (305) *Ov. papayae*

- *Oidium* s. lat. (generic affinity unclear) - a single species (on *Carica*; appressoria lobed, conidia catenescent) ..... (847) *O. caricae-papayae*
- *Pseudoidium* - a single species (on *Carica*) ..... *P. caricae* (see (407) *Erysiphe caricae*)

3.34 Caryophyllaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on various hosts) ..... (405) *E. buhrii*
- Golovinomyces - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Leveillula*

1. Conidia uniformly ellipsoid-cylindrical ..... (145) *L. cylindrospora*

1. Conidia dimorphic, primary conidia differ from secondary conidia 2

2. Primary conidia ellipsoid-ovoid, sublanceolate to cylindrical (sides mostly ± parallel to each other), ± narrowed towards a short conical apex, tips usually obtuse; on *Acanthophyllum* ..... (137) *L. bornmuelleriana*

2. Primary conidia lanceolate, narrowed towards a pointed apex; on other hosts ..... (169) *L. taurica* s. lat.

3.35 Cassuarinaceae

- *Oidium* s. lat. - *Oidium* sp. on *Casuarina*, South America (Hirata 1966, Amano 1986)

3.36 Celastraceae

- *Erysiphe* sect. *Microsphaera*

  1. Apex of appendages simple or once branched, appendages long, 1-4 times the chasmothecial diam., chasmothecia small, 80-95 µm diam.; on *Maytenus*, South America ..... (592) *E. oehrensii*
  1. Apex of the appendages richly branched, more than two times; on other hosts 2
  2. Appendages 1-3.5(-4.5) times as long as the chasmothecial diam., apical branchings dense and regular, when mature tips distinctly recurved or straight 3
  2. Appendages very long, 3.5-12 times the chasmothecial diam., or branchings loose, diffuse, irregular, tips always straight 6
  3. Appendages (1.5-)2-3.5(-4.5) times as long as the chasmothecial diam.; on *Celastrus*, China ..... (516) *E. celastri*
  3. Appendages 1-2 times the chasmothecial diam.; on *Euonymus* 4
  4. Tips of the ultimate branchlets straight ..... (570) *E. lianyungangensis*
  4. Tips distinctly recurved 5
  5. Mycelium forming dense persistent patches; chasmothecial appendages 4-8, length 1-1.3(-1.5) times the chasmothecial diam.; on *Euonymus japonicus* and *E. fortunei* ... (544) *E. euonymicola*
  5. Mycelium evanescent to persistent, but not in dense patches: appendages 1-2, length usually 1.5 times the chasmothecial diam.; on *Euonymus*, North America ..... (605) *E. pseudopusilla*
  6. Appendages 3.5-12 times as long as the chasmothecial diam., ultimate tips of the branchings recurved when mature, asci 8-spored: on *Euonymus lanceolatus* and *E. sieboldianus*, Japan ..... (579) *E. mayumi*
  6. Appendages 1-7 times the chasmothecial diam., tips straight, asci 2-5-spored .. (543) *E. euonymi*

- *Erysiphe* sect. *Uncinula* - a single species (on *Celastrus*) ..... (747) *E. sengokui*

- *Phyllactinia* - a single species (on *Celastrus*) ..... (214) *Ph. celastri*

3.37 Cercidiphyllaceae

- *Podosphaera* sect. *Podosphaera* - a single species (on *Cercidiphyllum*) ..... (16) *P. cercidiphyvlli*

3.38 Chenopodiaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on several hosts) ..... (403) *E. betae*

- *Leveillula*

  1. Conidia cylindrical, with cingulum-like rings near the ends ..... (168) *L. saxaouli*
  1. Conidia ellipsoid-cylindrical, without any rings ..... (145) *L. cylindrospora* [*L. taurica* s. lat. was reported from *Spinacia*]

3.39 Chloranthaceae

- Erysiphe sect. Erysiphe - a single species (on Chloranthus) ..... (413) *E. chloranthi*

3.40 Cistaceae

- *Golovinomyces* - a single species ..... (342) *G. orontii* [as *Euoidium violae*]

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Helianthemum*) ..... (71) *P. helianthemi*

  Anamorph

- *Oidiopsis* - a single species (on Cistus) ..... (176) *Os. cisti*

3.41 Cleomaceae

- *Leveillula* - a single species (on *Cleome* and *Tarenaya*) ..... (143) *L. cleomis*

  Anamorph

- *Oidium* s. lat. (generic affinity unclear) - a single species (on *Cleome*; appressoria lobed, conidia catenescent) ..... (846) *O. capparidacearum*

3.42 Clethraceae

- *Erysiphe* sect. *Microsphaera* - a single species (on *Clethra*) ..... (521) *E. clethrae*

3.43 Combretaceae

- *Erysiphe* sect. *Uncinula*

  1. Chasmothecia 110-180 µm diam., 10-25 appendages, 6-12 times as long as the chasmothecial diam; on *Combretum*, Africa ..... (696) *E. floccosa*
  1. Chasmothecia 100-160 µm diam., 45-75 appendages, 1-2 times the chasmothecial diam.; on *Combretum*, Africa ..... (683) *E. combreticola*

- *Phyllactinia* - see key to the species of *Phyllactinia*

3.44 Convolvulaceae

- *Erysiphe* sect. *Erysiphe*

  1. Appendages very strongly branched, 1-3(-5) times; on *Calystegia hederacea* and *Convolvulus*, China (416) *E. convolvuli* var. *dichotoma*
  1. Appendages simple or moderately branched (1-2 times) 2
  2. Asci (2-)3-4(-6)-spored; on *Convolvulus* ..... (416) *E. convolvuli* var. *convolvuli*
  2. Asci (3-)5-6-spored; on Calystegia ..... (416) *E. convolvuli* var. *calystegiae*

- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

  Anamorphs

- *Oidium* s. lat. (generic affinity unclear)

  On *Ipomoea purpurea* (Romania) ..... (863) *O. pharbitidis*
  On *Rivea* ..... (865) *O. riveae*

- *Pseudoidium* - a single species (on *Ipomoea* and *Merremia*) ..... (798) *Ps. ipomoeae*

3.45 Coriariaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on Coriaria) ..... (416) *E. coriariicola*
- *Erysiphe* sect. *Microsphaera* - a single species (on Coriaria) ..... (523) *E. coriariae*
- *Erysiphe* sect. *Typhulochaeta* - a single species (on Coriaria) ..... (649) *E. typhulochaetoides*
- *Erysiphe* sect. *Uncinula* - a single species (on Coriaria) ..... (684) *E. coriariigena*
- *Phyllactinia* - see key to the species of *Phyllactinia*

3.46 Cornaceae (incl. Alangiaceae)

- *Erysiphe* sect. *Microsphaera*

  1. Appendages 5-15 times as long as the chasmothecial diam., apex mostly simple, sometimes 1-2 times dichotomously branched, tips of the ultimate branchlets straight; on *Cornus*, Europe, Central Asia, Iran ..... (635) *E. tortilis*

  1. Appendages shorter, apex always branched more than two times when mature, tips recurved ... 2

  2. Appendages 1-2.5 times as long as the chasmothecial diam., often flexuous; on *Helwingia*, Japan ..... (557) *E. helwingiae*

  2. Appendages mostly 1-1.5 times the chasmothecial diam, stiff; on *Cornus*, North America, Asia .. .. (606) *E. pulchra*

- *Erysiphe* sect. *Typhulochaeta* - a single species (on *Alangium*) ..... (646) *E. alangiicola*
- *Erysiphe* sect. *Uncinula* - a single species (on *Alangium*) ..... (653) *E. alangii*
- *Phyllactinia* - see key to the species of *Phyllactinia*

3.47 Crassulaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on host of various genera) ..... (471) *E. sedi*
- *Erysiphe* sect. *Microsphaera* - a single species (on host various genera) ..... (637) *E. umbilici*
- *Golovinomyces* - a single species ..... (342) *G. orontii* [as *Euoidium violae*]

  Anamorph
- *Pseudoidium* - a single species (on *Crassula* and Kalanchoë) ..... (802) *Ps. kalanchoës*

3.48 Crossosomataceae

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Glossopetalon*) ..... (50) *P. celastracearum*

3.49 Cucurbitaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Actinostemma* and *Schizopepon* Asia) .... (393) *E. actinostemmatis*
- *Golovinomyces*

  1. Conidia short, usually 25-35 µm long, 12-18 µm wide, foot-cells of the conidiophores always straight ..... (325) *G. cucurbitacearum*

  1. Conidia usually longer, up to 40 µm, and 15-23 µm wide, foot-cells often curved (342) *G. orontii*

- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.
- *Podosphaera* sect. *Sphaerotheca* - a single species (on various hosts) ..... (107) *P. xanthii*

3.50 Cunoniaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Weinmannia*) ..... (408) *E. carpophila*

3.51 Cyclanthaceae

- *Phyllactinia* sp. - on *Cyclanthus*, USA (Hirata 1966, Amano 1986)

3.52 Datiscaceae

- *Leveillula* - a single species ..... (169) *L. taurica*

3.53 Diervillaceae

- *Erysiphe* sect. *Erysiphe*

  1. Chasmothecia 85-190 µm diam., mostly about 110-160 µm, ascospores 16-36 x 9-17 µm; on *Weigela*, Asia, Japan ..... (420) *E. diervillae* var. *diervillae*
  1. Chasmothecia 85-125(-140) µm diam., ascospores 15-20(-25) x 9-14 µm 2
  2. Appendages usually unbranched ..... (420) *E. diervillae* var. *weigelae*
  2. Appendages often irregularly branched; on *Weigela praecox* .. (429) *E. diervillae* var. *chasanensis*

- *Erysiphe* sect. *Microsphaera* - a single species (on *Weigela decora*, Japan) . (644) *E. weigelae-decorae*
- *Erysiphe* sect. *Uncinula* - a single species (on *Weigela decora*, Japan) ..... (710) *E. lata*

3.54 Dipsacaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on various host) ..... (438) *E. knautiae*
- *Leveillula* - a single species ..... (169) *L. taurica* s. lat
- *Podosphaera* sect. *Sphaerotheca* - a single species (on various hosts) ..... (56) *P. dipsacacearum*

3.55 Ebenaceae

- *Phyllactinia* - a single species (on *Diospyros*) ..... (245) *P. kakicola*

3.56 Elaeagnaceae

- *Leveillula* - a single species (on *Elaeagnus* and *Shepherdia*) ..... (147) *L. elaeagni*
- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Shepherdia*) ..... (96) *P. shepherdiae*

3.57 Elaeocarpaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Aristotelia*, New Zealand) ..... (418) *E. densa*
- *Striatoidium* - a single species (on Aristotelia) ..... (386) *St. maquii*

3.58 Ericaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Rhododendron* in Asia) ..... (463) *E. rhododendri*
- *Erysiphe* sect. *Microsphaera*

  1. Appendages long, 1.5-6 times as long as the chasmothecial diam., tips of the ultimate branchlets usually not recurved 2
  1. Appendages shorter, tips always distinctly recurved 3
  2. Apices of the appendages dichotomously branched, rather tight, compact, regular, sometimes widely forked, rarely forked near the base or deeply cleft, tips mostly straight or knob-like, occasionally slightly recurved, appendages aseptate or with a single basal septum; on various hosts, North America ..... (638) *E. vaccinii*
  2. Apices of the appendages loosely and irregularly branched, tips straight, often digitate, appendages (0-)1-4(-7)-septate; on Rhododendron ..... (533) *E. digitata*
  3. Chasmothecia with 10-40 appendages, branchings dense and regular; on *Rhododendron* and other hosts of the *Ericaceae* in Europe and North America ..... (499) *E. azaleae*
  3. Chasmothecia with fewer appendages, 3-12, or branchings loose, wide, diffuse, in Asia 4
  4. Appendages 3-12, length 0.75-1.5 times the chasmothecial diam., branchings dense and regular, on *Vaccinium*, Japan ..... (643) *E. wallrothii*

4. Appendages 6-29, mostly 10-20, length (1-)1.5-2.5(-3.5) times the chasmothecial diam. branchings loose, wide, diffuse, appendages; on *Rhododendron*, Japan ..... (565) *E. izuensis*

- *Golovinomyces* - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Phyllactinia* - a single species (on various hosts) ..... (226) *Ph. enkianthi*
- *Podosphaera* sect. *Podosphaera*

1. Appendages 1.5-6 times as long as the chasmothecial diam, mostly rather stiff; on Vaccinium ... . (24) *P. myrtillina* var. *myrtillina*
1. Appendages, mostly 5-10 times the chasmothecial diam., very long and flexuous; on *Vaccinium* . ..... (24) *P. myrtillina* var. *major*

3.59 Escalloniaceae

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Escallonia*) ..... (80) *P. negeri*

3.60 Euphorbiaceae (see also *Phyllanthaceae*)

- *Erysiphe* sect. *Erysiphe*

1. Asci usually immature, ascospores not developed, chasmothecial appendages arising equatorially or from the upper half, stiff, setiform, 0-1-septate, pigmented, (10-)20-50 in number; on *Acalypha*, Asia, Africa ..... (391) *E. acalyphae*
1. Asci usually mature, spores developed, appendages arising from the lower half, mycelioid, septate 2
2. Appendages shorter than the chasmothecial diam., hyaline; on *Acalypha* and *Jatropha*, South Africa (436) *E. jatrophae*
2. Appendages 0.5-7 times the chasmothecial diam. 3
3. Amphigenous; chasmothecial appendages brown below, paler to hyaline above; on *Mallotus*, Asia (447) *E. malloti*
3. Hypophyllous; appendages brown throughout when mature; on *Chamaesyce hypericifolia*, North America ..... (423) *E. euphorbiae*

- *Erysiphe* sect. *Microsphaera* - a single species (on *Euphorbia*, North America) . (545) *E. euphorbiicola*
- *Erysiphe* sect. *Uncinula*

1. Chasmothecial appendages 6-13 in number, 1-2 times as long as the chasmothecial diam.; on *Vernicia*, China ..... (655) *E. aleuritis*
1. Appendages usually number 10-80(-100) 2
2. Appendages 11-21(-36) in number, about as long as the chasmothecial diam., sometimes shorter; on *Alchornea*, China ..... (692) *E. euphorbiacearum*
2. Appendages (19-)23-80(-100) in number, 0.6-1.7 times or 1-2 times the chasmothecial diam., width almost equal throughout 3
3. Width of the appendages narrowed towards the tip, wall somewhat thickened at the base; on *Croton*, Asia ..... (686) *E. crotonis*
3. Width of the appendages almost equal throughout and wall thin throughout or appendages distinctly enlarged just below the coiled apex and distinctly thick-walled below 4
4. Width of the appendages somewhat increasing upwards, but distinctly enlarged just below the coiled apex, wall distinctly thickened below; on *Mallotus* ..... (717) *E. malloticola*
4. Width of the appendages almost equal throughout, thin-walled throughout; on *Alchornea*, China (*E. alchorneae* s. lat.) 5
5. Chasmothecia (95-)110-140(-150) µm diam., appendages (19-)23-35(-45) in number, ascospores 3-5, width (12-)15-18(-20) µm ..... (654) *E. alchorneae* var. *alchorneae*

5. Chasmothecia 90-140 µm diam., appendages (29-)42-78(-103) in number; ascospores 4-6(-7), width 10-15 µm ..... (654) *E. alchorneae* var. *elliptispora*

- *Golovinomyces*

1. Chasmothecia 125-180(-200) µm diam., appendages mostly shorter then the chasmothecial diam.; conidia cylindrical-ovoid, about 25-34 x 12-17.5 µm; on *Euphorbia*, South America .... (314) *G. andinus*
1. Chasmothecia smaller, appendages longer; and/or conidia larger, especially wider, not cylindrical 2
2. Chasmothecia rather large, up to 170 µm; on *Eremocarpus*, North America .. (335) *G. immersus*
2. Chasmothecia smaller, about 85-145 µm; on other hosts 3
3. Conidia narrow, 12-15 µm wide; on *Euphorbia*, South America ..... (329) *G. euphorbiicola*
3. Conidia wider, 14-20 µm; on *Acalypha*, USA ..... (353) *G. sparsus*

- *Leveillula*

1. Primary and secondary conidia clavate, apically not pointed; on *Euphorbia pulcherrima* and other species, Africa, sporadically introduced in Europe ..... (142) *L. clavata*
1. Primary conidia ellipsoid-ovoid, ovoid-lanceolate to lanceolate, attenuated towards the apex, secondary conidia ± ellipsoid-cylindrical 2
2. Primary conidia rather variable, ellipsoid-ovoid, ovoid-lanceolate, attenuated towards the apex or cylindrical with short conical apex, occasionally with abruptly attenuated tip; on *Euphorbia* spp. ..... (155) *L. lanata*
2. Primary conidia ± lanceolate (cylindrical primary conidia lacking); on other hosts 3
3. Primary conidia oblong lanceolate, up to 80 µm long, length/width ratio mostly > 3.5, up to 6.5 (169) *L. taurica* s. lat.
3. Primary conidia lanceolate, length/width ratio usually 2.4-3.5(-4), length usually up to 65 µm; on *Chrozophora* or *Ricinus* 4
4. Maximum width of primary conidia usually in the lower half; chasmothecial appendages usually poorly developed and very short; on Ricinus ..... (165) *L. ricini*
4. Maximum width of primary conidia usually in the middle; chasmothecial appendages well developed, numerous, but shorter than the chasmothecial diam.; on *Chrozophora* .... (141) *L. chrozophorae*

- *Phyllactinia* - see key to the species of *Phyllactinia*

- *Podosphaera* sect. *Sphaerotheca*

1. Appendages very long, about 4-14 times as long as the chasmothecial diam., thick-walled, strongly sinuous; on *Euphorbia helioscopia*, Japan ..... (63) *P. euphorbiae-helioscopiae*
1. Appendages shorter, thin-walled 2
2. Chasmothecia large, 95-120 µm diam., appendages poorly developed, very short, rudimentary, often lacking, peridium cells small, obscure; on *Croton*, India ..... (53) *P. crotonis*
2. Chasmothecia smaller, appendages well developed, not lacking but usually few, and/or peridium cells large and conspicuous 3
3. Peridium cells small, inconspicuous, 8-20 µm diam.; conidia ellipsoid-cylindrical, mostly ± cylindrical, narrow, (20-)24-34 x 12.5-16.5(-18) µm, persistent secondary mycelium formed; on *Euphorbia*, Europe, Central Asia, Siberia ..... (62) *P. euphorbiae*
3. Peridium cells larger, conspicuous; conidia ellipsoid-ovoid to doliiform, often wider, without persistent secondary mycelium; on hosts in Asia 4
4. Peridium cells 15-25(-35) µm diam., ascospores small, 15-22.5 x 10-17.5 µm, asci uniform: on *Mallotus*, China ..... (78) *P. malloti*
4. Peridium cells 15-40 µm diam., often larger than 25 µm, ascospores large when mature, 20-28 x 17-22.5 µm, two types of asci, mature asci very thin-walled, large, rapidly swelling in water, immature asci thick-walled, spores small; on *Acalypha*, *Euphorbia*, *Pedilanthus*, Asia .... (64) *P. euphorbiae-hirtae*

Anamorphs

- *Euoidium* - a single species ..... (342) *Eu. violae* [*Golovinomyces orontii*]
- *Fibroidium*

  On *Acalypha* ..... (109) *F. acalyphae*
  On *Euphorbia cyparissias*, Europe ..... (112) *F. cyparissiae*
  On *Euphorbia pilulifera*, India ..... (115) *F. euphorbiicola*

- *Oidium* s. lat. (generic affinity unclear) - a single species (on *Hevea*; conidia catenescent) .... (854) *O. heveae*
- *Ovulariopsis*

  1. Conidia clavate, apex papillate, 55-100 µm long; on Macaranga ..... (302) *Ov. macarangae*
  1. Conidia clavate-spathuliform, apex rounded to apiculate, shorter, 40-70 µm; on *Mallotus* .... (303) *Ov. malloti*

- *Pseudoidium*

  On *Aleurites* ..... (810) *Ps. moluccanum*
  On *Euphorbia pulcherrima* (and possibly other species) ..... (823) *Ps. poinsettiae*
  On *Hevea* ..... *Ps. anacardii* (see (606) *E. quercicola*)
  On *Jatropha* ..... (801) *Ps. jatrophae*
  On *Manihot* ..... (808) *Ps. manihoticola*

3.61 Eupteleaceae

- *Phyllactinia* - a single species (on Euptelea) ..... (230) *Ph. eupteleae*

Anamorph

- *Oidium* s. lat. - *Oidium* sp. on *Euptelea*, Japan (Hirata 1966, Amano 1986)

3.62 Fabaceae (Leguminosae)

- *Brasiliomyces*

  1. Chasmothecia very small, about 35-50 µm diam., only with 2 asci, ascospores 6, pale greenish to olivaceous; *Dalbergia cultrata*, Thailand ..... (838) *B. chiangmaiensis*
  1. Chasmothecia larger, (45-)50-75(-80) µm diam., with (2-)3-5 asci, ascospores 5-8, yellowish; on *Adenopodia* and *Schotia*, South Africa ..... (839) *B. entadae*

- *Erysiphe* sect. *Erysiphe* and sect. *Microsphaera*

  1. Chasmothecia 135-230 µm diam., with about 20-80 appendages, simple or once branched; infections confined to pods of *Acacia catechu*, India ..... (493) *E. acaciae*
  1. With other features 2
  2. Chasmothecia with only 1-4(-7) appendages, 0(-3)-septate, apex occasionally 1(-2) times branched; on *Pueraria*, China ..... (462) *E. puerariae*
  2. Chasmothecia with numerous appendages 3
  3. Chasmothecial appendages mycelioid (geniculate-sinuous), about 0.5-3 times as long as the chasmothecial diam., arising equatorially and from the lower half, unbranched or irregularly branched 4
  3. Chasmothecial appendages either apically at least partly dichotomously branched and/or appendages not mycelioid, straight to flexuous, and very long, 3-10 times the chasmothecial diam. 14

4. Appendages usually curved, thin-walled, "spider-like"; rather short, 0.5-1(-2) times the chasmothecial diam., hyaline or only faintly yellowish, 0-1(-2)-septate; on *Genista*, *Melilotus* and *Thermopsis*, Asia ..... (633) *E. thermopsidis*

4. Appendages not characteristically curved, not "spider-like" 5

5. Appendages frequently irregularly branched or even branched in a coral-like manner 6

5. Appendages usually unbranched, only occasionally irregularly branched 7

6. Appendages frequently and strongly branched, hyaline to yellowish, aseptate or only with 1-2 inconspicuous septa; on *Lathyrus* and *Vicia* in Asia ..... (484) *E. viciae-unijugae*

6. Appendages moderately branched, brown throughout or at least in the lower half, thin-walled, conspicuously pluriseptate; on *Lathyrus* and *Ononis*, Europe ..... (458) *E. pisi* var. *cruchetiana*

7. Chasmothecia large, (100-)110-185(-210) µm diam., confined to stems, appendages narrow, 3.5-7 µm wide, fairly thick-walled throughout, aseptate or only with few inconspicuous septa; on *Astragalus*, Asia, Europe ..... (410) *E. caulicola*

8. Chasmothecial appendages at least thick-walled towards the base, aseptate or only with few rather inconspicuous septa, verrucose 9

9. Chasmothecia 90-120 µm diam., appendages brown throughout or brown below and paler towards the tip when mature, usually unbranched, only occasionally irregularly branched, with short branchlets; on *Baptisia* spp., North America ..... (401) *E. baptisiicola*

9. Chasmothecia large, 90-180 µm diam., appendages colorless or only faintly pigmented at the base, rather narrow, 3.5-8.5 µm, at first unbranched, but apex always irregularly to dichotomously branched when fully mature, on *Anthyllis* and *Hedysarum*, Asia and Europe, see immature samples of (554) *E. hedysari*; similar but appendages 5-10.5 µm wide, causing deformations and defoliation of the hosts, on *Alhagi* and *Sophora* s. lat., Asia, see immature samples of (508) *E. bremeri* and (624) *E. sophorae*

10. Chasmothecia small, 65-100(-110) µm diam., asci 2-7-spored, ascospores small, 14-20 X 9-13.5 µm on *Cercis*, China ..... (412) *E. cercidis*

10. Chasmothecia and ascospores larger 11

11. Asci with 2-4 rather large ascospores; foot-cells of conidiophores short, straight, 20-30 µm long; on *Hoffmanseggia*, South America, Argentina ..... (419) *E. deserticola*

11. Asci (2-)3-8-spored; foot-cells longer or curved-sinuous; on other hosts 12

12. Chasmothecia scattered to usually gregarious, appendages pigmented, at least brown in the lower half, 4-10 µm wide, asci 3-5(-6)-spored; foot-cells of the conidiophores straight; on *Pisum* and numerous other hosts, worldwide ..... (458) *E. pisi* var. *pisi*

12. Chasmothecia characteristically (regularly) scattered, appendages colorless or only faintly pigmented, yellowish, narrow, (2-)3-6(-8) µm wide, asci 4-8-spored; foot-cells of the conidiophores curved-sinuous; on *Amphicarpaea*, *Desmodium*, *Glycine*, *Lespedeza* 13

13. Asci 4-7-spored, mostly 5-6-spored; on *Amphicarpaea*, *Desmodium*, *Glycine*, North America and Asia ..... (428) *E. glycines*

13. Asci 6-8-spored; on *Lespedeza*, Asia ..... (440) *E. lespedezae*

14. Only 1-4(-7) appendages, in the lower half of the chasmothecium, usually simple, occasionally 1 to 2 times dichotomously branched, chasmothecia (70-)90-110 µm diam.; on *Pueraria*, China ..... (462) *Erysiphe puerariae*

14. Appendages numerous; on other hosts 15

15. Appendages numbering 50-100, apices strongly branched; on *Astragalus*, Central Asia ..... (619) *E. seravschanica*

15. Appendages fewer 16

16. Appendages 1-3(-3.5) times as long as the chasmothecial diam., stiff or only slightly flexuous, rather coarse, not mycelioid, apex always strongly branched 17

16. Appendages fairly long, 1-10 times the chasmothecial diam., when shorter (about 1-3.5 times the diam.), either mycelioid, geniculate-sinuous, or mostly simple, with only a few branchings 23

17. Chasmothecia small, 75-100 µm diam., asci 6-8-spored, appendages numbering 7-9, tips of ultimate branchlets straight; on *Maackia*, Far East of Russia ..... (520) *E. cladrastidis*

17. Chasmothecia larger, asci usually 3-7-spored; on other hosts 18

18. Appendages rather regularly branched, tips of the ultimate branchlets usually distinctly recurved 19

18. Appendages rather irregularly branched or tips of the ultimate branchlets straight 20

19. Tips of ultimate branchlets always distinctly recurved: on *Gleditsia*, North America .... (608) *E. ravenelii*

19. Tips straight to recurved; on *Lathyrus*, North America ..... (569) *E. lathyricola*

20. Apical branchings fairly regular, dense, compact, tips always straight 21

20. Apical branchings either loose, diffuse, tips straight (on numerous hosts in North America, also on *Robinia*, seldom in Asia, on *Lespedeza* and *Indigofera*), or branchings extremely variable, loose to dense, tips straight or partly recurved, North American species 22

21. Appendages 1-2.5 times as long as the chasmothectal diam.; on *Caragana*, *Colutea* and *Robinia*, Asia, introduced in Europe and North America ..... (596) *E. palczewskii*

21. Appendages 1.5-3.5 times the chasmothectal diam.; on *Indigofera*, Asia ..... (562) *E. indigoferae*

22. Apical branchings of appendages always extremely variable, diffuse, loose to dense, compact, tips straight or a varying percentage recurved; on *Vicia*, North America ..... (575) *E. ludens* [similar, but branchings mostly rather regular. denser; on *Lathyrus*, see *E. lathyricola*]

22. Apical branchings always diffuse, irregular, tips always straight, appendages 1-4.5 (mostly 1.5-2.5) times as long as the chasmothecial diam.; on numerous hosts (but not on *Vicia* and *Lathyrus*), North to South America, seldom in Asia ..... (532) *E. diffusa* var. *diffusa*

23. Appendages with apices strongly branched, tips not recurved, 2-4.5 times as long as the chasmothecial diam., flexuous, on some host genera in North America, above all on *Meibomia*, *Psoralea* and *Robinia* ..... (532) *E. diffusa* var. *elongata*

23. Appendages mostly rarely branched, tips straight or recurved, strongly myceltoid, or appendages longer, 3-10 times the chasmothecial diam., and sometimes flexuous or rather stiff 24

24. Appendages short, 0.5-4 times the chasmothecial diam., strongly sinuous-geniculate, contorted, apex often simple, branchings rarely developed, wall mostly thickened and verruculose: on *Alhagi*, *Anthyllis*, *Genista*, *Hedysarum*, *Robinia*, *Sophora* s. lat., *Thermopsis*, Asia and Europe, or *Sesbania*, South America 25

24. Appendages very long, mostly 3-10 times the chasmothectal diam., when relatively short, appendages rather stiff. not mycelioid; on other host genera (but also on *Sophora* s. lat.) 30

25. Mycelium dense, persistent, causing distortions and defoliation, "witches' brooms"; on *Alhagi* and *Sophora* s. lat., Asia 26

25. Mycelium subpersistent, without distortion or defoliation, amphigenous and caulicolous; on other host genera 27

26. Appendages always dichotomously branched when mature, relatively regular; on *Sophora* and allied genera ..... (624) *E. sophorae*

26. Appendages only occasionally dichotomously branched, less regular; on *Alhagi* . (508) *E. bremeri*

27. Chasmothecia large, (95-)110-170(-180) µm diam., appendages narrow, 3.5-8.5 µm wide, numbering 5-20, tips often recurved when fully mature, appendages in mature samples strongly rough-walled; on *Anthyilis maura*, *Hedysarum* spp., Asia and Europe ..... (555) *E. hedysari*

27. Chasmothecia smaller, about 80-140 µm diam., appendages wider, up to about 10 µm, tips straight; on other hosts 28

28. Appendages very numerous, 10-40, mostly more than 20, faintly rough-walled; on *Genista* and *Thermopsis*, Asia, Armenia ..... (633) *E. thermopsidis*

28. Appendages less numerous, about 6-25, mostly 10-20, distinctly rough-walled, often coarsely verruculose 29

29. Asci (4-)5-6(-7)-spored, ascospores small, 14-20 x 10-15 µm; foot-cells of the conidiophores 30-65 µm long; on *Robinia*, China ..... (612) *E. robiniae* var. *chinensis*

29. Asci (2-)3-4(-5)-spored, ascospores larger, 20-28 x 9-12 µm; foot-cells of the conidiophores shorter, 20-45 µm: on *Sesbania*, South America ..... (620) *E. sesbaniae*

30. Appendages flexuous, but not mycelioid, most apices simple, only a varying percentage diffusely and widely branched 1-3 times in fully mature samples, appendages either ± horizontally spread, septate and pigmented, at least up to the middle of the stalk, or tending to point in one direction, aseptate or 1(-2)-septate, hyaline or only pigmented at the very base, (*E. trifoliorum* complex: *E. astragali*, *E. baeumleri*, *E. baptisiae*, *E. intermedia*, *E. trifoliorum*) 31

30. Appendages mycelioid, irregularly sinuous-geniculate (on *Astragalus* or *Spartium*) or flexuous, apices always frequently dichotomously branched 38

31. Appendages frequently branched in mature samples, with a moderate tendency to point in one direction, tips straight; on *Vicia*, North America, Asia, Europe .....(500) *E. baeumleri*

31. Appendages rarely branched; on other hosts 32

32. Appendages mostly with a conspicuous tendency to point in one direction, sometimes even almost fasciculate, tips often recurved in fully mature samples; on *Astragalus*, *Oxytropis* ....(497) *E. astragali*

32. Appendages either horizontally spread, tips straight to somewhat curved or appendages only with a slight to moderate tendency to point in one direction and tips straight; on various other host genera 33

33. Chasmothecia small, 70-90(-105) µm diam., appendages obviously verrucose, at least below; on *Desmanthus*, USA .....(530) *E. desmanthi*

33. Chasmothecia larger, on average > 90 µm, appendages smooth to verruculose towards the base; on other hosts 34

34. Foot-cells of the conidiophores usually curved to flexuous, sinuous; appendages horizontally spread, aseptate, colourless; on *Baptisia*, Europe .....(501) *E. baptisiae*

34. Foot-cells of the conidiophores usually straight, only occasionally slightly curved or sinuous; appendages either tending to point in one direction, or septate and pigmented below the septa ..35

35. Chasmothecial appendages equatorial or somewhat in the upper half, horizontally spread or somewhat pointing in one direction, 0-3-septate below; on Galega .....(550) *E. galegae*

35. Appendages ± equatorial; on other hosts 36

36. Appendages (0)-1-septate, hyaline or only pigmented at the very base, often with a slight to moderate tendency to point in one direction; on Lupinus .....(563) *E. intermedia*

36. Appendages 0-6-septate, pigmented at least in the lower half, usually horizontally spread 37

37. Appendages thin-walled, only up to 1.5 µm thick below, peridium cells irregularly polygonal; on *Trifolium* and hosts of various other genera .....(636) *E. trifoliorum*

37. Appendages thick-walled at the base (up to 3.5 µm), peridium cells irregularly shaped, rather daedaleoid; on *Caragana*, *Gliricidia* and *Robinia* .....(612) *E. robiniae* var. *robiniae*

38. Appendages mycelioid, sinuous-geniculate, tips of the ultimate branchlets at least partly distinctly recurved when mature, sometimes almost spirally coiled; on *Spartium*, *Astragalus* 39

38. Appendages flexuous, sometimes almost sinuous, but not typically mycelioid-geniculate, tips in some species tips straight, not recurved; on other hosts 40

39. Appendages smooth to faintly rough-walled, branchings of different orders frequently recurved, flexuous to curled, tips mostly recurved to almost spirally coiled; on *Astragalus*, Asia, North America ....(528) *E. crispula*

39. Appendages obviously verrucose, only primary branches sometimes recurved, tips straight to partly recurved; on *Spartium*, Mediterranean region.....(609) *E. rayssiae*

40. Appendages very long, 5-10 times the chasmothecial diam., apex very richly and rather regularly and densely branched, 3-8, mostly 4-7 times, tips straight; on *Caragana sinica*, China .... (572) *E. longissima*

40. Appendages either shorter, and/or apex loosely, diffusely and irregularly branched, and/or tips recurved, on other hosts 41

41. Appendages very long, up to 12 times the chasmothecial diam., apex fairly regularly branched, tips at least partly distinctly recurved in mature samples; on *Robinia* and *Laburnum* (also recorded on *Cytisus*, *Genista*, *Chamaecytisus*) 42

41. Appendages mostly shorter, apex irregularly branched, tips straight or only some slightly recurved, on other hosts 43

42. Chasmothecia small, 75-100 µm diam., 5-10(-15) appendages, 3-6 asci, ascospores small, 15-20 x 8-12 µm; on *Robinia*, Eastern Europe ..... (603) *E. pseudacaciae*

42. Chasmothecia 90-150 µm diam., 6-20 appendages, 5-10 asci, ascospores 20-25 x 10-14 µm; mostly on *Laburnum* (also recorded on *Cytisus*, *Genista*, *Chamaecytisus*) ..... (553) *E. guarinonii*

43. Appendages very long, 3.5-10 times the chasmothecial diam., mostly 4-8 times; endemic in China, on *Sphaerophysa* ..... (626) *E. swainsonae*

43. Appendages shorter, mostly 3-6 times the chasmothecial diam.; on other hosts 44

44. On *Colutea*, *Caragana*, *Oxytropis*, *Sophora*, Asia ..... (522) *E. coluteae*

44. On *Ononis*, Europe, France, endemic ..... (518) *E. chouardii*
[Appendages up to 4.5 times as long as the chasmothecial diam., in North America on some other hosts (e.g. *Psoralea*, *Meibomia*), see (530) *E. diffusa*]

- *Erysiphe* sect. *Uncinula*

1. Chasmothecia 180-300 µm diam., appendages 3-7 times as long as the chasmothecial diam.; on *Brachystegia*, Africa ..... (669) *E. brachystegiae*

1. Chasmothecia 80-180 µm diam., appendages 0.5-1.5 times the chasmothecial diam. 2

2. Appendages thick-walled throughout 3

2. Appendages thin-walled thoughout or at least thin above and only somewhat thicker below 4

3. Chasmothecia with 80-150 appendages, asci 4-spored; on *Pterocarpus*, Africa (704) *E. incrassata*

3. Chasmothecia with 60-100 appendages, asci 6-8-spored; on *Pericopsis*, Africa ..... (652) *E. afrormosiae*

4. Chasmothecia with 60-100 appendages; on *Albizia*, Africa ..... (659) *E. angusiana*

4. Chasmothecia with less than 50 appendages 5

5. Appendages 10-20(-25), asci 4-6-spored; on *Styphnolobium japonicum* ..... (750) *E. sinensis*

5. Appendages about 25-35, asci 6-8-spored 6

6. Width of appendages often somewhat decreasing towards the tip; on *Maackia*, China ..... (713) *E. maackiae*

6. Width of appendages ± equal throughout; on *Bowdichia*, Brazil ..... (658) *E. alvimii*

- *Leveillula*

1. Primary conidia lanceolate to ellipsoid-lanceolate, maximum width in the middle or below; asci up to 4-spored; on *Alhagi* ..... (134) *L. alhagi*

1. Primary conidia ellipsoid-ovoid to subcylindrical, maximum width variable in position; asci 2-spored; on various legumes ..... (163) *L. papilionacearum*

- *Microidium*

1. Foot-cells of the conidiophores 30-90 µm long; on *Bauhinia* spp., South America ..... (843) *Mo. bauhiniicola*

1. Foot-cells of the conidiophores shorter, 15-35 µm long: on *Sesbania grandiflora*, Asia ..... (842) *Mo. agatidis*

- *Ovulariopsis*/*Phyllactinia* - see key to the species of *Phyllactinia*

- *Pleochaeta* - a single species (on *Prosopis*, South America) ..... (287) *Pl. prosopidis*

- *Podosphaera* sect. *Sphaerotheca*

1. Outer cells of the chasmothecial wall (peridium cells) irregular, not polygonal, walls usually strongly sinuous, appendages narrow and fragile; on *Senna*, India ..... (47) *P. cassiae*

1. Peridium cells more polygonal to rounded, walls often straight or slightly curved; on other hosts 2

2. Chasmothecia small, 50-95 µm diam., appendages shorter than the chasmothecial diam., ascospores small, 12.5-15 x 7-9 µm; on *Teramnus*, India ..... (102) *P. teramni*

2. Chasmothecia larger (up to 110 µm diam.) and/or appendages longer, 0.5-5 times the chasmothecial diam., ascospores larger, up to about 20 x 15 µm; on other hosts 3

3. Ascospores with length/width ratio less than 1.5 (subglobose); on *Astragalus. Hedysarum*, artcic-alpine (circumpolar) ..... (41) *P. astragali*

3. Ascospores with length/width ratio about 1.5-1.6:; in Asia on *Phaseolus*, *Vigna* and other hosts . ..... (107) *P. xanthii*

- *Queirozia* - a single species (on *Platycyamus*, Brazil) ..... (290) *Q. turbinata*

Anamorphs

- *Oidiopsis* - a single species (on *Lablab*) ..... (178) *Os. macrospora*
- *Oidium* s. lat. (generic affinity unclear)

  On *Chamaecrista leschenaultiana* (appressoria indistinct; conidia solitary) .... (849) *O. cassiae-leschenaultianae*

  On *Erythrina indica* ..... (852) *O. ernythrinae*

  On *Senna hirsuta* (conidia catenescent) ..... (848) *O. cassiae-hirsutae*

- *Pseudoidium*

  On *Abrus* ..... (766) *Ps. abri*

  On *Acacia* (mycelium mainly epiphyllous, in persistent patches, conidia doliifom) .... (606) *Ps. anacardii* (see *E. quercicola*)

  On *Alysicarpus* ..... (769) *Ps. alysicarpi*

  On *Bauhinia*:

  1. Appressoria nipple-shaped to slightly lobed; host tissue discoloured yellowish, reddish, later brownish; India ..... (779) *Ps. caesalpiniacearum*

  1. Appressoria multilobed, host tissue not discoloured, amphigenous, mycelium effuse to dense; on *Bauhinia*, South Africa ..... (773) *Ps. bauhiniae*

  On *Cassia* and *Senna* ..... (780) *Ps. cassiae-siameae*

  On *Ceratonia siliqua* ..... (782) *Ps. ceratoniae*

  On *Clitoria ternatea* ..... (785) *Ps. clitoriae*

  On *Crotalaria* ..... (787) *Ps. crotalariae*

  On *Hardenbergia* ..... (794) *Ps. hardenbergiae*

  On *Parkinsonia* ..... (815) *Ps. parkinsoniae*

  On *Peltophorum* ..... (820) *Ps. peltophori*

  On *Sesbania* ..... (792) *Ps. fabacearum*

  On *Tamarindus* ..... (829) *Ps. tamarindi*

3.63 Fagaceae

- *Cystotheca* - see key to the species of this genus
- *Erysiphe* sect. *Californiomyces* - see key to the species of this section
- *Erysiphe* sect. *Erysiphe*

1. Chasmothecia 70-110(-120) µm diam, ... 2

1. Chasmothecia smaller, average below 80 µm 3
2. Appendages 0.5-4 times as long as the chasmothecial diam. (50-400 µm); on *Quercus* spp. ..... (430) *E. gracilis* var. *gracilis*
2. Appendages longer, (200-)400-800 µm; on *Quercus* spp., Japan .(430) *E. gracilis* var. *longissima*
3. Appendages very short, 0.1-0.5 times as long as the chasmothecial diam., often branched; asci (3-)4-7(-8)-spored; on *Castanopsis* and *Quercus* spp., Asia ..... (473) *E. sikkimensis*
3. Appendages longer, 0.3-1.5(-2) times the chasmothecial diam., unbranched; asci 2-4-spored; on *Quercus glauca*, India ..... (424) *E. farmanii*

- *Erysiphe* sect. *Microsphaera*

1. Appendages at least partly trichotomously branched, 1-1.5 times as long as the chasmothecial diam.; on *Quercus*, North America ..... (510) *E. calocladophora*
1. Appendages dichotomously branched 2
2. Chasmothecia on *Erineum*-galls, rarely outside the galls, and 75-100 µm diam., 3-10 appendages, usually 1-1.5 times as long as the chasmothecial diam., asci with 6-8 small ascospores, appendages brown; and only pigmented near the base; on *Fagus* in North America ..... (541) *E. erineophila*
2. Chasmothecia not on galls, chasmothecia may be larger, and appendages may be more numerous and/or longer, hyaline or only pigmented at the base 3
3. Mycelium usually hypophyllous, evanescent; appendages rather short, 0.5-1(-1.25) times as long as the chasmothecial diam., asci with 3-6 large ascospores, 20-30 x 13-21 µm; on *Quercus*, North America ..... (491) *E. abbreviata*
3. Mycelium amphigenous, and/or appendages longer, or asci 6-8-spored 4
4. Mycelium and chasmothecia hypophyllous; mycelium scarce, evanescent 5
4. Mycelium and chasmothecia amphigenous, mainly epiphyllous; mycelium well developed, persistent 6
5. Mycelium causing necrotic discoloration, conidia 25-38 µm long, doliiform; on *Quercus acutissima* and *Q. variabilis*, Japan ..... (560) *E. hypogena*
5. Mycelium not causing necrotic discoloration, conidia very long, 30-45(-65) µm, cylindrical; on *Quercus*, Asia, Europe, New Zealand .....(561) *E. hypophylla*
6. Appendages long and flexuous, 1.5-3 times the chasmothecial diam., 6.5-12.5 µm wide below, chasmothecia small, 75-115(-125) µm diam.; on *Castanea* and *Castanopsis*, North America ....(513) *E. castaneae*
6. Appendages about as long as the chasmothecial diam. (on *Castanea* in Asia, Europe or *Quercus* in Asia), or appendages shorter and chasmothecia larger (on *Quercus*), or appendages very long, up to 6 times the chasmothecial diam. (on *Quercus* in North America), or appendages narrower, only 6-9 µm wide (on *Quercus*, Asia) 7
7. Chasmothecial appendages very long and flexuous, 2-6 times the chasmothecial diam., asci 4-6-spored; on Quercus, North America ..... (547) *E. extensa* var. *extensa*
7. Appendages shorter, and/or asci 6-8-spored 8
8. Chasmothecia small, 65-115(-125) µm diam.; on *Quercus acutissima* and *Q. variabilis* or *Castanea* and *Castanopsis* in Asia 9
8. Chasmothecia larger, average > 100 µm diam. 10
9. Conidia doliform, (20-)25-35 µm long; asci 5-8; on *Quercus acutissima* and *Q. variabilis*, Japan (and possibly China) ..... (540) *E. epigena*
9. Conidia ellipsoid-ovoid, 30-45 µm long, asci 2-6; on *Castanea* and *Castanopsis*, China ....(514) *E. castaneigena*
10. Appendages with 0-5 septa, often pigmented; on *Castanea seguinii*, China ..... (617) *E. seguinii*
10. Appendages 0-1(-2)-septate, hyaline or only pigmented at the base; on other hosts 11
11. Conidia ± cylindrical (-ellipsoid); asci (3-)5-6(-8)-spored, appendages 1-2.5 times as long as the chasmothecial diam.; on *Quercus* in North America ..... (547) *M. extensa* var. *curta*

11. Conidia ellipsoid-ovoid to doliiform, asci 6-8-spored on various hosts of the *Fagaceae* (*E. alphitoides* s. lat.) 12

12. Appendages usually 1-1.5 times as long as the chasmothecial diam.; on *Fagaceae*, almost circumglobal ..... (495) *E. alphitoides*

12. Appendages rather short, about as long as the chasmothecial diam. or somewhat shorter; on *Quercus phylliraeoides* in Japan (principal host *Quercus*, but also on other species), mainly in Asia, but also introduced in Europe (despite morphological separation from *E. alphitoides* being very difficult, it is genetically clearly distinct) ..... (607) *E. quercicola*

- *Erysiphe* sect. *Typhulochaeta*

1. Special apical cells ("appendages" on chasmothecia) clavate, 10-20 µm wide, very numerous, about 90-150, arranged in circular rows; on *Castanopsis* and *Quercus*, Asia ..... (648) *E. japonica*

1. Special apical cells bristle-like, apices often somewhat swollen, capped with an amber coloured elliptical mass of waxy material, few, about 5-30, irregularly scattered; on *Quercus* in North America ..... (647) *E. couchii*

- *Erysiphe* sect. *Uncinula*

1. Chasmothecia 150-230 µm diam., about 50-250 appendages, septate throughout, ascospores curved 2

1. Chasmothecia 85-125 µm diam., less than 50 appendages, 0-1(-2)-septate, ascospores not curved 3

2. Appendages 3-8 µm wide throughout, septa often reaching the apical part, even the circinate part; on *Quercus*, Asia ..... see (2) *Parauncinula septata*

2. Appendages 4-6.5 µm wide below, width decreasing towards the tip, septa not reaching the apical part; on *Fagus*, Japan ..... (1) *Parauncinula curvispora*

3. Width of appendages almost equal throughout 4

3. Width of appendages usually increasing towards the apex 5

4. Chasmothecia with 6-16 appendages, about as long as the chasmothecial diam., often forked in the lower half; on *Quercus*, Japan ..... (667) *E. bifurcata*

4. Chasmothecia with (12-)18-32 appendages, longer, 1.5-2.5 times the chasmothecial diam., unbranched; on *Fagus crenata*, Japan ..... (761) *E. wadae*

5. Chasmothecia 95-115 µm diam., with 9-20 appendages, asci 3-5; on *Quercus*, France ..... (741) *E. pyrenaica*

5. Chasmothecia larger, 100-135 µm, with (15-)25-40 appendages, asci 8-12; on *Quercus incana*, India ..... (742) *E. quercifolia*

- *Parauncinula* (see key to the species)

- *Phyllactinia* - see key to the species of *Phyllactinia*

3.64 Fumariaceae

- *Erysiphe* sect. *Erysiphe*

1. Conidia cylindrical, 27-48(-55) x 12-21 µm; chasmothecia 85-150 µm diam., asci 3-6-spored; on *Fumaria* ..... (417) *E. cruciferarum*

1. Conidia ellipsoid-cylindrical, long, 48-63 x 15-23 µm; chasmothecia 80-105 µm diam., asci 4-8-spored; on *Corydalis*, Japan, Far East of Russia ..... (485) *E. werneri*

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Corydalis*) ..... (74) *P. koreana*

3.65 Gentianaceae

- *Euoidium*

  1. Foot-cells of the conidiophores straight, up to 160 um long, followed by 1-4 cells, shorter than, about as long as, or longer than the foot-cell; on *Exacum* ..... (366) *E. pseudolongipes*
  1. A moderately long foot-cell, 30-100 µm, often curved at the base, followed by shorter cells .... (342) *E. violae* [*Golovinomyces orontii*]

- *Podosphaera* sect. *Sphaerotheca* - *Podosphaera* sp. on *Gentiana*, Tajikistan (Hirata 1966, Amano 1986)

3.66 Geraniaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Erodium* and *Geranium*) ..... (428) *E. geraniacearum*
- *Leveillula* - a single species (on *Geranium*) ..... (148) *L. geraniacearum*
- *Neoërysiphe* - a single species (on *Erodium* and *Geranium*), Asia, introduced in Europe (376) *N. geranii*
- *Podosphaera* sect. *Sphaerotheca*

  1. Persistent mycelium often forming dense layers, consisting of brownish, straight hyphae; appendages of the chasmothecia not distinctly mycelioid, always long, 1-5 times the chasmothecial diam., mostly rather straight; on *Geranium* ..... (67) *P. fugax*
  1. Persistent mycelium sparingly developed, often almost absent; appendages mycelioid, often sinuous-geniculate, length mostly rather short and only about the chasmothecial diam., (range 0.5-2.5 times the diam.), ascospores mostly subglobose; on *Biebersteinia* and *Erodium* ..... (61) *P. erodii*

  Anamorph

- *Fibroidium* - a single species (on *Pelargonium*) ..... (119) *F. pelargonii*

3.67 Gesneriaceae

- *Golovinomyces* - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Podosphaera* sect. *Sphaerotheca* - a single species ..... (107) *P. xanthii*

3.68 Grossulariaceae

- *Erysiphe* sect. *Microsphaera*

  1. Tips of the ultimate branchlets of chasmothecial appendages straight; on *Ribes* spp. in the Northern hemisphere ..... (552) *E. grossulariae*
  1. Ultimate tips distinctly recurved; on *Ribes magellanica*, South America ..... (611) *E. ribicola*

- *Leveillula* - a single species (on *Ribes*) ..... (169) *L. taurica* s. lat.
- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Podosphaera* sect. *Sphaerotheca* - a single species (on Ribes) ..... (79) *P. mors-uvae*

3.69 Gunneraceae

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Gunnera*) ..... (70) *P. gunnerae*

3.70 Haedoraceae

- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

3.71 Haloragaceae

- *Podosphaera* sect. *Sphaerotheca* - *Podosphaera* sp. on *Haloragis*, Japan (Hirata 1966, Amano 1986)

3.72 Hamamelidaceae

- *Erysiphe* sect. *Microsphaera* - a single species (on *Corylopsis*) ..... (526) *E. corylopsidis*
- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Podosphaera* - a single species (on *Hamamelis*, North America) ..... (15) *P. biuncinata*

3.73 Hydrangeaceae (incl. Philadelphaceae)

- *Erysiphe* sect. *Erysiphe* - a single species (on *Hydrangea*, North America) ..... (460) *E. poeltii*
- *Golovinomyces* - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Erysiphe* sect. *Microsphaera* - a single species (on *Deutzia*) ..... (531) *E. deutziae*
- *Erysiphe* sect. *Uncinula*

  1. Chasmothecial appendages short, 0.5-1(-1.5) times the chasmothecial diam.; on *Hydrangea bretschneideri*, China ..... (764) *E. yanshanensis*

  1. Appendages longer, 1.5-4 times the diam. 2

  2. Appendages 1-4 times the chasmothecial diam., somewhat mycelioid, 0-9(-12)-septate; on *Hydrangea paniculata*, Asia ..... (702) *E. hydrangeae*
  2. Appendages 1.5-2.5 times the chasmothecial diam., not mycelioid, 0-1-septate; on *Schizophragma* ..... (746) *E. schizophragmatis*

- *Phyllactinia* - see key to the species of *Phyllactinia*

Anamorph

- *Pseudoidium* - a single species (on *Hydrangea*) ..... (797) *Ps. hortensiae*

3.74 Hydrophyllaceae

- *Golovinomyces* - a single species (on *Hydrophyllum*) ..... (333) *G. hydrophyllacearum*
- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

3.75 Hypericaceae

- *Cystotheca* - a single species (on *Calophyllum*) ..... (6) *C. indica*
- *Erysiphe* sect. *Microsphaera*

  1. Appendages 2-8 times as long as the chasmothecial diam., apex often simple, sometimes 1-2(-3) times loosely branched, tips straight; on *Hypericum*, Asia, Europe ..... (558) *E. hyperici*

  1. Appendages 1-1.6 times the chasmothecial diam., apex (2-)4-6(-7) times densely branched; on *Hypericum patulum*, China ..... (559) *E. hypericicola*

- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

3.76 Juglandaceae

- *Erysiphe* sect. *Microsphaera*

  1. Apex of the appendages only 1-3(-4) times dichotomously branched, loose, often deeply cleft, on *Juglandaceae*, Asia ..... (566) *E. juglandis*

  1. Apex 3-6 times densely and strongly branched; North American species 2

  2. Mycelium hypophyllous, sparingly developed, evanescent; appendages thick-walled throughout, mostly yellowish; on *Carya* ..... (512) *E. caryae*
  2. Mycelium amphigenous, in dense patches, persistent; appendages thin-walled above and thicker towards the base, hyaline; on *Juglans* ..... (567) *E. juglandis-nigrae*

- *Phyllactinia* - see key to the species of *Phyllactinia*

3.77 Lamiaceae (Labiatae)

- *Erysiphe* sect. *Erysiphe*

  1. Asci 6-8-spored, chasmothecial appendages hyaline, (1-)3-6 times as long as the chasmothecial diam.; on *Isodon* ..... (459) *E. plectranti*

  1. Asci(2-)3-6(-8)-spored and/or appendages pigmented or ± setiform, not mycelioid, with omewhat pointed tips 2

  2. Appendages mostly ± setiform, young appendages 0-1-septate, hyaline, but older ones septate, pigmented, apex usually somewhat pointed, asci (3-)4-8-spored; on Isodon, Asia ..... (406) *E. bunkiniana*

  2. Appendages mycelioid, all septate, asci (2-)3–6(-8)-spored 3

  3. Appendages thin-walled, apex not enlarged; on various hosts ..... (432) *E. hommae*

  3. Appendages thick-walled below, apices often somewhat enlarged, ± clavate; on Isodon ..... (434) *E. huayinensis*

- *Erysiphe* sect. *Uncinula* - a single species (on *Tectona*) ..... (752) *E. tectonae*

- *Golovinomyces* - a single species (on numerous hosts) ..... (318) *G. biocellatus*

- *Leveillula*

  1. Primary conidia ellipsoid-subcylindrical or somewhat wider in the upper half, maximum width in the middle or upper half; on *Nepeta* ..... (149) *L. golovinii*

  1. Primary conidia ellipsoid-lanceolate, maximum width in the middle or below 2

  2. Primary conidia usually broadly ellipsoid(-lanceolate), 35-80 x 12-24 µm, maximum width usually in the middle; on a wide range of *Lamiaceae* ..... (146) *L. duriaei*

  2. Primary conidia ± lanceolate, more slender, maximum width usually in the lower half; on various other hosts ..... (169) *L. taurica* s. lat.

- Neoërysiphe - a single species (on various hosts) ..... (374) *N. galeopsidis*

- *Phyllactinia* - see key to the species of *Phyllactinia*

- *Podosphaera* sect. *Sphaerotheca* - a single species (on various hosts) ..... (58) *P. elsholtziae*

Anamorphs

- *Euoidium* - a single species ..... (342) *Eu. violae* [*Golovinomyces orontii*]

- *Oidiopsis* - a single species (on *Ballota rupestris*) ..... (177) *Os. gigaspora*

- *Oidium* s. lat. (generic affinity unclear)

  On *Ocimum sanctum* ..... (860) *O. ocimi-sancti*

  On *Roylea* ..... (866) *O. royleae*

3.78 Lardizabalaceae

- *Erysiphe* sect. *Microsphaera*

  1. Chasmothecia 100-125 µm diam., 5-9 appendages, somewhat shorter than the chasmothecial diam.; on *Decaisnea*, China ..... (529) *E. decaisneae*

  1. Chasmothecia 80-110 µm diam., 10-18 appendages, 1-1.5 times the chasmothectal diam.; on Akebia, Asia ..... (494) *E. akebiae*

3.79 Lauraceae

- *Erysiphe* sect. *Microsphaera*

  1. Chasmothecial appendages septate, apical branchings diffuse, tips not recurved; on *Cinnamomum*, USA ..... (519) *E. cinnamomicola*

  1. Appendages 0-1-septate, branchings regular, tips distinctly recurved when mature, Asia 2

  2. Appendages 3-6(-11) in number, (0.5.-)0.75-1 times as long as the chasmothectal diam; on *Lindera glauca*, China ..... (503) *E. benzoin*

  2. Appendages (2-)6-15(-22) in number, 1-2(- 2.5) times the chasmothecial diam.; on *Lindera* and *Litsea*, Asia ..... (507) *E. blasti*

- *Erysiphe* sect. *Uncinula*

  1. Appendages dimorphic, with long equatorial appendages, apex coiled, and in addition with short bristle-like "appendages" (anchor hyphae) in the upper half (subsect. *Uncinuliella*), on *Machilus*, India ..... (714) *E. machiliana*

  1. Appendages not dimorphic, anchor hyphae in the upper hall lacking 2

  2. Appendages ± uniform in width and thick-walled throughout; on *Litsea*, China ..... (687) *E. dabashanensis*

  2. Appendages decreasing in width from base to top, thin-walled, slightly thicker below, on Litsea, China ..... (705) *E. irregularis*

- *Phyllactinia* - a single species (on various hostsON) ..... (250) *Ph. linderae*

Anamorphs

- *Pseudoidium*

  On *Cinnamomum*

  1. Conidia ovoid-doliiform, 24-37 x 15-21.5 µm; on *Cinnamomum camphora* ..... (783) *Ps. cinnamomi*

  1. Conidia larger, ellipsoid-cylindrical, 42-55 x 18-26 µm; on *C. japonicum* ..... (784) *Ps. cinnamomi-japonici*

  On *Laurus nobilis* ..... (805) *Ps. lauracearum*

  On *Persea americana* ..... (822) *Ps. perseae-americanae*

3.80 Ledocarpaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Balbisia*) ..... (400) *E. balbisiae*

3.81 Limnanthaceae

- *Pseudoidium* - a single species (on Limnanthes) ..... (807) *Ps. limnanthis*

3.82 Linaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Linum*) ..... (442) *E. lini*
- Golovinomyces - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- Leveillula - a single species ..... (169) *L. taurica* s. lat.
- *Podosphaera* sect. *Sphaerotheca* - a single species (on Linum) ..... (75) *P. lini*

3.83 Loasaceae

- *Oidium* s. lat. - *Oidium* sp., on *Mentzelia*, Russia (Hirata 1986, Amano 1986)

3.84 Loganiaceae

- *Oidium* s. lat. - *Oidium* sp., on *Spigelia*, Africa, North America (Hirata 1986, Amano 1986)

3.85 Loranthaceae

- *Leveillula* - a single species (on *Loranthus*) ..... (159) *L. loranthi*

  Anamorph

- *Oidium* s. lat. (generic affinity unclear) - a single spectes (on Dendrophthoë) (851) *O. dendrophthoaë*

3.86 Lythraceae

- *Ervsiphe* sect. *Erysiphe* - a single species (on *Cuphea* and *Lythrum*) ..... (445) *E. lythri*
- *Ervsiphe* sect. *Uncinula* (subsect. *Uncinuliella*) - a single species (on *Lagerstroemia*) ..... (663) E. australiana
- *Phyllactinia* - a single species ..... (236) *Ph. guttata* s. lat.

  Anamorphs

- *Euoidium* - a single species (on *Woodfordia*) ..... (371) *Eu. woodfordiae*
- *Ovulariopsis* - a single spectes (on *Lawsonia inermis*) ..... (300) *Ov. lawsoniae*
- *Pseudoidium* - a single species (on *Lagerstroemia subcostata* [differs from the anamorph of *Erysiphe australiana* in having narrower hyphae and conidiophores and different germ tubes]) ... (836) *Ps. yenii*

3.87 Magnoliaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Liriodendron*) ..... (443) *E. liriodendri*
- *Erysiphe* sect. *Microsphaera*

  1. Appendages with hemispherical swelling at the base; on *Magnolia*, China ..... (509) *E. bulbosa*
  1. Appendages without basal swelling 2
  2. Appendages 0.75-1.5 times as long as the chasmothecial diam., apices regularly branched, tips distinctly recurved; conidia 20-38 x 12-20 µm; on *Magnolia*, North America, Japan, introduced in Europe and South America ..... (576) *E. magnifica*
  2. Appendages 1.5-2(-2.5) times the chasmothecial diam., branchings dense to diffuse, tips straight, not recurved; conidia broader, 30-38 x 18-25 µm; on *Houpoea obovata*, Japan (577) *E. magnoliae*

- *Phyllactinia* - see key to the species of *Phyllactinia*

3.88 Malphigiaceae

- *Oidiopsis* - a single species (on *Galphima glauca*) ..... (181) *Os. thryallidis*

3.89 Malvaceae (incl. *Bombacaceae*, *Sterculiaceae*)

- *Brasiliomyces* - a single species (on *Abutilon*, *Gossypium*, *Lavatera*, *Malachra*, *Malvastrum*) ..... (840) *B. malachrae*
- *Erysiphe* sect. *Erysiphe*

  1. Chasmothecia larger, 100-140 µm diam., appendages simple or 1-2(-3) times irregularly branched, only 1-2 times the chasmothecial diam.; on *Lavatera* and *Malva* ..... (448) *E. malvae*
  1. Chasmothecia smaller, 65-115 µm diam.; appendages usually unbranched, 0.3-3.5 times as long as the chasmothecial diam.; on other host 2
  2. Chasmothecia (80-)90-115 µm diam.; appendages (1-)2-5.5 times as long as the chasmothecial diam.; on *Firmiana* ..... (426) *E. firmianae*

2. Chasmothecia smaller, 65-100 µm diam.; appendages 0.3-3.5 times as long as the chasmothecial diam.; on *Abelmoschus manihot* ..... (389) *E. abelmoschicola*

- *Erysiphe* sect. *Uncinula*

1. Width of the appendages increasing from base to top, straight to curved, distinctly thick-walled towards the base; on *Firmiana simplex*, China, Japan ..... (682) *E. clintoniopsis*

1. Width of the appendages equal or almost equal throughout, slightly increasing or decreasing towards the tip, or irregular, often somewhat flexuous and geniculate when mature, thin-walled or slightly thicker at the base 2

2. Chasmothecia with 6-24 appendages 3

2. Chasmothecia with 30-100 appendages 4

3. Chasmothecia 80-130 µm diam., apex of appendages circinate, width within the coil often descreasing towards its tip; on *Firmiana simplex* ..... (723) *E. nishidana*

3. Chasmothecia 80-110 µm diam., apex of appendages uncinate, width not decreasing towards the tip; on *Kydia calycina* ..... (709) *E. kydiae-calycinae*

4. Width of the appendages irregular, almost equal throughout, slightly increasing or decreasing towards the tip, often somewhat flexuous and geniculate when mature; on *Thespesia* (= *Azanza*), Asia, India ..... (665) *E. azanzae*

4. Width of the appendages equal throughout; on *Ceiba*, South America ..... (677) *E. ceibae*

- *Golovinomyces*

1. Chasmothecia frequently formed, appendages partly arising from the upper half of the chasmothecium, asci 2-spored; on *Illiamna*, *Napaea*, North America ..... (313) *G. americanus*

1. Chasmothecia rarely formed, appendages in the lower half, asci 2-4-spored ..... (342) *G. orontii*

- *Leveillula*

1. Primary conidia with abruptly attenuated tip (somewhat apiculate); on various hosts of the *Malvaceae* ..... (144) *L. contractirostris*

1. Primary conidia gradually attenuated towards the apex, tips pointed; on *Gossypium*, possibly also on other hosts ..... (169) *L. taurica*

- Neoërysiphe- a single species (on *Alcea*) ..... (374) *N. galeopsidis*

- *Phyllactinia* - see key to the species of *Phyllactinia*

- *Podosphaera* sect. *Sphaerotheca*

1. Chasmothecia small, about 70-90 µm diam., peridium cells usually 10-25 µm diam.; on *Hibiscus mutabilis* ..... (72) *P. hibiscicola*

1. Chasmothecia larger, up to 110 µm diam., peridium cells larger, at least some > 25 µm diam.; on other hosts ..... (107) *P. xanthii*

- *Fibroidium*

On *Hibiscus*

1. Conidia usually 25-35 µm long; on *Hibiscus esculentus* ..... (108) *F. abelmoschi*

1. Conidia up to about 50 µm long; on *Hibiscus* spp. ..... (110) *F. balakrishnanii*

On *Malachra* ..... (118) *F. malachrae*

- *Oidium* s. lat. (generic affinity unclear)

On *Abutilon* ..... (845) *O. abutili*

On *Sida* ..... (868) *O. sidae*

- *Ovulariopsis* - a single species (on *Wissadula*) ..... (309) *Ov. wissadulae*

- *Pseudoidium*

On *Dombaya* ..... (790) *Ps. dombayae*

On *Kydia* ..... (803) *Ps. kydiae*

On *Pavonia* ..... (818) *Ps. pavoniae*

On *Urena lobata*

1. Conidiophores 100-245 µm long, foot-cells long and slender, followed by 1-3 cells, about as long as the foot-cell, shorter, or much longer; Taiwan ..... (834) *Ps. urenae*
1. Conidiophores 60-140 µm long, foot-cells followed by 1-3 shorter cells; appressoria conspicuously lobed; Cuba ..... (827) *Ps. schmiedeknechtii*

3.90 Martyniaceae

- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

3.91 Medusagynaceae

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Medusagyne*) ..... (107) *P. xanthii*

3.92 Meliaceae

- *Erysiphe* sect. *Uncinula*

1. Appendages of the chasmothecia frequently nodulose; on *Cedrela*, Asia ..... (676) *E. cedrelae* var. *nodulosae*
1. Appendages not nodulose, simple; on *Cedrela*, Asia ..... (676) *E. cedrelae* var. *cedrelae*

- *Phyllactinia* - a single species ..... (236) *Ph. guttata* s. lat

Anamorphs

- *Pseudoidium*

On *Azadirachta* ..... (772) *Ps. azadirachtae*

On *Heynea* ..... (832) *Ps. trichiliae*

On *Melia* ..... (809) *Ps. meliacearum*

3.93 Menispermaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Stephania*) ..... (475) *E. stephaniae*
- *Erysiphe* sect. *Microsphaera*

1. Tips of ultimate branchlets of appendages straight, not recurved, apices densely and rather regularly branched, Asia ..... (604) *E. pseudolonicerae*
1. Tips distinctly recurved, apices regularly branched 2
2. Chasmothecia 70-115 µm diam., appendages numbering (2-)4-11; on *Sinomenium*, Asia ..... (623) *E. sinomenii*
2. Chasmothecia larger, (80-)90-135(-145) µm diam., appendages about 4-20; on *Menispermum* ..3
3. Branchings of the appendages rather dense and compact, regular, usually with the edges (corners) between two main branches rounded, i.e. corners not "angular"; on *Menispermum*, North America ..... (581) *E. menispermi* var. *menispermi*
3. Branchings looser, corners between two branches usually somewhat angular, not rounded; on *Menispermum*, Asia ..... (581) *E. menispermi* var. *dahurica*

Anamorph

- *Pseudoidium* - a single species (on *Cocculus*, India) ..... (786) *Ps. cocculi*

3.94 Misodendraceae

- *Erysiphe* sect. *Microsphaera* - a single species (on *Misodendrum*) .....(587) *E. myzodendri*

3.95 Moraceae

- *Erysiphe* sect. *Uncinula*

  1. Appendages dimorphic, with 15-35 equatorial appendages, long, apex coiled, and also with short bristle like "appendages" (anchor hyphae) in the upper half (subsect. *Uncinuliella*); on *Ficus roxburghii*, India .....(694) *E. ficicola*

  1. Appendages uniform, equatorial, bristle-like anchor hyphae in the upper half lacking 2

  2. Chasmothecia with few appendages, about 4-14; on *Maclura tricuspidata* 3

  2. Chasmothecia with numerous appendages, about 10-45 4

  3. Appendages 0.5-1 times as long as the chasmothecial diam., aseptate, straight to curved .....(739) *E. pseudoehretiae*

  3. Appendages 1-1.5 times the chasmothecial diam., with a single septum, mostly flexuous, geniculate-sinuous, sometimes subnodulose .....(764) *E. yaanensis*

  4. Width of the appendages increasing towards the tip; on *Ficus* and *Maclura* 5

  4. Width of the appendages almost equal throughout or decreasing towards the apex, smooth or faintly rough-walled; on *Ficus*, *Morus* 9

  5. Apex of appendages usually enlarged, to give a ± clavate appearance; on *Maclura tricuspidata*, China .....(680) *E. clavulata*

  5. Circinate apex usually not enlarged; on *Ficus* 6

  6. Width of the appendages gradually increasing from base to top (*E. religiosa* s. lat.) 7

  6. Width of the appendages increasing for up to 2/3-3/4 of the stalk, but then decreasing towards the tip (*E. aspera* s. lat.) 8

  7. Asci 3-6-spored; on *Ficus religiosa*, India .....(743) *E. religiosa* var. *religiosa*

  7. Asci 2-4-spored; on *Ficus nervosa*, India .....(743) *E. religiosa* var. *fici-nervosae*

  8. Appendages numbering 15-35, length 1-2 times the chasmothecial diam.; on *Ficus* species .(662) *E. aspera* var. *aspera*

  8. Appendages fewer and shorter; on *Ficus sycomorus*, South Africa .....(662) *E. aspera* var. *sparsichaeta*

  9. Appendages obviously thick-walled towards the base, appendages 15-25; on *Morus*, Asia .....(721) *E. mori*

  9. Appendages thin-walled throughout, sometimes very slightly thicker at the base 10

  10. Appendages numbering 20-45, length 1-2 times the chasmothecial diam.; on *Morus rubra*, North America .....(700) *E. geniculata*

  10. Appendages 10-20, length 0.75-1 times the chasmothecial diam.; on *Ficus*, Africa .....(732) *E. pirottiana*

- Golovinomyces - a single species .....(342) *G. orontii* [as *Euoidium violae*]

- *Phyllactinia* - see key to the species of *Phyllactinia*

- *Podosphaera* sect. *Sphaerotheca*

  1. Peridium cells of the chasmothecia large, conspicuous, 10-50 µm diam., appendages mycelioid, mostly short, on *Fatoua*, Japan .....(93) *P. pseudofusca*

  1. Peridium cells small, inconspicuous, 8-25(-30) µm diam., appendages fairly straight, not mycelioid, usually long, up to 6 times the chasmothecial diam.; on *Humulus* .....(77) *P. macularis*

3.96 Moringiaceae

- *Pseudoidium* - a single species (on Moringia) .....(811) *Ps. moringae*

3.97 Moriniaceae

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Morinia*) ..... (56) *P. dipsacacearum*

3.98 Myoporaceae

- *Podosphaera* sect. *Sphaerotheca* - "*P. fuliginea* s. lat." on *Myopora* (Hirata 1986, Amano 1986)

3.99 Myrsinaceae

- *Erysiphe* sect. *Uncinula* - a single species (on *Embelia*) ..... (690) *E. embeliae*

3.100 Myrtaceae

- *Erysiphe* sect. *Uncinula* - a single species (on *Stenocalyx uniflorus*, South America) . (664) *E. australis*
- Golovinomyces - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

  Anamorphs

  1. Foot-cells of the conidiophores cylindrical, 40-80 µm long, conidia in chains, without fibrosin bodies; on *Eucalyptus* and other hosts ..... (342) *Euoidium violae* [*Golovinomyces orontii*]
  1. Foot-cells very long, 80-170 µm, width increasing towards the tip, conidia in chains but with fibrosin bodies; on *Eucalyptus* and maybe on some other hosts ..... *Fibroidium* sp. (see (38) *Podosphaera aphanis*) [*Oidium* s. lat. collections have been recorded on *Callistemon*, *Chamaelaucium*, *Eucalyptus*, *Melaleuca*, *Myrcia*, and *Myrtus*]

3.101 Nolanaceae

- *Oidium* s. lat. - *Oidium* sp. on *Nolana* (Hirata 1986, Amano 1986)

3.102 Nothofagaceae

- *Erysiphe* sect. *Uncinula*

  1. Chasmothecial appendages not helically twisted; on *Nothofagus*, South America ..... (716) *E.magellanica*
  1. Appendages helically twisted 2
  2. Appendages with a few coils below the uncinate apex; on *Nothofagus*, South America ..... (724) *E. nothofagi*
  2. Appendages strongly twisted with at least 15-25 coils, from base to almost top; on *Nothofagus*, South America ..... (728) *E. patagoniaca*

3.103 Nymphaeaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Nelumbo*) ..... (478) *E. takamatsui*
- *Erysiphe* sect. *Microsphaera* - a single species (on *Nelumbo*) ..... (576) *E. magnifica*

3.104 Nyssaceae (see *Cornaceae*)

3.105 Oleaceae (incl. *Nyctaginaceae*)

- *Erysiphe* sect. *Microsphaera*

  1. Chasmothecia with 10-30 appendages, tips of ultimate branchlets straight, apex 3-6 times irregularly branched, branching-diffuse, lax; on *Forestiera neomexicana*, USA ..... (590) *E. neomexicana*
  1. Appendages 4-16, tips recurved 2

2. Asci (3-)4-8-spored, apex of appendages 3-5 times dichotomously branched, densely and regularly, or partly loosely branched, primary branches elongated, often deeply cleft; on *Ligustrum*, Japan . . . . . (571) *E. ligustri*

2. Asci either 6-8-spored (on *Ligustrum* and *Syringa*), or branchings very regular, uniform; on other hosts, or on *Ligustrum* in North America 3

3. Asci usually 4-5-spored, appendages hyaline or only pigmented at the very base; on various *Oleaceae*, North America, introduced in Europe . . . . . (630) *E. syringae*

3. Asci (5-)6-8-spored, appendages pigmented, brownish, at the base or up to the middle of the stalk, sometimes even reaching the upper half on Syyringa, Asia, Japan and Far East of Russia, introduced in Europe . . . . . (631) *E. syringae-japonicae*

- *Erysiphe* sect. *Typhulochaeta* - a single species (on ?Fraxinus) . . . . . (648) *E. japonica*

- *Erysiphe* sect. *Uncinula*

1. Chasmothecial appendages thick-walled, often almost throughout, distinctly verrucose; on *Chionanthus*, China . . . . . (679) *E. chionanthi*

1. Appendages thin-walled throughout or thin above and thicker towards the base, smooth to faintly rough-walled; on Fraxinus, Asia 2

2. Chasmothecia with (10-)15-35 appendages, 4-8.5 µm wide throughout, not enlarged towards the apex, thin-walled throughout or only slightly thicker near the base . . . . . (698) *E. fraxinicola*

2. Chasmothecia with 4-25 appendages, 5-9.5 µm wide throughout or often somewhat increasing towards the apex, walls thin above and obviously thick towards the base . . . . . (744) *E. salmonii*

- *Leveillula* - a single species . . . . . (169) *L. taurica* s. lat.

- *Phyllactinia* - see key to the species of *Phyllactinia*

Anamorphs

- *Oidium* s. lat. - a single species (on *Mirabilis*) . . . . . (859) *O. mirabilifoli*

- *Pseudoidium*

On *Boerhaavia* . . . . . (774) *Ps. boerhaaviae*
On *Jasminum* . . . . . (800) *Ps. jasmini*
On *Mirabilis* . . . . . (814) *Ps. nyctaginacearum*
On *Nyctanthes* . . . . . (776) *Ps. braunii*

3.106 Onagraceae (= *Oenotheraceae*)

- *Erysiphe* sect. *Erysiphe*

1. Conidia ellipsoid, 30-46 x 14-20 µm, foot-cells of the conidiophores tollowed by a longer cell, a cell of the same length or a shorter cell; chasmothecia 70-105 µm diam., only few appendages, brown when mature; on *Circaea* . . . . . (414) *E. circaecae*

1. Conidia ellipsoid-ovoid to doliiform, 26-35 x 14-19.5 µm, foot-cells always followed by shorter cells; chasmothecia (75-)90-140(-160) µm diam., appendages numerous, hyaline or only pigmented below; on *Oenothera* . . . . . (433) *E. howeana*

- *Leveillula* - a single species . . . . . (169) *L. taurica* s. lat.

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Epilobium*) . . . . . (59) *P. epilobii*

3.107 Orobanchaceae

- *Golovinomyces*

  1. Chasmothecia usually formed; foot-cells of the conidiophores straight (on Cordylanthus) ..... (347) *G. rogersonii*
  1. Chasmothecia rarely formed; foot-cells often curved; on other hosts ..... (342) *G. orontii* [as *Euoidium violae*]

- *Leveillula*

  1. All conidia broadly ellipsoid-ovoid; on *Bungea* ..... (172) *L. verbasci*
  1. Primary conidia lanceolate, secondary ones ± cylindrical ..... (169) *L. taurica* s. lat.

- *Podosphaera* sect. *Sphaerotheca* - a single species (on hosts of various genera) (87) *P. phtheirospermi*

3.108 Oxalidaceae

- *Erysiphe* sect. *Microsphaera* - a single species (on *Oxalis*) ..... (614) *E. russellii*
- *Golovinomyces* - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Leveillula* - a single species (on Oxalis) ..... (162) *L. oxalidicola*

3.109 Paeoniaceae

- *Erysiphe* sect. *Erysiphe* - a single species (in *Paeonia*) ..... (453) *E. paeoniae*
- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Paeonia*) ..... (82) *P. paeoniae*

3.110 Papaveraceae

- *Erysiphe* sect. *Erysiphe*

  1. Chasmothecia 70-150 µm diam., appendages mostly 1-2 times as long as the chasmothecial diam.; on *Papaver* ..... (417) *E. cruciferarum*
  1. Chasmothecia small, about 70-100 µm diam., appendages longer, (0.5-)1-7 times the chasmothecial diam.; on *Hylomecon*, *Macleaya* and *Meconopsis* 2
  2. On *Macleaya* and *Meconopsis* ..... (446) *E. macleayae*
  2. On *Hylomecon* ..... (435) *E. hylomeci*

- Golovimomyces - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Leveillula* - a single species ..... (169) *L. taurica*
- *Podosphaera* sect. *Sphaerotheca* - a single species (on Papaver) ..... (84) *P. papaveris*

3.111 Parnassiaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Parnassia*) ..... (455) *E. parnassiae*

3.112 Passifloraceae

- *Leveillula* - a single species ..... (169) *L. taurica*
- *Phyllactinia* - on *Passiflora caerulea* ..... *Phyllactinia* sp. (see notes under *Ov. passiflorae*)

  Anamorphs

- *Oidium* s. lat. (generic affinity unclear)

  On *Passiflora* (conidia catenescent) ..... (861) *O. passifloracearum*
  On *Tasconia*, South America (Hirata 1966, Amano 1986) ..... *Oidium* sp.

- *Ovulariopsis* - a single species (on *Passiflora*) ..... (306) *Ov. passiflorae*
- *Pseudoidium* - a single species (on *Passiflora*) ..... (816) *Ps. passiflorae*

3.113 Pedaliaceae

- Golovimomyces - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

  Anamorphs
- *Euoidium* - a single species (on *Sesamum*) ..... (368) *Eu. sesami*
- *Fibroidium* - a single species (on *Sesamum*) ..... (121) *F. sesami*
- *Pseudoidium* - a single species (on *Ibicella* and *Sesamum*) ..... (819) *Ps. pedaliacearum*

3.114 Phrymaceae

- *Golovinomyces* - a single species (on *Mimulus guttatus*) ..... (319) *G. brunneopunctatus*
- *Leveillula* - a single species (on *Dodartia*) ..... (152) *L. jaczewskii*

3.115 Phyllanthaceae

- *Erysiphe* sect. *Microsphaera*

  1. Appendages 2-13 times as long as the chasmothecial diam., asci 8-spored; on *Flueggea* ..... (616) *E. securinegae*
  1. Appendages 2-4 times the chasmothecial diam., asci 4-7-spored; on *Phyllanthus*, Japan ..... (599) *E. phyllanthi*
- *Erysiphe* sect. *Uncinula* - a single species (on *Bischofia*, China) ..... (668) *E. bischofiae*
- *Microidium* - a single species (on *Phyllanthus*) ..... (844) *Mo. phyllanthi*
- *Phyllactinia* - see key to the species of *Phyllactinia*

  Anamorph
- *Oidiopsis* - a single species (on *Andrachne*) ..... (174) *Os. andrachnes*

3.116 Phytolaccaceae

- *Oidium* s. lat. - *Oidium* sp.; on *Phytolacca*, *Rivinia*, Uganda, South America (Amano 1986)

3.117 Piperaceae

- *Oidium* s. lat. - a single species (on Piper) ..... (864) *O. piperis*

3.118 Pittosporaceae

- *Oidium* s. lat. - *Oidium* sp.; on *Pittosporum*, Balearic Islands (Amano 1986)

3.119 Plantaginaceae

- *Golovinomyces*

  1. Chasmothecia usually formed; on *Plantago* ..... (351) *G. sordidus*
  1. Chasmothecia rarely formed; on other hosts ..... (342) *G. orontii* [as *Euoidium violae*]
- *Leveillula*

  1. Primary conidia 35-65 x 9-20 µm, length < 50 µm on average; on *Linaria* ..... (158) *L. linariae*
  1. Primary conidia longer, usually > 50 µm; on other hosts ..... (169) *L. taurica*
- *Podosphaera* sect. *Sphaerotheca*

1. Peridium cells of intermediate size, 10-30 µm diam., between 15 and 25 µm on average; on *Veronicastrum* 2
1. Peridium cells large and conspicuous, (10-)15-50(-60) µm diam., average > 20 µm, at least some cells > 30 µm 3
2. Chasmothecia 80-110 µm diam.; peridium cells 8-30 µm diam.; on *Veronicastrum sibiricum*, Asia (97) *P. sibirica*
2. Chasmothecia smaller (50-)60-80 µm diam.; peridium cells 10-35(-40) µm diam.; on *Veronicastrum virginicum*, North America ..... (104) *P. veronicastri*
3. Appendages poorly developed, short, about as long as the chasmothecial or shorter, often rudimentary, few; on *Veronica* ..... (68) *P. fuliginea*
3. Appendages well developed, longer, 0.5-5 times the chasmothecial diam.; on *Plantago* ..... (90) *P. plantaginis*

Anamorph

- *Oidium* s. lat. (generic affinity unclear) - a single species (on *Scoparia*; conidia catenescent) ..... (867) *O. scopariae*

3.120 Platanaceae

- *Erysiphe* sect. *Microsphaera* - a single species (on Platanus) ..... (601) *E. platani*
- *Phyllactinia* - a single species (on *Platanus*) ..... (236) *P. guttata* s. lat.

3.121 Plumbaginaceae

- *Erysiphe* sect. *Erysiphe*

1. Appendages of the chasmothecia aseptate, asci (S-)7-11, inner wall of the peridium golden yellow; on *Limonium suffruticosum*, China ..... (399) *E. aurea*
1. Appendages with some septa, asci 3-8, inner wall of the peridium not golden yellow; on numerous hosts of the genus *Limonium*, Europe to Asia ..... (441) *E. limonii*

- *Leveillula* - a single species ..... (169) *L. taurica* s. lat. [collections on *Plumbago* resemble *L. golovinii*]

3.122 Poaceae (Gramineae)

- *Blumeria* - a single species (on numerous hosts) ..... (4) *B. graminis*

3.123 Polemoniaceae

- *Golovinomyces*

1. Peridium cells of the chasmothecia 10-30 µm diam., appendages 5-12 µm wide; on *Phlox* and *Polemonium*, Europe, Asia, America ..... (340) *G. magnicellulatus* var. *magnicellulatus*
1. Peridium cells up to 40 µm diam., appendages 6-13(-18) µm wide; on *Polemonium chinense* and *P. linifolium*, China and Far East of Russia ..... (340) *E. magnicellulatus* var. *robustus*

- *Leveillula* - a single species ..... (169) *L. taurica* [collections on *Polemonium* resemble *L. golovinii*]

- *Podosphaera* sect. *Sphaerotheca*

1. Peridium cells of the chasmothecia large, 10-50 µm diam.; on *Phlox* ..... (107) *P. xanthii*
1. Peridium cells smaller, 8-25 µm diam. 2
2. Appendages of the chasmothecia arising from the lower half, mycelioid, 0.25-3 times as long as the chasmothecial diam., thin-walled; on various hosts in North America ..... (52) *P. collomiae*
2. Appendages arising equatorially or from the upper half, not mycelioid, long and fairly straight, (1-)3-6 times the chasmothecial diam.; on *Polemonium*, Europe to Asia ..... (91) *P. polemonii*

3.124 Polygalaceae

- *Erysiphe* sect. *Erysiphe* - "*E. communis*" on *Polygala*, Italy (Amano 1986)

3.125 Polygonaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on various hosts) ..... (461) *E. polygoni*
- *Erysiphe* sect. *Microsphaera*

  1. Chasmothecia with about 6-15 appendages; on *Atraphaxis* and *Calligonum* ..... (498) *E. atraphaxis* var. *atraphaxis*
  1. Chasmothecia with (12-)20-44 appendages; on *Atraphaxis* ..... (498) *E. atraphaxis* var. *pluriappendicis*

- *Golovinomyces* - a single species (on *Eriogonum*) ..... (321) *G. californicus*
- *Leveillula*

  1. Primary conidia ellipsoid-ovoid to short lanceolate, 25-50 x 10-16 µm; on *Calligonum* ..... (139) *L. calligoni*
  1. Primary conidia lanceolate, longer, usually > 50 µm long; on other hosts . (169) *L. taurica* s. lat.

  Anamorph

- *Pseudoidium* - a single species, on *Antigonon* ..... (770) *Ps. antigononis*

3.126 Potamogetonaceae

- Golovinomyces - a single species ..... (342) *G. orontii* [as *Euoidium violae*]

3.127 Primulaceae

- Golovinomyces - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

  Anamorphs

- *Fibroidium* - a single species (on *Primula obconica*) ..... (120) *F. primulae-obconicae*
- *Pseudoidium* - a single species (on *Cyclamen*) ..... (789) *Ps. cyclaminis*

3.128 Proteaceae

- *Phyllactinia* - a single species (on *Embothrium*) ..... (198) *Ph. antarctica*

3.129 Punicaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Punica*) ..... (463) *E. punicae*

3.130 Ranunculaceae

- *Erysiphe* sect. *Erysiphe* (*E. aquilegiae* s. lat.)

  1. Chasmothecial appendages very long, (1-)3-12 times as long as the chasmothecial diam., not distinctly mycelioid, fairly straight, often setiform ..... (397) *E. aquilegiae* var. *aquilegiae*
  1. Appendages shorter, 0.5-4 times the chasmothecial diam., ± mycelioid ..... (397) *E. aquilegiae* var. *ranunculi*

- *Erysiphe* sect. *Microsphaera* - a single species (on *Helleborus*) ..... (556) *E. hellebori*
- *Leveillula* - a single species ..... (169) *L. taurica*

- *Podosphaera* sect. *Sphaerotheca*

  1. Peridium cells of chasmothecia not very conspicuous, 8-20(-25) µm diam., chasmothecia (55-)60-90 µm diam., ascospores 14-20 x 9.5-14.5 µm; on *Adonis*, Romania, Ukraine ..... (94) *P. savulescui*
  1. Peridium cells larger and conspicuous, 15-40 µm diam., usually more than 20 µm diam. 2
  2. Chasmothecia small, 55-70 µm diam.; on *Thalictrum*, Europe ..... (103) *P. thalictri*
  2. Chasmothecia larger, 65-85 µm diam.; on *Adonis*, *Delphinium*, *Trollius*, Europe, Asia, North America ..... (54) *P. delphinii*

  Anamorph

- *Euoidium* - a single species (on *Ranunculus*, South America) ..... (359) *Eu. fuegianum*

3.131 Resedaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Reseda*) ..... (417) *E. cruciferarum*
- *Leveillula* - a single species (on *Reseda*) ..... (169) *L. taurica* s. lat.

3.132 Rhamnaceae

- *Erysiphe* sect. *Microsphaera*

  1. Chasmothecial appendages very long and flexuous, (1.5-)2-7 times as long as the chasmothecial diam., mostly 3-5 times, numbering 4-12(-16), apex only 2-4 times branched, primary branches elongated, often somewhat recurved, on *Frangula alnus*, Europe ..... (537) *E. divaricata*
  1. Appendages shorter, 0.5-3 times the chasmothecial diam., apex with a different mode of branching; on other hosts 2
  2. Appendages 1-6-septate, brown, at least in the lower half, apex 4-6 times branched, primary branches mostly elongated, asci 6-8-spored; on *Berchemia*, Japan ..... (506) *E. berchemiae*
  2. Appendages O-1-septate 3
  3. Apex of the appendages only 1-3 times branched, branching loose, widely forked, primary branches usually elongated, asci 6-8-spored; on *Hovenia*, Japan ..... (645) *E. yamadae*
  3. Apex strongly branched, 2-6 times, branching denser, and different from above; on other hosts .4
  4. Chasmothecial appendages 2-2.5 times as long as the chasmothecial diam., apex regularly branched, tips of the ultimate branchlets straight; on *Discaria*, South America ..... (536) *E. discariae*
  4. Appendages either shorter, mostly 1-1.5 times the diam. or longer, mostly 1.5-3 times the diam., tips recurved, at least some recurved when mature; on other hosts 5
  5. Appendages relatively long, flexuous, 1-3, mostly 1.5-3 times the chasmothecial diam.; on *Ceanothus* and *Colubrina*, North America ..... (627) *E. sydowiana*
  5. Appendages shorter, mostly rather stiff, 0.75-2, mostly 1-1.5 times the chasmothecial diam. ... 6
  6. Chasmothecia small, 50-85 µm diam., with 2-4 asci, appendages with tips acuminate to obtuse, inflated, digitate or recurved, branching regular or somewhat irregular; on *Rhamnus rugulosus*, China ..... (610) *E. rhamnicola*
  6. Chasmothecia larger, 75-110 µm diam., with 3-8 asci, tips distinctly recurved when mature 7
  7. Conidia ellipsoid-ovoid to doliiform; ascospores small, 15-21 x 9-13 µm; on *Ceanothus americanus*, North America ..... (515) *E. ceanothi*
  7. Conidia ellipsoid-cylindrical, mostly cylindrical; ascospores often larger; on *Rhamnus*, Europe, Asia 8
  8. Asci (2-)3-5-spored, ascospores 15-21(-24) x 8.5-15 µm; on *Rhamnus cathartica*, Europe to Central Asia and northwestern China ..... (549) *E. friesii* var. *friesii*
  8. Asci 6-7(-8)-spored, ascospores 16-24 x 9-12 µm; on *Rhamnus*, Asia (China, Far East of Russia, Japan, Korea) ..... (549) *E. friesii* var. *dahurica*

- *Phyllactinia* - see key to the species of *Phyllactinia*

  Anamorph

- *Pseudoidium* - a single species (in *Zizyphus*) ..... (837) *Ps. zizyphi*

3.133 Rosaceae

- *Erysiphe* sect. *Erysiphe*

  1. Chasmothecia 120-210 µm diam., asci 10-20 in number, (4-)5-6(-7)-spored; on *Geum*, South America ..... (427) *E. frickii*
  1. Chasmothecia 70-150 µm diam.; on other hosts 2
  2. Asci 2-4-spored; on *Pentaphylloides* and *Potentilla* ..... (480) *E. thuemenii*
  2. Asci 4-8-spored 3
  3. Appendages short, shorter than the chasmothecial diam.; on *Rubus*, New Zealand ..... (468) *E. rubicola*
  3. Appendages 0.5-6 times as long as the chasmothecial diam. 4
  4. Appendages arising from the lower half, septate, asci 6-8-spored; on *Filipendula*, Europe to Asia ..... (481) *E. ulmariae*
  4. Appendages equatorially arising and somewhat from the upper half, aseptate, asci 4-6-spored; on *Acaena* ..... (390) *E. acaenae*

- *Erysiphe* sect. *Microsphaera*

  1. Appendages dimorphic, with short unbranched terminal "appendages" and long, sinuous, equatorial appendages with branched apex; on Rosa, Asia ..... (613) *E. rosae*
  1. Appendages uniform, equatorial, straight, with branched apex 2
  2. Apex of appendages 3 times branched, tips straight, asci 8-spored; on Rosa, Asia ..... (568) *E. karisiana*
  2. Apex (2-)4-5 times branched, tips recurved, asci (4-)5-7(-8)-spored; on *Exochorda*, India (546) *E. exochordae*

- *Erysiphe* sect. *Uncinula*

  1. Appendages dimorphic, with short, terminal "appendages" (anchor hyphae) and long, equatorial appendages with circinate apex (subsect. *Uncinuliella*), on *Rosa* (*E. simulans* s. lat.) 2
  1. Appendages uniform, only with long equatorial appendages 4
  2. Chasmothecia with few only 6-16 appendages ..... (749) *E. simulans* var. *rosae-rubi*
  2. Chasmothecia with numerous appendages, about 10-30 3
  3. Chasmothecia 80-125 µm diam., appendages hyaline to pigmented, asci 4-6-spored ..... (749) *E. simulans* var. *simulans*
  3. Chasmothecia smaller, 70-110 µm diam., appendages hyaline, only brown at the very base, asci 3-5(-6)-spored ..... (749) *E. simulans* var. *tandae*
  4. Chasmothecia 145-180 µm diam., with 45-150 appendages, about as long as the chasmothecial diam., thin-walled; on *Crataegus*, Far East of Russia ..... (685) *E. crataegi*
  4. Chasmothecia (80-)85-115(-150) µm diam., with fewer appendages, longer and thick-walled towards the base; on *Prunus* ..... (737) *E. prunastri*

- *Golovinomyces* - a single species ..... (342) *G. orontii* [as *Euoidium violae*]

- *Leveillula* - a single species ..... (169) *L. taurica*

- *Phyllactinia* - see key to the species of *Phyllactinia*

- *Podosphaera* sect. *Podosphaera*

  1. Appendages of the chasmothecia ± equatorial and horizontally spread or some arising somewhat in the upper upper half and straight to curved upwards, but never forming a terminal tuft, sometimes even arising from the lower half (subsect. *Podosphaera*) 2
  1. Appendages in the upper half of the chasmothecia, often almost fasciculate, usually ± straight and ± pointing in the same direction, few in number, only 1-8 (subsect. *Tridactyla*) 15
  2. Ascospores curved, bean- to crescent-shaped; on *Cydonia* and *Sorbus*, Asia 3

2. Ascospores ellipsoid-ovoid, not curved or only a few occasionally slightly curved 4

3. Chasmothecia about 70-90 µm diam., ascospores always distinctly curved, crescent-shaped, sometimes strongly so; on *Sorbus alnifolia* and *S. commixta*, Japan ..... (18) *P. curvispora*

3. Chasmothecia larger, about (85-)90-100(-110) µm diam., ascospores slightly curved, bean-shaped; on *Cydonia oblonga*, India, Israel ..... (17) *P. clandestina* var. *cydoniae*

4. Appendages arising from the lower half of the chasmothecia, rather mycelioid, geniculate-flexuous; on *Prunus incana*, Georgia ..... (26) *P. salatai*

4. Appendages ± equatorial, stiff, setiform or flexuous, but not geniculate; on other hosts 5

5. Appendages few, usually 2-6; on *Sorbus* or *Spiraea douglasii* 6

5. Appendages numerous, usually 5-20; on numerous genera of the *Rosaceae* (including *Sorbus commixta* in Asia, Japan and *Spiraea* spp.) 7

6. Appendages 1-3 times as long as the chasmothecial diam., 2-7-septate; on *Sorbus aucuparia*, occasionally on other *Sorbus* species, Europe to Asia (China) ..... (14) *P. aucupariae*

6. Appendages (1.5-)2-4.5 times the chasmothecial diam., mostly 5-10-septate; on *Spiraea douglasii*, North America ..... (29) *P. spiraeae-douglasii*

7. Appendages 5-15, mostly 6-12 per chasmothecium; on *Crataegus*, *Cydonia*, *Mespilus* and *Pyrus* 8

7. Appendages more numerous, up to about 35 per chasmothecium, often more than 15, on *Amelanchier*, *Crataegus*, *Holodiscus*, *Prunus*, *Spiraea* 9

8. Appendages usually 1-2 times as long as the chasmothecial diam.; on *Crataegus*, *Cydonia*, *Mespilus* and *Pyrus*, Europe to Asia, North America, introduced in other parts of the world ..... (17) *P. clandestina* var. *clandestina*

8. Appendages 1-3.5(-4) times the chasmothecial diam.; on *Crataegus* spp., North America ..... (17) *P. clandestina* var. *perlonga*

9. Terminal oculus of the asci small, 8-12 ym diam., often rather inconspicuous; on *Holodiscus* and *Spiraea* spp. 10

9. Terminal oculus larger, mostly 15-20 um diam., appendages 1-3 times as long as the chasmothecial diam.; on *Amelanchier*, *Crataegus*, *Prunus*, *Spiraea japonica* 12

10. Appendages relatively short, (0.5-)0.75-2(-2.5) times the chasmothecial diam.; on *Spiraea* spp. in Asia and North America ..... (23) *P. minor* var. *minor*

10. Appendages longer, 1.5-3.5 times the chasmothecial diam.; on *Holodiscus discolor* or *Spiraea corymbosa* 11

11. Appendages up to 20 in number, 5-10-septate; on *Spiraea corymbosa* ..... (23) *P. minor* var. *longissima*

11. Appendages 5-12 in number, 2-7-septate; on *Holodiscus discolor*, North America (20) *P. holodisci*

12. Apices of appendages (30-)40-60(-70) µm wide, regularly branched, not deeply cleft; on *Spiraea japonica* ..... (30) *P. spiraeicola*

12. Apices of appendages about 20-50 µm wide (when tightly branched, i.e. with short primary branches) 13

13. Primary branches occasionally elongated, deeply cleft or even branched near the base, mature asci usually thin-walled, 1-2 um wide; on *Amelanchier*; North America, introduced in Europe ..... (13) *P. amelanchieris*

13. Primary branched always very short, branched part very compact, deeply cleft appendages rare, wall of mature asci usually thicker, (1-)2-3(-4) µm wide; on *Crataegus* and *Prunus*, North America 14

14. Chasmothecia usually with 6-20(-25) appendages; on *Prunus* ..... (25) *P. prunicola*

14. Chasmothecia usually with (6-)10-35(-38) appendages; on *Crataegus* ..... (17) *P. clandestina* var. *luxurians*

15. Apex of the appendages usually unbranched, occasionally 1-2 times branched 16

15. Apex of the appendages always branched 17

16. Appendages usually simple, but apex sometimes 1-2(-3) times dichotomously branched, hyaline or only somewhat brown at the very base, aseptate; on *Malus* ..... (21) *P. leucotricha*

16. Appendages always unbranched, brown and septate; on *Crataegus*, China ..... (28)

17. Chasmothecia with only 1-2(-3) appendages; on *Prunus* sp., Asia, China .. (34) *P. wuyishanensis*

17. Chasmothecia with (1-)2-6(-8) appendages (*Podosphaera tridactyla* s. lat.); on *Prunus* (s. lat.) spp. 18

18. Appendages rather long, up to 450 µm, with up to 6 septa, asci 5-8-spored; on *Prunus buergeriana* and *P. grayana*, Japan ..... (22) *P. longiseta*

18. Appendages usually shorter, variable, but mostly up to about 300 µm long, with 0-4(-6) septa; asci (4-)6-8-spored; on various host species of *Prunus* s. lat., widespread ..... (32) *P. tridactyla*

- *Podosphaera* sect. *Sphaerotheca*

1. Chasmothecial appendages poorly developed, very short, rudimentary, often almost lacking; on *Dryas* or *Sorbus* 2

1. Appendages well developed, numerous 3

2. Chasmothecia 50-65 µm diam., appendages 2.5-5 µm wide, ascospores 17-24 x 9.5-16 µm; on *Sorbus*, Europe ..... (81) *P. niesslii*

2. Chasmothecia 65-95 µm diam., appendages 4-7 µm wide, ascospores subglobose, 16-21 x 13-18 µm, on *Dryas*, Europe ..... (106) *P. volkartii*

3. At least some appendages arising from the upper half of the chasmothecium, becoming thick-walled, at least below, not mycelioid, fairly straight, setiform; on *Filipendula*, *Sanguisorba*, *Spiraea* 4

3. All appendages arising from the lower half of the chasmothecium, thin-walled, mycelioid; on other hosts 6

4. Infected leaves and stems neither disfigured nor distorted; on *Sanguisorba* ..... (65) *P. ferruginea*

4. Infected leaves and stems frequently disfigured and distorted; on *Spiraea* and *Filipendula* 5

5. On *Filipendula* spp. ..... (66) *P. filipendulae*

5. On *Spiraea* spp. ..... (100) *P. spiraeae*

6. Persistent mycelium dense, pannose, secondary mycelium pigmented with age, hyphae often thick-walled; on *Rosa*, *Prunus* s. lat. and *Stephanandra* 7

6. Persistent mycelium not pannose, no secondary mycelium formed, neither pigmented nor thick-walled; on other hosts 8

7. Mycelium amphigenous, pannose layers white to greyish, sometimes greyish brown; on *Rosa* and *Prunus* s. lat. ..... (83) *P. pannosa*

7. Mycelium hypophyllous, pannose layers yellowish brown to dark brown; on *Stephanandra*, Asia (101) *P. stephanandrae*

8. Chasmothecia with few appendages; infections on inflorescences and leaves, old, brown, infected shoots, leaves and fruits from previous season remain on host plant, and are blackened by a dense covering of overwintered chasmothecia; on *Physocarpus*, North America ..... (88) *P. physocarpi*

8. Chasmothecia with numerous appendages; symptoms different 9

9. Appendages 0.25-6 times as long as the chasmothecial diam., 3.5-8 µm wide, ± brown when mature; on various hosts, incl. *Potentilla* ..... (38) *P. aphanis* var. *aphanis*

9. Appendages often very short and narrow, 3.5-6 µm wide, hyaline or only yellowish; on *Potentilla* ..... (38) *P. aphanis* var. *hyalina*

Anamorphs

- *Oidium* s. lat. (generic affinity unclear) - a single species (on *Spiraea*, India; conidia solitary) ..... (870) *O. spiraeae*

- *Pseudoidium* - a single species (on *Prinsepia*) ..... (824) *Ps. prinsepiae*

3.134 Rubiaceae

- *Erysiphe* sect. *Microsphaera*

  1. Chasmothecia with numerous appendages, usually 40-60, tips of the ultimate branchlets not recurved, branchings diffuse; on *Hamiltonia*, India ..... (602) *E. prasadii*

  1. Appendages fewer, 4-19, tips recurved, appendages septate and pigmented; on *Cephalanthus*, North America ..... (618) *E. semitosta*

- *Golovinomyces*

  1. Conidia 15-20 µm wide; on *Rubia* ..... (348) *G. rubiae*

  1. Conidia narrower, (10-)13-15.5 µm wide; on other hosts 2

  2. Mycelium well developed, appendages not very fragile, interwoven with the secondary mycelium, forming a loose pigmented felt; on *Galium*, in Asia and Europe ..... (346) *G. riedlianus*

  2. Mycelium poorly developed, barely visible, appendages very fragile, forming a delicate interlacement, but not forming felt-like layers, asci oblong, length/width ratio around 2; on *Calceolaria* and *Galium aparine* in South America (Argentina) ..... (320) *G. calceolariae*

- *Leveillula* - a single species (on *Rubia*) ..... (166) *L. rubiae*

- Neoërysiphe

  1. Chasmothecia large, (80-)100-140(-160) µm diam., appendages hyaline, later sometimes faintly pigmented, ascospores not developed until after overwintering, i.e. asci in the current season always immature; on *Galium* spp. ..... (375) *N. galii*

  1. Chasmothecia smaller, 80-115 µm diam., appendages brown, ascospores develop in the current season on the living host; on *Rubia*, Turkey ..... (382) *N. rubiae*

  Anamorphs

- *Ovulariopsis* - a single species (on *Cephalanthus*) ..... (295) *Ov. cephalanthi*

- *Pseudoidium*

  On *Cephalanthus* ..... (781) *Ps. cephalanthi*
  On *Pavetta* ..... (817) *Ps. pavettae*

3.135 Rutaceae

- *Erysiphe* sect. *Microsphaera*

  1. Chasmothecia (60-)70-100(-110) µm diam., asci 4-5-spored; on Orixa ..... (593) *E. orixae*

  1. Chasmothecia larger, usually > 100 µm, asci (6-)8-spored; on *Citrus* ..... (607) *E. quercicola*

- *Erysiphe* sect. *Uncinula* - a single species (on *Tetradium daniellii*) ..... (691) *E. euodiae*

- *Golovinomyces* - a single species ..... (342) *G. orontii* [*Euoidium violae*]

- *Leveillula* - a single species ..... (167) *L. rutae*

- *Phyllactinia* - see key to the species of *Phyllactinia*

  Anamorphs

- *Fibroidium* - a single species (on *Citrus*) ..... (122) *F. tingitaninum*

- *Ovulariopsis*

  1. Mycelium white; conidia often curved, 15-23 µm wide; on *Zanthoxylum rhoifolium* ..... (299) *Ov. farinosa*

  1. Mycelium pale brown-ochraceous; conidia straight, narrower, 14-18 µm wide; on *Zanthoxylum fagara* ..... (310) *Ov. zanthoxyli*

- *Pseudoidium*

  1. Conidia doliiform to subcylindrical, about 30-48 x 13-18 µm; on *Citrus* ..... (465) *Ps. anacardi* (= *Oidium citri*) [see *Erysiphe quercicola*]
  1. Conidia ± ovoid, 19-38 x 11-18 µm; on *Boronia*, Australia ..... (775) *Ps. boroniae*

- *Setoidium* - a single species (on *Murraya*) ..... (12) *So. murrayae*

3.136 Sabiaceae

- *Erysiphe* sect. *Microsphaera* - a single species (on *Meliosma*) ..... (580) *E. meliosmae*
- *Phyllactinia* - a single species (on Sabia) ..... (273) *Ph. sabiae*

3.137 Salicaceae (incl. *Flacourtiaceae*)

- *Erysiphe* sect. *Microsphaera* - a single species (on *Flacourtia*) ..... (548) *E. flacourtiae*
- *Erysiphe* sect. *Uncinula*

  1. Appendages numbering only (5-)9-11(-13), width increasing towards the tip; on *Populus yunnanensis* ..... (739) *E. pseudocedrelae*
  1. Appendages numerous, more than 16 2
  2. Appendages very numerous, 78-150, about 5.6-7.6 um wide below, somewhat decreasing in width towards the tip; on *Populus adenopoda*, China ..... (697) *E. fragilis*
  2. Appendages about 17-100, width ± uniform throughout or somewhat increasing towards the tip or with very numerous appendages, 150-400 3
  3. Appendages uniformly short, 0.5-1 times the chasmothecial diam., 5-12 µm wide throughout, arising somewhat from the upper half 4
  3. Appendages longer, usually more slender; on *Idesia*, *Populus* or *Salix* 5
  4. Chasmothecia 95-170 µm diam., with 35-120 appendages, asci 3-6-spored, ascospores 18-28 x 10-16 µm; conidiophores and foot-cells relatively short, 40-65 µm and 25-40 µm, respectively; on *Salix* ..... (672) *E. capreae*
  4. Chasmothecia 150-225 µm diam., with 150-400 appendages, asci 2-4-spored, ascospores large, about 35 x 20 µm; conidiophores and foot-cells very long, 60-200 µm and 40-90(-110) µm, respectively; on *Salix* ..... (740) *E. pseudoregularis*
  5. Chasmothecia large, (95-)120-200 µm diam., width of the appendages mostly somewhat increasing towards the tip; walls thin or somewhat thicker below 6
  5. Chasmothecia smaller, usually 100-150 µm diam., width of the appendages almost uniform throughout and always thin-walled throughout 7
  6. Appendages numbering 35-120, thin-walled, but somewhat thicker towards the base; on *Populus* and *Salix*, Asia ..... (718) *E. mandshurica*
  6. Appendages numbering 19-40(-48), thin-walled throughout; on *Idesia*, India ..... (703) *E. idesiae*
  7. Appendages flexuous-sinuous, only numbering 17-40, asci 5-8-spored; on *Populus*, Asia ..... (734) *E. populicola*
  7. Appendages ± stiff, not sinuous, greater in number, (20-)25–110(-150), asci usually 3-6-spored 8
  8. Appendages simple, outline regular, without swellings or constrictions; on numerous hosts ..... (651) *E. adunca* var. *adunca*
  8. Appendages with irregular outline due to swellings and constrictions; Asia ..... (651) *E. adunca* var. *salicis-gracilistylae*

- *Pleochaeta* - a single species (on *Salix*) ..... (288) *P. salicicola*
- *Phyllactinia* - a single species (on various hosts) ..... (263) *P. populi*
- *Podosphaera* sect. *Podosphaera* - a single species (on *Salix*) ..... (27) *P. schlechtendalii*

3.138 Salvatoriaceae

- *Leveillula* - a single species ..... (169) *L. taurica*

3.139 Santalaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Thesium*) ..... (479) *E. thesii*
- *Erysiphe* sect. *Microsphaera* - a single species (on *Myoschilos*), South America .... (586) *E. myoschili*
- *Erysiphe* sect. *Uncinula* - a single species (on *Buckleya*) ..... (670) *E. buckleyae*

  Anamorph
- *Pseudoidium* - a single species (on *Santalum*) ..... (826) *Ps. santalacearum*

3.140 Sapindaceae incl. *Aceraceae*, *Hippocastanaceae*

- *Brasiliomyces* - a single species (on *Sapindus*) ..... (841) *B. setosus*
- *Erysiphe* sect. *Microsphaera* - a single species (on *Aesculus*) ..... (495) *E. alphitoides*
- *Erysiphe* sect. *Uncinula*

  1. Appendages with bulbous base; on *Koelreuteria* ..... (671) *E. bulbouncinula*
  1. Appendages without bulbous base 2
  2. Appendages dimorphic, with long equatorial appendages, apex coiled, upper part distinctly sinuous, and in addition with short bristle-like "appendages" (anchor hyphae) in the upper half (subsect. *Uncinuliella*); on *Aesculus* and *Sapindus* ..... (695) *E. flexuosa*
  2. Appendages not dimorphic, only with equatorial, uncinuloid appendages, not sinuous 3
  3. Appendages long, 2-8 times the chasmothecial diam., 30-80 in number, widely and loosely curved at the apex; on *Acer ibericum*, Armenia ..... (726) *E. paradoxa*
  3. Appendages shorter, 0.3-2 times the chasmothecial diam. 4
  4. Apex of the appendages helicoid, appendages thick-walled and pigmented below; on *Allophylus*, Africa ..... (656) *E. allophyli*
  4. Apex not helicoid; on other hosts 5
  5. Chasmothecia about 85-135 µm diam., with about 4-45 appendages, 0.5-2 times as long as the chasmothecial diam. 6
  5. Chasmothecia 115-270(-310) µm diam., with about 90-170 appendages, shorter than the chasmothecial diam., asci 6-8-spores 8
  6. Chasmothecia with only 4-19 appendages, 0.5-1.5 times as long as the chasmothecial diam., width narrowed towards the apex; on *Sapindus* ..... (745) *E. sapindi*
  6. Chasmothecia with (10-)18-40(-50) appendages, 1-2 times the chasmothecial diam.., width variable, almost equal throughout, somewhat increasing from base to top or at first increasing and then decreasing towards the apex; on *Acer* in Asia (*E. ljubarskii* s. lat.) 7
  7. Apex of the appendages usually not enlarged ..... (712) *E. ljubarskii* var. *ljubarskii*
  7. Apex of the appendages somewhat enlarged ..... (712) *E. ljubarskii* var. *aduncoides*
  8. Chasmothecia 115-225 µm diam., appendages thin-walled; on *Acer* in North America ..... [see (133) *Takamatsuella circinata*]
  8. Chasmothecia (150-)195-270(-310) µm diam., appendages thin-walled above, thick towards the base; on *Acer* in China ..... [see (129) *Sawadaea nankinensis*]

- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Sawadaea* - see key to the species of *Sawadaea*
- *Takamatsuella* - a single species (on *Acer* spp.) ..... (133) *T. circinata*

  Anamorph
- *Pseudoidium* - a single species (on *Nephelium*) ..... (813) *P. nephelii*

3.141 Sapotaceae

- *Oidium* s. lat. - *Oidium* sp. on *Lucuma*, South America (Amano 1986)

3.142 Saxifragaceae (excl. *Grossulariaceae*, *Hydrangeaceae*, *Parnassiaceae*)

- *Erysiphe* sect. *Erysiphe*

  1. Appendages dimorphic, short, stiff, terminal, as well as long mycelioid and equatorial to subequatorial; on *Rodgersia*, Asia ..... (466) *E. rodgersiae*
  1. Appendages uniform, mycelioid 2
  2. Chasmothecia very small, 60-75 µm diam.; on *Chrysosplenium ramosum* ..... (464) *E. pusilla*
  2. Chasmothecia larger, diam. > 75 µm 3
  3. Chasmothecia (70-)80-115(-120) µm diam., appendages not very numerous; on *Chrysosplenium*, *Saxifraga*, Asia ..... (440) *E. krumbholzii*
  3. Chasmothecia 105-150 µm diam., appendages numerous, brown; on *Aceriphyllum*, Korea .... (393) *E. aceriphylli*

- *Leveillula* - a single species ..... (169) *L. taurica*
- *Phyllactinia* - a single species ..... (236) *Ph. guttata* s. lat.
- *Podosphaera* sect. *Sphaerotheca*

  1. Peridium cells of the chasmothecia small, 8-25 µm diam., at least some appendages arising from upper half of chasmothecium, long and setiform, not mycelioid, straight or usually widely curved, becoming thick-walled ..... (40) *P. astilbicola*
  1. Peridium cells large and conspicuous, (10-)15-45(-55) µm diam., appendages in the lower half, often mycelioid, flexuous, thin-walled throughout 2
  2. Ascospores small, often subglobose, 13-22 x 10-16 µm; on *Saxifraga alpina* ..... (37) *P. alpina*
  2. Ascospores large, ellipsoid, 18-30 x 11-18 µm; on *Heuchera*, *Saxifraga*, *Tellima*, *Tiarella*, North America, introduced in Europe ..... (76) *P. macrospora*

3.143 Schisandraceae

- *Erysiphe* sect. *Microsphaera* - a single species (on *Schisandra*) ..... (615) *E. schizandrae*

3.144 Scrophulariaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Phygelius*) ..... (456) *E. phygelii*
- *Golovinomyces*

  1. Chasmothecia with very short and narrow appendages, shorter than the chasmothecial diam., 3.5-7.5 µm wide; conidiophores very long up to 200 µm, foot-cells 90-150 µm in length, conidia catenescent, ovoid-doliiform, rather wide, 30-45(-60) x 19-28(-30) µm, length/width ratio more than 2; on *Verbascum* ..... (355) *G. verbasci*
  1. Chasmothecia rarely formed, but with well-developed, long appendages, often wider; conidiophores shorter, foot-cells shorter than 100 µm, conidia narrower; on other hosts ..... (342) *G. orontii*

- *Neoërysiphe* - a single species (on *Chelone*, North America) ..... (372) *N. chelones*
- *Leveillula*

  1. Conidia relatively broad, primary conidia ± broadly ovoid or ellipsoid-ovoid, secondary conidia ellipsoid-ovoid, 35-55 x 15-26 µm; on Verbascum ..... (172) *L. verbasci*
  1. Conidia long and slender, primary conidia ± lanceolate, apically pointed, secondary conidia ± ellipsoid-cylindrical, 30-80 x 9-22 µm; on other hosts ..... (169) *L. taurica* s. lat.

- *Phyllactinia* - see key to the species of *Phyllactinia*

- *Podosphaera* sect. *Sphaerotheca*

  1. Chasmothecia relatively small, about 60-90 µm diam., average < 80 µm, ascus with small terminal oculus, about 8-15 µm diam.; on Scrophularia ..... (87) *P. phtheirospermi*
  1. Chasmothecia larger, ca. 80-110 µm diam., average > 80 µm, ascus with larger terminal oculus, ca. 15-25 µm diam.; on *Scrophularia* ..... (107) *P. xanthii*

  Anamorphs

- *Pseuoidium*

  On *Buddleja*

  1. Appressoria multilobed; conidiophores geniculate-curved: South Africa ..(777) *Ps. buddlejae*
  1. Appressoria nipple-shaped; conidiophores straight; Asia (India) (778) *Ps. buddlejae-asiaticae*

3.145 Simarubaceae

- *Erysiphe* sect. *Microsphaera* - a single species (on *Picrasma*) ..... (600) *E. picrasmae*
- *Erysiphe* sect. *Uncinula*

  1. Chasmothecia with 5-12 appendages, shorter than the chasmothecial diam., about 5-8 asci; on *Ailanthus* ..... (688) *E. delavayi*
  1. Chasmothecia with 10-25 appendages, about 1.5-2 times the chasmothectal diam., about 4-6 asci; on *Picrasma* ..... (731) *E. picrasmicola*

- *Phyllactinia* - a single species (on Ailanthus) ..... (188) *Ph. ailanthi*

  Anamorph

- *Pseudoidium* - a single species (on *Ailanthus*) ..... (768) *Ps. ailanthi*

3.146 Solanaceae

- *Arthrocladiella* - a single species (on Lycium) ..... (387) *A. mougeotii*
- *Erysiphe* sect. *Uncinula* - a single species (on Jaborosa) ..... (706) *E. jaborosae*
- *Golovinomyces*

  1. Chasmothecia usually formed, appendages often poorly developed but usually shorter than the chasmothecial diam., asci 2-spored, ascospores frequently developed; on Hyoscyamus ..... (334) *G. hyoscyami*
  1. Chasmothecia very rarely formed, appendages well-developed, longer, asci often 3-spored; on other hosts ..... (342) *G. orontii*

- *Leveillula* - a single species (on various hosts) ..... (169) *L. taurica*
  [Voytyuk (2007) recorded *L. braunii* on *Capsicum* in Israel]
- *Phyllactinia* - a single species (on *Lycium*, South America) ..... (216) *P. chubutiana*
- *Podosphaera* sect. *Sphaerotheca*

  1. Asci with a small oculus (thin apical portion), 10-15 µm diam. ..... (98) *P. solanacearum*
  1. Asci with large oculus, about 15-25 µm diam. ..... (107) *P. xanthii*

  Anamorphs

- *Euoidium*

  1. Width of the conidiophores distinctly increasing from base to top, foot-cells of the conidiophores 40-90 µm long, followed by 1-2 cells, 50-300 µm long; on *Nicotiana*, *Petunia* and *Solanum* ..... (362) *Eu. longipes*

1. Width of the conidiophores not distinctly increasing, foot-cells followed by 1-3 much shorter cells 2
2. Foot-cells 95-180 µm long; on *Solanaceae* in Australia ..... (362) *Eu. lycopersici*
2. Foot-cells 30-100 µm long; on *Solanaceae*, almost worldwide ..... (342) *Eu. violae* [*Golovinomyces oronti*]

- *Pseudoidium* - a single species (on *Solanum lycopersicum*) ..... (812) *Ps. neolycopersici*
- *Striatoidium* - a single species (on Jaborosa) ..... (385) *St. jaborosae*

3.147 Stachyuraceae

- *Phyllactinia* - *Phyllactinia* sp., on *Stachyurus*, Japan (Amano 1986)

3.148 Staphylaceae

- *Erysiphe* sect. *Microsphaera* - a single species (on *Staphylea*) ..... (625) *E. staphyleae*
- *Erysiphe* sect. *Uncinula* - a single species (on *Euscaphis*) ..... (693) *E. euscaphidis*

3.149 Sterculiaceae (see Malvaceae)

3.150 Styracaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on Styrax) ..... (450) *E. monascogera*
- *Erysiphe* sect. *Microsphaera* - a single species (on *Styrax*) ..... (584) *E. miyabeana*
- *Erysiphe* sect. *Uncinula*

1. Chasmothecial appendages flexuous, often geniculate, abruptly bent; on *Styrax obassia*, Japan ..... (752) *E. togashiana* var. *togashiana*
1. Appendages straight to curved, not geniculate; on *Pterostyrax hispida*, Japan ..... (752) *E. togashiana* var. *rigida*

3.151 Symplocaceae

- *Erysiphe* sect. *Erysiphe*

1. Chasmothecia 70-90 µm diam., with very few appendages, less than 10, hyaline to yellowish, asci 7-8-spored; on *Symplocos racemosa* ..... (476) *E. symploci*
1. Chasmothecia (70-)80-110(-120) µm diam., with numerous appendages, more than 10, brown, asci 4-6(-7)-spored; on *Symplocos chinensis* and *S. paniculata* ..... (477) *E. symplocicola*

- *Erysiphe* sect. *Microsphaera*

1. Appendages long and flexuous, 1.5-3.5 times the chasmothecial diam., mostly 2-2.5 times, chasmothecia 60-95 µm diam.; on *Symplocos*, China ..... (629) *E. symplocigena*
1. Appendages short, 0.5-1.5 times the chasmothecial diam., often somewhat shorter than the diam., chasmothecia 70-115(-130) µm diam.; on *Symplocos*, China, Japan ..... (591) *E. nomurae*

- *Phyllactinia* - a single species ..... (236) *P. guttata* s. lat.

3.152 Tamaricaceae

- *Podosphaera* sect. *Sphaerotheca* - *Podosphaera* sp. ("*P. macularis*"), on *Tamarix*, USA (Amano 1986), a very doubtful record

3.153 Thymelaeaceae

- *Erysiphe* sect. *Microsphaera* - a single species (on Ovidia) ..... (595) *E. ovidiae*
- *Leveillula* - a single species ..... (169) *L. taurica*

3.154 Tiliaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Triumfetta*, South Africa) ..... (420) *E. doidgeae*
- *Erysiphe* sect. *Microsphaera* - a single species (on *Tilia*) ..... (634) *E. tiliae*
- *Erysiphe* sect. *Uncinula*

  1. Chasmothecia 90-185 µm diam., with 15-40 appendages, width always increasing up to the circinate tip; on *Tilia americana*, North America ..... (681) *E. clintonii*
  1. Chasmothecia 80-125 µm diam., with 6-25 appendages; on *Tilia* in Asia (*E. oleosa* s. lat.) 2
  2. Width of the appendages almost uniform throughout or somewhat increasing towards the tip, but circinate apex not enlarged, sometimes even narrowed within the coil; on various host species, China to Japan ..... (725) *E. oleosa* var. *oleosa*
  2. Width usually increasing from base to top, circinate apex also somewhat enlarged; on *Tilia maximowicziana* and *T. miqueliana*, Japan ..... (725) *E. oleosa* var. *zhengii*

- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.
- *Phyllactinia* - a single species ..... (236) *Ph. guttata* s. lat

Anamorphs

- *Pseudoidium*

  On *Grewia* ..... (793) *Ps. grewiae*
  On *Triumfetta* ..... (830) *Ps. tirumalense*

3.155 Tropacolaceae

- *Leveillula* - a single species (on Tropaeolum) ..... (171) *L. tropaeolicola*

3.156 Ulmaceae (see also *Cannabaceae*)

- *Erysiphe* sect. *Microsphaera* - a single species (on Ulmus) ..... (588) *E. neglecta*
- *Erysiphe* sect. *Uncinula*

  1. Upper part of appendages (below the circinate apex) spirally twisted, asci 2-spored, chasmothecia 55-110 µm diam.; on Ulmus, Asia ..... (707) *E. kenjiana*
  1. Upper part of appendages not twisted below the apex 2
  2. Asci (2-)3-8-spored ..... (755) *E. ulmi* var. *ulmi-foliaceae*
  2. Asci 2-spored 3
  3. Chasmothecia (70-)75-100(-115) µm diam., with 9-19 appendages, width increasing towards the tip; on *Ulmus*, Europe, Asia ..... (755) *E. ulmi* var. *ulmi*
  3. Chasmothecia (95-)120-170(-190) µm diam., with mostly 45-85 appendages, width uniform throughout; on *Ulmus*, North America ..... (715) *E. macrospora*

- *Phyllactinia* - see key to the species of *Phyllactinia*
- *Podosphaera* sect. *Podosphaera* - a single species (on *Ulmus*) ..... (31) *P. spiralis*

Anamorphs

- *Pseudoidium* - a single species (on *Holoptelea*) ..... (796) *Ps. holopteleae*

3.157 Urticaceae

- *Erysiphe* sect. *Erysiphe*

  1. Chasmothecial appendages 0.5-1.5 times as long as the chasmothecial diam., narrow, (3-)4-6(-7.5) µm wide, hyaline or only faintly pigmented; on *Urtica*, rarely *Pilea* ..... (482) *E. urticae*
  1. Chasmothecial appendages longer, up to about 4 times the chasmothecial. diam., wider, up to about 9 µm, at least below; on *Laportea* or *Pilea* 2
  2. Chasmothecia 100-150 µm diam., appendages hyaline or only somewhat brownish below; on *Laportea*, Japan ..... (451) *E. otanii*
  2. Chasmothecia smaller, 80-120(-130) µm diam., appendages brown throughout when mature or brown below and paler above; on *Pilea*, Asia ..... (457) *E. pileae*

- *Golovinomyces*

  1. Chasmothecia 120-170 µm diam., often immersed in the dense mycelium; on *Laportea*, Japan ... . (337) *G. laporteae*
  1. Chasmothecia 80-145 µm diam., not immersed in the mycelium; on other hosts 2
  2. Chasmothecia frequently formed, usually scattered; mycelium thin, effuse; on *Parietaria*, *Pilea*, North America ..... (332) *G. greeneanus*
  2. Chasmothecia very rarely formed, ± gregarious; occasional infections on other hosts, Asia, Europe ..... (342) *G. orontii*

- *Leveillula* - a single species ..... (169) *L. taurica*

- *Phyllactinia* - see key to the species of *Phyllactinia*

- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Parietaria*, Central Asia, introduced in Europe) ..... (85) *P. parietariae*

  Anamorphs

- *Euoidium*

  1. Foot-cells of the conidiophores straight; on *Gonostegia* and *Urtica*, India ..... (369) *Eu. urticae*
  1. Foot-cells often curved ..... (342) *Eu. violae* [*Golovinomyces orontii*]

- *Oidiopsis* - a single species (on *Parietaria*) ..... (179) *Os. parietariae*

- *Oidium* s. lat. (generic affinity unclear) - a single species (on *Gonostegia*) ..... (853) *O. gonostegiae*

3.158 Valerianaceae

- *Golovinomyces*

  1. On *Valeriana* and *Centranthus* ..... (354) *G. valerianae*
  1. On *Valerianella* ..... (342) *G. orontii*

3.159 Verbenaceae

- *Erysiphe* sect. *Microsphaera* - a single species (on *Verbena*) ..... (640) *E. verbenicola*

- *Golovinomyces*

  1. Chasmothecia frequently formed; conidiophores usually straight and somewhat constricted at the basal septum; on *Verbena*, Asia, North America ..... (356) *G. verbenae*
  1. Chasmothecia very rarely formed; conidiophores often curved at the base and not constricted at the basal septum; occasional infections, in Europe and Asia, on *Verbena* ..... (342) *G. orontii*

- *Leveillula* - a single species ..... (169) *L. taurica* s. lat.

- *Podosphaera* sect. *Sphaerotheca*

1. Peridium cells small, 10-25 µm diam., appendages very long, only 0-2-septate, asci small, 35-50 x 30-50 µm, 5-7-spored, spores 20-23 x 10-13 µm; on *Callicarpa*, Japan ..... (44) *P. callicarpae*

1. Peridium cells larger, 15-55 µm diam., and/or appendages shorter, with more septa, asci larger, 8-spored, spores small, usually shorter than 20 µm 2

2. Peridium cells of medium size, 10-35 µm diam., mostly 15-30 µm; on *Clerodendron*, Japan ..... (73) *P. intermedia*

2. Peridium cells very large, (10-)15-55 µm, frequently > 30 µm diam.; on *Verbena*, *Gmelina* ..... (107) *P. xanthii*

Anamorphs

- *Fibroidium* - a single species (on *Diostea*) ..... (113) *F. diosteae*
- *Ovulariopsis* - a single species (on *Duranta*) ..... (296) *Ov. durantae*
- *Pseudoidium* - a single species (on *Stachytarpheta*) ..... (828) *Ps. stachytarphetae*
- *Striatoidium* - a single species (on Aloysia) ..... (382) *Sto. aloysiae*

3.160 Violaceae

- *Golovinomyces* - a single species (on *Viola*) ..... (342) *G. orontii*
- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Viola*) ..... (105) *P. violae*

3.161 Vitaceae

- *Golovinomyces* - a single species ..... (342) *G. orontii* [as *Euoidium violae*]
- *Erysiphe* sect. *Uncinula*

1. Chasmothecial appendages long and flexuous, 1-6, mostly 2-5 times as long as the chasmothecial diam.; on *Ampelopsis* and *Vitis* ..... (722) *E. necator* var. *necator*

1. Appendages shorter, rather stiff, 0.75-2.5, mostly about 2 times the chasmothecial diam.; on *Parthenocissus*, North America ..... (722) *E. necator* var. *ampelopsidis*

- *Phyllactinia* - a single species (on *Ampelopsis*, *Parthenocissus* and *Vitis*) ..... (193) *Ph. ampelopsidis*
- *Podosphaera* sect. *Sphaerotheca* - a single species (on *Cayratia*) ..... (49) *P. cayratiae*

Anamorph

- *Ovulariopsis* - a single species (on *Ampelopsis glandulosa*) ..... (291) *O. ampelopsidis-ciliatae*

3.162 Vochysiaceae

- *Erysiphe* sect. *Uncinula*

1. Chasmothecia 80-130 µm diam., appendages thin-walled, apex circinate; on *Qualea grandiflora*, Brazil ..... (701) *E. heringeriana*

1. Chasmothecia smaller, diameter < 100 µm, appendages thick-walled, apex uncinate; on *Qualea parviflora*, Brazil ..... (760) *E. viegasii*

3.163 Zygophyllaceae

- *Erysiphe* sect. *Erysiphe* - a single species (on *Peganum*) ..... (395) *E. alashanensis*
- *Leveillula* - a single species ..... (169) *L. taurica*

Anamorph

- *Pseudoidium* - a single species (on *Tribulus*) ..... (831) *P. tribuli*

4 Parauncinula

Key to the species

1. Width of the chasmothecial appendages more or less equal throughout, septate up to the circinate part; on *Quercus* spp., Asia ..... (2) *P. septata*

1. Width of the chasmothecial appendages somewhat decreasing towards the apex, septa not reaching the upper part; on *Fagus* spp., Japan ..... (1) *P. curvispora*

5 Cystotheca

Key to the species of *Cystotheca*

1. Chasmothecia with numerous, very long appendages, 100-500 µm; on *Calophyllum apetalum*, *Hypericaceae* (*Guttiferae*) ..... (6) *C. indica*

1. Appendages of the chasmothecia lacking or few, very short, shorter than the chasmothecial diam., usually less than 80 µm in length; on hosts of the *Fagaceae* 2

2. Special aerial hyphae curved to falcate, 80-200(-250) µm long and 5-16(-20) µm wide 3

2. Special aerial hyphae lacking or filiform, longer, up to about 450 µm long, and narrower, (2.5-)3-6.5(-7.5) µm wide 4

3. Mycelial patches dark, at first pale brown, later turning dark brown or sometimes nearly black; chasmothecia 60-75(-90) µm diam.; asci (6-)8-spored; on various hosts of the *Fagaceae*, Asia ..... (11) *C. wrightii*

3. Mycelial patches at first with hyaline, thin primary mycelium; chasmothecia somewhat larger, 60-90(-95) µm diam.; asci 4-5(-8)-spored; on *Quercus incana*, India ..... (9) *C. quercina*

4. Special aerial hyphae lacking; chasmothecia (60-)70-80(-85) um diam.; on *Castanopsis* spp., China ..... (5) *C. esetacea*

4. Special aerial hyphae developed, filiform 5

5. Mycelial patches dark brown to nearly black; chasmothecia 90-130 µm diam.; appendages lacking or rudimentary; asci subglobose, 80-105 µm diam.; on *Castanea argentea*, Java ..... (10) *C. tjibodensis*

5. Mycelial patches at first whitish, later greyish to light brown or purplish brown; appendages present; asci broadly ellipsoid-ovoid to subglobose; on *Quercus* spp. 6

6. Mycelial patches at first whitish, later greyish to light brown; chasmothecia 75-115(-135) µm diam.. appendages present, short, narrow; asci 75-100 50-70 um; on various hosts of the *Fagaceae*, North America, Asia ..... (7) *C. lanestris*

6. Mycelial patches purplish brown; chasmothecia smaller, 60-70 µm diam.; asci smaller, about 60-75 x 35-45 µm; on *Quercus multinervis*, China ..... (8) *C. nanyuensis*

6 Podosphaera

6.1 Podosphaera sect. Podosphaera

Key to the species

1. Chasmothecia with appendages spreading radially around the equator or some appendages somewhat in the upper upper half, straight to curved upwards, but never formed as terminal tuft, sometimes even arising from the lower half (subsect. *Podosphaera*) 2

1. Appendages in the upper half of the chasmothecia, few, only 1-8, often almost fasciculate, usually ± straight but pointing in one direction (subsect. *Tridactyla*) 21

2. Appendages arising from the lower half of the chasmothecia, rather mycelioid, geniculate-flexuosa; on *Prunus incana*, Georgia ..... (26) *P. salatai*

2. Appendages ± equatorial, stiff, setiform or flexuous, but not geniculate; on other hosts 3

3. Appendages very long, 1.5-8 times as long as the chasmothecial diam., thin-walled, wall only slightly thicker at the base, 0-1-septate, apex only 1-2(-3) times branched, primary branches usually elongated and somewhat recurved; on *Hamamelis*, North America ..... (15) *P. biuncinata*

3. Appendages either shorter (0.5-3.5 times the chasmothecial diam.) and/or thick-walled, with more than two septa, strongly branched 4

4. Appendages with a single septum at the thick-walled base, thin-walled above, hyaline, tips of the ultimate branchlets distinctly recurved when mature, ascomata small, 55-75 µm diam.; on Viburnum, Japan ... . (33) *P. viburni*

4. Appendages with two or more septa, septa reaching the upper half of the stalk, appendages pigmented and moderately thick-walled throughout, and/or chasmothecia larger, about 70-105 µm diam.; on other hosts 5

5. Chasmothecia small, 60-75 µm diam., tips of the ultimate branchlets distinctly recurved, ascospores small, 13-20 x 11-13 µm; on *Cercidiphyllum*, Japan ..... (16) *P. cercidiphylli*

5. Either chasmothecia larger and/or tips of the ultimate branchlets knob-like, not recurved or rarely only slightly so; on other hosts 6

6. Appendages very long, 1.5-10 times the chasmothecial diam.; on *Vaccinium* 7

6. Appendages shorter, about 0.5-4.5 times the chasmothecial diam.; on hosts of the *Rosaceae* or *Betula* 8

7. Appendages about 1.5-6 times the chasmothecial diam., rather stiff . (24a) *P. myrtillina* var. *myrtillina*

7. Appendages longer and flexuous, mostly about 5-10 times the chasmothecial diam. .... (24b) *P. myrtillina* var. *major*

8. Chasmothecia (55-)60-85(-90) µm diam., with 3-8 appendages, ascospores small and almost globose, 13.5-20 x 10-14 µm; on *Erineum* galls of *Betula*, China, Russia ..... (19) *P. erineophila*

8. Chasmothecia 60-110 µm diam., with 4-25 appendages, ascospores larger, (15-)18-25(-30) x 10-18 µm; on *Rosaceae* 9

9. Ascospores curved, bean- to crescent-shaped; on *Cydonia* and *Sorbus*, Asia 10

9. Ascospores ellipsoid-ovoid, not curved or only a few ascospores occasionally slightly curved 11

10. Chasmothecia about 70-90 µm diam., ascospores always distinctly curved, crescent-shaped, sometimes strongly so; on *Sorbus alnifolia* and *S. commixta*, Japan ..... (18) *P. curvispora*

10. Chasmothecia larger, about (85-)90-100(-110) µm diam., ascospores slightly curved, bean-shaped; on *Cydonia oblonga*, India, Israel ..... (17b) *P. clandestina* var. *cydoniae*

11. Chasmothecial appendages few, usually 2-6; on *Sorbus* or *Spiraea douglasii* 12

11. Chasmothecial appendages numerous, usually 5-20; on numerous genera of the *Rosaceae* (including *Sorbus commixta* in Asia, Japan and *Spiraea* spp.) 13

12. Appendages 1-3 times as long as the chasmothecial diam., 2-7-septate; on *Sorbus aucuparia*, occasionally on other *Sorbus* species, Europe to Asia (China) ..... (14) *P. aucupariae*

12. Appendages (1.5-)2-4.5 times as long as the chasmothecial diam., mostly 5-10-septate; on *Spiraea douglasii*, North America ..... (29) *P. spiraeae-douglasii*

13. Appendages 5-15, mostly 6-12, per chasmothecium; on *Crataegus*, *Cydonia*, *Mespilus* and *Pyrus* ...14

13. Appendages more numerous, up to about 35 per chasmothecium, often more than 15; on *Amelanchier*, *Crataegus*, *Holodiscus*, *Prunus*, *Spiraea* 15

14. Appendages usually 1-2 times as long as the chasmothecial diam.; on *Crataegus*, *Cydonia*, *Mespilus* and *Pyrus*, Europe to Asia, North America, introduced in other parts of the world ..... (17a) *P. clandestina* var. *clandestina*

14. Appendages 1-3.5(-4) times as long as the chasmothecial diam.; on *Crataegus* spp., North America ..... (17d) *P. clandestina* var. *perlonga*

15. Terminal oculus of the asci small, 8-12 µm diam., often rather inconspicuous; on *Holodiscus* and *Spiraea* sp. 16

15. Terminal oculus of the asci larger, mostly 15-20 µm diam., appendages 1-3 times as long as the chasmothecial diam.; on *Amelanchier*, *Crataegus*, *Prunus*, *Spiraea japonica* 18

16. Appendages relatively short, (0.5-)0.75-2(-2.5) times the chasmothecial diam.; on *Spiraea* spp. in Asia and North America ..... (23a) *P. minor* var. *minor*

16. Appendages longer, 1.5-3.5 times as long as the chasmothecial diam.; on *Holodiscus discolor* or *Spiraea corymbosa* 17

17. Chasmothecia with up to 20 appendages, 5-10-septate; on *Spiraea douglasii* ..... (23b) *P. minor* var. *longissima*

17. Chasmothecia with 5-12 appendages, 2-7-septate; on *Holodiscus discolor*, North America ..... (20) *P. holodisci*

18. Apices of appendages (30-)40-60(-70) µm wide, regularly branched, not deeply cleft; on *Spiraea japonica* ..... (30) *P. spiraeicola*

18. Apices of appendages about 20-50 µm wide (when tightly branched, i.e. with short primary branches) 19

19. Occasionally with elongated primary branches, deeply cleft or even branched near the base, mature asci usually thin-walled, 1-2 µm wide; on *Amelanchier*; North America, introduced in Europe ..... (13) *P. amelanchieris*

19. Primary branched always very short, branched part very compact, deeply cleft appendages rare, wall of mature asci usually thicker, (1-)2-3(-4) µm wide; on *Crataegus* and *Prunus*, North America 20

20. Chasmothecia usually with 6-20(-25) appendages; on *Prunus* ..... (25) *P. prunicola*

20. Chasmothecia usually with (6-)10-35(-38) appendages; on *Crataegus* ..... (17c) *P. clandestina* var. *luxurians*

21. Appendages spirally twisted; on *Ulmus*, Japan ..... (31) *P. spiralis*

21. Appendages not twisted, straight 22

22. Appendages very long, about 6-12 times the chasmothecial diam.; on *Salix*, Europe ..... (27) *P. schlechtendalii*

22. Appendages shorter, about 1-6 times the chasmothecial diam.; on other hosts 23

23. Apex of the appendage usually unbranched, occasionally 1-2 times branched 24

23. Apex of the appendages always branched 25

24. Appendages usually simple, hyaline or only somewhat brown at the very base, aseptate but apex sometimes 1-2(-3) times dichotomously branched; on *Malus* ..... (21) *P. leucotricha*

24. Appendages always unbranched, brown and septate; on *Crataegus*, China ..... (28) *P. setacea*

25. Chasmothecia with only 1-2(-3) appendages; Asia, China, on *Prunus* sp. ..... (34) *P. wuyishanensis*

25. Chasmothecia with (1-)2-6(-8) appendages; on *Prunus* (s. lat.) spp. (*P. tridactyla* s. lat.) 26

26. Appendages rather long, up to 450 µm, with up to 6 septa, asci 5-8-spored; on *Prunus buergeriana* and *P. grayana*, Japan ..... (22) *P. longiseta*

26. Appendages usually shorter, variable but mostly up to about 300 µm, 0-4(-6) septa; asci (4-)6-8-spored; on various host species of *Prunus* s. lat., widespread ..... (32) *P. tridactyla*

6.2 Podosphaera sect. Sphaerotheca

Key to the species

1. Peridium of chasmothecium thin, yellowish, semitransparent composed of daedaleoid cells, about 10-35 µm diam.; on *Gunnera magellanica*, Argentina ..... (70) *P. gunnerae*

1. Peridium dark, not semitransparent, cells different; on other hosts 2

2. Outer peridium cells not very conspicuous, relatively small, 5-25 µm diam., average usually below 20 µm (subsect. *Sphaerotheca*) 3

2. Outer peridium cells conspicuous, larger, 10-55 µm diam., average above 20 µm, sometimes above 30 µm [or in intermediate species, outer peridium cells usually rather conspicuous, 10-30 µm diam., averaging between 15 and 25 µm] 33

3. Infections on small, densely arranged witches' brooms caused by proliferations of buds of *Celtis occidentalis*; appendages few (0-10), very short; North America ..... (89) *P. phytoptophila*

3. Not on witches' brooms; on other hosts 4

4. Chasmothecial appendages absent or very few, 0-10, short, rudimentary (on *Croton* or *Dryas*) 5

4. Appendages well-developed, numerous, short to long; on other hosts 6

5. Chasmothecia small, about 65-95 µm diam.; conidial state sparingly developed, inconspicuous, conidia usually not developed; on *Dryas*, Europe ..... (106) *P. volkartii*

5. Chasmothecia larger, about 95-120 µm diam.; conidial state well-developed, conidia abundant; on *Croton*, India ..... (53) *P. crotonis*

6. Secondary mycelium present, formed as dense, pannose mycelium that turns yellowish, yellowish brown, brown or dark brown; hyphae usually becoming ± thick-walled; chasmothecia ± immersed in mycelial patches (on *Euphorbia*, *Geranium*, *Linum*, *Prunus*, *Ribes*, *Rosa*, *Stephanandra*) 7

6. Secondary mycelium not developed, mycelium white, evanescent to persistent, neither becoming thick-walled nor pigmented (some species with very long appendages may form brown patches on the host leaves, but these patches are only formed by the appendages themselves) 12

7. Appendages numerous, well-developed, often densely crowded around the ascoma, long, 1-5 times as long as the chasmothecial diam.; on *Geranium* ..... (67) *P. fugax*

7. Appendages few, often sparingly developed, not densely crowded, usually rather short, about as long as the chasmothecial diam., often shorter, occasionally up to 3 times the chasmothecial diam.; on other hosts 8

8. Hyphae of the secondary mycelium narrow, 3-7 µm wide; conidia usually ± cylindrical and slender, only about 12.5-16.5 µm wide; on *Euphorbia*, Europe ..... (62) *P. euphorbiae*

8. Hyphae of the secondary mycelium wider, about 3-9.5 µm; on other hosts 9

9. Hyphae of the secondary mycelium long, setiform, thick-walled; conidia broadly ellipsoid-ovoid, doliiform, 11-20 µm wide; on *Ribes* ..... (79) *P. mors-uvae*

9. Hyphae of the secondary mycelium either flexuous and contorted or not thick-walled; conidia narrower, only 10-16 µm wide; on other hosts 10

10. Chasmothecia large, 80-125 µm diam.; appendages thin-walled; hyphae of the secondary mycelium thin-walled, later becoming moderately thick-walled; on *Linum* ..... (75) *P. lini*

10. Chasmothecia either smaller, 65-115 µm diam., or hyphae of the secondary mycelium thick-walled . 11

11. Hyphae of the secondary mycelium frequently branched; on *Stephanandra*, Asia ..... (101) *P. stephanandrae*

11. Hyphae of the secondary mycelium rarely branched; on *Rosa*, *Prunus* ..... (83) *P. pannosa*

12. Appendages very long, 5-12 times as long as the chasmothecial diam., strongly sinuous and thick-walled throughout; on *Euphorbia helioscopia*, Japan ..... (63) *P. euphorbiae-helioscopiae*

12. Appendages shorter, thin-walled or only thicker towards the base 13

13. Appendages rather long, about 1-6 times as long as the chasmothecial diam., at least partly arising from the upper half of the ascoma 14

13. Appendages short to long, but always confined to the lower half of the ascoma 20

14. Appendages flexuous, thin-walled or only slightly thickened below; on *Humulus* or *Parietaria* (in the *Podosphaera* on *Epilobium* the appendages usually arise from the lower half, but occasionally they may reach the upper half; see *P. epilobii*) 15

14. Appendages rather setiform, straight to curved, always conspicuously thick-walled towards the base; on *Filipendula*, *Spiraea*, *Sanguisorba*, *Polemonium* or *Astilbe* 16

15. Mycelium amphigenous, maculate (characteristic symptoms caused by numerous limited patches on leaves); on *Humulus* ..... (77) *P. macularis*

15. Mycelium amphigenous, effuse, thin, inconspicuous, not maculate; on *Parietaria*, Central Asia, Europe ..... (85) *P. parietariae*

16. Mycelium dense, forming persistent patches, sometimes completely covering stems and leaves causing disfiguration and distortion; on *Filipendula* or *Spiraea* 17

16. Mycelium evanescent to persistent, white, forming patches or effuse and sometimes completely covering leaves, but leaves and stems not disfigured or distorted 18

17. On *Filipendula* spp. ..... (66) *P. filipendulae*

17. On *Spiraea* spp. ..... (100) *P. spiraeae*

18. Mycelium evanescent to subpersistent; appendages only 1-4(-4) times as long as the chasmothecial diam.; on *Astilbe*, Chima to Japan ..... (40) *P. astilbicola*

18. Mycelium usually persistent; appendages mostly longer, 3-6 times as long as the chasmothecial diam.; on *Sanguisorba* or *Polemonium* 19

19. Conidia usually 25-35 x 14-22 µm; on *Sanguisorba* (*Rosaceae*) ..... (65) *P. ferruginea*

19. Conidia usually narrower, 25-30(-35) x 11.5-17 µm; on *Polemonium* (*Polemoniaceae*) (91) *P. polemonii*

20. Appendages long, about 1-5 times as long as the chasmothecial diam., only 0-3-septate; asci 5-7-spored; on *Callicarpa*, Japan ..... (44) *P. callicarpae*

20. Appendages either shorter or (if long) with more septa; asci (6-)8-spored 21

21. Chasmothecia, small, about 50-65 µm diam., hypophyllous, scattered; appendages shorter than the chasmothecial diam., narrow, 2.5-5 µm wide; on *Sorbus*, Europe ..... (81) *P. niesslii*

21. Chasmothecia larger and or appendages longer and wider 22

22. Appendages 05-6 times as long as the chasmothecial diam.. characteristically contorted, sinuous-twisted, sometimes even subhelicatd, becoming thick-walled (on *Rhus* or *Escallonia*) 23

22. Appendages ± mycelioid, often contorted, but not characterstically sinuous-twisted, thin-walled 24

23. On *Rhus* (*Anacardiaceae*), North America ..... (92) *P. pruinosa*

23. On *Escallonia* (*Escalloniaceae*), South America ..... (80) *P. negeri*

24. Ascospores small, often subglobose, 11-22.5 x 9-16 µm, average length < 20 µm; on *Biebersteinia*, *Erodium*, *Adonis* or *Papaver* (Europe to Central Asia, Mediterranean region, North Africa) 25

24. Ascospores larger, about 16-30 µm long, average >20 µm (if shorter, then in North America), on *Epilobium*, *Glossopetalon*, *Paeonia*, *Shepherdia*, and species in *Dipsacaceae*, *Polemoniaceae*, *Rosaceae* 27

25. Chasmothecia (55-)60-90 µm diam.; appendages 0.5-3 times as long as the chasmothecial diam.; on *Adonis*, East Europe ..... (94) *P. savulescui*

25. Chasmothecia larger, 80-130 µm diam. 26

26. Appendages few, usually short, not exceeding the chasmothecial diam.; on *Papaver*, *Armenia* ..... (84) *P. papaveris*

26. Appendages always numerous, length variable, 0.5-2.5 times as long as the chasmothecial diam., usually densely crowded around the ascomata; on *Erodium* and *Biebersteinia*, Europe, Mediterranean region, North Africa, Central Asia ..... (61) *P. erodii*

27. Chasmothecia with few appendages, length variable, short and rudimentary to long, up to 4 times the chasmothecial diam.; old, brown, infected leaves, shoots, and fruits remain attached over winter turning almost black due to a dense covering of aggregated chasmothecia; on *Physocarpus*, North America ..... (88) *P. physocarpi*

27. Chasmothecia with numerous appendages, appearance on host different 28

28. Fully developed appendages pigmented, brown, at least brown in the lower half and paler above; peridium cells small, average < 20 µm; on various hosts of *Rosaceae*; almost circumglobal ..... (38a) *P. aphanis* var. *aphanis*
[Peridium cells intermediate in size, up to 30 µm diam.; on *Dipsacaceae*, see *P. dipsacacearum*; on *Epilobium*, see *P. epilobii*]

28. Fully developed appendages hyaline to yellowish, rarely faintly brownish below; on *Glossopetalon*, *Shepherdia* or *Polemoniaceae* (North America) or on *Potentilla*; or *Paeonia* (when appendages are brown below and hyaline above) 29

29. Appendages 1.5-5 times as long as the chasmothecial diam.; ascomata scattered; on *Paeonia*, China ..... (82) *P. paeoniae*

29. Appendages shorter, ascomata often gregarious; on other hosts 30

30. Chasmothecia usually aggregated, forming dark brown patches, sometimes even a covering; appendages 4-11 µm wide, length variable, 0.25-3 times as long as the chasmothecial diam.; on *Polemoniaceae*, North America ..... (52) *P. collomiae*

30. Chasmothecia often scattered; appendages narrower, 3.5-8 µm wide, often consistently shorter than the chasmothecial diam.; on other hosts 31

31. Conidia relatively stout, about 28-33 x 19-23 µm; on *Potentilla*, North America, Asia, Europe ..... (38b) *P. aphanis* var. *hyalina*

31. Conidia about 20-36 x 12-21 µm; on *Shepherdia* or *Glossopetalon* 32

32. Conidia 24-36 x 16-21 µm; ascospores (16-)18-27.5 x (10-)12-18 µm; on *Shepherdia*, North America ..... (96) *P. shepherdiae*

32. Conidia 20-30 x 12-14 µm; ascospores 13-20 x 7.5-12.5 µm; on *Glossopetalon*, North America ..... (50) *P. celastracearum*

33. Peridium cells of intermediate size, 10-30 µm diam., on average between 15 and 25 µm 34

33. Peridium cells large and conspicuous, (10-)15-50(-60) µm diam., average > 20 µm, at least some always > 30 µm 44

34. Chasmothecial appendages very long, 4-14 times as long as the chasmothecial diam., strongly sinuous, thick-walled; on *Euphorbia helioscopia*, Japan ..... (63) *P. euphorbiae-helioscopiae*

34. Appendages shorter or thin-walled 35

35. Chasmothecia with numerous appendages, length up to 5 times the chasmothecial diam.; on *Epilobium* or *Dipsacaceae*, Europe, Asia, North America 36

35. Chasmothecia with few appendages, usually less than 10; on some hosts in Asia, China to Japan and North America 37

36. Foot-cells of the conidiophores subcylindrical, 30-80 x 8-13 µm, basal septum not elevated above subtending hyphal cell; on *Epilobium* (*Onagraceae*) ..... (59) *P. epilobii*

36. Foot-cells of the conidiophores increasing somewhat in width from base to top, 40-80 x 7-12 µm (7-8 µm at base), basal septum mostly elevated somewhat above subtending hyphal cell; on *Dipsacaceae* ..... (56) *P. dipsacacearum*

37. Appendages (2-)4-10 times as long as the chasmothecial diam.; on *Codonopsis*, Asia ..... (51) *P. codonopsidis*

37. Appendages shorter, up to 4 times as long as the chasmothecial diam. 38

38. Chasmothecia 75-90(-100) µm diam.; appendages usually 1-4 times as long as the chasmothecial diam.; asci large, 55-100 x 55-80 µm; on *Catalpa* or *Hibiscus*, Asia 39

38. Chasmothecia larger, and/or appendages shorter, and/or asci smaller (about 45-80 µm in length); on other hosts 40

39. Appendages up to 2 times as long as the chasmothecial diam.; on *Hibiscus* ..... (72) *P. hibiscicola*

39. Appendages up to 4 times the chasmothecial diam.; on *Catalpa* ..... (48) *P. catalpae*

40. On *Veronicastrum* (*Plantaginaceae*); ascospores maturing early, large, up to 25 x 17 µm, average length usually > 20 µm 41

40. On hosts of other families; ascospores smaller, about 14-22.5 µm long, average < 20 µm 42

41. Chasmothecia 80-110 µm diam.; peridium cells 8-30 µm diam.; on *Veronicastrum sibiricum*, *Asia* ..... (97) *P. sibirica*

41. Chasmothecia smaller (SO-)60-80 µm diam.; peridium cells 10-35(-40) µm diam.; on *Veronicastrum virginicum*, North America ..... (104) *P. veronicastri*

42. Appendages long, 0.7-5(-7) times the chasmothecial diam.; on *Cayratia*, Asia ..... (49) *P. cayratiae*

42. Appendages shorter, 0.25-1.5(-2) times the chasmothecial diam. 43

43. Appendages narrow, only 2.5-7.5 µm wide; on *Mallotus*, China ..... (78) *P. malloti*

43. Appendages 4-9 µm wide, rather coarse; on *Clerodendron*, Japan ..... (73) *P. intermedia*

44. Asci characteristically dimorphic in a single collection, immature asci subglobose-elliptical, about 60-95 x 50-65 µm and ascospores small and subglobose, < 20 µm long; mature asci larger, rapidly swelling in water up to 130 x 80 µm containing larger ascospores, 20-28 x 16-22.5 µm; on *Acalypha*, *Euphorbia*, *Pedilanthus* (*Euphorbiaceae*) or *Corydalis ochotensis* (*Fumariaceae*), Asia 45

44. Asci and ascospores not typically dimorphic, uniform, both either small or large 46

45. Immature asci fairly thick-walled, mature asci very thin-walled, rapidly swelling in water, large, 70-130 x 65-80 µm; ascospores large, 20-28 x 17-22.5 µm; foot-cells of the conidiophores 35-90 µm long; on *Euphorbiaceae* (*Acalypha*, *Euphorbia*, *Pedilanthus*), Asia ..... (64) *P. euphorbiae-hirtae*

45. All asci uniformly thin-walled, wall up to 2 µm; swollen asci up to 110 µm long; mature ascospores only 16-18 µm wide; foot-cells of the conidiophores shorter, 25-60 µm long; on *Corydalis ochotensis* (*Fumariaceae*), Japan, Korea ..... (74) *P. koreana*

46. Appendages (2-)4-10 times as long as the chasmothecial diam.; chasmothecia small, 60-80 µµ diam.; on *Codonopsis*, Asia ..... (51) *P. codonopsidis*

46. Appendages shorter or chasmothecia larger, average diam. > 80 µm 47

47. Ascospores maturing rather late, nevertheless rather large. 18-28 x 14-19 µm, often faintly pigmented, yellowish to pale golden-brown; ascomata large, 80-120 µm diam.; terminal oculi of the asci large, (15-)20-25(-30) µm diam.; mycelium persistent, but without dark, thick-walled secondary mycelium; on *Pericallis* ×*hybrida* ..... (86) *P. pericallidis*

47. Either ascospores maturing late and small, average length < 20 µm, or ascospores maturing early and large, average length > 20 µm; and/or ascomata smaller or oculi of the asci smaller; ascospores colourless 48

48. Ascospores maturing early (easily visible in usually mature asci), large, about 18-30 x 10-20 µm, average length > 20 µm, mostly ellipsoid-ovoid 49

48. Ascospores maturing rather late (asci often immature, filled with granules and oil drops), ascospores small, about 13-22 x 11-16 µm, average length < 20 µm, most broadly ellipsoid-ovoid or subglobose 58

49. Appendages fairly numerous, long, 1-6.5 times the chasmothecial diam., arising from both lower and upper halves of the ascomata; on *Viola*, North America ..... (105) *P. violae*

49. Appendages either few (less than 10) and/or shorter, confined to the lower half of the ascomata ... 50

50. Appendages fairly long, length variable, 0.5-6 times the chasmothecial diam.; on hosts of the *Asteraceae* (*Pericallis*, *Senecio*), *Plantaginaceae*, *Veroniceae* (*Veronica*, *Veronicastrum*), *Ranunculaceae*, *Saxifragaceae* 51

50. Appendages uniformly shorter, about 0.5-2 times the chasmothecia! diam.; on other hosts [if peridium cells intermediate between subsect. *Sphaerotheca* and subsect. *Magnicellulatae*, i.e. about 10-35 µm diam., see *P. hibiscicola* if on *Hibiscus*, or *P. veronicastri* if on *Veronicastrum virginicum*] 55

51. Mycelium evanescent to ± persistent, persistent pigmented mycelium not or only very sparingly formed, dark patches on the leaves usually absent; on *Adonis*, *Delphinium*, *Trollius* (*Ranunculaceae*) ..... (54) *P. delphinii*

51. Mycelium usually persistent; hyphae turning brown, and together with ascomata plus appendages forming dark patches or a complete covering of leaves; on other hosts 52

52. Secondary mycelium present; hyphae becoming brown and thick-walled; on Senecio spp. ..... (95) *P. senecionis*

52. Secondary mycelium absent, although mycelium persistent; on other hosts 53

53. Conidia usually large, about 30-40 x 16-26 µm; on *Saxifragaceae* ..... (76) *P. macrospora*

53. Conidia smaller, about 24-35 x 15-19 µm; on *Veronica* or *Veronicastrum* 54

54. Peridium cells of the ascomata (10-)15-S0 µm diam.; asci with large terminal oculi, 18-25 µm diam; on *Veronica* (incl. *Pseudolysimachion*) ..... (68) *P. fuliginea*

54. Peridium cells of the ascomata smaller 10-35 µm diam.; asci with small terminal oculi, 8-15 µm diam.; on *Veronicastrum virginicum*, North America ..... (104) *P. veronicastri*

55. Chasmothecia 60-80 µm diam.; on *Thalictrum* or *Veronicastrum virginicum* 56

55. Chasmothecia larger, about 70-110 µm diam.; on other hosts 57

56. On *Thalictrum* (*Ranunculaceae*), Asia, Europe ..... (103) *P. thalictri*

56. On *Veronicastrum virginicum* (*Plantaginaceae*), North America ..... (104) *P. veronicastri*

57. Appendages few, about 0.5-2 times as long as the chasmothecial diam.: on *Veronicastrum sibiricum*, Asia ..... (97) *P. sibirica*
[On *Asteraceae*, *Carica*, cucurbits, *Fabaceae*, *Verbena* and other hosts; ascospores usually small due to late maturation, but may be larger when fully mature, i.e. > 20 µm in length; see *P. xanthii*]

57. Appendages few, short, often rudimentary; on *Brassicaceae* ..... (57) *P. drabae*
[On Plantago most ascospores maturing late, asci often immature; ascospores subglobose, 16-24 x 10-16 µm; see *P. plantaginis*]

58. Chasmothecia rather small, on average < 70 µm diam.; on *Teramnus* or *Thalictrum* 59

58. Chasmothecia larger, (65-)70-110 µm diam.; on other hosts 60

59. Appendages 0.5-1.5 times as long as the chasmothecial diam., 4-9.5 µm wide; ascospores 16-22(-24) x 10-14 µm; on *Thalictrum* ..... (103) *P. thalictri*

59. Appendages shorter than the chasmothecial diam., narrow, 3.5-6.5 µm, ascospores smaller, 12.5-15 x 7-9 µm; om *Teramnus*, India ..... (102) *P. teramni*

60. Peridium cells intermediate, 10-35 µm diam., mostly 15-30 µm; on *Cayratia*, *Clerodendron* or *Mallotus*, Asia 61

60. Peridium cells conspicuous and large, (10-)15-50(-65) µm diam, frequently larger than 30 µm 63

61. Appendages of the chasmothecia long, 0.7-5(-7) times as long as the chasmothecial diam.; on *Cayratia*, Asia .....(49) *P. cayratiae*

61. Appendages shorter, 0.25-1.5(-2) times as long as the chasmothecial diam. 62

62. Appendages narrow, only 2.5- 7.5 µm wide; on *Mallotus* .....(78) *P. malloti*

62. Appendages wider, 4-9 µm thick; on *Clerodendron*, Japan ..... (73) *P. intermedia*

63. Appendages poorly developed, very short, usually shorter than the chasmothecial diam. or ± equal to it, often rudimentary, few or even lacking 64

63. Appendages well developed, longer, 0.5-6 times the chasmothecial diam. 66

64. Mycelium usually well developed, amphigenous, ± persistent; conidial state well developed; on *Plantago* .....(90) *P. plantaginis*

64. Mycelium mostly ± evanescent; conidial state sparingly developed; on *Helianthemum* or *Asclepias* . 65

65. On *Helianthemum*, Europe .....(71) *P. helianthemi*

65. On *Asclepias*, North America .....(99) *P. sparsa*
[On *Brassicaceae*, ascospores usually well developed and large, see *P. drabae*; occasionally there are forms with relatively short appendages on *Verbena* or on hosts of the *Cucurbitaceae*, *Asteraceae* and *Lamiaceae*, see *P. elsholtziae*, *P. erigerontis-canadensis* and *P. xanthii*]

66. Peridium cells intermediate, 10-25(-37.5) µm diam.; on *Hibiscus*, Asia ..... (72) *P. hibiscicola*

66. Peridium cells larger and conspicuous, 10-50 µm diam., often larger than 30 µm 67

67. Appendages few, narrow, 3.5-7.5 µm wide, fragile; on *Senna occidentalis*, India ..... (47) *P. cassiae*

67. Appendages wider and/or not fragile; on other hosts 68

68. Appendages simple or often 1-2 times irregularly branched; ascospores globose-subglobose; on *Cardamine*, Japan .....(45) *P. cardamines*

68. Appendages usually unbranched; ascospores broadly ellipsoid-ovoid to subglobose; on other hosts .. 69

69. Asci with large terminal oculi (thin apical portion of the wall), 15-30 µm diam. 70

69. Asci with small terminal oculi, 8-15 µm diam. (average about 12 µm) or oculi intermediate, 10-20 µm diam., average about 15 µm (on *Impatiens noli-tangere*, *Saxifraga alpina*) 74

70. Mycelium persistent, with hyphae up to 12 µm wide; forming secondary mycelium, at least in old infections, secondary hyphae turning brown and thick-walled; oculus of the asci (10-)15-20(-25) µm diam.; chasmothecial appendages well developed, coarse, up to 4 times as long as the chasmothecial diam.; on *Ainsliaea* (Asia) or *Senecio* (northern hemisphere) 71

70. Mycelium evanescent to persistent, secondary mycelium absent, but if present, then asci with larger oculi, up to 30 µm diam.; on other hosts (or on *Senecio* in the Southern hemisphere) 72

71. Persistent secondary mycelium and long chasmothecial appendages often forming conspicuous brown patches on leaves (in old infections); on *Senecio*, northern hemisphere ..... (95) *P. senecionis*

71. Persistent secondary mycelium inconspicuous, thin, without brown patches on leaves; on *Ainsliaea*, Asia .....(36) *P. ainsliaeae*

72. With thick-walled secondary mycelium; chasmothecia small, 70-90 µm, on average < 85 µm; oculi of the asci large, 20-30 µm diam., on average about 25 µm; on *Adenocaulon himalaicum*, Japan ..... (35) *P. adenocauli*

72. Without thick-walled secondary mycelium; chasmothecia larger, 70-110 µm diam., on average > 85 µm; oculi of the asci smaller, 15-25 µm diam. (on average about 18-20 µm) 73

73. On a wide range of hosts of the *Asteraceae*, *Cucurbitaceae*, *Fabaceae*, *Verbenaceae* and other families, worldwide ..... (107) *P. xanthii*

73. On *Carpesium*, Japan, endemic (morphologically close to but genetically clearly distinct from *P. xanthii*) ..... (46) *P. carpesiicola*

74. Ascomata large, 65-100 µm diam.; asci with intermediate terminal oculi, 10-20 µm diam., average about 15 µm; on *Impatiens noli-tangere* or *Saxifraga alpina* 75

74. Asci with small terminal oculi, 8-15 µm diam., average about 10-12 µm; on other hosts 76

75. With abundant, well developed secondary mycelium; secondary hyphae becoming brown and thick-walled; on *Saxifraga alpina*, Europe ..... (37) *P. alpina*

75. Mycelium persistent, but without abundant secondary mycelium, on *Impatiens* .... (42) *P. balsaminae*

76. Ascomata large, 75-100 µm diam., average > 85 µm 77

76. Ascomata smaller 55-90 µm diam., average < 85 µm 81

77. Appendages of the chasmothecia 1-6 times as long as the chasmothecial diam.; on *Dicliptera* (*Acanthaceae*) ..... (55) *P. diclipterae*

77. Appendages shorter, 0.5-3 times as long as the chasmothecial diam.; on other host species 78

78. Mycelium evanescent to ± persistent, usually without brown persistent hyphae; on *Asclepias*, *Metaplexis*, *Tylophora*, *Asclepiadaceae* ..... (99) *P. sparsa*

78. Often with brown persistent hyphae 79

79. With abundant persistent secondary mycelium, whitish to brown, smooth to verruculose; persistent mycelium and abundant chasmothecia forming dark brown patches or covers on leaves; on *Solanum dulcamara* and probably other hosts of the *Solanaceae* ..... (98) *P. solanacearum*

79. Without secondary mycelium, but persistent hyphae turning brown; on other hosts 80

80. On *Fatoua* (*Moraceae*), Japan ..... (93) *P. pseudofusca*

80. On Aster (incl. *Kalimeris*), Japan ..... (39) *P. astericola*

81. Length/width ratio of the conidia about 1.9-2.1; on *Astragalus*, *Hedysarum* or *Veronica* 82

81. Length/width ratio of the conidia about 1.5-1.9; on other hosts 83

82. Ascospores ripening early, length/width ratio > 1.5; on *Veronica* (*Plantaginaceae*) ... (68) *P. fuliginea*

82. Ascospores ripening late, length/width ratio < 1.5, asci often immature; on *Astragalus*, *Hedysarum* (*Fabaceae*), Asia, North America, arctic-alpine in Europe ..... (41) *P. astragali*

83. Chasmothecia with long appendages, up to 6 times as long as the chasmothecial diam.; with brown, thick-walled secondary mycelium; on *Bidens* or *Doronicum* 84

83. Appendages shorter, up to about 3 times as long as the chasmothecial diam.; on other hosts 85

84. On *Bidens cernua*, North America ..... (43) *P. bidenticola*

84. On *Doronicum* spp., Europe to Caucasus and Central Asia ..... (69) *P. fusca*

85. Anamorph usually well developed; chasmothecia scattered to loosely aggregated; on hosts of the *Asteraceae* ..... (60) *P. erigerontis-canadensis*

85. Anamorph usually not well developed; chasmothecia often densely aggregated; on other hosts 86

86. On hosts of the *Orobanchaceae* and *Scrophularia* (*Scrophulariaceae*) ..... (87) *P. phtheirospermi*

86. On hosts of the Lamiaceae ..... (58) *P. elsholtziae*

7 Sawadaea

Key to the species

1. Chasmothecial appendages uniformly unbranched or only seldom branched 2

1. Chasmothecial appendages at least partly branched 3

2. Chasmothecial appendages about 80-150 µm long and 5-7.5(-9) µm wide, apex always uncinate-circinate when mature; on *Acer buergerianum*, Asia, China and Japan ..... (129) *S. nankinensis*

2. Chasmothecial appendages shorter and wider, 25-50 x 9-13(-15) µm, apex usually straight, occasionally hooked; on *Koelreuteria* spp. ..... (127) *S. koelreuteriae*

3. Chasmothecial appendages relatively few, less than 40 per chasmothecium, very short, usually not exceeding 80 µm in length; on *Aesculus wilsonii*, Asia, China ..... (123) *S. aesculi*

3. Appendages numerous, usually more than 40, sometimes longer; on *Acer*, rarely on *Aesculus hippocastanum* in Europe 4

4. Appendages very numerous. about 100-250 per chasmothecium. densely crowded, with numerous branchlets, 1-3 times dichotomously to trichotomously branched, occasionally even tetrachotomously branched, simple appendages few; on various host species of the genus Acer in Asia (China, Japan), introduced in Australia ..... (131) *S. polyfida*

4. Number of appendages fewer, up to 100 per chasmothecium, 1-2(-4) times dichotomously, sometimes trichotomously branched, often also unbranched 5

5. Chasmothecial appendages deeply cleft, branched in the lower half, often even in the lower third 6

5. Chasmothecial appendages not deeply cleft, branched in about the middle or upper half 7

6. Mycelium amphigenous; appendages 0-2(-4) times dichotomously branched or frequently unbranched; on Acer mono. Japan, Far East of Russia ..... (125) *S. bifida*

6. Mycelium epiphyllous, distinctly maculate; unbranched appendages rare; on *Acer pseudosieboldianum*, Far East of Russia ..... (128) *S. kovaliana*

7. Peridium cells at least partly radially arranged; appendages sinuous to ± nodulose; on *Acer caudatum* and *A. davidii*, China ..... (126) *S. bomiensis*

7. Cells not radially arranged: appendages neither undulate nor nodulose or only a few appendages occasionally slightly sinuous-nodulose: on various *Acer* spp. [rarely on *Aesculus hippocastanum*) 8

8. Macro-conidia about (20-)25-35 x (12-)13-18(-21) µm, length/width ratio 1.3-2.1, average about 1.8, micro-conidia about 6-18 x 5-12 µm; chasmothecial appendages simple or dichotomously to trichotomously branched, branched appendages dominant (50% to almost 100%); mycelium and chasmothecia usually hypophyllous ..... (124) *S. bicornis*

8. Macro-conidia shorter, about 19-30 x 13-19, length/width ratio about 1.3-1.7; micro-conidia about 6-11 x 5-9 µm; many appendages simple or branched dichotomously, rarely trichotomously 9

9. Appendages 1-2(-3) times dichotomously branched: mycelium and chasmothecia usually epiphyllous .. .. (132) *S. tulasnei*

9. Appendages 1-4 times dichotomously branched; mycelium and chasmothecia usually hypophyllous .... (130) *S. negundinis*

8 Leveillula

1. Conidia dumbbell-like, i.e. ± cylindrical with cingulum-like thickened ends; on hosts of the *Apiaceae*, *Chenopodiaceae* or on *Loranthus* 2

1. Conidia not dumbbell-like, when cylindrical, subcylindrical or somewhat narrowed in the middle, then without any cingulum-like swellings at the ends 4

2. Appendages mostly poorly developed, very short, often rudimentary; on hosts of the *Chenopodiaceae* (168) *L. saxaouli*

2. Appendages usually well developed, about as long as, or shorter than the chasmothecial diam. 3

3. Asci 25-35(-40) µm wide, ascospores 15-20(-25) µm wide; on hosts of the *Apiaceae* (156) *L. lanuginosa*

3. Asci narrower, 15-30 µm, ascospores also narrower, 10-17 µm; on *Loranthus europaeus*, *Loranthaceae* ..... (159) *L. loranthi*

4. Conidia uniformly clavate: appendages of the chasmothecia well developed, width increasing towards the tip, apical part of appendages readily swelling in water, sometimes dissolving; on *Euphorbia pulcherrima*, Africa, introduced in Europe ..... (142) *L. clavata*

4. Conidia not clavate, at least not all conidia clavate; width of appendages not distinctly increasing towards the tip, apices not swelling in water 5

5. Conidial surface with very conspicuous, large, dense warts, i.e. strongly verrucose-squamulose (warts very conspicuous, even when viewed by light microscopy); on *Thevenotia* ..... (170) *L. thevenotiae*

5. Conidia not verrucose-squamulose, warts, if visible at all by light microscopy, fine, not very conspicuous; on other hosts 6

6. Primary conidia ± cylindrical or ellipsoid-ovoid to cylindrical, sides mostly ± parallel to each other or somewhat wider in the upper half, conidia always or at least partly somewhat narrowed in the middle, ends rounded, truncate or ± narrowed towards the apex, conical, tips usually obtuse 7

6. Primary conidia neither cylindrical nor ellipsoid-cylindrical, but ± lanceolate, ovoid-lanceolate, ovoid or ellipsoid-ovoid, apex ± pointed 18

7. Primary conidia with obtuse apex, not distinctly narrowed towards the apex and not pointed, shape cylindrical, subcylindrical or somewhat wider in the upper half; on hosts of the *Chenopodiaceae* and *Caryophyllaceae* (*Silene*) ..... (145) *L. cylindrospora*

7. Primary conidia mostly with conical apex, narrowed towards the usually obtuse tip or conidia narrowed in the middle; on other hosts 8

8. Primary conidia relatively small, about (35-)40-55(-60) µm long, always or occasionally narrowed in the middle, apex rounded to short conical; on *Chondrilla*, *Dodartia*, *Hexinia*, *Lactuca* or *Rubia* [most primary conidia ovoid-lanceolate, but some may be cylindrical; on *Euphorbia*, see *L. lanata*] 9

8. Primary conidia larger, about 40-80 µm long, not distinctly narrowed in the middle, or only slightly so, apex mostly distinctly conical; on other hosts 12

9. Primary and secondary conidia clearly differentiated, cylindrical primary conidia with short conical apex 10

9. Primary and secondary conidia not clearly differentiated, conidia uniformly subcylindrical, usually somewhat narrowed in the middle, ends always rounded 11

10. Chasmothecia with well developed appendages; primary conidia subcylindrical, sides more or less parallel to each other or conidia somewhat wider in the upper half, occasionally slightly narrowed in the middle, apex rounded to short conical; on *Chondrilla*, *Hexinia* or *Lactuca*, *Asteraceae* .... (154) *L. lactucarum*

10. Chasmothecia with poorly developed appendages; primary conidia variable, subylindrical to ellipsoid-ovoid, if subcylindrical not narrowed in the middle; on *Dodartia*, *Phrymaceae* ..... (152) *L. jaczewskil*

11. Chasmothecia large, (150-)200-270(-290) µm diam., with numerous asci, 30-70; on *Chondrilla*, Iran (150) *L. guilanensis*

11. Chasmothecia smaller, 160-230(-250) µm diam., asci less than 40; on *Rubia*, Iran ..... (166) *L. rubiae*

12. Secondary conidia subcylindrical to ellipsoid, widest in the middle; chasmothecial appendages simple or once branched, ascospores small, shorter than 25 µm; on *Geranium* spp. ..... (148) *L. geraniacearum*

12. Secondary conidia ± cylindrical to somewhat clavate or slightly narrowed in the middle; and/or chasmothecial appendages either uniformly unbranched or multibranched, ascospores longer, about 25-40 µm, on other hosts 13

13. Primary and secondary conidia subcylindrical, often somewhat wider in the upper half, somewhat narrowed in the middle, maximum width usually in the upper half; chasmothecial appendages usually branched 14

13. Primary conidia with either variable maximum width, from base to top, and chasmothecial appendages usually unbranched (on composites or *Fabaceae*) or multibranched (on *Acanthophyllum*), or primary conidia subcylindrical, narrowed in the middle, widest in the lower or upper half (on *Cleome*) [primary conidia rather variable, usually ellipsoid-ovoid to lanceolate, but occasionally subcylindrical; on *Catalpa*, see *L. catalpae*] 15

14. On *Carum*, *Helianthemum*, *Nepeta*, *Plumbago*, *Polemonium* ..... (149) *L. golovinii*

14. On *Mindium* (and possibly *Campanula*) ..... (160) *L. mindii*

15. Primary conidia subcylindrical, often narrowed in the middle, i.e. widest in the upper as well as lower half. conidial surface (SEM) with hemispherical to oblong papillae, up to 0.6 um long; on *Cleome* ... . (143) *L. cleomis*

15. Primary conidia ellipsoid-cylindrical, usually not narrowed in the middle, usually with a single maximum, position variable, in the middle, lower or upper half, conidial surface (SEM) with hemispherical to spherical papillae, 0,1-0,2 µm diam. 16

16. Chasmothecial appendages mostly unbranched; on *Picris* and other compositae ..... (164) *L. picridis*

16. Chasmothecial appendages mostly branched, often even multibranched, coralloid 17

17. Length/width ratio of secondary conidia 2.3-5.0, conidia at least partly constricted in the middle; on *Acanthophyllum* ..... (137) *L. bornmuelleriana*

17. Length/width ratio of secondary conidia 2.0-3.9, not constricted in the middle; on various hosts of the *Fabaceae* ..... (162) *L. papilionaceae*

18. Primary as well as secondary conidia broadly ovoid to ellipsoid-ovoid, about 35-55 x 15-26 µm, length/width ratio 1.5-2.5, apex obtuse or only slightly narrowed, rarely some conidia clavate, germ tubes pigmented, brownish; on *Verbascum* ..... (172) *L. verbasci*

18. Primary conidia lanceolate or ellipsoid-ovoid, length/width ratio usually > 2.5, usually distinctly narrowed towards the tip; or primary conidia broadly ellipsoid-obovoid, apex rounded, length/width ratio 2.2-3.2; germ tubes colourless; on other hosts 19

19. Primary conidia broadly ellipsoid-obovoid, apex rounded, length/width ratio 2.2-3.2, secondary conidia subcylindrical-doliiform, subclavate; chasmothecia relatively small, 130-180(-200) µm; on *Helichrysum* ..... (151) *L. helichrysi*

19. Primary conidia lanceolate or ellipsoid-ovoid, but usually distinctly narrowed towards the tip, secondary conidia cylindrical or somewhat wider in the upper half; chasmothecia larger, mostly about 150-250 µm diam. 20

20. Primary conidia rather variable, ellipsoid-ovoid, ovoid-lanceolate, narrowed towards the apex or cylindrical with short conical apex; on *Catalpa*, *Dodartia* or *Euphorbia* 21

20. Cylindrical primary conidia lacking; on other hosts 23

21. Chasmothecia with well developed appendages, simple or branched; on Euphorbia .....(155) *L. lanata*

21. Chasmothecia with poorly developed appendages, very short; on other hosts 22

22. Primary conidia sometimes abruptly narrowed at the apex, average length > 50 µm; on Catalpa (140) *L. catalpae*

22. Primary conidia not abruptly narrowed at the apex, average length < 50 µm; on *Dodartia* ..... (152) *L. jaczewskii*

23. Primary conidia mostly distinctly widest in the lower half (shape ± lanceolate) 24

23. Primary conidia mostly ± widest in the middle or only slightly below (shape not distinctly lanceolate) 35

24. Primary conidia lanceolate, usually up to 65 µm long, length/width ratio usually 2.4-3.5(-4) [or very variable, 2.2-6, but on average < 3.5, on *Haplophyllum*]; on *Elaeagnus*, *Eryngium* spp. and other hosts of the *Apiaceae*, *Linaria*, *Parietaria*, *Ricinus* 25

24. Primary conidia oblong lanceolate, up to 80 µm long, length/width ratio mostly > 3.5, up to 6.5 ..30

25. Secondary conidia ellipsoid-ovoid; on *Elaeagnus* .....(147) *L. elaeagni*

25. Secondary conidia cylindrical, subcylindrical of often somewhat wider in the upper half (somewhat clavate); on other hosts 26

26. Conidia with poorly developed papillae (SEM), papillae almost absent and lacking in the upper part of primary condidia; on *Parietaria* .....(179) *Oidiopsis parietariae*

26. Conidia with well developed papillae (SEM); on other hosts 27

27. Chasmothecial appendages poorly developed, rudimentary or appendages mostly unbranched; on *Linaria* or *Ricinus* spp. 28

27. Chasmothecial appendages well developed, frequently branched; on other hosts 29

28. Appendages always developed, but usually unbranched; on *Linaria* spp., *Plantaginaceae* ..... (158) *L. linariae*

28. Appendages poorly developed, rudimentary, if developed then branched; on *Ricinus* ....(165) *L. ricini*

29. Length/width ratio of primary conidia rather variable, 2.2-6 (average 3.1) on *Haplophyllum* spp. (167) *L. rutae*

29. Length/width ratio of primary conidia less variable, usually not larger than 3.5; on *Eryngium* spp. or *Pimpinella*, *Apiaceae* [and possibly *Capsicum*] .....(138) *L. braunii*

30. Secondary conidia dimorphic, either ellipsoid-ovoid or cylindrical to slightly widened in the upper half; primary conidia often with somewhat amphora-like base; chasmothecia rather small, 120-185 µm diam.; on Oxalis spp. .....(162) *L. oxalidicola*

30. Secondary conidia not dimorphic, subcylindrical, often somewhat wider in the upper half, primary conidia usually without amphora-like base; chasmothecia larger,. mostly 150-250 µm diam.; on other hosts 31

31. Chasmothecial appendages usually simple or only branched once; on *Tropaeolum* (171) *L. tropaeolicola*

31. Chasmothecial appendages often branched, even multibranched 32

32. Asci occasionally up to 4-spored; Alhagi .....(134) *L. alhagi*

32. Asci 2-spored; on other hosts 33

33. On a wide range of hosts .....(169) *L. taurica*

33. On *Haplophyllum* and *Ruta* spp. or *Lactuca serriola* 34

34. On *Haplophyllum* spp. and *Ruta* (biologically distinct from *L. taurica*) .....(167) *L. rutae*

34. On *Lactuca serriola* (genetically clearly distinct from *L. taurica*) ..... (183) *L. lactucae-serriolae*

35. Secondary conidia small, 30-40 x 10-14 µm, primary conidia also small, only 25-30 x 10-14 mm; on *Calligonum* ..... (139) *L. calligoni*

35. Secondary conidia larger, longer and/or wider, at least some larger than 40 x 15 µm, or primary conidia larger, at least some larger than 50 x 14 µm; on other hosts 36

36. Length/width ratio of primary conidia on average > 3; on *Allium*, *Carlina* or *Odontospermum* 37

36. Length/width ratio of primary conidia usually up to 3 [1.8-3(-4.1)]; on other hosts 39

37. Primary conidia with abruptly constricted tips; on *Odontospermum* ..... (136) *L. asterisci*

37. Primary conidia gradually narrowed up to the apex, tips not abruptly constricted 38

38. Conidia with a distinct, longitudinally oriented surface wrinkling; chasmothecia with poorly developed, very short, hyaline appendages; on Allium ..... (135) *L. allii*

38. Conidia with a net-like surface wrinkling forming polyangular meshes; chasmothecia with well developed appendages, brown below and colourless above; on Carlina ..... (173) *L. wasseri*

39. Apex of primary conidia pronounced, often abruptly narrowed, conidial surface somewhat papillate; on hosts of the *Malvaceae* or *Impatiens* 40

39. Apex of primary conidia obtuse to pointed, but neither abruptly narrowed, nor conidial surface papillate 40

40. Papillae on the surface of primary conidia (SEM) mostly spherical, often confined to base or apex; on hosts of the *Malvaceae* ..... (144) *L. contractirostris*

40. Papillae on primary conidia (SEM) hemispherical, evenly spread; on *Impatiens* ..... (175) *Oidiopsis balsaminae*

41. Primary conidia with apex obtuse or only slightly narrowed, primary conidia broadly ellipsoid-ovoid, length/width ratio about 2.3-2.9; on hosts of the *Lamiaceae* ..... (146) *L. duriaei*

41. Primary conidia usually distinctly narrowed towards the apex, somewhat pointed; on hosts of the *Asteraceae*, *Chrozophora* or *Mercurialis* 42

42. Primary conidia ellipsoid-ovoid, rather short, about 40-50 x 16-20 µm long, length/width ratio 2.2-2.8, conidial surface (SEM) with papillae on secondary conidia in groups of 6-15, spherical, 0.3-0.6 µm diam.; on *Osteospermum* ..... (161) *L. osteospermi*

42. Primary conidia longer, 50-65 µm, conidial surface (SEM) with evenly spread papillae or in smaller groups of only 3-5; on other hosts 43

43. Primary conidia ovoid or broadly ellipsoid-ovoid, up to 27 µm wide, conidial surface (SEM) with short net-like surface wrinkling, meshes polyangular, 0.5-4 x 0.3-2.5 µm, papillae on secondary conidia evenly spread or in groups of 3-5, spherical or hemispherical; on *Cynara* and other hosts of the *Asteraceae* ..... (157) *L. lappae*

43. Primary conidia narrower, average < 20 µm wide, conidial surface (SEM) with elongated net-like surface wrinkling, meshes 3-6(-7) x 0.8-2.5 µm, papillae usually spherical, evenly spread; on *Chrozophora* and *Mercurialis* ..... (141) *L. chrozophorae*

9 Phyllactinia

- Aceraceae, see Sapindaceae
- Actinidiaceae (on Actinidia sp.)

  1. Chasmothecia very large, (230-)280-400(-435) um diam., average > 300 µm, with (10-)15-24 appendages ..... (185) *P. actinidiae-latifoliae*
  1. Chasmothecia smaller, 150-310 µm diam., average < 300 µm, appendages 8-18 2

2. Chasmothecia 150-230 µm diam., usually ≤ 200 µm ..... (183) *P. actinidiae*
2. Chasmothecia larger, (190-)200-310 µm, usually > 200 µm ..... (184) *P. actinidiae-formosanae*

- Alangiaceae

  On *Alangium* spp. ..... (189) *P. alangii*

- Anacardiaceae

1. Conidia very variable in shape, characteristically dimorphic; on *Amphipterygium* or *Sclerocarya* .2
1. Conidia uniform or conidial state lacking; on other hosts 3
2. Secondary conidia ellipsoid-cylindrical to clavate; on *Amphipterygium molle*, Mexico .....(194) ..... *P. amphipterygii*
2. Secondary conidia variable, but some flask-shaped; on *Sclerocarya birrea* subsp. *caffra*, South Africa ....(235) *P. gorteri*
3. Chasmothecia large, 220-280 µm diam.; on *Pistacia* spp. .....(262) *P. pistaciae*
3. Chasmothecia smaller, 145-250 µm: on other hosts 4
4. Appendages about as long as the chasmothecial diam. or shorter; on *Lannea coromandelica* ....(247) *P. lanneae*
4. Appendages (0.7-)1-2(-2.5) times the chasmothecial diam.; on *Rhus* spp. ..... (268) *P. rhoina*

- Araliaceae

  On *Kalopanax septemlobus* ..... (246) *P. kalopanacis*

- Asclepiadaceae

  On *Asclepias* spp. .....(232) *P. fraxini*

- Berberidiaceae

  On *Berberis* spp. ..... (201) *P. berberidis*

- Betulaceae

1. Conidia usually clavate with rounded apex, always non-papillate 2
1. Conidia mostly apiculate, clavate-spathuliform, obpyriform 5
2. Stems of the penicillate cells with simple to branched apex, bifurcate or with several cylindrical-conical branchlets; on *Alnus* or *Ostrya* 3
2. Stems of the penicillate cells with numerous short, often knob-like branchlets; on *Carpinus* or *Corylus* 4
3. Chasmothecia with 6-15 appendages, stems of the penicillate cells 25-60 µm long, filaments 2-5 µm wide, apex not distinctly swollen; on *Alnus* spp. (*Betulaceae*, *Betuloideae*), North America, Europe .....(192) *P.alnicola*
3. Chasmothecia with 4-8 appendages, stems of the penicillate cells short, 15-45 µm long, filaments 2-4 µm wide, apex distinctly swollen to 3-7 µm wide; on *Ostrya virginiana* (*Betulaceae*, *Coryloideae*), North America ..... (256) *P. ostryae*
4. On *Carpinus* spp. .....(209) *P. carpini*
4. On *Corylus* spp. ..... (236) *P. guttata*
5. Chasmothecia rather small, 150-180 µm diam.; on *Carpinus* spp., Japan .....(210) *P. carpinicola*
5. Chasmothecia larger, 160-250 ym diam.; on *Alnus* in Asia or *Betula* 6
6. Filaments of the penicillate cells about as long as the stem or shorter; on Alnus spp. in Asia .... (191) *P. alni*
6. Filaments of the penicillate cells about as long as the stem or longer; on *Betula* (202) *P. betulae*

- Bignoniaceae (*Paulownia*, see Scrophulariaceae)

1. Conidiophores rigid, setiform, thick-walled; on *Crescentia alata* (Guatemala, Mexico) ..... (270) *P. rigida*

1. Conidiophores not rigid, setiform and thick-walled; on other hosts 2

2. Chasmothecia with 4-12 appendages, 1-2 times as long as the chasmothecial diam.; on Catalpa ..... (213) *P. catalpae*

2. Chasmothecia with 14-18 appendages, about as long as the chasmothecial diam. or shorter; on *Heterophragma roxburghii* ..... (239) *P. heterophragmatis*

- Bombacaceae, see Malvaceae

- Boraginaceae

1. Chasmothecia with 7-14 appendages, (0.9-)1.4-2.2(-2.8) times as long as the chasmothecial diam.; on *Ehretia coryfolia* ..... (223) *P. ehretiae*

1. Chasmothecia with 10-25 appendages, about as long as the chasmothecial diam. or shorter; ..... (280) *P. thirumalachari*

- Calycanthaceae

On *Calycanthus* spp. ..... (206) *P. calycanthi*

- Cannabaceae

1. Asci 2-4(-5)-spored; on *Trema* sp. ..... (282) *P. tremae*

1. Asci 2-spored; on *Pteroceltis tatarinowii* ..... (264) *P. pteroceltidis*

- Caricaceae

1. Conidia dimorphic, primary conidia lanceolate, apex pointed, secondary conidia clavate; on Carica it South America ..... (208) *P. caricifolia*

1. Conidia uniformly clavate, occasionally subclavate or subcylindrical; on Carica in Africa ..... (305) *Ovulariopsis papayae*

- Celastraceae

On Celastrus spp. ..... (214) *P. celastri*

- Combretaceae

1. Chasmothecia large, 275-400 xm diam., with 15-20 appendages, about as long as the chasmothecial diam.; on *Combretum zeyheri*, South Africa ..... (217) *P. combreti*

1. Chasmothecia smaller, (120-)170-250 um diam., with 5-18 appendages, (0.5-)1-2.5 times the chasmothecial diam.; on *Combretum ovalifolium* and *Terminalia* spp. ..... (279) *P. terminaliae*

- Coriariaceae

On *Coriaria sinica* ..... (215) *P. coriariae*

- Cornaceae

1. On *Camptotheca* spp. [former *Nyssaceae*] ..... (207) *P. camptothecae*

1. On *Cornus* spp. (*Cornaceae* s. str.] ..... (219) *P. corni*

- Ebenaceae

On *Diospyros* spp. ..... (245) *P. kakicola*

- Elaeagnaceae

1. Conidia clavate; on *Elaeagnus argentea* and *Shepherdia argentea*, North America ..... (234) *P. elaeagni*

1. Conidia with angular outline; on *Hippophaë rhamnoides*, Asia, Europe ..... (240) *P. hippophaës*

- Ericaceae

  On *Enkianthus chinensis*, *Lyonia ovalifolia* and *Rhododendron* spp. ..... (226) *P. enkianthi*

- Euphorbiaceae (*Andrachne*, *Bridelia*, see *Phyllanthaceae*)

  1. Conidia dimorphic, primary conidia lanceolate, secondary conidia oblanceolate to ellipsoid-ovoid; ascospores usually not developed; on *Sebastiana* ..... (276) *P. sebastianiae*
  1. Conidia not dimorphic; ascospores usually developed 2
  2. Chasmothecia 145-177 µm diam., with 4-9 appendages, ascospores 25-30 µm wide; on *Aleurites* (190) *P. aleuritidis*
  2. Chasmothecia larger, 150-220 µm diam., with 6-15 appendages, ascospores narrower, 12-20 µm wide; on *Sapium* ..... (275) *P. sapii*

- Eupteleaceae

  On *Euptelea polyandra*, Japan ..... (230) *P. eupteleae*

- Fabaceae

  1. Chasmothecia and anamorph present or only anamorph present 2
  1. Only chasmothecia present, anamorph lacking or unknown 15
  2. Conidia uniform, clavate or broadly clavate-obovoid 3
  2. Conidia either uniform, but not clavate, or distinctly dimorphic 7
  3. Conidia broadly clavate-obovoid, 35-60 x 18-28 µm, conidiophores straight; on *Erythrina abyssinica*, Zambia ..... (298) *Ovulariopsis erythrinae-abyssinicae*
  3. Conidia uniformly clavate, usually longer and more slender 4
  4. Foot-cells of the conidiophores sinuous-twisted at the base; on *Dalbergia* spp., Asia ..... (221) *P. dalbergiae*
  4. Foot-cells straight or straight to flexuous throughout 5
  5. Appendages less than 10 per chasmothecium, about as long as the chasmothecial diam.; on *Sphenostylis angustifolia*, South Africa ..... (278) *P. sphenostylidis*
  5. Appendages up to 15 per chasmothecium, 1-2 times the chasmothecial diam.; on other hosts .. 6
  6. Asci always immature; conidiophores straight to flexuous-sinuous throughout; on *Erythrina caffra*, South Africa ..... (227) *P. erythrinae*
  6. Asci usually developed and mature, with 2-3 ascospores; conidiophores straight; on *Fraxinus* spp. and other hosts of the *Oleaceae*, in Europe occasionally On *Wisteria sinensis* .... (232) *P. fraxini*
  7. Conidia uniformly ellipsoid-cylindrical, oblong, sometimes with somewhat swollen ends 8
  7. Conidia not ellipsoid-cylindrical or conidia distinctly dimorphic 12
  8. Conidia often somewhat enlarged at the base, cingulum-like, i.e. with circumferential swelling; on *Adesmia campestris*, South America (Argentina) ..... (186) *P. adesmiae*
  8. Conidia without cingulum-like structures 9
  9. Conidia subcylindrical, but often somewhat constricted in the middle, 10-15 µm wide at the ends and 6-9 um wide in the middle; on *Acacia* spp., Asia, South Africa ..... (182) *P. acaciae*
  9. Conidia ellipsoid-cylindrical, not concave in the middle (or with some old conidia becoming narrower in the middle, but then cylindrical conidia wider, up to 18 µm) 10
  10. Conidia ellipsoid to narrowly ellipsoid-oblong, occasionally navicular (almost clavate, but apex attenuated, pointed, "boat-shaped"), 40-80 x 17.5-27.5 µm; on *Cajanus cajan*, South Africa ..... (297) *Ovulariopsis ellipsospora*
  10. Conidia ellipsoid-cylindrical, but not navicular, smaller, above all narrower, about 40-60 x 10-20 µm 11
  11. Chasmothecia small, 150-180 µm diam., with 8-12 appendages; conidia ellipsoid-cylindrical, 40-50 x 10-20 µm; on *Cassia fistula*, Asia (India) ..... (212) *P. cassiae-fistulae*

11. Chasmothecia larger, 180-230 µm diam., with 10-15 appendages; conidia subcylindrical, oblong, occasionally width slightly increasing towards the apex (subclavate), 40-60 x 10-18 µm, some older conidia narrower (7-9 µm) in the middle; on *Burkea africana*, South Africa ..... (231) *P. evansii*

12. Conidiophores with straight foot-cells; conidia ventricose-lanceolate, tapering towards a pointed apex, finally becoming lageniform, with obtuse apex; on *Cassia abbreviata*, South Africa ..... (211) *P. cassiae*

12. Conidiophores at least partly flexuous-sinuous; conidia distinctly dimorphic, lanceolate and clavate 13

13. Foot-cells of the conidiophores straight to flexuous-sinuous at the base, basal septum elevated 10-35 µm above the junction with the mother cell, flexuous-sinuous portion usually confined to the part below the basal septum; conidia 50-90 x 15-26 µm; on *Erythrina americana*, Mexico ..... (228) *P. erythrinae-americanae*

13. Foot-cells flexuous-sinuous to subhelicoid throughout, first septum at the very base or only elevated 5-10 µm 14

14. Conidia very narrow, 40-70 x 8-15 µm; on *Leucaena latisiliqua*, North America (Mexico, Honduras) ..... (301) *Ovulariopsis leucaenae*

14. Conidia wider than 15 µm on average ..... (271) *P. robiniae*

15. Chasmothecia large, 200-330 µm diam., appendages 5-16, long, (1-)1.5-2(-2.5) times the chasmothecial diam.; on *Desmodium sinuatum*, China ..... (222) *P. desmodii*

15. Chasmothecia smaller, diameter < 250 µm, appendages mostly shorter 16

16. Chasmothecia small, 150-190 µm diam., average < 180 µm, appendages about as long as the chasmothecial diam.; on *Cassia* spp. 17

16. Chasmothecia larger, average > 180 µm, or appendages longer; on other hosts 18

17. On *Cassia abbreviata*, South Africa ..... (211) *P. cassiae*

17. On *Cassia fistula*, India (distinct from *P. cassiae* in the anamorph) ..... (212) *P. cassiae-fistulae*

18. Asci always lacking, not developed or immature even in mature chasmothecia, appendages 1-2 times as long as the chasmothecial diam.; On *Erythrina* spp. 19

18. Asci developed in mature chasmothecia or appendages shorter 20

19. Chasmothecia (140-)150-200 µm diam., with 4-10 appendages; on *Erythrina americana*, Mexico ..... (228) *P. erythrinae-americanae*

19. Chasmothecia up to 250 µm diam., with 9-22 appendages ..... (227) *P. erythrinae*

20. Appendages occasionally nodulose, surface irregular, coarsely verrucose, tips rounded, rarely uncinate; on *Indigofera scabrida*, China ..... (283) *P. verruculosa*

20. Appendages not nodulose, smooth 21

21. Appendages about as long as the chasmothecial diam. or usually shorter 22

21. Appendages 1-1.5(-2) times the chasmothecial diam. 24

22. Asci 2-3-spored; on *Acacia* spp., Asia (India), South Africa ..... (182) *P. acaciae*

22. Asci 2-spored; on other hosts 23

23. Appendages 6-8; on *Bauhinia* sp., India ..... (200) *P. bauhiniae*

23. Appendages 10-18; on *Robinia* spp., North America ..... (271) *P. robiniae*

24. Ascospores very large, 43-64 x 16-22 µm; on *Adesmia campestris*, Argentina .. (186) *P. adesmiae*

24. Ascospores smaller, length below 40 µm 25

25. Appendages 1-1.5(-2) times as long as the chasmothecial diam. 26

25. Appendages about as long as the chasmothecial diam. or shorter 27

26. Chasmothecia 190-250 µm diam., average > 200 µm, penicillate cells mostly ampulliform, wider at the base and narrower upwards, distinctly branched at the apex; occasionally on *Wisteria sinensis*, Europe ..... (232) *P. fraxini*

26. Chasmothecia smaller, 165-230 µm diam., average < 200 µm, penicillate cells narrowly cylindrical, not distinctly branched; on *Caesalpinia japonica*, *C. sepiaria* and *Gleditsia sinensis* (= *G. macracantha*), Asia ..... (204) *P. caesalpiniae*

27. Appendages few, 4-10 28
27. Appendages numerous, 6-20, usually more than 10 29
28. On *Sphenostylis angustifolia*, South Africa ..... (278) *P. sphenostylidis*
28. On *Phaseolus trilobus*, India ..... (260) *P. phaseolina*
29. Asci very numerous, up to 40, 2-3-spored; on *Burkea africana*, South Africa ..... (231) *P. evansii*
29. Asci less numerous, usually 4-15, 2-spored; on *Dalbergia* spp., Asia ..... (221) *P. dalbergiae*

- Fagaceae

1. Conidia characteristically angular in shape, almost cylindrical or more rounded, often centrally constricted, dumb-bell-shaped. rarely some conidia subclavate; on *Fagus* and *Quercus* spp. in North America ..... (197) *P. angulata* var. *angulata*
1. Conidia clavate to somewhat spathuliform; on *Castanea*, *Fagus* and *Quercus* spp. in Asia and Europe 2
2. Chasmothecia 175-265 µm diam., usually < 250 µm, with 4-18 appendages, 0.75-2 times as long as the chasmothecial diam. ..... (255) *P. orbicularis*
2. Chasmothecia larger, 250-350(-400) µm diam., with 8-30 appendages, about as long as the chasmothecial diam. or shorter ..... (272) *P. roboris*

- Grossulariaceae

1. Conidia clavate; chasmothecia 170-265(-350) µm diam.; on *Ribes* spp., South America, Argentina ..... (198) *P. antarctica*
1. Conidia clavate to spathuliform, pyriform, cymbiform; chasmothecia somewhat smaller, 170-230 µm diam.; on *Ribes* spp. in the northern hemisphere ..... (269) *P. ribes*

- Hamamelidaceae

1. Chasmothecia 150-270 µm diam., stems of the penicillate cell usually unbranched; on *Corylopsis* spp. and *Fortunearia sinensis* ..... (220) *P. corylopsidis*
1. Chasmothecia smaller, (140-)150-175(-190) µm diam., stems of the penicillate cells mostly branched; on *Hamamelis* ..... (237) *P. hamamelidis*

- Hydrangeaceae

1. Conidia broadly obovoid-obpyriform to subclavate-spathuliform; chasmothecia 200-265 µm diam.; on *Jamesia americana* ..... (242) *P. jamesiae*
1. Conidia probably clavate; chasmothecia smaller, 140-225 µm diam.; on *Philadelphus* spp. ..... (261) *P. philadelphi*

- Juglandaceae

1. Chasmothecia large, 225-330 µm diam., but only with few appendages, 5-12; on *Juglans mandshurica* ..... (244) *P. juglandis-mandshuricae*
1. Chasmothecia smaller, 150-250 µm diam., with up to 22 appendages when relatively large, i.e. when ∅ > 200 µm ..... (243) *P. juglandis*

- Lamiaceae

1. Conidia smooth; chasmothecia (140-)175-235 µm diam., appendages (0.8-)1-2.5 times as long as the chasmothecial diam., bulbous base 30-45 µm diam.; on *Elsholtzia*, *Eurysolen* and *Rabdosia* spp. ..... (225) *P. elsholtziae*
1. Conidia verruculose; chasmothecia larger, 250-340 µm diam., appendages 1-1.3 times as long as the chasmothecial diam., bulbous base 35-65 µm diam.; On *Gmelina arborea* ... (234) *P. gmelina*

- Lauraceae

On *Litsea cubeba*, *Lindera* spp. and *Sassafras tsumu* ..... (248) *P. linderae*

- Magnoliaceae

1. Chasmothecial ∅ usually > 200 µm, stem of the penicillate cells unbranched, bifurcate or with several distinct branchlets; on *Liriodendron tulipifera* ..... (249) *P. liriodendri*

1. Chasmothecial ∅ usually < 200 µm, stem of the penicillate cells often unbranched or with small, often knob-like projections; on *Magnolia* spp. ..... (250) *P. magnolia*

- Malvaceae (incl. *Bombacaceae*)

1. Chasmothecia large, 210-325 µm diam., with 9-29 appendages; on *Firmiana simplex* ..... (277) *P. sinensis*

1. Chasmothecia smaller, 140-255 µm diam., with few appendages; on *Ceiba speciosa* ..... (215) *P. chorisia*

- Meliaceae

On *Melia azedarach* and *Toona* spp. ..... (281) *P. toonae*

- Moraceae

1. Asci 2-spored; on *Broussonetia kazinoki*, *Cudrania* sp., *Morus* spp. ..... (253) *P. moricola*

1. Asci 2-4-spored, often 3-4-spored; on *Broussonetia* and *Ficus* spp. ..... (204) *P. broussonetiae-kaempferi*

- Nyssaceae, see *Cornaceae*

- Oleaceae

– 1. Foot-cells of the conidiophores cylindrical, straight; on *Chionanthus*, *Fraxinus*, *Ligustrum* and *Syringa* spp., North America, Central Asia, Asia Minor, Caucasus, Europe ..... (232) *P. fraxini*

1. Foot-cells flexuous, spirally twisted; on *Fraxinus* spp. in Asia (China, Iran, Japan, Korea, Russia, Far East) ..... (233) *P. fraxinicola*

- Phyllanthaceae

1. Appendages 1.5-2 times as long as the chasmothecial diam.; on *Bridelia* spp. ..(203) *P. brideliae*

1. Appendages 1-1.5 times the chasmothecial diam.; on *Andrachne* spp. ..... (196) *P. andrachnes*

- Rhamnaceae

1. Chasmothecia 200-240 µm diam., ascospores (35-)45-50 x 20-28 µm; on *Discaria chacaye*, Argentina ..... (195) *P. ampulliformis*

1. Chasmothecia smaller, 125-185 µm diam., ascospores 28-35 x 10-20 µm; on *Paliurus spina-christi*, Asia, Caucasus, Europe ..... (257) *P. paliuri*

- Rosaceae

1. Chasmothecia relatively small, (135-)140-185(-200) µm diam. 2

1. Chasmothecia usually larger, diam. > 200 µm 3

2. Asci 2-spored ..... (251) *P. mali*

2. Asci 4-6-spored; on *Pyrus communis*, India ..... (266) *P. pyri-communis*

3. Chasmothecia 170-280 µm diam., bulbous basal swelling (25-)30-55 µm diam., appendages 0.5-2 times as long as the chasmothecial diam., filaments of the penicillate cells usually not longer than the stem portion ..... (267) *P. pyri-serotinae*

3. Chasmothecia larger, 225-350 µm diam., bulbous basal swelling larger, 30-80 µm diam.., filaments of the penicillate cells as long as, shorter or longer than the stem 4

4. Bulbous basal swelling of the appendages hyaline, filaments of the penicillate cells about as long as the stem or longer, apex up to 6 µm wide; on *Prunus* (*Amygdalus*) spp., Asia, Caucasus ..... (199) *P. babayanii*

4. Bulbous basal swelling of the appendages sometimes pigmented; filaments of the penicillate cells about as long as the stem or shorter with apices strongly swollen up to 10 µm in width; on *Holodiscus discolor*, North America ..... (241) *P. holodisci*

- Rutaceae

  1. Chasmothecia with (7-)10-17(-25) appendages, (0.3-)0.5-1(-2) times as long as the chasmothecial diam., bulbous basal swelling poorly developed; on *Tetradium daniellii* ..... (229) *P. euodiae*
  1. Chasmothecia with 4-12 appendages, (0.8-)1.5-2(-2.5) times as long as the chasmothecial diam., bulbous basal swelling well developed, 25-50 µm diam.; on *Zanthoxylum* spp. ..... (284) *P. zanthoxylicola*

- Sabiaceae

  On *Sabia* spp. ..... (273) *P. sabiae*

- Salicaceae

  – On *Populus* and *Salix* spp. ..... (263) *P. populi*

- Sapindaceae (incl. *Aceraceae*)

  1. Appendages short, 0.5-1.3 times as long as the chasmothecial diam., bulbous basal swelling of the appendages 20-35(-40) µm diam., ascospores 20-35 µm long; on *Aeculus* spp. .. (187) *P. aesculi*
  1. Appendages 1-2 times as long as the chasmothecial diam., bulbous basal swelling larger, 30-55 µm diam., ascospores longer, 25-55 µm; on *Acer* spp. ..... (252) *P. marissalii*

- Scrophulariaceae

  1. Chasmothecia very large, 250-400 µm diam., with 12-30 appendages; on *Paulownia* spp. ..... (274) *P. salmonii*
  1. Chasmothecia smaller, 125-180 µm diam., with 5-8 appendages; on *Paulownia tomentosa* ..... (259) *P. paulowniae*

- Simarubaceae

  On *Ailanthus* spp. ..... (188) *P. ailanthi*

- Solanaceae

  On Lycium chilense ..... (216) *P. chubutiana*

- Sterculiaceae (see *Malvaceae*)

- Styracaceae

  On *Alniphyllum fortunei*, *Halesia macgregorii* and *Pterostyrax* spp. ..... (264) *P. pterostyracis*

- Ulmaceae (*Hemiptelea* and *Pteroceltis*, see *Cannabaceae*)

  1. Conidial state abundant, conidia characteristically angular in shape, almost cylindrical or more rounded, often centrally constricted, dumb-bell-shaped, rarely some conidia subclavate; chasmothecia large, (180-)200-280(-340) µm diam., with 6-12 appendages, bulbous basal swelling 30-65 µm diam; on *Ulmus* spp. in North America ..... (197) *P. angulata* var. *ulmi*
  1. Conidial state state sparingly developed or lacking, conidia, if present, clavate; chasmothecia about 170-250 µm diam.; in Asia and Europe 2
  2. Stems of the penicillate cells of the chasmothecia usually with 4-12 short cylindrical to bulbous branchlets: on *Hemiptelea davidii*, Korea ..... (238) *P. hemipteleae*
  2. Stems of the penicillate cells unbranched or with few subcylindrical-conical branchlets; on Ulmus spp., Europe ..... (254) *P. nivea*

- Urticaceae

  On Parietaria officinalis ..... (258) *P. parietariae*

- Verbenaceae (*Gmelina*), see *Lamiaceae*

- Vitaceae

  On *Ampelopsis*, *Parthenocissus* and *Vitis* spp. ..... (193) *P. ampelopsidis*

10 Pleochaeta

1. Asci 2(-3)-spored; chasmothecial appendages thick-walled throughout even when young 2

1. Asci (2-)3-5-spored; appendages at first thin-walled, becoming thicker with age 3

2. Appendages short, shorter than the chasmothecial diam. (0.25-0.75 times the diam.), length rather variable, shorter and longer appendages mixed on the same chasmothecium; on *Celtis* (*Cannabaceae*), North and South America ..... (286) *P. polychaeta*

2. Appendages longer (0.75-)1-1.5 times the diam., length rather uniform; on *Prosopis* (Fabaceae), South America ..... (287) *P. prosopidis*

3. Appendages thin-walled; on *Salix* (Salicaceae), China ..... (288) *P. salicicola*

3. Appendages at first thin-walled, later becoming moderately thick-walled or even thick-walled throughout; on *Aphananthe*, *Celtis*, Asia, South Africa 4

4. On *Aphananthe* and various *Celtis* spp., Asia, South Africa ..... (289) *P. shiraiana*

4. On *Celtis australis*, North India ..... (285) *P. indica*

11 Golovinomyces

- 1. Conidiophores very long, foot-cells (or sometimes following cells) very long, about 80-250 µm,width conspicuously increasing from base to top, or foot-cells about 40-80 µm long, subcylindrical, followed by a following cell about as long as the foot-cell or longer; conidia large, 25-50(-70) x 16-30 µm, especially wide, mostly > 20 µm, length/width ratio usually less than 2, broadly ellipsoid-ovoid to doluform, conidia often with slightly constricted ends (limoniform); conidial germination of the *longitubus* pattern within the *Euoidium* type - on *Eremocarpus*, *Verbascum* or various host species of the *Asteraceae* (*Ambrosia ambrosioides* [= *Franseria ambrosioides*], *Arctium*, *Centaurea montana* and some other species of this genus, *Echinops*, *Onopordum*); or foot-cells subcylindrical, 35-120 x 9-18 µm, followed by 1-3 shorter cells, but conidia broadly ellipsoid-ovoid, doliiform to limoniform, about 25-45 x 15-27 µm, length/width ratio usually < 2 (1.3-2.1, mostly 1.4-1.6) and conidial germination of the *longitubus* pattern - on hosts of the *Anthemideae* (*Artemisia*, rarely *Achillea*) and *Heliantheae* (*Ambrosia*, *Helianthus*, *Rudbeckia*, *Zinnia angustifolia*); [*Golovimomyces* sect. *Depressi*] 2

1. Conidiophores shorter, foot-cells about 40-140 µm long, mostly 40-80 µm, cylindrical, usually followed by 1-3 shorter cells; conidia ellipsoid-ovoid to doliiform, sometimes subcylindrical, usually narrower, about 13-22 µm wide, seldom wider, conidial germination of the common *Euoidium* type; [*Golovinomyces* sect. *Golovimomyces*] 8

2. Chasmothecia mostly 95-150 µm diam.; appendages usually very short, shorter than the chasmothecial diam., often rudimentary, 3-9 ttm wide, hyaline or only faintly pigmented; on *Artemisia*, *Eremocarpus* or *Verbascum*, rarely on *Achillea millefolium* 3

2. Either chasmothecia larger, often larger than 150 µm diam., or appendages well developed, wider, brown when mature; on other species of *Asteraceae* 5

3. Foot-cells of the conidiophores 35-120 x 10-18 µm, subcylindrical or slightly increasing in width from base to top, followed by shorter cells; on hosts of the *Anthemideae* (*Artemisia*, rarely *Achillea*) ..... (316) *G. artemisiae*

3. Foot-cells of the conidiophores either much longer, about 80-160 µm, distinctly increasing in width from base to top, or foot-cells about 50-80 µm long, followed by much longer cells; on other hosts 4

4. Foot-cells of the conidiophores very long, up to 160 µm, followed by much shorter cells; on *Verbascum*, Asia, Europe, anamorph introduced in North America ..... (355) *G. verbasci*

4. Foot-cells up to about 80 µm long, often followed by a longer cell; on *Eremocarpus*, North America ..... (335) *G. immersus*

5. Conidiophores with short or long foot-cells followed by shorter cells; on *Arctium*, some *Centaurea* spp. including *C. montana*, *Onopordum* and various plants of the *Heliantheae* (*Ambrosia*, *Helianthus*, *Rudbeckia*, *Zinnia angustifolia*) 6

5. Conidiophores with a long foot-cell followed by shorter cells or often with a short or moderately long foot cell followed by a cell of about the same length or much longer, sometimes very long; on *Echinops* or *Ambrosia ambrosioides* 7

6. Foot-cells of the conidiophores cylindrical, 35-80 x 9-15 µm; chasmothecia subglobose, on various plants of the *Heliantheae* (*Ambrosia*, *Helianthus*, *Rudbeckia*, *Zinnia angustifolia*) ..... (312) *G. ambrosiae*

6. Foot-cells of the conidiophores 80-190 µm long, mostly somewhat increasing in width from base to top; chasmothecia usually depressed-lentiform when mature; on *Arctium*, some *Centaurea* spp. including *C. montana*, *Onopordum* ..... (327) *G. depressus*

7. Foot-cells of the conidiophores subcylindrical, 40-80 µm long, followed by 2-4 cells, the first following cell about as long as the foot-cell or longer; on *Ambrosia ambrosioides* [= *Franseria ambrosioides*], USA ..... (331) *G. franseriae*

7. Foot-cells increasing in width from base to top, straight, about 40-100(-150) x 10-20 µm, followed by some shorter cells or by a longer first following cell, about 100-170 µm, and a second cell about 40-100 µm, often followed by a further 1-2 short cells about 20-30 µm long, (the lengths of the first and second cells may be exchanged); on *Echinops*, Asia, Caucasus, Europe ..... (328) *G. echinopis*

8. Persistent secondary mycelium formed, composed of rather coarse, brown, thin- to moderately thick-walled hyphae, forming a brown felt around aggregated ascomata; asci 2-4-spored, often with 3 or 4 spores; on *Mimulus*, North America ..... (319) *G. brunneopunctatus*

8. Without secondary mycelium, at most some hyphae around ascomata turning brown, but not thick-walled, and/or consistently 2-spored 9

9. Appendages at least partly arising from the upper half of the ascomata; on species of *Hydrophyllaceae* or *Malvaceae* in North America, on *Rubiaceae* or rarely on *Asteraceae* 10

9. Appendages arising both equatorially and from the basal half, never or only rarely from the upper half 14

10. Outer peridium cells large, 8-40 µm diam., length occasionally up to 50 µm; appendages rather coarse and broad, 5-12(-15) µm wide, often rather straight; on *Hydrophyllaceae*, North America ..... (333) *G. hydrophyllacearum*

10. Either peridium cells smaller, about 8-30 µm diam., and/or appendages narrower, about 3-10 µm wide, mycelioid, geniculate-sinuous, not straight; on other hosts 11

11. On *Napaea* and *Sphaeralcea* (*Malvaceae*), confined to North America ..... (313) *G. americanus*

11. On other hosts 12

12. On *Rubiaceae* 13

12. On composites (*Asteraceae*); appendages usually equatorial and in the lower half, but sometimes some also reaching the upper half; see *G. cichoracearum* s. lat. 38

13. Mycelium well developed, appendages not very fragile, interwoven with the secondary mycelium, forming a loose pigmented felt; on *Galium*, in Asia and Europe ..... (315) *G. riedlianus*

13. Mycelium poorly developed, barely visible, appendages very fragile, forming a delicate interlacement, but not forming felt-like layers, asci oblong, length/width ratio around 2; on *Calceolaria* and *Galium aparine* in South America (Argentina) ..... (320) *G. calceolariae*

14. Conidia ± cylindrical, narrow, 25-38 x 12-18 µm, on average < 15 µm wide; on *Euphorbia* spp., South America (and ? China) 15

14. Conidia ± ellipsoid-ovoid to doliiform (-limoniform), broader, on average > 15 µm wide (if narrower on other hosts in the northern hemisphere) 16

15. Mycelium mostly dense and persistent, *Leveillula*-like (see section 14.1.5.1); ascomata 125-180(-200) µm diam.; appendages usually shorter than the chasmothecial diam.; on *Euphorbia* spp., Argentina, Chile (and ? China) ..... (314) *G. andinus*

15. Mycelium effuse or in thin patches, evanescent to almost persistent; ascomata 85-130 µm diam.; appendages 0.5-2 times the chasmothecial diam.; on *Euphorbia collina* var. *nahuelhuapina*, Argentina ..... (329) *G. euphorbiicola*

16. Chasmothecia with short appendages, usually shorter than the chasmothecial diam., often very short 17

16. Chasmothecia with well developed appendages, about 0.5-4 times the chasmothecial diam.. mostly about as long or longer than the diam. 23

17. Chasmothecia with only a few appendages, very short, often rudimentary; on *Cordylanthus* [*Orobanchaceae*], North America ..... (347) *G. rogersonii*

17. Chasmothecia with numerous short appendages; on other hosts 18

18. Appendages (4-)6-10(-12) µm wide, completely brown when mature, 0.25-1.5 times the chasmothecial diam., usually shorter than the diam.; on *Hyoscyamus* or composites 19

18. Appendages narrow, about 2-7 µm wide, usually shorter than the chasmothecial diam., hyaline to faintly pigmented; on *Asteraceae* (*Artemisia*, *Achillea*, *Chrysothamnus*, *Ericameria*, *Grindelia*, *Lorandersonia*), *Polygonaceae* (*Eriogonum*), or brown to dark brown below and paler towards the tip; on *Rubia*, Asia 20

19. On *Hyoscyamus* (*Solanaceae*) ..... (334) *G. hyoscyami*

19. On composites (*G. cichoracearum* s. lat.) 38

20. Appendages brown to dark brown below and paler towards the tip; on Rubia, Asia ..... (348) *G. rubiae*

20. Appendages hyaline to faintly pigmented; on *Artemisia*, *Achillea*, *Chrysothamnus* (also *Ericameria*, *Grindelia*, *Lorandersonia*), *Eriogonum* 21

21. Conidia cylindrical-doliiform (-ovoid), small, about 20-32 x 10-15 µm; on *Chrysothamnus*, *Ericameria*, *Grindelia*, *Lorandersonia*, western USA ..... (345) *G. pseudosepultus*

21. Conidia larger, above all wider, 14-26 µm, ellipsoid-ovoid to doliifom 22

22. Conidia about 16-26 µm wide, conidial germination mainly of the *longitubus* pattern within the *Euoidium* type, conidiophores often somewhat constricted at the basal septum; asci about 25-50 µm wide; on *Artemisia*, rarely on *Achillea* ..... see (316) *G. artemisiae*

22. Conidia 14-22.5 µm wide; conidial germination not mainly of the *longitubus* pattern within *Euoidium* type, conidiophores not constricted at the basal septum; asci slender, about 20-35 µm wide; on *Eriogonum*, North America ..... (321) *G. californicus*

23. Mycelium forming characteristic, dense, white, persistent patches, often confluent, or forming a complete cover; outer peridium cells large, about 10-40 µm diam.; on *Polemoniaceae* 24

23. Appearance of the mycelium different or peridium cells smaller; on other hosts 25

24. Chasmothecial appendages (4-)6-10(-12) µm wide, usually without constrictions; peridium cells 10-35 µm diam.; on *Phlox* and *Polemonium* ..... (340) *G. magnicellulatus* var. *magnicellulatus*

24. Appendages wider, (4-)6-13(-18) µm, with numerous characteristic constrictions; peridium cells up to 40 µm diam., on *Polemonium chinense* (incl. *P. linifolium*), China and Far East of Russia ..... (340) *G. magnicellulatus* var. *robustus*

25. Chasmothecia about 120-170 µm diam., usually immersed in dense mycelial layers or patches; mycelium turning brown with age; on *Laportea*, Japan ..... (337) *G. laporteae*

25. Chasmothecia different, and/or smaller, mycelium effuse or in patches with/or without brown hyphae; on other hosts 26

26. Mycelium effuse, rarely in irregular patches, thin, often rather inconspicuous, evanescent (-almost persistent); chasmothecia usually scattered; on *Acalypha*, *Parietaria* or *Pilea*, North America 27

26. Mycelium effuse or in patches, conspicuous, almost persistent; chasmothecia mostly ± gregarious; on other hosts 28

27. Foot-cells of the conidiophores sometimes followed by a very long cell; asci occasionally 3-spored; on *Parietaria* and *Pilea* (*Urticaceae*) ..... (332) *G. greeneanus*

27. Foot-cells long, followed by shorter cells; asci 2-spored; on *Acalypha* (*Euphorbiaceae*) (353) *G. sparsus*

28. Appendages of mature ascomata usually distinctly verrucose; foot-cells of the conidiophores curved; on *Valeriana*, also on *Centranthus*, *Fedia*, *Patrinia* ..... (354) *G. valerianae*

28. Appendages smooth or only faintly rough-walled, and/or foot-cells straight; on other hosts 29

29. Conidiophores frequently constricted at the basal septum; mature asci filled with numerous oil-drops; on *Lamiaceae* or *Verbenaceae* 30

29. Conidiophores not conspicuously constricted at the basal septum; asci (when mature) not filled with oil-drops; on other hosts 31

30. Foot-cells of the conidiophores cylindrical or subcylindrical; on *Lamiaceae* ..... (318) *G. biocellatus*

30. Foot-cells increasing somewhat in width towards the tip; on *Verbena* (*Verbenaceae*), common in North America, rare in Asia and Europe ..... (356) *G. verbenae*

31. Conidia 25-45 x 15-27 µm (when fresh), broadly ellipsoid-ovoid to doliiform to limoniform, length/width ratio 1.3-1.9, mostly 1.4-1.6; conidial germination mainly of the *longitubus* pattern within the *Euoidium* type; on *Ambrosia*, *Iva*, *Helianthus*, *Rudbeckia*, *Zinnia* (*Asteraceae*, *Heliantheae*] ..(312) *G. ambrosiae*

31. Conidia narrower, more slender, length/width ratio about 1.3-2.6; conidial germination of the normal *Euoidium* type 32

32. Mycelium usually in persistent, dense, limited patches; conidial germ tubes short, often twisted; on *Boraginaceae* ..... (326) *G. cynoglossi*

32. Appearance of the mycelium different, and/or germ tubes longer, not twisted; on other hosts 33

33. On *Arabis*, Asia; on *Adenophora*, *Plantago* or *Galium* 34

33. On other hosts 37

34. Foot-cells of the conidiophores curved at the base; on *Plantago* ..... (351) *G. sordidus*

34. Foot-cells consistently straight or variable, straight to curved 35

35. Foot-cells 40-85 x 9-13 µm; chasmothecial appendages equatorial and in the lower half, but occasionally also in the upper half; on *Galium* ..... (346) *G. riedlianus*

35. Foot-cells up to 130 µm long; chasmothecial appendages in the lower half 36

36. Foot cells arising from the upper side or laterally from the hyphal mother cells, straight to curved; on *Adenophora* (*Campanulaceae*) ..... (311) *G. adenophorae*

36. Conidiophores always from the upper side of mother cells, consistently straight; on *Arabis* and *Cardaminopsis* (*Brassicaceae*), Asia ..... (315) *G. arabidis*

37. Developing conidia usually not distinctly swollen, forming relatively short chains; mature conidia (10-)15-23(-25) µm wide; conidiophores erect, foot-cells straight or often curved, especially at the base; hyphal appressoria nipple-shaped or often poorly developed; germ tubes short, often somewhat twisted, broadened or bent, rarely forked; ascomata seldom developed; asci often 3- or 4-spored; on numerous host species of various plant families, including *Cucurbitaceae* (also on some cultivated hosts of the *Asteraceae*, e.g. *Chrysanthemum*, *Dahlia*, *Helianthus*, *Matricaria*, *Scorzonera*, but usually only in inoculation experiments and greenhouses, not under field conditions) ..... (342) *G. orontii*

37. Developing conidia usually conspicuously swollen, often in long chains; conidiophores erect, straight, cylindrical to distinctly curved; hyphal appressoria conspicuously nipple-shaped, sometimes with a crenulate surface or lobed; germ tubes short to moderately long, simple; ascomata frequently developed (on composites); asci usually consistently 2-spored or only occasionally 3-spored; on various hosts of the *Asteraceae* (*G. cichoracearum* s. lat.) or on *Cucurbitaceae* (foot-cells of the conidiophores straight; dried conidia in herbarium samples about 12-16 µm wide, on average < 15 µm; asci 2-spored) 38

38. On *Cucurbitaceae* ..... (325) *G. cucurbitacearum*

38. On various tribes of the *Asteraceae* (*G. cichoracearum* l. lat.) 39

39. Conidia small, about 20-30 x 10-15 µm; ascospores small and subglobose, about 14-19 x 10-13 µm; on *Goniocaulon indicum*, India ..... (343) *G. ponnaensis*

39. Conidia larger; ascospores larger, usually not subglobose; on other hosts 40

40. Foot-cells of the conidiophores curved; conidia broadly ellipsoid-doliiform, 20-35 x 15-22 µm, length width ratio (1-)1.2-2; chasmothecia large, about (100-)120-160 µm diam.; appendages usually shorter than the chasmothecial diam.; on species of *Senecio* sect. *Senecio*, above all *S. sylvaticus*, *S. viscosus* and *S. vulgaris*, but also *S. jacobaea* ..... (330) *G. fischeri*

40. Foot-cells of the conidiophores not curved, and/or conidia with a length/width ratio of about 1.5-2.3; and or chasmothecia smaller; and/or appendages longer; on other hosts 41

41. Conidia narrow, 28-38 x 10-18 µm, width on average < 15 µm: on *Prenanthes* ... (344) *G. prenanthis*

41. Conidia broader, width on average > 15 µm: on other hosts 42

42. Chasmothecia mainly caulicolous, immersed in a dense mycelial felt, 70-120 µm diam.; ascus wall very thin, about 1 µm wide; on *Lygodesmia*, USA ..... (322) *G. caulicola*

42. Chasmothecia mainly foliicolous and/or larger; ascus wall 1-2 µm wide; on other hosts 43

43. Chasmothecia relatively small, 85-115 µm diam., appendages 1-2 times as long as the chasmothecial diam.; foot-cells of the conidiophores 90-120 x 12-16 µm; conidia up to 55 µm long; on *Leuceria thermarum*, Argentina ..... (338) *G. leuceriae*

43. Chasmothecia larger or appendages shorter, about as long as the chasmothecial diam. or mostly shorter; foot-cells usually 30-80 x 9-14 µm, conidia usually up to 40 µm long 44

44. Foot cells arising somewhat laterally from the hyphal mother cells, often curved, even sinuous throughout or only at the base 45

44. Foot cells arising from the upper surface of the mother cells, always straight 49

45. All foot cells curved at the base, often strongly so or even sinuous; hyphal appressoria frequently lobed; confined to *Sonchus* spp. [*Cichorioideae*, *Sonchinae*] ..... (350) *G. sonchicola*

45. Shape of foot-cells variable, straight to curved, and/or most or all hyphal appressoria nipple-shaped, only occasionally slightly lobed; on other hosts 46

46. Hyphal appressoria variable, nipple-shaped to lobed; on various plants of the *Cichorioideae* ..... (323) *G. cichoracearum* s. str

46. Hyphal appressoria completely or almost completely nipple-shaped; on other hosts (*Asteroideae*) ... 47

47. Shape of foot-cells of the conidiophores variable, straight to curved; appendages 0.5-4 times as long as the chasmothecial diam.; on the *Eupatorieae* (*Ageratina*, *Coniclinium*, *Eupatorium*, *Eutrochium*, *Praxelis*) ..... (324) *G. circumfusus*

47. All or almost all foot-cells curved: on the *Astereae* 48

48. Chasmothecial appendages uniformly short, mostly shorter than the chasmothecial diam.; on *Aster* s. lat. (*Galatella*, *Symphyotrichum*) ..... (317b) *G. asterum* var. *moroczkovskii*

48. Appendages variable in length, 0.5-2.5 times the chasmothecial diam.; on *Solidago* spp. ..... (317c) *G. asterum* var. *solidaginis*

49. Mature chasmothecia usually depressed at the base or somewhat lentiform; on *Carduoideae*, *Inuleae* and *Senecioneae* 50

49. Mature chasmothecia usually subglobose; on other hosts 52

50. On *Inula*, *Inuleae* ..... (336) *G. inulae*

50. On hosts of the *Carduoideae* or *Senecioneae* 51

51. On plants of the *Carduoideae* ..... (341) *G. montagnei*

51. On plants of the *Senecioneae* ..... (349) *G. senecionis*

52. Appendages about 0.5-4 times as long as the chasmothecial diam.; on *Cichorioideae* or *Eupatorieae* 53

52. Appendages uniformly short, usually about as long as the chasmothecial diam. or shorter; on other hosts ..... (323) *G. cichoracearum* s. str

53. Hyphal appressoria consistently nipple-shaped; on the *Eupatorieae* ..... (324) *G.circumfusus*

54. On the *Heliantheae* (*Coreopsis*, *Dahlia*, *Melampodium*, *Tithonia*, *Xanthium*, *Zinnia*, etc.) ..... (352) *G. spadiceus*

54. On the *Anthemideae* or *Astereae* 55

55. On the *Anthemideae* ..... (339) *G. macrocarpus*

55. On the *Astereae* (*Aster* s. lat.) ..... (317a) *G. asterum* var. *asterum*

12 Neoërysiphe

1. Appressoria on hyphae often nipple-shaped sometimes lobed; asci 2-4-spored, often 2-spored; ascospore development in the current season or after overwintering; on *Rubiaceae* 2

1. Appressoria on hyphae mostly lobed, occasionally nipple-shaped or lacking; asci only mature after overwintering, 2-8-, mostly 3-6-spored; on hosts of other families 3

2. Chasmothecia large, (80-)100-140(-160) µm diam.; appendages hyaline, later sometimes faintly pigmented; ascospores only mature after overwintering, i.e. asci in the current season always immature, on *Galium* spp. ..... (375) *N. galii*

2. Chasmothecia smaller, 80-115 µm diam.; appendages brown; ascospore development in the current season on the living host; on *Rubia* sp., Turkey ..... (382) *N. rubiae*

3. Appendages pigmented when mature, brown, at least in the lower half, usually 3-6 µm wide; on *Lamiaceae*, *Scrophulariaceae*, occasionally on other families 4

3. Appendages of the chasmothecia hyaline to only faintly pigmented below, up to 10 µm wide, or appendages dimorphic, i.e. hyaline and thin-walled or pale to dark brown and thick-walled, 6-9 µm wide, or appendages uniformly brown, but up to 10 µm wide and strongly geniculate-sinuous to helically twisted; on hosts of the *Asteraceae* and *Geraniaceae* 5

4. On various host genera of the *Lamiaceae*, occasionally on hosts of other families . (374) *N. galeopsidis*

4. On *Chelone glabra* (*Scrophulariaceae*), North America ..... (372) *N. chelones*

5. On *Erodium* and *Geranium* (*Geraniaceae*), Asia, Eastern Europe, introduced in New Zealand ..... (376) *N. geranii*

5. On *Asteraceae*, Asia, Australia, Europe, North America 6

6. Mycelium inconspicuous, secondary mycelium absent, hyphal appressoria lacking; chasmothecia 85-140 µm diam., appendages pigmented throughout, yellowish brown to medium dark brown; on *Gnaphalium*, Europe ..... (377) *N. gnaphalii*

6. Mycelium well developed, secondary mycelium present or, if mycelium inconspicuous and secondary mycelium absent, chasmothecia much larger, up to 200 µm diam., appendages not uniformly pigmented: on other hosts. 7

7. Mycelium inconspicuous, secondary mycelium absent; chasmothecia rather large, up to 200 µm, mainly 125-170 µm, asci numerous, 16-32 per chasmothecium; on *Phagnalon*; in the Mediterranean region ..... (379) *N. joerstadii*

7. Mycelium well developed, secondary mycelium present; chasmothecia smaller, usually 95-150 µm, if large then asci about 7-18 per chasmothecium 8

8. Chasmothecia very large. about 175-210 µm diam., peridium cells labyrinthiform, 14-70 µm long and 7-15 µm wide, appendages dimorphic, either hyaline and thin-walled or pigmented and thick-walled; on *Senecio*, Australia ..... (380) *N. kerribeeensis*

8. Chasmothecia smaller, only up to 175 µm diam., peridium cells irregularly polygonal, smaller, 5-20(-30) µm diam.; appendages not dimorphic 9

9. Chasmothecia large, mainly 125-165 µm, with visible evagination rather than a concavity on the lower side; on various hosts of the *Asteraceae*, North America (Mexico, USA), South America (Argentina), ? Asia (India) ..... (373) *N. cumminsiana*

9. Chasmothecia smaller, concave in the lower part; in Asia and Europe 10

10. Mycelium pure white; conidia mainly cylindrical with rounded ends or oblong ellipsoidal, averave length width ratio 2.7; appendages hyaline, occasionally somewhat brownish, peridial surface indistinctly meshed or even knobbly; on *Cacalia* and *Ligularia* in Japan ..... (378) *N. hiratae*

10. Primary mycelium yellowish, sometimes even somewhat brownish, secondary mycelium mainly white or sometimes faintly pigmented; conidia ellipsoidal or short cylindrical with rounded ends, often somew hat limoniform, average length/width ratio 1.9; appendages brownish, occasionally hyaline, peridial surface meshed (var. *nevoi*) or even coarsely pitted (scrobiculate, var. *scolymi*; on *Scolymus*, Israel); on different composites, mainly of tribe *Cichorieae*, eastern Europe, Mediterranean region ..... (381) *N. nevoi*

13 Erysiphe

13.1 Erysiphe sect. Erysiphe

1. Chasmothecia with a single globose ascus, rarely two asci, small, 60-85(-95) µm diam.; on fruits and sepals of *Styrax*, Japan ..... (450) *E. monoascogera*

1. Chasmothecia with two to numerous asci 2

2. Asci usually not developed, immature before overwintering, chasmothecia with numerous stiff, setiform appendages, (10-)20-50, equatorial or in the upper half; on *Acalypha*, Asia, Africa .(398) *E. acalyphae*

2. Asci developed in the current season, ascospores also usually developed, and/or appendages not setiform, but mycelium-like, and/or appendages not in the upper half 3

3. Chasmothecia very large, 200-250 µm diam., appendages very numerous, up to 50, in the upper half, pointing upwards in one direction, extremely long, up to 4-5000 µm; on *Carpinus laxiflora*, Japan ..... (425) *E. fimbriata*

3. Chasmothecia much smaller or appendages equatorial or in the lower half, not turning upwards, much shorter; on other hosts 4

4. Asci usually 6-8-spored, frequently 8-spored 5

4. Asci 2-7-spored, mostly 3-6-spored, sometimes 5-7-spored, but not with 8 spores (or only very rarely few asci with 8 Spores) 22

5. Chasmothecia large, usually 110-230 µm diam., mostly larger than 140 µm diam. 6

5. Chasmothecia smaller, about 70-140 µm diam. 10

6. Infections on twigs and female catkins of Alnus 7

6. Infections usually on leaves and stems, sometimes inflorescences of other hosts 8

7. Chasmothecia about 120-160 µm diam., appendages 2-5 times as long as the chasmothecial diam., asci 8-15; on Alnus, Europe ..... (483) *E. vernalis*

7. Chasmothecia about 130-230 µm diam., appendages mostly 0.5-2 times as long as the chasmothecial diam. (rarely up to 4 times), asci 15-30; on Alnus, North America ..... (394) *E. aggregata*

8. Appendages of the chasmothecia only 3-5.5 µm wide, shape characteristically sinuous to geniculate, ascospores small, 15-22 x 9-15 µm; on *Weinmannia*, New Zealand ..... (408) *E. carpophila*

8. Appendages 5-8 µm wide; Asian species 9

9. Appendages flexuous, but not characteristically sinuous-geniculate, ascospores large, 15-36 x 9-17 µm; on *Weigela*, Asia ..... (420) *E. diervillae* var. *diervillae*

9. Appendages sinuous-tortuous (-geniculate), ascospores smaller, 15-22.5 x 10-12.5 µm; on *Altingia*, China ..... (396) *E. altingiae*

10. Chasmothecia 70-90 µm diam., appendages few, less than 10, often irregularly branched, long, only 2-3 asci; on *Symplocos*, West Sikkim ..... (476) *E. symploci*

10. Chasmothecia often larger with numerous appendages, Asci numerous 11

11. Chasmothecia with dimorphic appendages, long mycelioid appendages ± equatorial, as well as short, rather stiff, bristle-like appendages in the upper half; on *Rodgersia podophylla*, Japan ..... (466) *E. rodgersiae*

11. Chasmothecia not dimorphic, with only a single type of appendage; on other hosts 12

12. Appendages without septa or only with a single septum near the base, usually unbranched 13

12. Appendages with 2 or more septa or frequently branched 14

13. Appendages about 4.5-5.5 µm wide, moderately thick-walled, apex usually rounded, very rarely circinate, 4-8 asci, about 40-60 µm long; on *Abelia*, China ..... (388) *E. abeliae*

13. Appendages 2.5-8 µm wide, thin-walled at least above, apex rounded or pointed, 5-12 asci, about 60-80 µm long; on *Weigela*, Asia ..... (420) E. *diervillae* var. *weigelae*

14. species confined to New Zealand 15

14. species confined to Asia and Europe 16

15. Appendages short, rarely exceeding the chasmothecial diam., narrow, only 3-5 µm wide, thin-walled; on Rubus ..... (468) *E. rubicola*

15. Appendages 0.5-3 times as long as the chasmothecial diam., 5-6.5 µm wide, moderately thick-walled; on *Aristotelia* ..... (418) *E. densa*

16. Appendages frequently branched; on *Cirsium* or *Weigela* 17

16. Appendages mostly unbranched; on other hosts 18

17. Appendages short, mostly shorter than the chasmothecial diam.; on *Cirsium*, Europe ..... (449) *E. mayorii* var. *mayorii*

17. Appendages longer, 1-3(-4) times as long as the chasmothecial diam.; on *Weigela praecox*, Asia, Far East of Russia ..... (420) *E. diervillae* var. *chasanensis*

18. Appendages stiff, setiform, 0.5-3 times as long as the chasmothecial diam., asci 3-9(-12); on *Plectranthus*, Asia ..... (408) *E. bunkiniana*

18. Appendages flexuous, mycelioid, mostly with 6-16 asci; on other hosts or on *Plectranthus*, Asia, but then much longer, (1-)3-6 times the chasmothecial diam. 19

19. Appendages long and narrow, 0.3-6 times as long as the chasmothecial diam., 3-6.5 µm wide, asci easily visible within the intact ascomata; on *Filipendula*, Asia and Europe ..... (481) *E. ulmariae*

19. Appendages shorter and wider, and/or peridium dark, asci not easily visible within intact ascomata 20

20. Appendages long, (1-)3-6 times the chasmothecial diam.; on *Plectranthus* ..... (459) *E. plectranthi*

20. Appendages shorter, (0.5-)1-3.5(-5) times the chasmothecial diam.; on other hosts 21

21. Appendages 0.5-5 times as long as the chasmothecial diam., usually very numerous; on Lespedeza (440) *E. lespedezae*

21. Appendages about as long as the chasmothecial diam., rather few; on Rhododendron ..... (465) *E. rhododendri*

22. Infections above all on stems, chasmothecia large, (100-)110-185(-210) µm diam., appendages fairly thick-walled throughout, strongly flexuous-sinuous to geniculate; on *Astragalus*, Asia and Europe (410) *E. caulicola*
[N.B. on legumes chasmothecia with appendages that are strongly geniculate-sinuous, thick-walled, at least below, 0-1(-2)-septate may be immature samples of *Erysiphe bremeri*, *E. hedysari*, *E. thermopsidis*, *E. rayssiae* and *E. robiniae* var. *chinensis* that have not developed terminal branchings characteristic of *Erysiphe* sect. *Microsphaera*, similarly, if on legumes, chasmothecia with appendages arising ± equatorially or somewhat in the upper half, that are very long, not mycelioid, horizontally spread or with a tendency to point in one direction, with walls ± thick below, may be immature samples of *E. trifoliorum*, *E. baeumleri*, *E. astragali*, or *E. hyperici* if on *Hypericum* (see key to species of *Erysiphe* sect. *Microsphaera*)]

22. Infections not confined to stems, chasmothecia either smaller or appendages thin-walled 23

23. Chasmothecia very large, 100-220 µm diam., often >150 µm im diam. 24

23. Chasmothecia smaller, averaging <150 µm diam, ... 25

24. Chasmothecia with very short appendages, often rudimentary, poorly developed, asci about 20-40 per chasmothecium; on *Chrysothammnus*, North America ..... (472) *E. sepulta*

24. Appendages up to six times as long as the chasmothecial diam., asci about 8-20; on *Geum quellyon* [= *G. chiloense*], South America ..... (427) *E. frickii*

25. Chasmothecia with dimorphic appendages, with numerous equatorial appendages, long and mycelioid, and short, stiff, bristle-like appendages in the upper half; on *Sambucus wightiana*, India, Jammu & Kashmir ..... (437) *E. kashmiriensis*

25. Chasmothecial appendages uniform, mycelioid, usually not in the upper half 26

26. Chasmothecia 60-85(-95) µm diam., appendages aseptate, verrucose throughout, only 2-4 asci; on hosts of the *Fagaceae*, Asia 27

26. Chasmothecia either larger and/or with more asci, and/or appendages septate or not verrucose 28

27. Appendages very short, 0.1-0.5 times the chasmothecial diam., often branched, asci (3-)4-7(-8)-spored ..... (473) *E. sikkimensis*

27. Appendages 0.3-1.5 times as long as the chasmothecial diam., unbranched, asci 2-4-spored ..... (424) *E. farmanii*

28. Chasmothecia with few appendages, only 1-14, mostly 0-10, 0-3-septate; on *Abelmoschus*, *Chrysosplenium*, *Linum*, *Pueraria* or *Phygelius*, Asia 29

28. Chasmothecia with more appendages, and/or appendages pluriseptate; on other hosts 31

29. Appendages hyaline, 1-3(-4) times as long as the chasmothecial diam., asci 45-75 x 40-55 µm; on *Pueraria*, China ..... (462) *E. puerariae*

29. Appendages pigmented at least below 30

30. Appendages very short, about as long as the chasmothecial diam. or shorter, asci globose or subglobose, 28-56.5 µm diam.; on *Phygelius*, China ..... (456) *E. phygelii*

30. Appendages much longer, usually longer than the chasmothecial diam., asci obovoid to subglobose, 35-55(-60) x 30-45(-50) µm, [2-4 per chasmothecium, 3-4-spored, ascospores 13-19 x 8-10 µm]; on *Chrvsosplenium*, Japan ..... (464) *E. pusilla*
[very similar, but asci somewhat longer, (35-)40-60(-70) µm, 4(-5) per chasmothecium, 4-5-spored, ascospores larger, 18-26 x 10-16 µm conidiophores 10-12 µm wide; on *Abelmoschus*, Japan, see (389) *E. abelmoschicola* or ascospores larger, 21-27 x 12-14 µm conidiophores 8-10 µm wide; on *Linum*, Japan, see (442) *E. lini*]

31. Appendages of the chasmothecia characteristically sinuous (-geniculate), narrow, 2.5- 5.5 µm wide, thick-walled throughout, aseptate or with few inconspicuous septa; on *Quercus* (incl. *Cyclobalanopsis*), Asia 32

31. Characteristics of the appendages different, not sinuous, or appendages wider, or not thick-walled, or conspicuously septate 33

32. Appendages 50-400 µm long ..... (430) *E. gracilis* var. *gracilis*

32. Appendages (200-)300-800 µm long ..... (430) *E. gracilis* var. *longissima*

33. Appendages hyaline (-yellowish), septate or hyaline and aseptate (on *Acaena*) or only with a single septum (on *Balbisia*, *Plectranthus*, *Thermopsis* or *Limonium*) [appendages colourless and short; on *Triumfetta*, South Africa, see immature *E. doidgeae*] 34

33. Appendages pigmented, at least brown below when fully mature, and/or pluriseptate 39

34. Chasmothecia (105-)125-150(-165) µm diam., appendages 3-14(-21), shorter than the chasmothecial diam., inner wall of the peridium golden yellow; on *Limonium suffruticosum*, China .... (399) *E. aurea*

34. Chasmothecia usually with more than 10 appendages (up 30 or even more), 0.5-5 times as long as the chasmothecial diam., inner wall not golden yellow 35

35. Chasmothecia large, usually 100-150 µm, appendages aseptate, 1-5 times as long as the chasmothecial diam.; South America, Argentina 36

35 Chasmothecia smaller, about 80-140 µm diam., appendages up to two times as long as the chasmothecial diam.; in Asia [chasmothecia only 50-105 µm diam.; on *Punica*, see (560) *E. punicae*] 37

36. Conidiophores with very long foot-cells, 80-140 µm; asci 11-15 per chasmothecium; on *Balbisia* ..... (400) *E. balbisiae*

36. Conidiophores with shorter foot-cells, 30-60 µm long; asci 4-12 per chasmothecium; on *Acaena* ..... (390) *E. acaenae*

37. Appendages 0.5-3 times as long as the chasmothecial diam., asci (3-)4-8-spored; on *Plectranthus*, China ..... (406) *E. bunkiniana*

37. Appendages 0.3-1.5 times as long as the chasmothecial diam., asci mostly 3-5-spored; on *Panax* or *Thermopsis* 38

38. Appendages 4-10.5 µm wide; foot-cells of the conidiophores straight to usually flexuous to sinuous; on *Thermopsis* ..... immature stages of (129) *E. thermopsidis* [see under *E.* sect. *Microsphaera*]

38. Appendages narrower, 3.5-5.5 µm wide; conidiophores straight; on *Panax* ..... (454) *E. panacis*

39. Chasmothecia 70-110 µm diam., appendages (0.5-)1-8(-10) times as long as the chasmothecial diam.; on hosts of the Papaveraceae 40

39. Chasmothecia larger or appendages shorter and/or on other hosts 41

40. Asci 5-12(-16), 4-6-spored, ascospores 17-24 x 11-14 µm; on *Hylomecon*, Asia ..... (435) *E. hylomeci*

40. Asci 2-5, (2-)3-4(-5)-spored, ascospores very large, 18-38 x 12-18 µm; on *Macleaya* and *Meconopsis*, Asia, Europe ..... (446) *E. macleayae*
[ascomata 75-120 µm diam., ascospores (14-)16-32 x (6.5-)10-18 µm; on Chloranthus, see *E. chloranthi*]

41. Chasmothecia with two types of asci, with small micro- and large macro-asci, (1-)2-3(-5) micro- as well as macro-asci together in a single chasmothecium; on *Begonia*, China ..... (402) *E. begoniae*

41. Only a single type of asci; on other hosts 42

42. Appendages 5-15, 0.25-4 times as long as the chasmothecial diam., stiff, setiform, coarse, 36-13 µm wide. thin-walled to moderately thick-walled; on *Parnassia*, North America ..... (455) *E. parnassiae*

42. Appendages mycelioid, not setiform (or narrower, or consistantly thin-walled) 43

43. Appendages almost uniform in width, about 5-9 µm, but apical part mostly conspicuously enlarged, subclavate, thin-walled, but evidently thick-walled towards the base; on *Plectranthus* or *Rorippa* in China or Japan 44

43. Appendages variable in length, but not clavate at the apex, thin-walled throughout (very rarely moderately thick-walled) 45

44. Asci 2-4-spored; on *Rorippa cantoniensis*, China ..... (467) *E. rorippae*

44. Asci (3-)5-6(-8)-spored; on *Plectranthus* ..... (434) *E. huayinensis*

45. Appendages frequently irregularly branched 46

45. Appendages simple, not branched (rarely few appendages irregularly to subdichotomously branched) 59

46. Chasmothecia with about 6-30 asci, often more than 10, appendages mostly about as long as the chasmothecial diam. or shorter; on *Cirsium* or *Cicerbita* 47

46. Chasmothecia with few asci, usually less than 10, and/or appendages longer 48

47. On *Cirsium*, confined to Japan and the Far East of Russia ..... (449) *E. mayorii* var. *japonica*

47. On *Cicerbita*, confined to Europe ..... (449) *E. mayorii* var. *cicerbitae*

48. Appendages long, 0.5-5 times the chasmothecial diam.; conidia ± cylindrical, long (25-)30-55(-65) x 14-22 µm; on *Convolvulus*, *Calystegia* (*E. convolvuli* s. lat.) 49

48. Appendages shorter (and/or conidia smaller); on other hosts 51

49. Asci (3-)5-6-spored; on *Calystegia* ..... (415) *E. convolvuli* var. *calystegiae*

49. Asci (2-)3-4(-5)-spored 50

50. Appendages strongly branched, 1-3(-5) times, often even subdichotomously branched; On *Calystegia* and *Convolvulus* ..... (415) *E. convolvuli* var. *dichotoma*

50. Appendages only 1-2 times irregularly branched; on *Calystegia* and *Convolvulus* ..... (415) *E. convolvuli* var. *convolvuli*

51. Appendages very frequently and very strongly branched, hyaline or only very faintly pigmented, aseptate or with few inconspicuous septa; on *Paeonia*, *Vicia*, *Lathyrus* 52

51. Appendages with moderate branchings, brown when mature, at least in the lower half, septate, septa conspicuous 53

52. Appendages short, 0.25-1(-2) times as long as the chasmothecial diam., thin-walled, verrucose throughout, asci usually (2-)3-6(-7)-spored; on *Paeonia* ..... (453) *E. paeoniae*

52. Appendages 0.15-1.5(-2.5) times as long as the chasmothecial diam., walls thin to moderately thick, smooth to rough-walled, asci usually 4-6-spored; on *Vicia* or *Lathyrus*, Asia .. (484) E. *viciae-unijugae*

53. Foot-cells of the conidiophores long, 35-75(-100) µm; on *Caryophyllaceae* or *Malva* 54

53. Foot-cells shorter, usually less than 50 µm long; on other hosts 55

54. Foot-cells of the conidiophores followed by shorter cells; on various host species of the *Caryophyllaceae* ..... (405) *E. buhrii*

54. Foot-cells of the conidiophores followed by shorter cells or a second cell about as long as the foot-cell; on *Lavatera* and *Malva* (*Malvaceae*) ..... (448) *E. malvae*

55. Conidia ± ellipsoid; on hosts of the *Fabaceae*, especially on *Ononis* and *Lathyrus* ..... (458) *E. pisi* var. *cruchetiana*

55. Conidia ± cylindrical; on other hosts 56

56. Foot-cells of the conidiophores usually followed by 1-2 shorter cells or cells of about the same length; on *Polygonaceae* ..... (461) *E. polygoni*

56. Foot-cells frequently followed by a longer first cell and a shorter second cell (dominant arrangement); on other hosts 57

57. On *Beta* and *Chenopodium* (*Chenopodiaceae*) ..... (403) *E. betae*

57. On other hosts 58

58. On *Amaranthus* and *Celosia* (*Amaranthaceae*) ..... (411) *E. celosiae*

58. On various host species of the *Apiaceae* ..... (433) *E. heraclei*

59. Chasmothecia about 80-115 µm diam., fragile, often with broken appendages, (1-)2-5.5 times as long as the chasmothecial diam., verrucose throughout; on *Firmiana*, China ..... (426) *E. firmianae*

59. Chasmothecia not fragile, and/or appendages shorter, and/or not verrucose throughout 60

60. Chasmothecia small, about 60-115 µm diam., mostly about 80-110 µm, average usually < 100 µm 61

60. Chasmothecia larger, about 80-150 µm diam., average usually larger than 100 µm 82

61. Asci 4-8-spored, frequently with 5-7 spores; on *Hydrangea* in North America, on *Corydalis*, Asia or *Stephania*, Asia 62

61. Asci 2-7-spored, mostly with 3-5 spores 64

62. Conidia about 26-33 x 13-18 µm; appendages (0.5-)1-6 times as long as the chasmothecial diam.; on *Hydrangea arborescens*, North America ..... (460) *E. poeltii*

62. Conidia larger, above all longer, about 35-65 x 15-26 µm; Asian species 63

63. Ascospores large, 19-36 x 11-17 µm, yellowish; on *Stephania* ..... (475) *E. stephaniae*

63. Ascospores smaller, 16-23 x 8.5-11 µm, colourless; on *Corydalis* ..... (485) *E. werneri*

64. Asci small, 33-55 x 30-40 µm, number of spores variable, 2-7, spores small, 14-20 x 9-13.5 µm; on *Cercis chinensis*, China (412) ..... *E. cercidis*

64. Asci mostly larger, number of ascospores not variable, spores larger, often longer than 20 µm [asci rather small, 2-4-spored; appendages hyaline or only brown at the base; on *Punica*, see (360) *E. punicae*] 65

65. Appendages very long, (0.5-)1-12 times the chasmothecial diam.; on *Euphorbia hypericifolia*, *Mallotus* and various species of the *Ranunculaceae*, (*Chloranthus*) 66

65. Appendages shorter, about 0.25-4, mostly 0.5-2.5 times the chasmothecial diam. 68

66. Appendages very long, about (1-)3-12 times the chasmothecial diam., not mycelioid, mostly brown throughout when mature; on various host species of the *Ranunculaceae* ..... (103) *E. aquilegiae* var. *aquilegiae*

66. Appendages (0.5-)1-7 times as long as the chasmothecial diam., mycelioid 67

67. Appendages often brown throughout when mature, smooth to faintly rough-walled; on *Euphorbia hypericifolia*, North and South America ..... (423) *E. euphorbiae*

67. Appendages brown below and paler or hyaline above, verrucose [conidia large, (27-)30-53 x 16-24 µm]; on *Mallotus*, Asia ..... (447) *E. malloti*
[Appendages smooth; conidia smaller; on *Chloranthus*, Asia, see *E. chloranthi*]

68. Appendages short, about as long as the chasmothecial diam. or SHorter 69

68. Appendages longer, 0.5-4 times the chasmothecial diam. 71

69. Appendages very short, length not more than half the diam. of the chasmothecium; on *Acalypha* and *Jatropha*, South Africa ..... (436) *E. jatrophae*

69. Appendages longer, usually 0.5-1 times the chasmothecial diam.; on species in Asia 70

70. Appendages often hyaline, asci 2-4-spored, ascospores 16-30 x 10-16 µm; on *Potentilla* ..... (480) *E. thuemenii*

70. Appendages at least partly pigmented, yellowish to brown below, asci 3-5-spored, ascospores 14-24 x 8.5-16 µm on *Saxifragaceae* ..... (439) *E. krumbholzii*

71. Appendages usually brown throughout when mature; on *Chloranthus*, *Circaea* or various host species of the *Lamiaceae* and *Ranunculaceae* 72

71. Appendages pigmented in the lower half, yellowish to brown, paler to hyaline upwards (occasionally very short appendages pigmented throughout); on other hosts 75

72. Foot-cells of the conidiophores often curved or flexuous; on *Circaea* ..... (414) *E. circaeae*

72. Foot-cells of the conidiophores straight 73

73. On host species of the *Ranunculaceae* ..... (397) *E. aquilegiae* var. *ranunculi*

73. On hosts of the *Lamiaceae* or *Chloranthus* 74

74. Foot-cells of the conidiophores short, 15-30 µm long; on *Chloranthus*, Japan, Far East of Russia ..... (413) *E. chloranthi*

74. Foot-cells of the conidiophores longer, 20-50 µm; on various hosts species of the *Lamiaceae* ..... (432) *E. hommae*

75. Chasmothecia usually with about 10-20 appendages, only with 2-4(-5) asci, (3-)4-6(-7)-spored; on *Symplocos*, China ..... (477) *E. symplocicola*

75. Chasmothecia with few appendages, often less than 10, and/or 3-8, often 5-6 asci, and/or asci 2-4-spored 76

76. Conidia cylindrical; on *Coriaria* or *Pachypodium* 77

76. Conidia ellipsoid-ovoid; on other hosts 78

77. Conidia about 30-45 x 13-18 µm; ascospores 20-28 x 13-18 µm; on *Coriaria* ..... (416) *E. coriariicola*

77. Conidia narrower, 9-13.5 µm wide; ascospores smaller, 18.5-21 x 7.5-10 pm; on *Pachypodium* (452) *E. pachypodii*

78. Conidia (20-)25-45(-50) x (12-)15-25 µm; ascospores (15-)20-30.5 x 8-17 µm; on *Asclepias* or *Dipsacaceae* 79

78. Conidia smaller, ascospores shorter; on other hosts 80

79. Chasmothecial appendages up to 4 times as long as the chasmothecial diam; germ tubes of the conidia short and aseptate; on various host species of the *Dipsacaceae* ..... (438) *E. knautiae*

79. Chasmothecial appendages up to 2 times as long as the chasmothecial diam.; germ tubes of the conidia short to long, septate or showing up to 25% *longitubus* pattern; on *Asclepias* ..... (398) *E. asclepiadis*

80. Mycelium amphigenous, in patches, persistent; on *Pilea* ..... (457) *E. pileae* [on *Lythrum* in Asia or *Cuphea* in North America, see small forms of *E. lythri*; on *Triumfetta*, South Africa, see small forms of *E. doidgeae*]

80. Mycelium usually effuse, thin, sparse, evanescent (-subpersistent), on *Geranium* or *Saxifragaceae* .. 81

81. On *Geranium* (*Geraniaceae*), North America, Asia, Europe ..... (428) *E. geraniacearum*

81. On *Saxifragaceae* (*Chrysosplenium*, *Saxifraga*), Asia (Japan, Far East of Russia) (439) *E. krumbholzii*

82. Appendages not very numerous, around 4-19, usually stiff and straight at least below, sometimes almost setiform, 0.5-1.5 times as long as the chasmothecial diam., aseptate or with few septa; on Catalpa ... (104) *E. catalpae*

82. Appendages not setiform, but flexuous and mycelioid throughout, and/or appendages numerous and conspicuously and richly septate ... 83

83. Appendages aseptate, verrucose, yellowish, sometimes brownish; on *Epimedium*, China ... (422) *E. epimedii* var. *epimedii*

83. Appendages 0-2-septate to pluriseptate ... 84

84. Asci with very thick wall, appendages with chain-like swellings in the upper part, asci 2-4-spored, spores 20-30 x 14-20 um; on *Sambucus*, Tibet ... (469) *E. sambuci* var. *crassitunicatae*

84. Wall of the asci not thick ... 85

85. Chasmothecia evenly scattered, with numerous appendages, 0.5-7 times the chasmothecial diam., hyaline or only yellowish, asci (3-)4-6(-8)-spored; on various host species of the *Fabaceae*, North America, Asia (428) *E. glycines*

85. Chasmothecia at least partly gregarious, and/or appendages shorter and brown, and/or asci 2-5-spored 86

86. Chasmothecial appendages long, (0.5-)1-4(-5) times the chasmothecial diam., asci 4-6-spored; on *Epimedium*, China ... (422) *E. epimedii* var. *brunnea*

86. Appendages shorter and/or asci 2-5-spored (or on hosts in South Africa) ... 87

87. Appendages very short, 0.5-1.5(-2) times the chasmothecial diam., mostly shorter than the diam., hyaline or only faintly pigmented; on *Urtica*, *Pilea* or *Limonium* ... 88

87. Appendages longer, 0.5-5 times the chasmothecial diam., often pigmented; on other hosts ... 89

88. Conidia ellipsoid-cylindrical, broad, about 25-48 x 10-20 µm; on *Urtica*, *Pilea* ... (482) *E. urticae* [conidia ellipsoid-doliiform; on *Triumfetta*, South Africa, see *E. doidgeae*]

88. Conidia narrower, ± cylindrical, about 25-47 x 9-16(-19) µm; on *Limonium* ... (441) *E. limonii*

89. Conidia ± cylindrical, slender, about 27-34 x 12.5-16 µm; chasmothecial appendages mostly rather stiff, straight, sometimes almost setiform; on *Liriodendron*, North America ... (443) *E. liriodendri*

89. Conidia either ± ellipsoid (-ovoid, -doliiform); and/or appendages mycelioid, flexuous, geniculate-sinuous ... 90

90. Conidia ± cylindrical, large, about (25-)30-45 x (10-)12-19(-25) µm; appendages sometimes irregularly branched; on *Malva* or *Polygonaceae* [on *Baptisia*, USA, see (401) *E. baptisiicola*] ... 91

90. Conidia ± ellipsoid (-ovoid, -doliiform); and/or appendages consistently simple; on other hosts ... 92

91. On *Polygonaceae* ... (461) *E. polygoni*

91. On *Malvaceae* ... (448) *E. malvae*

92. Conidia cylindrical (-doliiform); on hosts of the *Capparales* and *Papaverales* or *Peganum* (*Zygophyllaceae*) ... 93

92. Conidia ± ellipsoid-ovoid, ellipsoid-subcylindrical, doliiform; on other hosts ... 94

93. Conidia about (25-)30-50(-62.5) x 10-21 µm, foot-cells of the conidiophores followed by shorter or sometimes somewhat longer cells; on hosts of the *Capparales* (*Brassicaceae*, *Capparidaceae*, *Cleomaceae*, *Resedaceae*) and *Papaverales* (*Fumariaceae*, *Papaveraceae*) ... (417) *E. cruciferarum*

93. Conidia narrower, (22-)26-39(-42) x 9-17 µm, foot-cells of the conidiophores always followed by shorter cells; on *Peganum* (*Zygophyllaceae*) ... (395) *E. alashanensis*

94. Appendages straight to sinuous-contorted or spirally twisted, asci 2-3-spored; foot-cells of the conidiophores 50-65 x 10-12 pm; on *Saussurea*, Japan ..... (404) *E. braunii*

94. Appendages mycelioid, but neither sinuous-contorted nor spirally twisted, asci 2-5-spored; foot-cells of the conidiophores usually shorter or if long narrower 95

95. Foot-cells of the conidiophores very long, 50-80 x 7-10 µm; on *Nelumbo* ..... (478) *E. takamatsui*

95. Foot-cells of the conidiophores shorter, on average less than 50 µm in length; on other hosts 96

96. Appendages rather long, up to 5 times as long as the chasmothecial diam., asci 3-6-spored; on *Thesium* or *Triumfetta* 97

96. Appendages shorter, and/or asci 2-4-spored; on other hosts 98

97. Appendages not very numerous, mostly only 5-15, 0.5-4 times as long as the chasmothecial diam.; on *Thesium* in the northern hemisphere ..... (497) *E. thesii*

97. Appendages numerous, 1-5 times the chasmothecial diam; on *Triumfetta*, South Africa ..... (421) *E. doidgeae*

98. Asci 2-4(-5)-spored, ascospores broadly ellipsoid-ovoid to subglobose, very wide, about 12-18(-20) µm; on *Sambucus* or *Sedum* 99

98. Asci 2-7-spored, ascospores narrower, only 8-16 µm wide, mostly 9-14 µm; on other hosts 100

99. Appendages narrow, (4-)5-6(-7.5) µm wide, brown throughout when mature; on Sambucus ..... (469) *E. sambuci* var. *sambuci*

99. Appendages wider, 3-10 µm, mostly pigmented below and paler upwards; on Sedum .... (471) *E. sedi*

100. Foot-cells of the conidiophores straight to often curved or somewhat sinuous; on *Carica* or legumes 101

100. Foot-cells of the conidiophores straight, not curved-sinuous or only rarely slightly so; on other hosts, but also on legumes [morphological differentiation of the species concerned difficult and only gradual, therefore not keyed out in detail] 102

101. Conidiophores up to 200 µm long; asci mostly 3-5 per chasmothecium, on Carica .... (407) *E. caricae*

101. Conidiophores up to 120 µm long; asci mostly 4-8 per chasmothecium; on various host species of the *Fabaceae* ..... (458) *E. pisi* var. *pisi*

102. On hosts of the *Bignoniaceae* (*Incarvillea*) ..... (470) *E. scholzii*

102. On hosts of the *Boraginaceae* (*Anchusa* and *Lycopsis*) ..... (444) *E. lycopsidis*

102. On hosts of the *Cucurbitaceae* (*Actinostemma*, *Schizopepon*) ..... (393) *E. actinostemmatis*

102. On hosts of the *Fabaceae* ..... (458) *E. pisi* var. *pisi*

102. On hosts of the *Lamiaceae* ..... (432) *E. hommae*

102. On hosts of the *Lythraceae* (*Cuphe* and *Lythrum*) ..... (445) *E. lythri*

102. On hosts of the *Onagraceae* (*Oenothera*) ..... (433) *E. howeana*

102. On hosts of the *Urticaceae* 103

103. Ascomata large, 100-150 µm diam., with numerous asci, 10-18; on *Laportea* ..... (451) *E. otani*

103. Ascomata smaller, 80-120(-130) µm diam., only with 3-10 asci; on *Pilea* ..... (457) *E. pileae*

13.2 Erysiphe sect. Californiomyces

1. Asci 2-spored; on *Lithocarpus* and *Quercus* spp., North America ..... (490) *E. trinae*

1. Asci 4-8-spored; Asian species 2

2. Chasmothecia very small, diameter < 50 µm; on *Quercus glauca*, Taiwan .. (487) *E. cyclobalanopsidis*

2. Chasmothecia larger, > 50 µm 3

3. Mycelium usually hypophyllous; asci 6-8-spored; ascospores olivaceous-brown; on *Castanopsis diversifolia*, *C. echinocarpa* (*Fagaceae*), Thailand and Indonesia (Java) ..... (486) *E. asiatica*

3. Mycelium usually epiphyllous; asci 4-6-spored: ascospores colourless 4

4. Chasmothecia (75-)80-90(-95) µm diam.; on *Quercus*, India ..... (488) *E. kumaonensis*

4. Chasmothecia smaller, (55.5-)58-82.5(-85) µm diam.; on *Castanopsis* and *Lithocarpus*, Thailand .... (489) *E. monoperidiata*

13.3 Erysiphe sect. Microsphaera

1. Appendages dimorphic, equatorial appendages sinuous to spirally twisted, long, terminal appendages short, bristle-like, straight to somewhat curved; on Rosa, Asia ..... (613) *E. rosae*

1. Appendages uniform, not sinuous-twisted 2

2. Infections on pods of *Acacia*, India; chasmothecia 115-230 µm diam., with 20-80 narrow appendages, apices only 1-2 times forked ..... (493) *E. acaciae*

2. With other features, either chasmothecia smaller and/or with fewer appendages, and/or more than two times branched 3

3. Chasmothecia with numerous appendages, about 50-100, branching lax, diffuse; on *Astragalus*, Tadzhikistan ..... (619) *E. seravschanica*

3. Appendages fewer, less than 50 4

4. Apices of appendages frequently trichotomously branched, sometimes primary branches elongated, main axis growing on and bearing sets of opposite branches or short outgrowths, appendages 5-28, short; chasmothecia 90-150 µm diam.; on *Quercus*, southern parts of the USA ..... (510) *E. calocladophora*

4. Apices dichotomously branched, rarely few appendages trichotomously branched (on *Robinia* in Asia sometimes trichotomously branched, see *E. palczewskii*) 5

5. Appendages with bulbose basal swelling, 16.5-27(-29.5) µm diam.; on *Magnolia liliiflora*, China .... (511) *E. bulbosa*

5. Appendages without bulbose swelling at the base, at most base slightly enlarged 6

6. Stalk of the appendages 1-6-septate, usually pigmented, at least in the lower half 7

6. Stalk aseptate or 0-1(-3)-septate, hyaline or only pigmented at the base, very rarely pigmented throughout 19

7. Appendages very long and flexuous, 2-12, mostly 2-6 times as long as the chasmothecial diam., apices frequently simple, not branched, occasionally 1-2 times branched, loose; on various host species of the *Fabaceae*, *Cornus* or *Hypericum*; or apices frequently branched, 1-4 times; on *Oxalis* 8

7. Appendages shorter, and/or apices always richly branched, mostly 3-6 times; on other hosts 12

8. Apices of the appendages frequently branched; on *Oxalis* ..... (614) *E. russellii*

8. Apices usually simple, occasionally 1-2 times branched 9

9. Appendages very long, about 5-15 times as long as the chasmothectal diam., usually pointing in one direction; on *Cornus* ..... (635) *E. tortilis*

9. Appendages shorter, mostly 2-6 times the chasmothecial diam., usually horizontally spread; on other hosts 10

1O. Conidia rather narrow, cylindrical, about 12-18 µm wide; on *Hypericum* ..... (558) *E. hyperici*

10. Conidia broader, ellipsoid-cylindrical, about 16-27 µm wide; on legumes 11

11. Chasmothecia (80-)90-150(-180) µm diam., mostly foliicolous; appendages smooth or only faintly rough-walled; on various hosts ..... (636) *E. trifoliorum*

11. Chasmothecia smaller, 70-90(-105) µm diam., caulicolous; appendages evidently verrucose; on *Desmanthus*, North America ..... (530) *E. desmanthi*

12. Tips of ultimate branchlets of appendages straight, not recurved; on *Begonia*, *Cinnamomum*, *Rhododendron* [or *Sedum*, *Sesbania*] 13

12. Tips distinctly recurved when mature, at least partly 15

13. Appendages (1.5-)2-4(-7) times as long as the chasmothecial diam., branching very loose; on *Rhododendron mekongensis* ..... (533) *E. digitata*

13. Appendages much shorter, 1-2 times as long as the chasmothecial diam. [appendages 0.5-3.5 times as long as the chasmothecial diam., 0-3(-4)-septate; on *Sesbania*, Argentina, see *E. sesbaniae*] 14

14. Appendages thin-walled, only slightly thicker near the base; asci 6-10, (3-)5-8-spored; conidia very large, (25-)35-60(-70) µm long; on *Begonia* ..... (502) *E. begoniicola*

14. Appendages obviously thick-walled towards the base; asci 2-8, (2-)3-5(-7)-spored; conidia smaller; on *Cinnamomum*, USA ..... (519) *E. cinnamomicola*
[appendages occasionally 1-3-septate; asci 3-5-spored; on *Sedum* in Asia; see *E. umbilici*]

15. Asci 3-5-spored; on *Cephalanthus*, North America ..... (618) *E. semitosta*

15. Asci 6-8-spored; on other hosts, ... 16

16. Appendages short, about 0.7-1.25 times as long as the chasmothecial diam.; on *Meliosma* or *Castanea* 17

16. Appendages longer, about 1.5-2.5 times the chasmothecial diam.; on *Berchemia* or *Corylus* 18

17. Chasmothecia 115-165 µm diam., with about 10-20 appendages; asci 7-16; on *Castanea seguinii*, China ..... (617) *E. seguinii*

17. Chasmothecia smaller about 70-110 µm diam., with 6-12 appendages; asci 2-5; on *Meliosma*, Japan ..... (580) *E. meliosmae*

18. Chasmothecia large, 80-140 µm diam.; appendages flexuous, irregular, often geniculate-sinuous, apical branching very variable, close and regular to diffuse, wide, regular branching with recurved tips, diffuse branching with straight tips; on *Corylus*, Japan ..... (525) *M. corylicola*

18. Chasmothecia smaller, 70-115(-120) µm diam.; appendages rather stiff, straight to curved, regular, apical branching regular, primary branches usually elongated, tips recurved; on *Berchemia*, Japan ..... (506) *E. berchemiae*

19. Appendages with a single septum distant from the base (by about a third to a half length of appendage), basal part pigmented, appendages 5-9, about as long as the chasmothecial diam. or shorter; on *Decaisnea* ..... (529) *E. decaisneae*

19. Appendages aseptate or with septum near the base; with other features; on other hosts 20

20. Apical branching extremely variable, diffuse and irregular to regular, tight, compact, tips straight or recurved; chasmothecia 95-160 µm diam.; appendages 6-25, 1-2.5 times as long as the chasmothecial diam.; on *Vicia*, North America ..... (575) *E. ludens*

20. Apical branching not variable, either consistently diffuse, loose or consistently tight, regular, compact 21

21. Appendages short, about 0.5-2.5 times as long as the chasmothecial diam., non-mycelioid, or somewhat flexuous and longer, about 1-4.5 times the diam., but then never mycelioid, neither geniculate nor strongly sinuous 22

21. Appendages either very long, 2-13 times the chasmothecial diam., or shorter, about 0.5-4 times the diam., but then strongly sinuous and geniculate, mycelioid (on various species of the *Fabaceae*) .. 162

22. Tips of the ultimate branchlets of the apices straight, not recurved (or only very few tips occasionally recurved) 23

22. Tips distinctly recurved when mature, at least partly 57

23. Appendages about as long as the chasmothecial diam. or often shorter; chasmothecia small, 75-115 µm diam., on average < 100 µm; with 5-9 short appendages 24

23. Appendages longer, 1-4 times the diam., or short, but then with 8-20 appendages 25

24. Appendages completely verrucose; asci 2-7; on *Corylus yunnanensis*, China ..... (641) *E. verruculosa*

24. Appendages smooth or almost so; asci 3; on *Viburnum sargentii*, Far East of Russia . (582) *E. miranda*

25. Appendages often trichotomously branched or with a tendency to form a main axis which grows on and bears lateral branchings or outgrowths or even opposite sets of such structures; appendages numbering about (2-)4-10(-13), 1-3 times as long as the chasmothecial diam; on *Robinia*, Asia (Far East of Russia and China) ..... (595) *E. palczewskii* p.p. (= *Microsphaera subtrichotoma*)

25. Appendages all dichotomously branched, with other features 26

26. Appendages aseptate or usually with some septa or septum-like lines that are distant from the base; chasmothecia with 10-25 appendages; on *Cinnamomum*, USA ..... (519) *E. cinnamomicola*

26. Appendages aseptate or 1(-2)-septate at the base; on other hosts 27

27. Appendages very numerous, mostly about 40-60; on *Hamiltonia*, India ..... (602) *E. prasadii*

27. Appendages fewer (less than 40) 28

28. Appendages short, usually 0.5-1.5(-2) times as long as the chasmothecial diam. 29

28. Appendages longer, 1-4 times the diam. (on *Lonicera tatarica* only 1-2 times) 44

29. Chasmothecia 75-90 µm diam.; appendages 7-9; asci 6-8-spored; ascospores 12-14 x 6-7 µm; on *Maackia amurensis*, Far East of Russia ..... (520) *E. cladrastidis*

29. Chasmothecia usually larger, often with more appendages; asci 3-8-spored; ascospores larger (chasmothecia larger, but asci 8-spored, appendages only 3 times branched; on *Rosa*, Asia, see (568) *E. karisiana*) 30

30. Appendages very numerous, 10-45, average > 15; on *Forestiera* or *Sambucus* 31

30. Appendages 3-20 32

31. Apices of the appendages lax, diffuse, loose, primary branches usually elongated; on *Forestiera*, USA . ..... (590) *E. neomexicana*

31. Apices tight, compact, regular, appearance digitate, primary branches always short; on *Sambucus*, Asia, Europe ..... (639b) *E. vanbruntiana* var. *sambuci-racemosae*

32. Branching very dense, compact, branches of all orders short, outline ± circular, appearance of the branching digitate; on *Abelia*, *Euonymus*, *Ribes* or *Sambucus* 33

32. Branching either looser, primary branches often elongated or dense, compact, but then not circular in outline, appearance not digitate; on other hosts 36

33. Appendages (0.5-)0.7-1(-1.5) times as long as the chasmothecial diam., branched part dense, compact, but not digitate, ultimate branchlets not elongated, tips obtuse to truncate; on *Abelia biflora*, China . ..... (517) *E. chifengensis*

33. Appendages usually 1-1.5 times as long as the chasmothecia diam., branched apical part often digitate, with elongated ultimate branchlets; on *Euonymus*, *Ribes* or *Sambucus* 34

34. Asci 8-spored; on *Euonymus japonicus*, China ..... (570) *E. lianyungangensis*

34. Asci 3-6-spored 35

35. Appendages arising equatorially or somewhat in the upper half, erect; conidia about (20-)23-33(-35) x 11-17.5 µm; on *Ribes*, North America, Central Asia, Europe ..... (552) *E. grossulariae*

35. Appendages equatorial or ± equatorial; conidia relatively large, 25-45 x 10-22 µm; on *Sambucus*, North America, Asia ..... (639a) *E. vanbruntiana* var. *vanbruntiana*

36. North American species, on *Lathyrus* or *Campsis radicans* 37

36. Asiatic or European species, on other hosts 38

37. Branching always uniform, rather regular, dichotomous, tips straight; on *Campsis radicans* (= woody plant) ..... (597) *E. peckii*

37. Branching variable, compact and regular to loose, occasionally trichotomously branched, tips usually straight, but sometimes a varying percentage recurved; on *Lathyrus* (herb) ..... (569) *E. lathyricola*

38. European species; chasmothecia with 6-12 appendages 39

38. Asiatic species, if in Europe then with more appendages (5-20) 40

39. Conidia cylindrical, 30-40 x 12-14 µm; on *Cotinus* ..... (527) *E. cotini*

39. Conidia ellipsoid-doliiform, subcylindrical, shorter and broader, 28-32 x 16-18 µm; on *Verbena* ×*hybrida* ..... (640) *E. verbenicola*

40. Asci (4-)8-12(-14), 3-5-spored; apices of the appendages (2-)3-5(-6) times branched; on *Hylotelephium*, *Rhodiola*, *Sedum* ..... (637) *E. umbilici*

40. Asci 3-8, if more asci apices of the appendages richly branched, 5-8 times, and/or with more ascospores 41

41. Apices of the appendages (4-)5-8 times tightly and regularly branched, compact, primary branches very short; on *Caragana*, *Colutea*, *Robinia*, Asia, introduced into Europe and North America ..... (596) *E. palczewskii*

41. Apices usually looser, primary branches often elongated; on other hosts 42

42. Asci 3-5(-6)-spored; on *Berberis*, Asia ..... (506b) *E. berberidis* var. *asiatica*

42. Asci (3-)5-8-spored, often 6-spored 43

43. Mycelium amphigenous, persistent; on *Menispermaceae*, Asia ..... (604) *E. pseudolonicerae*

43. Mycelium mostly hypophyllous, evanescent; on *Hypericum patulum*, China ..... (559) *M. hypericicola*

44. Conidia broadly ellipsoid-ovoid to subglobose (about 30-38 x 18-25 µm); on *Houpoea* (*Magnolia*) *obovata*, Japan ..... (577) *E. magnoliae*

44. Conidia ellipsoid-ovoid to subcylindrical, slender 45

45. Chasmothecia small, 80-95 µm diam.; appendages 1-4 times as long as the chasmothecial diam., apices only once loosely dichotomously branched; on *Maytenus*, Argentina ..... (591) *E. oehrensii*

45. Chasmothecia larger and/or apices of the appendages branched more than once 46

46. Apices of the appendages regular, dense, compact; on *Caragana*, *Indigofera* or *Lonicera* 47

46. Apices loose, diffuse, often irregular 50

47. Appendages 1.5-3.5(-4) times as long as the chasmothecial diam., stiff to flexuous 48

47. Appendages only 1-2 times the diam., rather stiff 49

48. Appendages flexuous; asci 4-5-spored; on *Lonicera*, North America ..... (511b) *E. caprifoliacearum* var. *flexuosa*

48. Appendages rather stiff to somewhat flexuous; asci up to 7-spored; on *Indigofera*, Asia ..... (562) *E. indigoferae*

49. Apices of the appendages only 3-5 times branched; chasmothecia (60-)70-110(-120) µm diam.; on *Lonicera tatarica* ..... (573b) *E. lonicerae* var. *ehrenbergii*

49. Apices (4-)5-8 times branched; chasmothecia about 80-140 µm diam.; on *Caragana*, *Colutea*, *Robinia* ..... (596) *E. palczewskii*

50. Appendages (1.5-)2-4(-7) times as long as the chasmothecial diam., (0-)2-4(-7)-septate, branching loose, with elongated branches; on *Rhododendron mekongensis* ..... (533) *E. digitata*

50. Appendages usually somewhat shorter, 1-3 times the diam., 0-1-septate; on other hosts 51

51. Chasmothecia small, 70-85 µm diam.; few asci, (2-)3(-4); appendages with a single septum near the middle, rarely aseptate; on *Lonicera ramosissima*, Japan ..... (574) *E. lonicerae-ramosissimae*

51. Chasmothecia larger, often more than 85 µm diam.; asci usually more numerous; and/or appendages aseptate or with a single basal septum; on other hosts 52

52. Chasmothecia small, (70-)80-90(-100) µm diam.; asci always 3 per chasmothecium, (6-)8-spored; on *Viburnum opulus*, Japan ..... (621) *E. shinanoensis*

52. Chasmothecia larger, with more asci, 3-6-spored; on other hosts 53

53. Conidia cylindrical, long and slender, both ends rounded, 20-50 x 9-18 µm; on *Berberis*, *Mahonia*, Central Asia, Asia Minor, Europe ..... (505a) *E. berberidis* var. *berberidis*

53. Conidia ellipsoid-cylindrical (-doliform), shorter, ends often truncate, about 25-35 x 11-17.5 µm; on other hosts 54

54. Appendages numbering about 6-12; on *Lonicera*, Central Asia, rarely in Japan, Europe ..... (573a) *E. lonicerae* var. *lonicerae*

54. Appendages numbering 7-30, usually more than 10 55

55. Appendages short, only 1-2 times the diam.; on *Lonicera tatarica* (573b) *E. lonicerae* var. *ehrenbergii*

55. Appendages longer 1-4.5 times the chasmothecial diam. 56

56. Appendages 1-3, mostly 1.5-2.5 times the chasmothecial diam.; on *Apios*, *Desmodium*, *Dolichos*, *Glycine*, *Glycyrrhiza*, *Lespedeza*, *Phaseolus*, *Senna*, *Strophostyles* (*Fabaceae*) ..... (532) *E. diffusa* var. *diffusa*

56. Appendages 2-4.5 times the diam.; on *Desmodium*, *Psoralea*, *Robinia*, *Ruprechtia* (*Fabaceae*), North and South America, rarely in Asia ..... (532) *E. diffusa* var. *elongata*

57. Apices of the appendages only 1-3 times branched, branching characteristically loose, wide, primary branches long; on *Hovenia* or *Juglans*, Asia 58

57. Apices richly branched, usually 3-6 times 59

58. Conidia about 35-40 x 15-18 µm; on *Hovenia* (*Rhamnaceae*) ..... (645) *E. yamadai*

58. Conidia smaller, about 20-33 x 11-17 µm; on *Juglans*, *Pterocarya* (*Juglandaceae*) .. (566) *E. juglandis*

59. Appendages (stalk) completely brown; chasmothecia 75-110 µm diam.; asci 8-spored; on erineum galls (due to mites) on *Fagus*, North America ..... (539) *E. erineophila*

59. Appendages hyaline, only pigmented at the base or only faintly pigmented from base to top (yellowish), or brown from base to about the middle of the stalk; not on mite galls 60

60. Appendages numerous, about 10-40; asci 4-6(-7)-spored; on *Rhododendron* and other hosts of the *Ericaceae*, North America, Europe ..... (499) *E. azaleae*

60. Appendages fewer (-20), or asci 6-8-spored; on other hosts 61

61. Stalk of the appendages either thin-walled throughout and mostly yellowish, or moderately thick-walled and lower half brown below becoming faint towards the middle or even the upper half of the stalk; on *Carya*, North America, or *Syringa*, Aiaa and Europe 62

61. Stalk only pigmented near the base, thin-walled, or thick-walled towards the base 63

62. Stalk usually yellowish, thick-walled throughout; asci (4-)S5-6(-7)-spored; on *Carya*, North America (512) *E. caryae*

62. Stalk, brown below becoming paler towards the apex, mostly moderately thick-walled; asci 5-8-spored, 8 ascospores common; on *Oleaceae*, mainly *Syringa*, East Asia, introduced into Europe ..... (631) *E. syringae-japonicae*
[very similar, but with chasmothecia only in North and South America; asci (3-)4-7(-8)-spored, very rarely 8-spored; see *E. syringae*]

63. Appendages long and flexuous, 1.5-4 times the chasmothecial diam., mostly 1.5-2.5 time 64

63. Appendages short and mostly stiff, 0.5-2 times as long as the chasmothecial diam. 82

64. Species in North or South America 65

64. Species in Asia (China to Japan) 72

65. South American species (Argentina, Chile); on *Berberis*, *Discaria* 66

65. North American species, on other hosts 67

66. Chasmothecia (80-)100-120 µm diam.; appendages 2-2.5 times as long as the chasmothecial diam.; asci 3-4, 5-6-spored; on *Discaria* ..... (536) *E. discariae*

66. Chasmothecia smaller, 60-110 µm diam.; appendages 2-4 times as long as the chasmothecial diam.; asci 8, 4-5-spored; on *Berberis buxifolia* ..... (632) *E. thaxteri*

67. Asci 5-8-spored; on *Corylaceae*, *Castanea* 68

67. Asci 3-6-spored 69

68. Appendages narrow, about 5-7.5 µm wide; on *Corylaceae* ..... (539) *E. ellisii*

68. Appendages 6.5-12.5 µm wide; on *Castanea*, *Castanopsis* ..... (513) *E. castaneae*

69. Ultimate tips (on appendages with tightly branched, compact apices) mostly not recurved, development of recurved tips rather late; on *Lonicera* ..... (511b) *E. caprifoliacearum* var. *flexuosa*

69. Ultimate tips distinctly recurved, development of the curved tips early; on other hosts 70

70. Conidia ± cylindrical; ascospores large, 18-25 x 12-17 µm; appendages 2-6 times as long as the chasmothecial diam.; on *Quercus* ..... (547a) *E. extensa* var. *extensa*

70. Conidia ellipsoid to doliiform; ascospores 14-22(-24) x 8.5-14 µm; appendages shorter; on *Gleditsia* or *Ceanothus* 71

71. On *Ceanothus* (except *C. americanus*) ..... (627) *E. sydowiana*

71. On *Gleditsia* ..... (608) *E. ravenelii*

72. Appendages few, average < 10 73

72. Appendages numerous, frequently > 10 77

73. Apices of the appendages very variable, loose or somewhat irregular, often deeply forked. or closer and compact, tips straight or recurved; on *Deutzia*, Japan, Far East of Russia, introduced into Europe ..... (531) *E. deutziae*

73. Apices uniform, more regular, either loose, primary branches elongated, or dense and compact 74

74. Ascospores small, 16-18 x 9-11 µm; primary branches of the apices of the appendages often characteristically recurved; on *Phyllanthus*, Japan ..... (599) *E. phyllanthi*

74. Ascospores larger, 16-26 µm long, often longer than 20 µm, primary branches not recurved 75

75. Appendages (thin-walled throughout or only slightly thicker near the base) with apices relatively regularly branched and tight or often looser, primary and secondary branches often elongated, appearence rather "angular", on *Abelia*, Japan ..... (492) *E. abeliicola*

75. Appendages with a different mode of branching; on *Symplocos* or *Celastrus*, in China 76

76. Apices of the appendages 3-6 times branched, rather tight, compact; asci 3-6; on *Celastrus* .... (516) *E. celastri*

76. Apices (2-)4-5 times branched, primary branches usually elongated, ± horizontally spread; asci (1-)2-6; on *Symplocos* ..... (629) *E. symplocigena*

77. Appendages thin-walled, long and flaccid, apices variable, regular and tight to irregular, ultimate branchlets long or short, straight or recurved; ascospores small, about 16-20 µm long; on *Berberis diaphana*, China ..... (622) *E. sichuanica*

77. Appendages thin-walled above, but obviously thick-walled towards the base (or appendages stiff, or ascospores larger, often longer than 20 µm) 78

78. Appendages, rather stiff, basal part often brown, 7-12 µm wide below, 8-35 in number; ascospores 16-30 x 8-15 µm; on *Berberis amurensis*, China, Japan ..... (585) *E. multappendicis*

78. Appendages usually flexuous, sometimes even irregular, geniculate-sinuous, and/or basal part not brown, and/or appendages narrower, about 6-8 µm wide; ascospores smaller 79

79. Appendages 6-29, mostly 10-20, often flexuous, irregular, geniculate-undulate, frequently curved, about 5-10 µm wide, sometimes enlarged at the very base (-18 µm), branching very loose, branches of all orders often elongated; on *Rhododendron*, Japan, Far East of Russia ..... (565) *E. izuensis*

79. Appendages only 4-18, stiff or flexuous, but neither geniculate nor sinuous, about 6-9 µm wide, not enlarged at the base, apices compact, tight 80

80. Apices loosely branched, primary branches often elongated, appendages flexuous; asci 4-6-spored; on *Berberis*, China, Japan ..... (504) *E. berberidicola*

80. Apices tightly branched, primary branches not elongated, appendages stiff to flexuous; asci 6-8-spored 81

81. Chasmothecia 70-100 µm diam.; on *Coriaria japonica*, Japan ..... (523) *E. coriariae*

81. Chasmothecia larger, often > 100 µm diam.; on *Quercus chenii*, China (495) E. alphitoides var. *chenii*

82. Chasmothecia small, about 50-80 µm diam.; asci 2-4, 7-spored; ascospores small, 13-20 x 7-12 µm; on *Rhamnus rugulosus*, China ..... (610) *E. rhamnicola*

82. Chasmothecia larger, often > 80 µm diam. 83

83. Asci 6-8-spored, frequently with 8 ascospores 84

83. Asci either 2-6-spored or number variable, i.e. 2-8, mostly 5-7, but not consistently 6-8-spored and rarely 8-spored 100

84. Chasmothecia small, usually 65-115 µm diam., average usually below 100 µm; appendages few, 3-16, often less than 10; ascospores small, only 14-20 µm long (rarely -24 µm) 85

84. Chasmothecia larger, mostly > 100 µm diam.; and/or with numerous appendages, usually more than 10; and/or with more asci and larger ascospores, often longer than 20 µm 91

85. Infections usually on erineum galls (due to mites); stalks of the appendages completely pigmented; chasmothecia sometimes outside the galls and stalk hyaline, only pigmented near the base; on *Fagus*, North America ..... (541) *E. erineophila*

85. Infections not on mite galls; on other hosts 86

86. Mycelium mainly hypophyllous, evanescent or almost persistent, chasmothecia mostly 80-110 µm diam.; appendages brown at the base, pigmentation sometimes reaching the middle of the stalk, although becoming paler, apices 3-6 times branched; asci 5-8-spored; on Syringa ... (631) *E. syringae-japonicae* [very similar, but with chasmothecia only in North and South America; asci (3-)4-7(-8)-spored, very rarely 8-spored; see *E. syringae*]

86. Mycelium amphigenous, persistent or evanescent, chasmothecia often somewhat larger; or hypophyllous and evanescent, but then chasmothecia usually larger, appendages colourless or only pigmented at the very base, apices richly branched, 4-6-times; on other hosts 87

87. Mycelium usually hypophyllous, evanescent, rarely amphigenous and persistent on the upper surface of the leaves; ascospores up to 24 µm in length; on *Alnus*, northerh hemisphere ..... (597) *E. penicillata*

87. Mycelium amphigenous or epiphyllous; on other hosts 88

88. Mycelium evanescent; on *Weigela decora*, Japan ..... (644) *E. weigelae-decorae*

88. Mycelium persistent; on *Castanea*, *Castanopsis*, *Corylus* or *Quercus* 89

89. Foot-cells of the conidiophores straight to flexuous-sinuous; on *Corylus* (*Corylaceae*), North America, Asia (China to Japan) ..... (524) *E. corylacearum*

89. Foot-cells always straight, cylindrical 90

90. Mycelium only epiphyllous; conidia 20-35 x 12-20 µm, doliiform, primary conidia obovoid; on *Quercus acutissima* and *Q. variabilis*, Japan (and possibly China) ..... (540) *E. epigena*

90. Mycelium amphigenous; conidia 30-45 x 16-22 µm; on *Castanea bungeana* and *Castanopsis delavayi* (*Fagaceae*), China ..... (514) *E. castaneigena*

91. Conidia long and cylindrical, about 40-55 x 12.5-15 µm; chasmothecial appendages 5-9, on *Ligustrum*, Japan ..... (571) *E. ligustri* (incl. *katumotoi*)

91. Conidia smaller, or number of appendages greater, usually more than 10; on other hosts 92

92. Appendages aseptate or with 1-5, frequently 1-2 septa; mycelium amphigenous, usually hypophyllous; on *Castanea seguinii*, China ..... (617) *E. seguinii*

92. Appendages with 0-1(-2) septa; on other hosts 93

93. Mycelium usually hypophyllous; mycelium scarce, evanescent; on *Alnus* or *Quercus* (conidia very long, about 30-45(-65) µm) or *Flacourtia* (India) 94

93. Mycelium amphigenous, mainly epiphyllous; mycelium well developed, persistent; on *Cornus* or *Fagaceae* (conidia shorter, stout, ellipsoid-doliiform) 97

94. Mycelium causing necrotic discoloration; on *Quercus acutissima* and *Q. variabilis*, Japan ..... (560) *E. hypogena*

94. Mycelium not causing necrotic discoloration 95

95. Appendages 0-3-septate; on *Flacourtia*, India ..... (548) *E. flacourtiae*

95. Appendages 0-1-septate; on Alnus or Quercus 96

96. Chasmothecia about 80-140 µm diam.; conidia very long, 30-45(-65) µm, cylindrical; on *Quercus*, Asia, Europe, New Zealand ..... (561) *E. hypophylla*

96. Chasmothecia smaller, (70-)80-110(-125) µm diam.; conidia shorter; on *Alnus*, northern hemisphere ..... (598) *E. penicillata*

97. Foot-cells of the conidiophores straight to somewhat curved-flexuous; on *Cornus* or *Benthamidia* ..... (606) *E. pulchra*

97. Foot-cells of the conidiophores straight; on other hosts 98

98. Chasmothecia 65-115(-125) µm diam.; on *Quercus acutissima* and *Q. variabilis*, Japan (540) *E. epigena*

98. Chasmothecia larger, average > 100 µm diam. (*E. alphitoides* s. lat.) 99

99. Appendages usually 1-1.5 times as long as the chasmothecial diam.; on *Fagaceae*, almost circumglobal ..... (495) *E. alphitoides*

99. Appendages rather short, about as long as the chasmothecial diam. or somewhat shorter; on *Quercus phylliraeoides* (principal host in *Quercus*, but also on other species) and on various tropical trees (*Anacardium*, *Bixa*, *Citrus*, *Hevea*, *Mangifera*, but mainly only as anamorph); on *Bixa* conidial germ tubes often bear long extensions, some with secondary appressoria, compared to only occasional short appressorial extensions on *E. alphitoides*; despite morphological discrimination against E. alphitoides being very difficult, it is genetically clearly distinct ..... (607) *E. quercicola*

100. Species collected in North, Central or South America 101

100. Species collected in Europe, Asia, New Zealand or Australia 122

101. Tips of apices of appendages mostly not distinctly recurved; chasmothecia 90-160 µm diam., appendages 6-18; asci 2-6-spored; on *Lathyrus*, North America ..... (569) *E. lathyricola*

101. Tips always distinctly recurved; with other features; on other hosts 102

102. Appendages 3-15, short, 0.5-1(-1.25) times the chasmothecial diam.; ascospores large, 20-30 x 13-21 µm; asci 3-6-spored; chasmothecia 70-110 µm diam.; mycelium usually hypophyllous; on *Quercus* .... (491) *E. abbreviata*

102. Appendages longer and/or ascospores smaller 103

103. Appendages rather long, 1.5-3 times the chasmothecial diam. (sometimes only 1.5-2.5 times); on *Castanea* and *Castanopsis*, see *E. castaneae*; on *Lonicera*, see *E. caprifoliacearum*; on *Gleditsia*, see *E. ravenelii*

103. Appendages shorter, 0.5-2 times the chasmothecial diam. 104

104. Appendages 1-2(-2.5) times as long as the chasmothecial diam.; asci 4-8-, mostly 5-6-spored; ascospores large, 20-28 x 11-18 µm; mycelium amphigenous, dense, forming persistent patches or a complete cover; on *Quercus* ..... (547b) *E. extensa* var. *curta*

104. Appendages shorter; and/or ascospores smaller; and/or asci only 2-5-spored; on other hosts or on hosts in South America 105

105. Chasmothecia large, about (75-)80-135(-145) µm diam.; appendages numerous, about 8-25; on *Cornus*, *Menispermum*, *Platanus*, *Gleditsia*, *Lonicera*, *Myoschilos* or *Ovidia* 106

105. Chasmothecia smaller, appendages mostly fewer; on other hosts 112

106. Appendages 0.75-1.5 times as long as the chasmothecial diam.; on *Menispermum* .... (581a) *E. menispermi* var. *menispermi*

106. Appendages 1-2.5 times the chasmothecial diam. 107

107. Asci 4-8-spored; ascospores small, 15-20 x 10-13 µm; on *Cornus* ..... (606) *E. pulchra*

107. Asci 3-6-spored; ascospores larger, (14-)16-26(-30) x 9-16 µm 108

108. Apices of the appendages richly branched, 4-8 times, mostly 5-7 times; on *Myoschilos*, South America ..... (587) *E. myoschili*

108. Apices 4-6 times branched; on other hosts 109

109. Chasmothecia 90-135 µm diam.; primary branches of the appendage apex often somewhat elongated; on *Gleditsia* ..... (608) *E. ravenelii*

109. Chasmothecia 75-125 µm diam.; branching usually tight and compact; on *Lonicera*, *Ovidia* or *Platanus* 110

110. Ascospores 12-16 µm wide; on Platanus ..... (601) *E. platani*

110. Ascospores 8-14 µm wide; on *Ovidia* or *Lonicera* 111

111. Conidia 25-40 µm long; asci 2-5-, mostly 4-spored; on *Lonicera*, North America ..... (510a) *E. caprifoliacearum* var. *caprifoliacearum*

111. Conidia 28-32 µm long; asci 4-6-spored; on *Ovidia*, Argentina ..... (595) *E. ovidiae*

112. Apices of the appendages tight and compact or only primary branches somewhat elongated; ascospores small, only 15-22 µm long; on *Ceanothus americanus*, *Euonymus*, *Juglans*, *Ribes* or *Ulmus* (ascospores larger, 18-25 µm long, on *Platanus*, See *E. platanii*) 113

112. Apices loosely branched, primary and secondary branches often elongated; ascospores small or longer 117

113. Asci 4-5-spored; primary branches of the appendage apex often elongated; on *Juglans* ..... (567) *E. juglandis-nigrae*

113. Asci 4-7-spored and branching tight and compact or asci 6-7-spored and primary branches occasionally somewhat elongated; on other hosts 114

114. Mycelium evanescent to almost persistent, dense persistent patches not formed; on *Ribes* or *Ulmus* 115

114. Mycelium in persistent, often in dense patches; on *Ceanothus* or *Euonymus* 116

115. Chasmothecia small, 65-100 µm diam.; appendages 5-12; cells of the chasmothecial wall obscure, about 10-15 µm diam.; asci 6-7-spored; on *Ulmus*, North America ..... (588) *E. neglecta*

115. Chasmothecia larger, up to 120 µm diam.; appendages 12-14; cells of the peridium wall conspicuous, 8-20 µm diam.; asci 5-6-spored; on *Ribes magellanica*, South America (Argentina) ... (611) *E. ribicola*

116. With up to 15 appendages, 1-2 times as long as the chasmothecial diam.; on *Ceanothus americanus* ..... (515) *E. ceanothi*

116. With 4-8 appendages, 1-1.5 times the chasmothecial diam.; *Euonymus fortunei* and *E. japonica* ..... (544) *E. euonymicola*

117. Asci 5-8-spored; ascospores small, 13-20 x 9-15 µm; on *Euonymus*, *Ilex* or *Nemopanthus* 118

117. Asci either 3-6-, often 4-spored, and/or ascospores larger, up to 25 µm in length; on *Betula*, *Magnolia*, *Oleaceae* or *Viburnum* 119

118. Conidia ± cylindrical; chasmothecia 70-110 µm diam.; appendages 4-9, 1-2 times as long as the chasmothecial diam.; asci 2-5; on *Euonymus* ..... (605) *E. pseudopusilla*

118. Conidia ellipsoid to barrel-shaped; chasmothecia 85-125 µm diam.; appendages 6-16, 0.75-1.5 times the chasmothecial diam.; asci 3-8; on *Ilex* or *Nemopanthus* ..... (589) *E. nemopanthi*

119. Asci mostly 3-5-spored; mycelium thin, effuse or in irregular patches, almost persistent; chasmothecia (75-)90-145 µm diam., average > 100 µm; on *Magnolia* ..... (576) *E. magnifica*

119. Asci 4-8-spored; on other hosts 120

120. Chasmothecia small, 65-105 µm diam., average < 100 µm; on *Betula* ... (594a) *E. ornata* var. *ornata*

120. Chasmothecia larger, 75-130 µm diam., often > 100 µm; on other hosts 121

121. Foot-cells of the conidiophores short, 15-30 µm long; on *Oleaceae* ..... (630) *E. syringae*

121. Foot-cells longer, 20-80 µm; on *Viburnum* ..... (642) *E. viburni*

122. Species distributed in Australia, New Zealand or Europe 123

122. Species distributed in Asia 131

123. Appendages short, mostly 0.5-1 times the chasmothecial diam., 4-10(-13) in number; chasmothecia about 75-105 µm diam.; on *Betula* ..... (594b) *E. ornata* var. *europaea*

123. Appendages longer, (0.5-)1-2 times the chasmothecial diam. 124

124. Conidiophores up to 200 µm long, foot-cells 35-120 µm, flexuous, curved-sinuous; apices of the appendages 4-6 times tightly and regularly branched, compact; asci with 3-5 large spores; on *Platanus*, North America, introduced into Europe and Australia ..... (601) *E. platani*

124. Conidiophores much shorter and/or foot-cells not flexuous (not curved-sinuous); or apices looser; and/or asci 4-8-spored; on other hosts 125

125. Chasmothecia 65-105 µm diam., average < 100 µm, with 3-8 appendages; on *Euonymus fortunei*, *E. japonicus* or *Viburnum lantana* 126

125. Chasmothecia larger, with more appendages; on other hosts 127

126. Mycelium evanescent or almost persistent; foot-cells of the conidiophores straight; asci 2-4, on *Viburnum* (mainly *V. lantana*) ..... (554) *E. hedwigii*

126. Mycelium in dense persistent patches; foot-cells flexuous-sinuous; asci 3-6; on *Euonymus fortunei* and *E. japonicus* ..... (544) *E. euonymicola*

127. Asci mostly 3-5-spored; on *Rhamnus* or *Syringa* 128

127. Asci mostly 5-7-spored; on *Betulia*, *Tilia* or *Viburnum* 129

128. Conidia ± cylindrical (-ellipsoid), slender, 27-40 x 10-16.5 µm; apices of the appendages rather tight and compact; on *Rhamnus cathartica* and other species ..... (549a) *E. friesii* var. *friesii*

128. Conidia mainly ellipsoid-doliitorm, about 25-38 x 10-19 µm; apices looser; on *Syringa*, introduced into Europe ..... (630) *E. syringae*

129. Appendages about as long as the chasmothecial diam.; ascospores < 20 µm long; on *Tilia* ..... (634) *E. tiliae*

129. Appendages usually 1-1.5 times the chasmothecial diam.; ascospores often > 20 µm (up to 30 µm) long 130

130. Chasmothecia about 75-130 µm diam.; with 4-22 appendages, apices regularly branched, compact, or primary branches elongated; on *Viburnum*, Europe, introduced into New Zealand .... (642) *E. viburni*

130. Chasmothecia about 65-105 µm diam., with 6-22 appendages, apices loosely branched, often somewhat irregular, secondary as well as primary branches often long; on *Betula*, very rare in *Europe* ..... (594a) *E. ornata* var. *ornata*

131. Chasmothecia rather large, about (85-)100-140(-150) µm diam.; ascospores large, up to 30 µm long; on *Exochordae* or *Schisandra* 132

131. Chasmothecia and/or ascospores smaller; on other hosts 133

132. Peridium cells of the chasmothecia conspicuous and large, 15-30 µm diam.; on *Schisandra*, Japan .... (615) *E. schizandrae*

132. Peridium cells of the chasmothecia inconspicuous and smaller, 8-13 µm diam.; on *Exochorda* ..... (546) *E. exochordae*

133. Chasmothecia small, 70-100 µm diam.; on *Eyonvmus fortunei* and *E. japonica* or *Ligustrum* 134

133. Chasmothecia larger, diam. often > 100 µm 135

134. Appendages of two types, branching either dense and compact, or loose, with elongated primary branches, often deeply forked; foot-cells of the conidiophores straight; on *Ligustrum*, Japan .... (571) *E. ligustri*

134. Appendages uniform, branching tight and compact; foot-cells flexuous-sinuous; on *Euonymus fortunei* and *E. japonica* ..... (544) *E. euonymicola*

135. Appendages short, about as long as the chasmothecial diam. or often shorter; on *Corylopsis*, *Dipelta*, *Lindera*, *Lonicera*, *Symplocos* or *Tilia* 136

135. Appendages longer, at least 1-1.5 times the chasmothecial diam. 141

136. Apices of the appendages usually very tightly and regularly branched, compact; on *Corylopsis*, *Lindera* or *Tilia* 137

136. Apices looser; on other hosts 139

137. Asci 4-8-spored; on *Tilia* ..... (634) *E. tiliae*

137. Asci 2-5-Spored 138

138. Ascospores large, about 20-30 x 11-20 µm; on *Lindera*, China ..... (503) *E. bezoin*

138. Ascospores smaller, 13-25.5 x 7.5-15 µm; on *Corylopsis*, Japan ..... (526) *E. corylopsidis*

139. Apical branching with primary branches often elongated, ± horizontally spread or somewhat recurved; ascospores 13-28 x 7.5-16 µm; on *Symplocos*, China, Japan ..... (589) *E. nomurae*

139. Apical branching different; ascospores somewhat smaller, about 15-22.5 x 7.5-12.5 µm; on other hosts 140

140. On *Lonicera*, Asia ..... (540) *E. erlangshanensis*

140. On *Dipelta*, China ..... (535) *E. dipeltae*

141. Apex 3-6 times branched, close and regular or loose, irregular, often deeply forked, primary branches long; appendage length variable, 4-16, 1-3(-4) times the chasmothecial diam.; chasmothecia 70-150 µm diam.; on *Deutzia*, Asia (Japan, Far East of Russia), introduced into Europe ..... (531) *E. deutziae*

141. Apex branching different; on other hosts 142

142. Asci 4-8-, mostly 5-7-spored 143

142. Asci 2-6-, mostly 3-5-spored, a varying percentage only 3- or 4-spored 157

143. Ascospores small, about 16-18 x 6-12 µm; asci 6-spored; on *Atractylodes*, Japan ..... (564) *E. itoana*

143. Ascospores larger, some even larger than 20 µm 144

144. Peridium not very dark, asci easily visible through the wall of the chasmothecium; appendages 4-18; on *Akebia*, Asia ..... (494) *E. akebiae*

144. Peridium dark, asci not visible through the wall; on other hosts 145

145. Chasmothecia small, average < 100 µm diam.; asci numbering 2-5; on *Clethra* or *Staphylea*, Japan 146

145. Chasmothecia often larger, > 100 µm diam.; with more asci; on other hosts 147

146. Appendages 4-10; conidia 25-40 x 15-25 µm; on *Staphylea* ..... (625) *E. staphyleae*

146. Appendages 7-16; conidia smaller, 25-32 x 14-20 µm; on *Clethra* ..... (521) *E. clethrae*

147. Apices of appendages very tight and regular, primary and secondary branches short; on *Aristolochia*, *Helwingia*, *Rhammnus*, *Schisandra*, *Vaccinium* 148

147. Apices looser, at least primary branches often elongated; on other hosts 152

148. Appendages 1-2.5 times as long as the chasmothecial diam.; on *Helwingia*, Japan .(557) *E. helwingiae*

148. Appendages shorter, 0.75-1.5 times the chasmothecial diam. 149

149. Chasmothecia with about 3-12, usually less than 10. appendages; on *Aristolochia* or *Vaccinium* ...150

149. Chasmothecia with about 7-18, usually more than 10, appendages; on *Rhammnus* or *Schisandra* ..151

150. Tips of the ultimate branchlets of the apices always distinctly recurved; on *Vaccinium*, Japan ..... (643) *E. wallrothii*

150. Tips in mature samples only partly recurved, obtuse or truncate; on Aristolochia, China ..... (496) *E. aristolochiae*

151. Chasmothecia (85-)100-140(-150) µm diam.; appendages 1-1.5(-2) times as long as the chasmothecial diam; on Schisandra ..... (615) *E. schizandrae*

151. Chasmothecia somewhat smaller on average, 80-130 µm diam.; appendages about as long as the chasmothecial diam (0.75-1.25 times); on *Rhammnus*, China to Japan ..... (549b) *E. friesii* var. *dahurica*

152. Apices of the appendages of characteristic "angular" appearance, angles between two branches ± acute, not rounded; foot-cells of the conidiophores often curved or somewhat twisted; on *Menispermum dauricum* ..... (581b) *E. menispermi* var. *dahurica*

152. Apices not "angular", on other hosts 153

153. Appendages (2-)4-11, average below 10; on *Sinomenium* ..... (623) *E. sinomenii*

153. Appendages 4-22, often more than 10 154

154. Appendages 1-2 times as long as the chasmothecial diam., apices rather regularly and tightly branched; on *Picrasma* ..... (600) *E. picrasmae*

154. Appendages usually 1-1.5 times as long as the chasmothecial diam., apical branching loose, especially primary branches often elongated 155

155. Apices loosely branched, often somewhat irregular, primary and secondary branches often long; on *Betula* ..... (594a) *E. ornata* var. *ornata*

155. Apices regularly branched, only primary branches characteristically elongated 156

156. Appendages often flexuous; mycelium amphigenous, often almost persistent; on *Styrax* ..... (584) *E. miyabeana*

156. Appendages stiff; mycelium often only hypophyllous and evanescent; on *Viburnum* ... (642) *E. viburni*

157. Appendages (6-10 µm wide) increased up to 15 µm at the very base; apices richly branched, 4-7 times; chasmothecia usually 85-125 µm diam.; on *Magnolia*, Asia, introduced into Europe (576) *E. magnifica*

157. Appendages not widened at the base, apices usually 3-5 times branched 158

158. Apices usually regularly and tightly branched; chasmothecia usually less than 100 µm diam.; on *Berberis heteropoda* or *Orixa* 159

158. Apices looser, primary and secondary branches often elongated 160

159. Appendages 1-1.5 times as long as the chasmothecial diam., 0-2(-4)-septate; on *Orixa*, Japan ..... (593) *E. orixae*

159. Appendages about 1-2 times the chasmothecial diam., 0-1-septate; on *Berberis heteropoda*, China, Kazakhstan ..... (534) *E. dimorpha*

160. Mycelium amphigenous, in dense, white patches, often confluent, covering the entire surface, sometimes irregularly effuse, persistent; appendages usually 1-1.5 times as long as the chasmothecial diam.; on hosts of the *Oleaceae* ..... (630) *E. syringae*

160. Mycelium effuse, thin, sometimes forming patches, evanescent to almost persistent; appendages 1-2 times the chasmothecial diam.; on other hosts 161

161. Chasmothecia up to 130 µm diam.; apices of the appendages tight and compact to loose, primary and secondary branches elongated, appendages (0-)1(-3)-septate; on *Lindera*, *Litsea*, *Parabenzoin* (*Lauraceae*) (507) *E. blasti*

161. Chasmothecia 75-115 µm diam.; apices always loose, primary branches characteristically elongated, appendages 0-1-septate; on *Lonicera* (*Caprifoliaceae*) ..... (583) *E. miurae*

162. Chasmothecia 100-145 µm diam.; appendages 10-14, 240-430 pm long, flexuous, often irregular; asci 2-4, 2-3-spored; on *Euonymus japonicus* ..... "*E. euonymi-japonici*"

162. Chasmothecia smaller; or appendages longer; or with more asci and ascospores per ascus 163

163. Apices 2-5 times densely and regularly branched, tips of the ultimate branchlets not recurved or only some slightly recurved, tips usually characteristically knob-like, appendages 1-7 times as long as the chasmothecial diam; on *Ericaceae*, North America, or *Catalpa*, North America, Europe 164

163. Apices of the appendages either tightly and regularly branched with tips distinctly recurved, or branching loose, often irregular with tips straight, but not knob-like or appendages mostly simple, only a few branched 1-3 times 165

164. Apices of the appendages 3-5(-6) times branched; on *Ericaceae* ..... (638) *E. vaccinii*

164. Apices usually only 2-4 times branched; on *Catalpa* ..... (538) *E. elevata*

165. Appendages 0.5-4 times as long as the chasmothecial diam., very irregular, mycelioid, strongly geniculate-sinuous; on legumes (*Alhagi*, *Anthyllis*, *Genista*, *Hedysarum*, *Robinia*, *Sesbania*, *Sophora*, *Thermopsis*) 166

165. Appendages longer, 1-10(-15) times the chasmothecial diam.; and/or appendages flexuous, but not mycelioid, not geniculate-sinuous 171

166. Mycelium dense, persistent, causing deformation and defoliation, "witches brooms"; on *Alhagi* or *Sophora* and allied genera, Asia 167

166. Mycelium without any deformation or defoliation, amphigenous and caulicolous, almost persistent; on other hosts 168

167. Appendages always dichotomously branched when mature, relatively regular; on *Sophora* and allied genera ..... (624) *E. sophorae*

167. Appendages only occasionally dichotomously branched, less regular; on *Alhagi* ..... (508) *E. bremeri*

168. Chasmothecia large, about (95-)110-170(-180) µm diam.; appendages narrow, about 3.5 8.5 µm wide, tips often recurved when fully mature, appendages 5-20 per ascoma, distinctly verrucose; on *Anthyllis*, *Hedysarum*, Asia, Europe ..... (555) *E. hedysari*

168. Chasmothecia smaller, 80-145 µm diam.; appendages wider, 4-10 µm wide, tips straight 169

169. Appendages 10-40, faintly rough-walled; on *Thermopsis*, Asia ..... (633) *E. thermopsidis*

169. Appendages less numerous, about 6-25, mostly 10-20, distinctly rough-walled, often coarsely verruculose 170

170. Asci (4-)5-6(-7)-spored, ascospores small, 14-20 x 10-15 µm; foot-cells of the conidiophores 30-65 µm long; on *Robinia*, China ..... (612b) *E. robiniae* var. *chinensis*

170. Asci (2-)3-4(-5)-spored, ascospores larger, 20-28 x 9-12 µm; foot-cells shorter, 20-45 µm long; on *Sesbania*, Argentina ..... (622) *E. sesbaniae*

171. Appendages 2-4.5 times as long as the chasmothecial diam., flexuous, apices richly branched (3-6 times), ultimate tips not recurved; in North America, on hosts of the Fabaceae, see (530) *E. diffusa* var. *elongata*; or on *Symphoricarpos*, North America, introduced into Europe, see *E. symphoricarpi*

171. Appendages longer, and/or apices often simple or only 1-3 times branched 172

172. Appendages septate and often pigmented 173

172. Appendages aseptate or only with a single septum near the base 178

173. Appendages about 5-15, horizontally spread, apices frequently 1-4 times branched; on *Oxalis*, North America, introduced into other parts of the world ..... (614) *E. russellii*

173. Appendages about 10-30, and/or with a tendency to point in one direction, and/or apices mostly simple, occasionally 1-2 times branched 174

174. Appendages very long, 5-15 times as long as the chasmothecial diam., with a strong tendency to point in one direction, conspicuously thick-walled towards the base; on *Cornus* ..... (635) *E. tortilis*

174. Appendages mostly 2-6 times as long as the chasmothecial diam., horizontally spread or with a moderate tendency to point in one direction, mostly only slightly thick-walled towards the base; on hosts of the *Fabaceae* 175

175. Chasmothecia 70-90(-105) µm diam.; appendages evidently verrucose; infections usually caulicolous; on *Desmanthus*, North America ..... (530) *E. desmanthi*

175. Chasmothecia larger, often >100 µm; appendages not verruculose; usually foliicolous 176

176. Appendages equatorial or somewhat in the upper half, 0-3-septate, only brown at the very base, distinctly thick-walled towards the base; on *Galega* ..... (550) *E. galegae*

176. Appendages equatorial, 1-6-septate, pigmented in the lower portion; on other hosts 177

177. Appendages thin-walled above and distinctly thick-walled towards the base (-2.5 µm); peridium cells irregularly shaped, daedaleoid; on *Caragana* and *Robinia* ..... (612) *E. robiniae* var. *robiniae*

177. Appendages thin-walled throughout or only slightly thickened towards the base (-1.5 µm); peridium cells irregularly polygonal; on *Trifolium* and other legumes ..... (636) *E. trifoliorum*

178. Apices of the appendages mostly simple, a varying percentage 1-3 times loosely branched, often deeply forked, tips mostly not recurved 179

178. Apices richly branched, only a few simple 188

179. Appendages horizontally spread or even somewhat descending; on *Baptisia* or *Galega* 180

179. Appendages with a tendency to point in one direction; on other hots 181

180. Appendages horizontally spread or even somewhat descending, usually 3-6 times as long as the chasmothecial diam., 0-3-septate; conidia up to 40 x 20 µm; on *Galega* ..... (552) *E. galegae*

180. Appendages horizontally spread, 4-10 times as long as the chasmothecial diam., aseptate; conidia 22-35 x 12-16 µm; on *Baptisia*, Europe ..... (501) *E. baptisiae*

181. On *Berberis* sp., Central Asia ..... (551) *E. golovinii*

181. On other hosts 182

182. Conidia long and cylindrical, about 35-50 x 11-18 µm; asci 5-22; on *Atraphaxis* and *Calligonum* .. 183

182. Conidia ellipsoid-cylindrical, smaller; and/or asci fewer, 3-12(-14); on hosts of the *Fabaceae*, *Helleborus* or *Hypericum* 184

183. Appendages numbering about 6-15; on *Atraphaxis*, *Calligonum* .. (498a) *E. atraphaxis* var. *atraphaxis*

183. Appendages numbering (12-)20-44; on *Atraphaxis manshurica* ..... (498b) *E. atraphaxis* var. *multappendicis*

184. Appendages relatively frequently branched, ultimate tips straight; on *Vicia*, North America, Asia, Europe ..... (500) *E. baeumleri*

184. Appendages often simple, rarely branched; on other hosts 185

185. Appendages mostly with a conspicuous tendency to point in one direction, sometimes even subfasciculate, ultimate tips often recurved in fully mature samples; on *Astragalus*, *Oxytropis* ..... (497) *E. astragali*

185. Appendages horizontally spread or only with a slight to moderate tendency to point in one direction, ultimate tips always straight; on other hosts 186

186. Appendages thin-walled; on *Helleborus* ..... (556) *E. hellebori*

186. Appendages distinctly thickened towards the base; on other hosts 187

187. Conidia slender, cylindrical, about 12-18 µm wide; on *Hypericum* ..... (558) *E. hyperici*

187. Conidia wider, ellipsoid-cylindrical, about 16-21 µm wide; on *Lupinus* ..... (563) *E. intermedia*

188. Tips of the ultimate branchlets of the apices distinctly recurved when mature 189

188. Tips straight, not recurved or only very rarely a few tips somewhat recurved 197

189. Appendages very irregular, mycelioid, strongly geniculate-undulate; on *Astragalus*, *Euonymus*, *Spartium* 190

189. Appendages flexuous, but not typically mycelioid, not geniculate-sinuous 192

190. Chasmothecia about 60-100 µm diam.; appendages up to 12 times as long as the chasmothecial diam.; on *Euonymus*, Japan ..... (579) *E. mayumi*

190. Chasmothecia larger, 80-160 µm diam.; appendages 2-8 times the chasmothecial diam., on hosts of the *Fabaceae* 191

191. Appendages smooth to faintly rough-walled, branching of different orders frequently recurved, flexuous to curled, ultimate tips recurved to almost spirally coiled; on *Astragalus*, Asia, North America ..... (528) *E. crispula*

191. Appendages distinctly verrucose, only primary branches somewhat recurved, tips straight or partly recurved; on *Spartium*, mainly Mediterranean region ..... (609) *E. rayssiae*

192. Chasmothecia 90-170 µm diam. 193

192. Chasmothecia smaller, about 60-110 µm diam. 194

193. Appendages 3-6 times as long as the chasmothecial diam., branching tight and regular; on *Quercus*, North America ..... (547a) *E. extensa* var *extensa*

193. Appendages 6-12 times as long as the chasmothecial diam., branching looser; on *Chamaecytisus* and *Laburnum*, Europe ..... (553) *E. guarinonii*

194. Chasmothecia (70-)80-110(-135) µm diam.; primary branches of the appendages characteristically elongated and recurved; on *Frangula*, Europe ..... (537) *E. divaricata*

194. Chasmothecia smaller and with a different mode of appendage branching; on other hosts 195

195. Asci (5-)6-8-spored; on *Flueggea*, China, Japan ..... (616) *E. securinegae*

195. Asci 3-6-spored; on other hosts, Europe to Central Asia 196

196. Appendages with a conspicuous tendency to point in one direction; ascospores 15-20 x 8-12 µm; on *Robinia* ..... (603) *E. pseudacaciae*

196. Appendages ± horizontally spread; ascospores larger, (15-)18-26 x (9-)10-14 µm; on Lonicera ..... (578) *E. magnusii*

197. Appendages very long, 5-10 times as long as the chasmothecial diam., apices rather regular, fairly dense, very richly branched, 3-8, mostly 4-7 times; on *Caragana*, China ..... (572) *E. longissima*

197. Appendages either shorter, and/or apices loose, diffuse, irregular 198

198. Asci (6-)8-spored; appendages very long, mostly 4-8 times the chasmothecial diam.; infections on inflorescences; on *Misodendrum punctulatum*, South America ..... (587) *E. myzodendri*

198. Asci 2-6-spored 199

199. Appendages very irregular, sinuous-geniculate, mycelioid; on *Euphorbia*, in North and South America ..... (545) *E. euphorbiicola*

199. Appendages flexuous, but not strongly sinuous-geniculate; in Asia or Europe 200

200. Chasmothecia about 80-110 µm diam.; appendages about 4-7.5 µm wide; on *Euonymus*, Europe to Central Asia ..... (543) *E. euonymi*

200. Chasmothecia often larger, size variable, about 80-180 µm diam.; appendages 5-11 µm wide; on hosts of the *Fabaceae* 201

201. Appendages very long, about 3.5-10, mostly 4-8 times the chasmothecial diam.; on *Sphaerophysa*, China ..... (626) *E. swainsonae*

201. Appendages shorter, 3-6 times the chasmothecial diam.; on other hosts 202

202. On *Ononis*, Europe, France, endemic ..... (518) *E. chouardii*

202. On *Colutea*, *Caragana*, *Oxytropis*, Asia ..... (522) *E. coluteae* [appendages up to 4.5 times as long as the chasmothecial diam.; on some hosts in North America, see (532) *E. diffusa* var. *elongata*]

13.4 Erysiphe sect. Typhulochaeta

1. Special apical cells few, 5-30 per chasmothecium, irregularly scattered in the upper half, apices often somewhat swollen, capped with an amber-coloured elliptical mass of waxy material; peridium cells radiately arranged; on *Quercus arizonica*, USA ..... (647) *E. couchii*

1. Special apical cells (appendage-like structures) clavate, 10-20 µm wide, very numerous, about 90-150 per chasmothecium, arranged in concentric circles 2

2. Chasmothecia rather large, 160-210 µm diam.; on *Coriaria sinica* (*Coriariaceae*), China ..... (649) *E. typhulochaetoides*

2. Chasmothecia smaller, about 130-180 µm diam.; on other hosts 3

3. Clavate apical cells 35-65(–70) x (9-)12-15(-17) µm; on hosts of *Fagaceae* (*Castanopsis*, *Quercus*) and (?) *Fraxinus japonica*, Asia ..... (648) *E. japonica*

3. Clavate apical cells larger, about 60-80 x 12.5-22 µm long; on *Alangium* (*Alangiaceae*), China ..... (646) *E. alangiiicola*

13.5 Erysiphe sect. Uncinula

- 1. Chasmothecia with a single type of typically uncinuloid appendages, arising more or less equatorially, rarely from the upper or lower half, appendages long, usually setiform, straight, stiff to flexuous, but not mycelioid, rarely more mycelioid, simple, rarely deeply cleft or apically bifid, tips always uncinate, circinate to subhelicoid (= subsect. *Uncinula*) or, in addition to the typical uncinuloid type, with shorter, mycelioid appendages (but not bristle-like) with straight apices (special dimorphic appendages on *Alnus pendula* in Japan where both types are ± equatorial, not in the upper half) 2

1. Chasmothecia with two types of appendage, i.e. with more or less equatorial typical uncinuloid appendages and short bristle-like to hyphal, apically often more or less pointed appendages [remnants of anchor hyphae] in the upper half (= subsect. *Uncinuliella*) or with equatorial, uncinuloid appendages which are bulbose at the base and in the upper half of the chasmothecium with short "terminal" appendages, ± capitate, with amber-coloured and irregularly shaped heads, on *Koelreuteria paniculata*, China (= subsect. *Bulbouncinula*) 146

2. Chasmothecial appendages septate and pigmented, about 1-14-septa, at least most appendages with 2 or 3 septa, pigmented in the lower half, paler towards the apex [appendages 0-2(-3)-septate, at least partly yellowish to brown in the lower half, on *Hydrangea bretschneideri* in China, see (764) *E. yanshanensis*; with 1-4-septate long, equatorial appendages and a second type of short, bristle-like appendages present in the upper half, on *Lagerstroemia*, see (664) *E. australiana*] 3

2. Appendages aseptate or with a single septum at the base, rarely with two septa, completely hyaline or only pigmented at the base [rarely aseptate and pigmented in the lower half, thick-walled below and thin-walled above, on *Allophylus*, Africa, see *Erysiphe allophyli*, or appendages thick-walled throughout, pigmented, but with a second type of short, bristle-like appendages present in the upper half, on *Rosa*, Asia, see 749. *E. simulans*] 11

3. Chasmothecia large, about 150-230 µm diam.; appendages very numerous, about 50-250, in the upper half of the chasmothecia, septa always reaching the upper half of the appendages; ascospores curved, crescent-shaped; on *Fagus* or *Quercus* (*Fagaceae*) 4

3. Chasmothecia smaller, about 70-140 µm diam., rarely larger (-250 µm); appendages about 4-50, arising from the equatorial zone of the chasmothecia; ascospores ellipsoid-ovoid, not curved 5

4. Septa of the appendages often reaching the top portion, often even the circinate part, width of the appendages ± equal throughout; on *Quercus*, China, Japan ..... see (2) *Parauncinula septata*

4. Septa reaching the upper half of the appendages, but never reaching the apex and circinate part, width of the appendages decreasing from base to top; on *Fagus*, Japan ..... see (1) *Parauncinula curvispora*

5. Chasmothecial appendages relatively short, about 0.75-3 times the chasmothecial diam., only with 0-S septa; on *Actinidia*, *Parthenocissus* or *Liquidambar* 6

5. Appendages long, flexuous, about 2-6 times the chasmothecial diam., or short, only 1-4 times the diam., in both cases with numerous septa, up to 14, but at least some appendages with more than 5, [appendages very irregular, geniculate-sinuous, often forked, only 0-6-septate; on *Actinidia*, see (650) *E. actinidiae* var. argutae] 9

6. Appendages very irregular, strongly geniculate-sinuous; on *Actinidia* Or *Liquidambar* 7

6. Appendages rather regular, stiff, straight to flexuous, curved, not or only rarely geniculate 8

7. Appendages usually 0-1-septate, but occasionally with up to 5 septa; chasmothecia in the upper half with short, simple "appendages" (anchor hyphae); asci mostly 8-spored; on *Liguidambar* ..... (756) *E. variabilis*

7. Appendages 0-3(-5)-septate; anchor hyphae in the upper half of the chasmothecia lacking; asci 4-8-spored on *Actinidia* ..... (650) *E. actinidiae* var. *argutae*

8. Appendages thick-walled towards the base; on *Actinidia*, Asia ..... (650) *E. actinidiae* var. *actinidiae*

8. Appendages thin-walled or moderately thick-walled throughout; on *Parthenocissus* (*Vitaceae*), North America ..... (722) *E. necator* var. *ampelopsidis*

9. Appendages relatively short, 1-4 times the chasmothecial diam., very irregular, mycelioid, geniculate-sinuous; on *Hydrangea*, Asia (China, Japan) ..... (702) *E. hydrangeae*

9. Appendages usually longer, 2-6 times the chasmothecial diam.; on other hosts 10

10. On *Vitis* and *Ampelopsis* (*Vitaceae*), almost circumglobal ..... (722) *E. necator* var. *necator*

10. On *Jaborosa* (*Solanaceae*), only known from the USA, New York (morphologically indistinguishable from *E. necator* var. *necator*) ..... (706) *E. jaborosae*

11. Appendages spirally twisted, helicoid, almost throughout or at least in the upper part below the uncinate-circinate apex 12

11. Appendages simple, not spirally twisted-helicoid (only apex uncinate-circinate to subhelicoid) 14

12. Appendages spirally twisted from base to almost top, with at least 15-25 coils; on *Nothofagus* × *antarctica*, Argentina ..... (728) *E. patagoniaca*

12. Appendages spirally twisted (helicoid) only in upper half (below the circinate part) and with only 1-8 coils 13

13. Apical part of appendages only 1-2 times spirally twisted; asci 2(-4)-spored; on *Ulmus*, Asia ..... (707) *E. kenjiana*

13. Apical part of appendages 3-8 times spirally twisted; asci 6-8-spored; on *Nothofagus*, South America ..... (724) *E. nothofagi*
[Asci 6-8-spored; with long, equatorial appendages which are sinuous or only slightly twisted, and a second type of bristle-like appendages in the upper half of the chasmothecia; on *Aesculus* and *Sapindus*, North America, see (695) *E. flexuosa*]

14. Chasmothecia very large, about 180-310 µm diam. 15

14. Chasmothecia smaller, about 60-230 µm diam., average below 200 µm 16

15. Appendages 3-7 times as long as the chasmothecial diam., only 25-50 per chasmothecium; on *Brachystegia* (*Fabaceae*), Africa ..... (669) *E. brachystegiae*

15. Appendages short, mostly shorter than the chasmothecial diam., very numerous, usually more than 100, asci 8-spored; on Acer (Aceraceae), China ..... see (130) *Sawadaea nankinensis*
[Appendages short, about as long as the chasmothecial diam. or shorter, but asc 2-5-spored (anamorphs belonging to the hyphomycete genus *Ovulariopsis* (incl. *Streptopodium*), foot-cells of the conidiophores twisted; mycelium partly endophytic; conidia large, about 40 - 80 µm long, often dimorphic, primary conidia often lanceolate, apex pointed, secondary conidia ellipsoid-cylindrical (-subclavate); on *Celtis*, *Prosopis*, *Platycyamus*, *Salix*, see species of *Pleochaeta* and *Queirozia*]

16. Some appendages mycelioid, strongly geniculate-sinuous, 1-4 times as long as the chasmothecial diam,, often with short lateral branchlets, tightly to often loosely uncinate-circinate or apical part widely curved; on Alnus or *Buckleya* in Asia 17

16. Appendages not mycelioid, without branchlets, and/or shorter or apex always tightly uncinate-circinate; on other hosts including Betula 18

17. Appendages with walls somewhat thickened towards the base, 0-2-septate, septa often somewhat distant from the point of attachment; on *Buckleya*, Japan ..... (670) *E. buckleyae*

17. Appendages thin-walled, 0-1(-2)-septate at the base; on *Alnus pendula*, Japan ..... (658) *E. amanoi*

18. Appendages very long, 2-12 times the chasmothecial diam., apex very loosely and widely curved or appendages fasciculate, forming an apical crown; or tips of the uncinate apex short bi- or trifid; or appendages thin-walled, but distal end becoming very thick-walled 19

18. Appendages shorter, 0.5-2.5 times the chasmothecial diam., neither with loosely curved apex, nor fasciculate, not with bi- or trifid apex, and not thin-walled with thick-walled distal end 22

19. Appendages in the upper half of the chasmothecia, fasciculate, forming an apical crown; on *Schinopsis* (*Anacardiaceae*), South America ..... see (3) *Caespitotheca forestalis*

19. Appendages arising equatorially or in the upper half, but not fasciculate, not crown-like 20

20. Appendages arising from the upper half of the chasmothecia, width increasing towards the apex, thin-walled, distal end becoming very thick-walled; chasmothecia embedded in white, dense, cottony cushions up to 2 mm deep; on *Combretum* (*Combretaceae*), Africa ..... (696) *E. floccosa*

20. Appendages arising equatorially, width ± equal throughout, distal end not thick-walled 21

21. Apex of the appendages short bi- or trifid, with recurved or uncinate ultimate branchlets; on *Carpinus*, China ..... (762) *E. wuyiensis*

21. Apex not short bi- or trifid, apex very loosely curved, sometimes loosely twisted; on *Acer*, Armenia (726) *E. paradoxa*

22. Walls of chasmothecial appendages thick throughout, from base to top, usually ± coalescent 23

22. Walls thin throughout or only partly thick, thin above and thick towards the base [rarely moderately thick throughout, but not coalescent; on *Nothofagus*, South America, see *E. magellanica*] 27

23. Appendages few, about 6-35 24

23. Appendages numerous, about 50-150 or more 25

24. Appendages 6-16, about as long as the chasmothecial diam. or somewhat shorter; on *Litsea* (*Lauraceae*) (687) *E. dabashanensis*

24. Appendages (12-)16-28(-35), 1-1.5 times the chasmothecial diam., a second type of short, bristle-like appendages present in the upper half; on *Liquidambar* (*Altingiaceae*) ..... (711) *E. liquidambaris*

25. Chasmothecia 85-125 µm diam.; asci 5-8; appendages arising equatorially; on *Celtis* (*Cannabaceae*), North America ..... (727) *E. parvula*

25. Chasmothecia larger, 100-180 µm diam.; asci 8-20; appendages in the upper half of the chasmothecia (asci 4-8-spored) 26
[chasmothecia about 150-230 µm diam.; asci 2-spored; on *Prosopis*, South America, see (288) *Pleochaeta prosopidis*]

26. Asci 4-spored; on Pterocarpus ..... (704) *E. incrassata*

26. Asci 6-8-spored; on Pericopsis ..... (652) *E. afrormosiae*

27. Walls of appendages thin, only slightly thicker at the base and at the very tip, apical part widely curved; on *Croton* (*Euphorbiaceae*), Africa ..... (686) *E. crotonis*

27. Walls either thin throughout or thin above and thick below, but apex never very thick-walled 28

28. Appendages very irregular, mycelioid, geniculate-sinuous, outline often very irregular, partly irregularly branched, sometimes with short mycelium-like outgrowths, tips often straight, only some tips uncinate-circinate; asci 6-8-spored; on *Buckleya* (*Santalaceae*), Japan .....see (670) *E. buckleyae*

28. Appendages regular, stiff, setiform to flexuous, rarely somewhat geniculate-sinuous, usually simple, seldom forked, but not irregularly branched 29

29. Appendages thin-walled throughout (or only very slightly thicker at the base) 30

29. Appendages thin-walled above, but wall thicker towards the base or thick-walled throughout 71

30. Appendages arising equatorially and from the upper half of the chasmothecia, numerous; on *Cordia*, *Ehretia* (*Boraginaceae*) or *Salix* (*Salicaceae*) 31

30. Appendages not in the upper half, confined to the equatorial zone 34

31. Appendages short, 0.3-1 times as long as the chasmothecial diam.; on Salix 32

31. Appendages longer, 0.75-3 times the chasmothecial diam.; on *Boraginaceae* 33

32. Chasmothecia 95-170 µm diam., with 35-120 appendages; conidiophores 40-65 µm long, foot-cells 25-40 µm long, followed by (1-)2(-3) shorter cells, conidia 25-35 x 10-16 µm ..... (672) *E. capreae*

32. Chasmothecia larger, 150-230 µm diam., with 150-350 appendages; conidiophores 60-200 µm long, foot-cells 40-90(-110) µm long, followed by 1-3 cells, the first following cell may be 30-100 µm long, condidia 25-45 x 12-24 µm ..... (740) *E. pseudoregularis*

33. Chasmothecia with 20-80 appendages; asci 3-spored; on *Ehretia*, South Africa .....(736) *E. praeterita*

33. Chasmothecia with 40-100 appendages; asci 4-6-spored; on *Cordia*, India ..... (754) *E. udaipurensis*

34. Appendages very numerous, (12-)35-150, usually more than 40 35

34. Appendages 3-50, usually less than 40 50

35. Appendages usually (9-)12-60(-80), wall of the appendages slightly thicker towards the base; on *Alnus*, Asia ..... (720) *E. miyabei*

35. Appendages always rich in number, more than 40, always thin-walled throughout; on other hosts .. 36

36. Appendages very numerous, about 80-150, very gracile, only 2.5-4 µm wide; on *Populus*, China ..... (697) *E. fragilis*

36. Appendages fewer, usually less than 100, more than 4 µm wide 37

37. Width of the appendages increasing from base to top 38

37. Width of the appendages equal throughout or even decreasing from base 41

38. Coiled apex of the appendages not enlarged; asci 8-spored; on *Crataegus*, Asia .....(685) *E. crataegi*

38. Coiled apex either enlarged or narrowed towards the tip and/or asci not 8-spored 39

39. Coiled part of the appendages obviously enlarged, wall of the appendages often somewhat thicker at the base; on *Populus* ..... (718) *E. mandshurica*

39. Coiled part not obviously enlarged, although width of the appendages increases upwards, it finally narrows towards the circinate part 40

40. Appendages short, about as long as the chasmothecial diam. or shorter; chasmothecia 140-180 µm diam.; on *Stereospermum* (*Bignoniaceae*), Africa ..... (748) *E. sibiliae*

40. Appendages longer, 1-2 times the chasmothecial diam.; chasmothecia 100-160 µm diam.; on *Combretum* (*Combretaceae*), Africa ..... (683) *E. combreticola*

41. Appendages very numerous, about 90-170 per chasmothecium, arising from the lower half of the chasmothecia; on *Acer*, North America ..... see (133) *Takamatsuella circinata*

41. Appendages often less than 100, arising equatorially; on other hosts, Africa or Asia 42

42. Asci (6-)8-spored 43

42. Asci 3-7-spored (the number of ascospores of two species in this group is unknown: chasmothecia about 100-150 µm diam., 35-60 appendages, on *Ceiba*, South America, see (677) *E. ceibae*; chasmothecia 140-185 µm diam., 60-100 appendages, on *Vernonia*, South America, see (758) *E. vernoniae*) 45

43. Asci large, about 60-95 x 30-45 µm; width of the appendages mostly slightly increasing towards the tip; on *Crataegus*, Far East of Russia ..... (685) *E. crataegi*

43. Asci smaller, 40-65 x 25-35 µm; width of the appendages ± equal throughout 44

44. Appendages about as long as the chasmothecial diam. or usually somewhat shorter, about 5.5 µm wide; on *Albizia* (*Fabaceae*), Africa ..... (660) *E. angusiana*

44. Appendages often longer than the chasmothecial diam., up to 1.5 times, width somewhat variable, 5-10 µm; on *Thespesia* (*Malvaceae*), India ..... (665) *E. azanzae*

45. Asci 3-6; on *Tecoma* (*Bignoniaceae*), South America ..... (730) *E. peruviana*

45. Asci 4-15; on *Alchornea* (Asia) or on various host species of the *Salicaceae* (Asia, North America, Europe) 46

46. Conidiophores up to 140 µm long, about 4-5 µm wide at the base, up to 9 µm wide above; on *Alchornea* (*Euphorbiaceae*), China ..... (654) *E. alchorneae* var. *elliptispora*

46. Conidiophores about 20-70 µm long, width ± equal throughout, 6-11 µm; on *Chosenia*, *Populus*, *Salix* (*Salicaceae*) 47

47. Appendages uniformly short, 0.5-1 times the chasmothecial diam., at least some arising from the upper half ..... (672) *E. capreae*

47. Appendages longer, about 1-2 times the chasmothecial diam., arising equatorially 48

48. Appendages with constrictions and swollen segments, outline irregular; on *Salix daphnoides*, *gilgiana*, *gracilistyla* ..... (651) *E. adunca* var. *salicis-gracilistylae*

48. Outline of the appendages regular, without constrictions or swollen segments 49

49. Chasmothecia 95-170 µm diam., width of appendages ± equal throughout, completely thin-walled ..... (651) *E. adunca* var. *adunca*

49. Chasmothecia larger, (95-)120-200 µm diam., width of appendages mostly somewhat increasing towards the tip, usually slightly thick-walled towards the base ..... (718) *E. mandshurica*

50. Width of the appendages increasing towards the tip, either increasing up to the circinate part or increasing and then narrowing to the circinate apex 51

50. Width of the appendages ± equal throughout or even decreasing towards the tip [or width variable, i.e. on same chasmothecium ± equal throughout, increasing or decreasing, usually somewhat thick-walled at the base; on *Acer*, see *E. ljubarskii*] 58

51. Chasmothecia (80-)125-200(-250) µm diam.; appendages 0-1-septate, but sometimes with up to 5 septa, pigmented in the lower half; asci (6-)8-spored; on *Liquidambar* (*Altingiaceae*) ..... (756) *E. variabilis*

51. Chasmothecia either much smaller, or appendages consistently 0-1-septate, hyaline or only pigmented at the very base) 52

52. Width of the appendages equal or ± equal thoughout or only somewhat increasing towards the tip; on *Euscaphis japonica*, China ..... (693) *E. euscaphidis*

52. Width of the appendages always increasing towards the tip; on other hosts 53

53. Chasmothecia large, 120-225 µm diam.; appendages numerous, 19-65; on *Idesia* or *Stereospermum* 54

53. Chasmothecia either much smaller or with fewer appendages, less than 20; on other hosts 55

54. Chasmothecia with 35-65 appendages, width increasing towards the tip, but then abruptly narrowing to an uncinate apex; on *Stereospermum*, Africa ..... (748) *E. sibiliae*

54. Chasmothecia with 19-48 appendages, width increasing from base to top, but then not abruptly narrowing at apex: on *Idesia*, Asia, India ..... (703) *E. idesiae*

55. Chasmothecia with (5-)9-11(-13) appendages, usually epiphyllous; asci thin-walled; on *Populus yunnanensis* ..... (738) *E. pseudocedrelae*

55. Chasmothecia with more appendages, and/or hypophyllous, or asci thick-walled; on other hosts 56

56. Asci fairly thick-walled; on *Rhus* (*Anacardiaceae*), Japan ..... (719) *E. matsunamiana*

56. Asci thin-walled; on *Cedrela* (*Meliaceae*) 57

57. Appendages mostly with nodulose swellings ..... (676) *E. cedrelae* var. *nodulosae*

57. Appendages simple, without swellings ..... (676) *E. cedrelae* var. *cedrelae*

58. Appendages usually 1-2-septate, basal septum usually elevated, basal cells about 6-30 µm long; on *Coriaria* or *Euscaphis*, China 59

58. Appendages 0-1-septate, very rarely with 2 septa, basal septum not distinctly elevated, basal cells shorter; on other hosts 60

59. Basal cells of the appendages about 15-30 µm long; appendages about as long as the chasmothecial diam.; on *Coriaria* ..... (684) *E. coriariigena*

59. Basal cells of the appendages about 6-16 um long; appendages mostly 1-2 times the chasmothecial diam.; on *Euscaphis* ..... (693) *E. euscaphidis*

60. Appendages few, 3-5(-8); on *Toxicodendron*, China ..... (753) *E. toxicodendricola*

60. Appendages numerous, usually more than 5; on other hosts 61

61. Asci 6-8-spored; on *Bowdichia* or *Fraxinus* 62

61. Asci 3-8-spored; on other hosts 63

62. Appendages 1-2.5 times as long as the chasmothecial diam., 4-10 µm wide; on Fraxinus, Asia ..... (698) *E. fraxinicola*

62. Appendages 0.75-1.5 times the chasmothecial diam., 5-15 µm wide; on *Bowdichia*, South America (Brazil) ..... (657) *E. alvimii*

63. Asci with 3-4 large ascospores, 25-36 x 16-24 µm; on *Qualea*, South America ... (701) *E. heringeriana*

63. Asci either usually 5-8-spored or ascospores smaller, about 16-26 x 9-16 µm (rarely up to 30 x 20 µm) 64

64. Appendages 17-45 per chasmothecium, usually more than 20 65

64. Appendages, mostly 6-20 68

65. Appendages narrow, 2.5-6(-7) µm wide, mostly somewhat decreasing in width towards the tip; on *Morus rubra*, North America ..... (700) *E. geniculata*

65. Appendages wider, about 5-9 µm, width either ± equal throughout or somewhat increasing upwards and then narrowing towards the tip; on other hosts, in Asia 66

66. Width of the appendages somewhat increasing upwards and then narrowing towards the tip; asci (4-)5-6(-7)-spored; on *Alnus* ..... (720) *E. miyabei*

66. Width of the appendages ± equal throughout; on other hosts 67

67. Appendages straight to curved or only sligthly flexuous; asci 3-5-spored; on *Alchornea* ..... (329) *E. alchorneae* var. *alchorneae*

67. Appendages flexuous-sinuous; asci (3-)5-8-spored; on *Populus laurifolia* and *P. nigra* ..... (734) *E. populicola*

68. Appendages 3.5-5.5 µm wide; on *Ficus*, Africa ..... (732) *E. pirottiana*

68. Appendages wider, 5-11 µm; on other hosts, Asia 69

69. Mycelium mainly hypophyllous; upper part of the appendages usually loosely curved; on *Sophora*, China (749) *E. sinensis*

69. Mycelium mainly epiphyllous; upper part of appendages not characteristically loosely curved, the whole appendage being straight or curved, flexuous or nodulose-geniculate; on other hosts 70

70. Appendages straight to curved, rather regular, width ± equal throughout; on *Alchornea*, China ..... (692) *E. euphorbiacearum*

70. Appendages often somewhat flexuous, irregular, geniculate when mature, width usually somewhat irregular, often narrowed towards the tip; on *Firmiana*, Asia ..... (723) *E. nishidana*

71. Width of the appendages increasing from base to top, including coiled apex, or appendages almost equal throughout, but apical portion partly distinctly enlarged 72

71. Width ± equal throughout or even decreasing towards the tip, or at first increasing (1/2-3/4 of the stalk) and then narrowing towards the tip, or gradually increasing up to the coiled part, but uncinate-circinate apex not distinctly enlarged, often even narrowed towards the tip (or width variable, irregular) 95

72. Width of the appendages ± equal throughout, 4-8 µm wide below, or width slightly larger in their upper half and coiled part; on *Ehretia corylifolia*, *Mallotus* or *Schizophragma* 73

72. Width of the appendages obviously increasing from base to top; on other hosts 75

73. Chasmothecia small, 55-110 µm diam.; appendages few, mostly 5-12, about as long as the chasmothecial diam. or shorter (0.5-1 ×); on *Ehretia corylifolia*, China ..... (689) *E. ehretiae* var. *ehretiae*

73. Chasmothecia larger, usually 80-140 µm diam.; appendages (5-)7-40, usually more than 10, 1-2.5 times the chasmothecial diam.; on other hosts 74

74. Appendages 7-22, 1.5-2.5 times as long as the chasmothecial diam.; ascospores up to 25 µm long; on *Schizophragma*, Japan ..... (746) *E. schizophragmatis*

74. Appendages up to 40, 1-2 times as long as the chasmothecial diam.; ascospores up to 35 µm long; on *Mallotus philippinensis*, India ..... (717) *E. malloticola*

75. Asci 2(-3)-spored; chasmothecia rather small, (70-)75-100(-115) um diam.; on Ulmus ..... (755) *E. ulmi* var. *ulmi*

75. Asci 2-8-spored, not uniformly 2-spored; on other hosts 76

76. Ascospores large, 20-35 x 10-20 µm; asci 2-6-spored; on *Mallotus* or *Quercus* 77

76. Ascospores smaller, at least narrower (up to 15 µm wide); on other hosts 79

77. Chasmothecia about 95-115 µm diam., with 9-20 appendages; on *Quercus ilex*, France ..... (741) *E. pyrenaica*

77. Chasmothecia larger, up to about 140 µm diam., with up to 40 appendages; Asian species 78

78. Width of the appendages usually ± equal (almost) throughout, 4-7 µm wide, but upper part just below the coiled apex and the apex itself distinctly enlarged; on *Mallotus philippinensis*, India ..... (717) *E. malloticola*

78. Width of the appendages mostly gradually increasing from base to top; on *Quercus incana*, India ..... (742) *E. quercifolia*

79. Appendages numerous, 15-50, usually more than 20; on *Tilia* in North America or on *Prunus* s. lat. in Europe and Central Asia 80

79. Appendages fewer, about 5-26, usually less than 20, if more (13-30) then in Asia (Japan) 81
[appendages 15-30, width gradually increasing towards the tip, but apex not conspicuously enlarged, often even narrowed towards the tip, on *Ficus*, see (661) *E. aspera* var. *aspera*]

80. Asci 4-8-spored; ascospores small, 13-20 x 8-12 µm; width of the appendages ± equal throughout or often somewhat increasing towards the tip, apex only slightly or moderately enlarged; in the upper half often with short bristle-like anchor hyphae; on *Prunus* s. lat., Europe to China ..... (737) *E. prunastri*

80. Asci 4-6-spored; ascospores larger, (16-)20-25 x (8-)10-14(-17) µm; width of the appendages obviously increasing towards the tip, apex usually conspicuously enlarged; upper half without any anchor hyphae; on *Tilia*, North America ..... (681) *E. clintonii*

81. Appendages 13-34 per chasmothecium, average > 20; and/or asci 2-5-spored; on *Ficus*, *Viburnum* or *Weigela* 82

81. Appendages less than 20 (on average); and/or asci 4-8-spored, at least some with 6 or 7 ascospores; on other hosts 85

82. Chasmothecia up to 130 µm diam., coiled apex usually at least somewhat enlarged; on *Viburnum* or *Weigela* 83

82. Chasmothecia 80-105 µm diam.; coiled apex of the appendages not distinctly enlarged; on *Ficus*, India 84

83. Coiled apex of the appendages distinctly enlarged; on *Viburnum* (*Adoxaceae*), Japan ..... (759) *E. viburnicola*

83. Coiled apex of the appendages not or only slightly enlarged; on *Weigela* (*Diervillaceae*) ..(710) *E. lata*

84. Asci 2-4-spored; on *Ficus nervosa* ..... (743) *E. religiosa* var. *fici-nervosae*

84. Asci 4-6-spored; on *Ficus religiosa* ..... (743) *E. religiosa* var. *religiosa*

85. Asci (2-)3-4-spored; chasmothecia (70-)75-100(-115) µm diam.; on *Ulmus* ..... (755) *E. ulmi* var. *ulmi-foliaceae*

85. Asci 4-8-spored; chasmothecia mostly larger 86

86. Chasmothecia rather small, (70-)85-100(-115) µm diam.; on *Aleurites*, *Aphananthe* or *Cudrania* ... 87

86. Chasmothecia larger, about 80-165 µm diam., at least some larger than 100 µm 89

87. Appendages 6-13 per chasmothecium, strongly geniculate-sinuous; on *Aleurites* (*Euphorbiaceae*) ..... (655) *E. aleuritis*

87. Appendages numerous, up to about 25; on other hosts 88

88. Appendages distinctly verrucose, (7-)11-23(-27) per chasmothecium; on *Cudrania* (*Moraceae*) ..... (680) *E. clavulata*

88. Appendages smooth or only faintly rough-walled, 6-25 per chasmothecium; on *Aphananthe* (*Cannabaceae*) ..... (660) *E. aphananthes*

89. Asci 6-8-spored, frequently 8-spored; appendages simple, outline regular (var. *cedrelae*) or subnodulose to nodulose, with swellings (var. *nodulosae*); on *Cedrela* (*Meliaceae*) ..... (676) *E. cedrelae*

89. Asci 3-7-spored, rarely 8-spored; on other hosts 90

90. Width of appendages 4.5-6.5 µm at the base, ± equal for about 2/3-3/4 of the stalk, or slightly decreasing towards the circinate end, but then gradually enlarging, to about 8-11 µm below the coiled part, appendages distinctly verrucose, especially in the lower half; on *Celtis caucasica* (678) *E. celtidis*

90. Width of the appendages gradually increasing from base to top, appendages smooth or faintly rough-walled 91

91. Appendages few, (5-)9-11(-13), wall of the appendages only slightly thicker towards the base; on *Populus yunnanensis* ..... (738) *E. pseudocedrelae*
[Chasmothecia with 6-13 appendages, but appendages very thick-walled towards the base, often even coalescent; on *Aleurites*, China, see (653) *E. aleuritis*]

91. Appendages 6-25, at least some chasmothecia with more than 15, and/or appendages distinctly thick-walled below, sometimes coalescent [or with (10-)20-40(-45) appendages; on *Acer*, China, see (710) *E. ljubarskii* var. *aleuritis*] 92

92. Appendages fairly long, 1.5-2.25 times the chasmothecial diam., mostly about 2 times, often with oil drops; on *Tilia*, Asia ..... (725) *E. oleosa* var. *zhengii*

92. Appendages shorter, about 0.5-1.5 times the chasmothecial diam. 93

93. On *Firmiana simplex* (*Malvaceae*); appendages usually stiff, straight to curved, not geniculate .. (681) ..... *E. clintoniopsis*

93. On *Celtis*, *Hemiptelea* or *Zelkowa* (*Cannabaceae*); appendages stiff to flexuous, often flexuous 94

94. Appendages only slightly (-moderately) enlarged at the apex; on *Celtis* and *Hemiptelea* .... (708) *E. kusanoi*

94. Appendages strongly and abruptly enlarged at the apex (10 µm), only about 5-6.5 µm wide near the base; on *Zelkowa* ..... (764) *E. zelkowae*

95. Asci 2(-3)-spored; on *Peristrophe* in India or *Ulmus* in North America 96

95. Asci 2-8-spored; on other hosts 97

96. Ascospores 24-40 x 13-21 µm; appendages numbering 45-80; on *Ulmus*, North America .... (715) *E. macrospora*

96. Ascospores smaller, 15-22 x 8-11 µm; appendages 7-25; on *Peristrophe*, India ... (729) *E. peristrophes*

97. Appendages numerous, 20-100, arising equatorially or somewhat from the upper half; on *Tectona*, Asia ..... (751) *E. tectonae*

97. Appendages fewer, not arising from the upper half; on other hosts 98

98. Appendages pigmented in the lower part, yellowish brown, numbering 14-40, about 5.5 µm wide below, gradually decreasing to a width of 3.5 µm above, apex characteristically helicoid; chasmothecia 80-150 µm diam.; on *Allophylus*, Africa ..... (656) *E. allophyli*

98. Appendages not pigmented or only brown at the very base 99

99. Appendages short, 0.5-1(-1.8) times the chasmothecial diam., shape irregular, with constrictions and swollen segments, often flexuous-geniculate, width and outline irregular, 0-2(-3)-septate, at least partly yellowish to brown in the lower half on *Hydrangea bretschneideri*, China ..... (763) *E. yanshanensis*

99. Appendages longer or shape and outline regular, and/or 0-1-septate, hyaline or only pigmented at the very base; on other hosts 100

100. Width of most appendages increasing towards the apex (for 1/2-3/4 of the stalk or even up to a point just below the coiled apex), but coiled apex not enlarged or even narrowing towards the extreme tip 101

100. Width of appendages ± equal throughout or decreasing from base to top, occasionally rather variable (but not increasing and then decreasing) 111

101. Asci 6-8-spored, frequently 8-spored; on *Carpinus cordata* or *Eugenia* 102

101. Asci 3-7(-8)-spored; on other hosts [asci 5-8-spored, on *Tilia*, see (725) *E. oleosa*] 103

102. Chasmothecia 100-170 µm diam.; appendages numbering 20-45; on *Eugenia*, South America ..... (664) *E. australis*

102. Chasmothecia 80-100 µm diam.; appendages 8-15; on *Carpinus cordata*, Japan ..... (673) *E. carpini-cordatae*

103. Appendages almost completely thick-walled, wall only somewhat thinner near the apex, verrucose; on *Chionanthus* (*Oleaceae*), China ..... (679) *E. chionanthi*

103. Appendages thin-walled above and gradually thicker towards the base, appendages in at least some species smooth or only faintly rough-walled 104

104. Appendages 5-12(-15) (on *Ehretia thyrsiflora*, *Euodia danielii* or *Ficus sycomorus*) 105

104. Appendages numerous, about 8-40, occasionally even more 107

105. Chasmothecia 90-125 µm diam.; asci (4-)5-7-spored; on *Tetradium danielii* ..... (691) *E. euodiae*

105. Chasmothecia smaller, 55-105 µm diam.; on other hosts 106

106. Asci 2-4-spored; on *Ehretia thyrsiflora*, Asia ..... (689) *E. ehretiae* var. *taiwanensis*

106. Asci 4-6-spored; on *Ficus sycomorus*, South Africa ..... (662) *E. aspera* var. *sparsichaeta*

107. Appendages narrow, only 3-6.5 µm wide below, usually verruculose; on *Ficus* 108

107. Appendages 5-8 µm wide, smooth to faintly rough-walled 109

108. Width of the appendages increasing from base to mostly only 2/3 or 3/4 of the stalk and then again decreasing; South Africa ..... (662) *E. aspera* var. *aspera*

108. Width of the appendages gradually increasing from base to always just below the coiled apex; Asia (India) [asci 3-6-spored, on *Ficus religiosa* = var. *religiosa*; or asci 2-4-spored, on *Ficus nervosa* = var. *fici-nervosae*] ..... (743) *E. religiosa*

109. Appendages rather stiff, straight to curved, mostly neither flexuous nor geniculate; asci 4-8-spored, usually 6-8-spored; on hosts of the *Anacardiaceae* ..... (757) *E. verniciferae*

109. Appendages usually flexuous, often geniculate; asci (2-)3-6(-7)-spored, but not 8-spored 110

110. Appendages 10-26; asci (2-)3-6-, mostly 4-5-spored; no *extensitubus* pattern on conidial germ tubes with subsessile-sessile appressoria; on *Morus* ..... (721) *E. mori*

110. Appendages (9-)15-40(-75); asci (4-)5-6(-7)-spored; *extensitubus* pattern present on some conidial germ tubes with subsessile-sessile appressoria; on *Alnus* ..... (720) *E. miyabei*

111. Chasmothecia 90-170 µm diam.; appendages 1.5-2.5 times as long as the chasmothecial diam., moderately thick-walled throughout or thin-walled above and thick-walled towards the base; asci 10-20, 3-5-spored; on *Nothofagus*, South America ..... (716) *E. magellanica*

111. Chasmothecia with other features (chasmothecia smaller and/or appendages shorter and/or asci fewer and/or with more ascospores and/or not in South America) 112

112. Appendages often irregular, width variable, either ± equal throughout or increasing upwards, some increasing up to 1/2-2/3 of the stalk and then narrowing towards the coiled apex, often with constricted parts (collapsed segments), outline irregular, wall only slightly thicker towards the base, numbering (10-)20-40(-45), length 1-2 times the chasmothecial diam., mostly 1.5-2 times, but apex not enlarged (= var. *ljubarskii*) or apex obviously enlarged (= var. *aduncoides*); on Acer, Asia ..... (712) *E. ljubarskii*

112. Appendages more regular, width either decreasing from base to top or ± equal throughout, without constrictions (furthermore, some species differ in having fewer appendages or thick walls, often almost coalescent at the base) 113

113. Width of most appendages distinctly decreasing from base to top [only with 4-8 appendages, strongly enlarged and brown at the base; on *Bischofia*, see (668) *E. bischofiae*] 114

113. Width ± equal throughout (or width somewhat irregular) 121

114. Chasmothecia 80-90 µm diam.; appendages 15-25, 4.5-8 µm wide below and 3.5-5 µm wide above; asci 3-5-spored; on *Pterostyrax*, Japan ..... (752) *E. togashiana* var. *rigida*

114. Chasmothecia larger (on average > 90 µm) or appendages, often more than 25 in number; asci 4-8-spored; on other hosts 115

115. Appendages 8-21(-26), about 6-10 µm wide at the base 116

115. Appendages 20-45, narrow, about 2.5-6.5 µm wide below 119

116. Wall of the appendages thickened below, even coalescent at the base, verrucose in the lower half; on *Sapindus* (*Sapindaceae*), China ..... (745) *E. sapindi*

116. Wall of the appendages somewhat thickened towards the base, but not coalescent, smooth to faintly rough-walled; on other hosts 117

117. Asci 6-8-spored, length of appendages uniform, 1-1.5 times the chasmothecial diam.,; on *Emblia* (*Myrsinacece*), India ..... (683) *E. embeliae*

117. Asci 4-7-spored; appendages uniformly short, about as long as the chasmothecial diam. or shorter, or length variable, 0.3-1.5 times the chasmothecial diam.; on other hosts 118

118. Length of the appendages rather variable, 0.3-1.5 times the chasmothecial diam., apex tightly circinate-subhelicoid; ascospores 15-20.5 x 10.5-14 µm; on *Litsea* (*Lauraceae*), China ..... (705) *E. irregularis*

118. Appendages uniformly short, about as long as the chasmothecial diam or shorter, apex loosely uncinate; ascospores 18-28 x 8-11 µm; on *Kydia*, India ..... (709) *E. kydiae-calycinae*

119. Appendages 1-1.5 times as long as the chasmothecial diam., straight to curved, verrucose; on *Maackia* (*Fabaceae*), China ..... (713) *E. maackiae*

119. Appendages 1-2 times the chasmothecial diam., flexuous, often geniculate or subundulate, smooth to faintly rough-walled 120

120. Appendages very narrow, 2.5-6 µm wide below, thin-walled throughout or only slightly thick-walled below; ascospores 18-24 µm long; on *Morus rubra*, USA ..... (700) *E. geniculata*

120. Appendages 4-6.5 µm wide below, distinctly thick-walled, sometimes even almost coalescent; ascospores 16-21 µm long; on *Styrax*, Japan ..... (752) *E. togashiana* var. *togashiana*

121. Chasmothecia with few appendages, (3-)5-12(-16), often less than 10 per chasmothecium; asci 3-7-spored 122

121. Appendages numerous, either more than 20 (on average) or between 10 and 20 (rarely 6-16, but then asci mostly 8-spored and appendages often forked) 126

122. Chasmothecia with 4-8 appendages, strongly enlarged and pigmented at the base, shorter than the chasmothecial diam.; on *Bischofia* (*Euphorbiaceae*), China ..... (668) *E. bischofiae*

122. Appendages mostly 5-12, not strongly enlarged at the base 123

123. Appendages 1-1.5 times as long as the chasmothecial diam., mostly flexuous, geniculate to sinuous, sometimes subnodulose; on *Cudrania* (*Moraceae*) ..... (763) *E. yaanensis*

123. Appendages shorter than the chasmothecial diam. (0.5-1 times the diam.), rather stiff, straight to curved 124

124. Chasmothecia large, 90-135 µm diam., (4-)5-8(-12) asci; on *Ailanthus*, China ..... (688) *E. delavayi*

124. Chasmothecia smaller, 55-110 µm diam., usually 60-100 µm 125

125. Ascospores fairly wide, 12-19 µm; on *Cudrania* (*Moraceae*) .....(739) *E. pseudoehretiae*

125. Ascospores narrower, 10-15 µm wide; on *Ehretia* (*Boraginaceae*) .....(689) *E. ehretiae*

126. Appendages very broad, about 7-12.5 µm wide throughout, (9-)15-35 per chasmothecium; asci 4-6-spored; on *Celastrus*, Asia .....(747) *E. sengokui*

126. Appendages narrower, mostly about 4-8 µm wide (sometimes 5-10 µm, but then asci 6-8-spored and with few appendages) 127

127. Appendages with 1-2 septa, distant from the base, basal cells 15-30 µm long, pigmented in the lower half; on *Coriaria*, China .....(684) *E. coriariigena*

127. Appendages with 0-1(-2) septa, but not distant from the base, with the lowest septum at the very base, hyaline or only pigmented at the very base 128

128. Appendages 16-26; ascospores yellowish (chasmothecia 90-120 µm diam.; appendages 1-1.5 times as long as the chasmothecial diam.; ascospores 4-6, large, 23-27 x 13-16.5 µm); on *Alangium* (*Alangiaceae*), China .....(653) *E. alangii*

128. Appendages either numerous, up to 45 or fewer, about 10-20, but then ascospores colourless; on other hosts 129

129. Appendages very numerous, about 15-45, mostly more than 20 130

129. Appendages fewer, 6-25, mostly about 10-20 139

130. Appendages thin-walled, only occasionally slightly thicker towards the base; ascospores 3-4 per ascus, large, 25-36 x 16-24 µm; on *Qualea* (*Vochysiaceae*), South America .....(701) *E. heringeriana*

130. Appendages distinctly thick-walled towards the base or thick-walled throughout; asci 4-8-spored; ascospores smaller 131

131. Asci 4-6-spored; appendages often geniculate-sinuous, abruptly bent; on *Styrax* (Asia) or *Morus rubra* (North America) 132

131. Asci 6-8-spored (or 4-8-spored, but then appendages straight, curved to somewhat flexuous, but not geniculate); on other hosts 133

132. Appendages distinctly thick-walled towards the base, often almost coalescent; ascospores 16-21 µm long; on *Styrax*, Japan .....(752) *E. togashiana* var. *togashiana*

132. Appendages thin-walled throughout or only slightly thicker below; ascospores 18-24 µm long; on *Morus rubra*, USA .....(700) *E. geniculata*

133. Appendages 1-1.5 times as long as the chasmothecial diam., width about 5-7 µm below, ± equal throughout or often somewhat narrowing to about 4-5.5 µm towards the tip; mycelium usually hypophyllous; on *Maackia* (*Fabaceae*) .....(713) *E. maackiae*

133. Appendages 1-2.5 times the chasmothecial diam., about 4-8.5 µm wide throughout or shishtly wider above; mycelium mostly amphigenous 134

134. With short appendages (anchor hyphae) on the upper half of chasmothecia as well as ± equatorial, long, uncinuloid appendages; on *Carpinus* 135

134. Anchor hyphae absent; on other host 137

135. Conidia relatively large, 25-45 x 10-19 µm; chasmothecia with (6-)10-20(-25) appendages, up to 360 µm long, mostly curved throughout (arched), anchor hyphae in the upper part few, 7-12; asci 2-6-spored; ascospores 15-28 x 10-19 µm; on *Carpinus betulus* and *C. tschonoskii* .....(661) *E. arcuata*

135. Conidia relatively small, 20-30 x 9-14 µm; chasmothecia with numerous appendages, 15-40, shorter, up to 300 µm, straight to flexuous, somewhat curved-sinuous, but not typically arched; anchor hyphae numerous, usually more than 15; asci (4-)6-8-spored: ascospores smaller, 13-20 x 7-12 µm; on other hosts 136

136. Foot-cells of the conidiophores straight to slightly sinuous-curved at the base; chasmothecial appendages 90-220 µm long, width within the apical coil slightly decreasing; on *Carpinus japonica*, Japan ..... (673) *E. carpinicola*

136. Foot-cells distinctly curved at the base; appendages up to 300 µm long, width within the apical coil ± uniform to slightly increasing; on *Carpinus laxiflora*, Japan, Korea ..... (675) *E. carpini-laxiflorae*

137. Asci 4-5-spored; on *Qualea*, Brazil ..... (760) *E. viegasii*

137. Asci (4-)6-8-spored; on other hosts, in Asia 138

138. Foot-cells of the conidiophores mostly straight; on *Fraxinus* (*Oleaceae*) ..... (698) *E. fraxinicola*

138. Foot-cells mostly curved-sinuous; on *Betula* (*Betulaceae*) ..... (666) *E. betulina*

139. Asci 4-6-spored 140

139. Asci 6-8-spored [asci 5-8-spored, on *Tilia*, see (725) *E. oleosa*] 144

140. Appendages 3.5-5.5 µm wide, shorter than the chasmothecial diam. (0.75-1 times); on *Ficus*, Africa ..... (732) *E. pirottiana*

140. Appendages wider, 5-11 µm, often somewhat longer; on other hosts, in *Asia* 141

141. Appendages 1.5-2.5 times as long as the chasmothecial diam.; on *Schizophragma*, Japan ..... (746) *E. schizophragmatis*

141. Appendages shorter, about 1-1.5 times the chasmothecial diam. 142

142. Appendages flexuous, often sinuous to geniculate when mature, although at first stiff, straight or somewhat curved, wall only slightly thicker at the base, often irregularly thickened, apex mostly uncinate; on *Sterculia* ..... (723) *E. nishidana*

142. Appendages always straight to curved, neither sinuous nor geniculate, sometimes widely curved, especially in their upper half; on other hosts 143

143. Appendages about as long as the chasmothecial diam., often widely curved, especially in their upper half, apex circinate to subhelicoid; on *Sophora* (*Fabaceae*), China ..... (750) *E. sinensis*

143. Appendages 1-1.5 times the chasmothecial diam., usually straight, apex tightly circinate; on *Garuga* (*Burseraceae*), India ..... (699) *E. garugae*

144. Appendages about as long as the chasmothecial diam., often forked, numbering 6-16; asci 5-8; on *Quercus*, Japan ..... (667) *E. bifurcata*

144. Appendages longer, 1-2 times the chasmothecial diam., not forked; asci 3-6 145

145. Foot-cells of the conidiophores straight; conidia 22-30 x 11-15 µm; on *Fraxinus* (*Oleaceae*) ..... (744) *E. salmonii*

145. Foot-cells straight to sinuous; conidia larger, 25-45 x 13-20 µm; on *Picrasma* (*Simarubaceae*) ..... (731) *E. picrasmicola*

146. Uncinuloid equatorial appendages with bulbose base; terminal appendages short, capitate; on *Koelreuteria paniculata*, China ..... (671) *E. bulbouncinula*

146. Uncinuloid equatorial appendages without bulbose base; terminal appendages (anchor hyphae) short, bristle-like to hyphal, apex often ± pointed 147

147. Uncinuloid appendages sinuous to helically twisted in their upper half, aseptate and hyaline; asci (6-)8-spored; on *Aesculus* and *Sapindus*, North America, introduced in Europe ..... (695) *E. flexuosa*

147. Uncinuloid appendages stiff and straight or flexuous, but not sinuous and not helically twisted; on other hosts 148

148. Appendages 1-4-septate, pigmented in their lower half; on *Lagerstroemia* or *Liquidambar* 149

148. Appendages 0-1-septate, very rarely with two septa; on other hosts 150

149. Chasmothecia 70-140 µm diam.; appendages thin-walled, but somewhat thickened towards the base, 1-3(-4)-septate; asci 3-6, 5-8-spored; on *Lagerstroemia* ..... (663) *E. australiana*

149. Chasmothecia (80-)110-190(-250) µm diam.; appendages thin-walled throughout, 1(-5)-septate; asci (3-)7-14(-24), (6-)8-spored; on *Liquidambar* ..... (756) *E. variabilis*

150. Appendages pigmented, brown throughout or only in the lower half, 1-2.5 times as long as the chasmothecial diam.; on *Fagus*, *Liguidambar* or *Rosa* 151

150. Appendages hyaline or only yellowish to brown at the base 155

151. Chasmothecia (80-)110-190(-250) µm diam.; appendages thin-walled, 0-1(-5)-septate; asci (6-)8-spored; on *Liquidambar* ..... (756) *E. variabilis*

151. Chasmothecia smaller, 75-125 µm diam.; appendages at least thick-walled towards the base; on other hosts 152

152. Appendages thick-walled below and thin-walled towards the apex, aseptate; asci (4-)6-8-spored; ascospores < 20 µm long; on *Fagus crenata*, Japan ..... (761) *E. wadae*

152. Appendages thick-walled throughout, often even coalescent, 0-1(-2)-septate; asci 3-6-spored; ascospores 15-29 µm long; on Rosa 153

153. Chasmothecia rather small, about 70-110 µm diam., average below 100 µm; asci 3-5(-6)-spored; appendages only pigmented near the base; on *Rosa multiflora*, Japan ..... (749) *E. simulans* var. *tandae*

153. Chasmothecia larger, 90-125 µm diam.; asci 4 6-spored: appendages pigmented throughout or at least in their lower half 154

154. Appendages 6-16 per chasmothecium; on *Rosa rubus*, China ..... (749) *E. simulans* var. *rosae-rubi*

154. Appendages 10-30; on *Rosa multiflora*, Japan ..... (749) *E. simulans* var. *simulans*

155. Appendages thick-walled almost throughout, width 4 equal throughout or decreasing towards the tip, apex not enlarged [chasmothecia (90-)115-145(-170) µm diam. var. *liquidambaris*; or chasmothecia larger, 160-200 µm diam. = var. *guiyangensis*]; on *Liquidambar*, China ..... (709) *E. liquidambaris*

155. Appendages only thick-walled towards the base, but thin-walled at least in their upper half; on other hosts or also on *Liquidambar* 156

156. Width of the appendages variable, uniform throughout, somewhat increasing from base to top or up to the middle or 2/3 of the stalk and then decreasing up to the coiled apex; on *Acer*, Asia ..... (712) *E. ljubarskii* var. *ljubarskii*

156. Width of the appendages not variable, either ± equal throughout, or uniformly increasing or even somewhat decreasing from base to top; on other hosts or also on Acer 157

157. Width of the chasmothecial appendages at least partly increasing from base to top 158

157. Width of appendages ± equal thoughout, apex usually not enlarged (on *Carpinus*) or width ± equal throughout to somewhat decreasing towards the apex (on *Pistacia*) 162

158. Chasmothecia small, 80-100 µm diam.; width of appendages always increasing from base to top, but apex not enlarged, width within the apical coil often even slightly decreasing; asci (2-)4-6, (2-)4-5-spored; ascospores large, 18-35 x 11-18 µms on *Ficus roxburghii*, India ..... (694) *E. ficicola*

158. Chasmothecia larger, 80-195 µm diam.; width of appendages ± equal throughout or some increasing from base to tops; on other hosts 159

1S9. Width of appendages ± equal thoughout or usually somewhat increasing from base to top; asci mostly 5-7-spored; ascospores small, 13-20 x 8-12 µm on *Prunus* spp. ..... (737) *E. prunastri*

159. Width of appendages always increasing from base to top and/or ascospores larger, their length usually > 20 µm; on other hosts 160

160. Chasmothecia (85-)140-170(-195) µm diam.; asci (4-)7-8-spored; on *Liquidambar* . (735) *E. praelonga*

160. Chasmothecia 80-140 µm diam.; asci (2-)3-6(-7)-spored; on other hosts 161

161. Asci (2-)3-5-spored; ascospores 20-35(-40) x 9-15 µm on *Machilus* ..... (714) *E. machiliana*

161. Asci (4-)5-6(-7)-spored; ascospores 16-30 x (7-)10-1S(-17) µm; on Acer ..... (712) *E. ljubarskii* var. *aduncoides*

162. Width of appendages ± equal throughout to somewhat decreasing from 5-7.5 µm below to 3.5-5.5 µm above; on Pistacia, China ..... (733) *E. pistaciae*

162. Width of the appendages ± equal from base to top; on *Carpinus* 163

163. Conidia relatively large, 25-45 x 10-19 µm; chasmothecia with (6-)10-20(-25) uncinuloid appendages, up to 360 µm long, mostly curved throughout (arched), anchor hyphae in the upper part few, 7-12; asci 2-6-spored; ascospores 15-28 x 10-19 µm; on *Carpinus betulus* and *C. tschonoskii* ... (661) *E. arcuata*

163. Conidia relatively small, 20-30 x 9-14 µm; chasmothecia with numerous uncinuloid appendages, 15-40, shorter, up to 300 µm, straight to flexuous, somewhat curved-sinuous, but not typically arched; anchor hyphae numerous, usually more than 15; asci (4-)6-8-spored; ascospores smaller, 13-20 x 7-12 µm; on other hosts 164

164. Foot-cells of the conidiophores straight to slightly sinuous-curved at the base; chasmothecial appendages 90-220 µm long, width within the apical coil slightly decreasing; on *Carpinus japonica*, Japan ..... (673) *E. carpinicola*

164. Foot-cells distinctly curved at the base; appendages up to 300 µm long, width within the apical coil ± uniform to slightly increasing; on *Carpinus laxiflora*, Japan, Korea ..... (67S) *E. carpini-laxiflorae*

14 Brasiliomyces

1. Mycelium with numerous setae arising from superficial hyphae, hypophyllous; ascomata usually with three asci, (4-)5-6-spored; on *Sapindus oahuensis* (Sapindaceae) ..... (841) *B. setosus*

1. Mycelium without any setae, mainly hypophyllous 2

2. Chasmothecia very small, (35-)38-45(-48) µm diam., with only two asci; on *Dalbergia cultrata* (*Fabaceae*), Thailand ..... (838) *B. chiangmaiensis*

2. Chasmothecia larger, 45-95 µm diam., with (2-)3-5 asci 3

3. Asci 5-8-spored; peridium cells daedaleoid; on *Fabaceae*, *Mimosoideae* (*Adenopodia* and *Schottia*), South Africa ..... (839) *B. entadae*

3. Asci (2-)4-5(-6)-spored; peridium cells irregularly polygonal; on *Malvaceae*, South America, India ..... (840) *B. malachrae*

15 Microidium

1. Foot-cells of the conidiophores twisted at the base; appressoria multilobed; on *Phyllanthus* ..... (844) *M. phyllanthi*

1. Foot-cells of the conidiophores straight, at most slightly curved, but never twisted; appressoria nipple-shaped to moderately lobed; on legumes 2

2. Foot-cells of the conidiophores 30-90 µm long; on *Bauhinia* spp., South America (843) *M. bauhiniicola*

2. Foot-cells of the conidiophores shorter, 15-35 µm long; on *Sesbania grandiflora*, Asia (842) *M. agatidis*