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Autor: Bolay, Adrien
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12. Identification keys

(English translation by O. Viret)

12.1 Identification keys based on the host plant families

Genera of Erysiphaceae

A. = <i>Arthrocladiella</i>	N. = <i>Neoerysiphe</i>
B. = <i>Blumeria</i>	O. = <i>Oidium</i>
E. = <i>Erysiphe</i>	P. = <i>Podosphaera</i>
G. = <i>Golovinomyces</i>	Ph. = <i>Phyllactinia</i>
L. = <i>Leveillula</i>	Sa. = <i>Sawadaea</i>

Acanthaceae

Generally only anamorph present; conidiophores of Euoidium type; conidia in chains without fibrosin bodies

- 1a Appressoria nipple-shaped, often indistinct; on *Thunbergia alata* **G. orontii** (70)
- 1b Appressoria mostly lobed; on *Acanthus mollis* and *A. spinosus*. **N. galeopsidis** (77)

Aceraceae

- 1a Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; appendages of the cleistothecia acicular, ampulliform at the base **Ph. guttata** (89)
- 1b Species only ectoparasitic; conidiophores of Euoidium type; conidia in chains, ± octagonal, with fibrosin bodies; macro- and microconidia; cleistothecia with appendage; apex uncinat or circinate, simple or dichotomously branched **2**

- 2a Cleistothecia with more than 50 % of the appendages ending with 2-8 crooks. **Sa. bicornis** (121)
- 2b Cleistothecia with more than 50 % of the appendages ending with one crook **Sa. tulasnei** (122)

Anacardiaceae

Only anamorph present, on *Cotinus coggygria*

- 1a Conidiophores of Euoidium type; conidia in chains, with fibrosin bodies **P. pannosa** (112)
- 1b Conidiophores of Pseudoidium type; conidia solitary; appressoria lobed **E. alphitoides** (4)

Apiaceae

Teleomorph generally present; conidiophores of Pseudoidium type; appressoria lobed; conidia solitary ± cylindrical; cleistothecia with simple, mycelioid appendages, often branched. **E. heraclei** (30)

Apocynaceae

Only anamorph present

- 1a Conidiophores of Euoidium type; conidia in chains, without fibrosin bodies; appressoria nipple-shaped or indistinct; on *Vinca major* **G. orontii** (70)
- 1b Conidiophores of Pseudoidium type; appressoria lobed; on *Vinca minor* **O. vincae** (87)

Asclepiadaceae

On *Asclepias*

- 1a Endo- and ectoparasitic species **2**
- 1b Ectoparasitic species only; conidiophores of Pseudoidium type; appressoria lobed . **Oidium sp.** (123)
- 2a Conidiophores of Oidiopsis type; cleistothecia with simple, mycelioid appendages **L. taurica** (76)
- 2b Conidiophores of Ovulariopsis type; cleistothecia with appendages acicular, ampulliform at the base **Ph. guttata** (89)

Asteraceae

- 1a Endo- and ectoparasitic species; conidiophores of Oidiopsis type **2**
- 1b Ectoparasitic species only **3**
- 2a Primary conidia cylindrical to ovoid with larger part between the middle and the apex; on *Picris* **L. picridis** (75)
- 2b Primary conidia lanceolate with larger part between the base and the middle; on *Cynara* and *Gazania* **L. taurica** (76)
- 3a Conidiophores of Pseudoidium type; conidia solitary; appressoria lobed; on *Cirsium* and *Cicerbita* **E. mayorii** (40)
- 3b Conidiophores of Euoidium type; conidia in chains; appressoria nipple-shaped or indistinct. **4**
- 4a Cleistothecia with one ascus; conidia with fibrosin bodies; on several host plants **P. fusca** (105)
- 4b Cleistothecia with several asci; conidia without fibrosin bodies **5**
- 5a Conidiophores very long, sometime 200-500 µm long. **6**
- 5b Conidiophores shorter, less than 100 µm **7**

- 6a On *Arctium*, *Centaurea*, *Onopordum* and *Stemmacantha* **G. depressus** (67)
 6b On *Echinops* **G. echinopsis** (68)
- 7a Conidia large (35-50 x 16-22 µm); teleomorph unknown; on *Dendranthema* **O. chrysanthemi** (80)
 7b Conidia smaller (20-40 x 12-25 µm); cleistothecia sometime present **8**
- 8a On *Artemisia* **G. artemisiae** (63)
 8b On other genera of the *Asteraceae*
 **G. cichoracearum** (65)

Balsaminaceae

Conidiophores of Euoidium type; appressoria nipple-shaped; conidia with fibrosin bodies; cleistothecia containing one ascus; on *Impatiens*
 **P. balsaminae** (95)

Begoniaceae

Mycelium on leaves, stems and inflorescences; cleistothecia very rare

- 1a Conidiophores of Pseudoidium type; appressoria lobed **E. begoniicola** (10)
 1b Conidiophores of Euoidium type; appressoria nipple-shaped, often indistinct **G. orontii** (70)

Berberidaceae

- 1a Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; cleistothecia with acicular appendages that are ampulliform at the base
 **Ph. guttata** (89)
 1b Ectoparasitic species only; conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with dichotomously branched appendages
 **E. berberidis** (11)

Betulaceae

- 1a Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; cleistothecia with acicular appendages that are ampulliform at the base; on *Alnus*, *Betula* and *Carpinus* **Ph. guttata** (89)
 1b Species only ectoparasitic; conidiophores of Pseudoidium type; appressoria lobed **2**
- 2a Cleistothecia abundant, with dichotomously branched appendages **3**
 2b Cleistothecia absent; on *Carpinus* .. **O. carpini** (79)
- 3a On *Alnus* **E. penicillata** (45)
 3b On *Betula* **E. ornata** (42)

Bignoniaceae

- 1a Conidiophores of Euoidium type; conidia in chains, without fibrosin bodies **2**
 1b Conidiophores of Pseudoidium type; conidia solitary **3**
- 2a Appressoria nipple-shaped or indistinct. On *Catalpa* and *Incarvillea* **G. orontii** (70)
 2b Appressoria predominantly lobed
 **N. galeopsidis** (77)
- 3a Conidia ellipsoid to ovoid, doliiform **4**
 3b Conidia cylindric to ellipsoid (24-40 x 14-20 µm); cleistothecia with flexuose, dichotomously branched appendages; on *Catalpa* **E. elevata** (21)
- 4a Foot-cells of the conidiophores 28-40 µm long; conidia 26-40 x 14-21 µm; cleistothecia with simple, mycelioid appendages; on *Catalpa* ... **E. catalpae** (Species frequent in Central Europe, but never identified in Switzerland.)
 4b Foot-cells of the conidiophores 15-25 µm long; conidia 21-32 x 12-16 µm; only the anamorph present; on *Incarvillea olgae* **E. scholzii** (52)

Boraginaceae

- 1a Conidiophores of Euoidium type; appressoria nipple-shaped, rare **G. cynoglossi** (66)
 1b Conidiophores of Pseudoidium type; appressoria lobed; on *Anchusa* **E. lycopsidis** (37)

Brassicaceae

- 1a Conidiophores of Pseudoidium type; appressoria lobed; conidia solitary **E. cruciferarum** (18)
 1b Conidiophores of Euoidium type; appressoria nipple-shaped; conidia in chains **2**
- 2a Conidia with fibrosin bodies; cleistothecia containing one ascus; appendages simple, mycelioid.
 **P. drabae** (98)
 2b Conidia without fibrosin bodies; cleistothecia rare, containing several asci **G. orontii** (70)

Campanulaceae

Conidiophores of Euoidium type; conidia in chains; appressoria nipple-shaped or indistinct; cleistothecia rare **G. orontii** (70)

Capparidaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with simple mycelioid appendages; on *Cleome* **E. cruciferarum** (18)

Caprifoliaceae

- 1a Endo- and ectoparasitic species. Conidiophores of Ovulariopsis type; appendages of the cleistothecia acicular, ampulliform at the base **Ph. guttata** (89)
- 1b Ectoparasitic species only; conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with dichotomously branched appendages **2**

- 2a On *Lonicera* **3**
- 2b On other genera **4**

- 3a Appendages 1-4 x longer than the cleistothecial diameter **E. loniceræ** (36)
- 3b Appendages 2-10 x longer than the cleistothecial diameter **E. magnusii** (39)

- 4a On *Viburnum* **5**
- 4b On other genera **6**

- 5a Cleistothecial diameter: 65-95 (-105) µm; 3-8 appendages; on *Viburnum burejaeticum*, *V. lantana* and *V. tinus* **E. hedwigii** (29)
- 5b Cleistothecial diameter: 75-125 µm; 4-16 appendages; on *V. opulus* and *V. trilobus* **E. viburni** (62)

- 6a Cleistothecia abundant; on *Sambucus* **E. vanbruntiana** (61)
- 6b Cleistothecia absent; on *Symphoricarpos* **E. symphoricarpi** (54)

Caricaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with mycelioid, sometime branched appendages; on *Carica pentagona* **E. caricæ** (14)

Caryophyllaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with simple mycelioid appendages **E. buhrrii** (13)

Celastraceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with dichotomously branched appendages

- 1a Mycelium diffuse; cleistothecial diameter: 80-115 µm; 4-12 asci containing each 3-5 ascospores; on *Euonymus europæus* and *E. maacki* **E. euonymi** (22)
- 1b Mycelium dense, effuse or patchy; cleistothecia very rare, diameter: 100-145 µm; 2-4 asci containing each 3-8 ascospores; on *Euonymus japonicum* and *E. fortunei* **E. euonymi-japonici** (23)

Chenopodiaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with simple mycelioid appendages; on *Beta* **E. betæ** (12)

Cistaceae

On *Helianthemum*

- 1a Endo- and ectoparasitic species; conidiophores of Oidiopsis type; cleistothecia with simple mycelioid appendages **L. taurica** (76)
- 1b Ectoparasitic species only; conidiophores of Euoidium type; conidia with fibrosin bodies; cleistothecia containing one ascus **P. helianthemii** (106)

Convolvulaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with simple mycelioid appendages; on *Calystegia*, *Convolvulus* and *Ipomoea* **E. convolvuli** (17)

Crassulaceae

- 1a Conidiophores of Euoidium type; conidia in chains; appressoria nipple-shaped or indistinct; on *Sedum* **G. orontii** (70)
- 1b Conidiophores of Pseudoidium type; appressoria lobed; conidia solitary; anamorph only present. **2**
- 2a Conidia cylindric, 35-48 x 10-20 µm; on *Kalanchoë* **O. kalanchoës** (82)
- 2b Conidia ellipsoid to ovoid, 25-40 x 10-20 µm; on *Chiastophyllum*, *Rhodiola* and *Sedum* . . **E. sedi** (53)

Cucurbitaceae

Conidiophores of Euoidium type; appressoria nipple-shaped or indistinct; conidia in chains

- 1a Conidia with fibrosin bodies; cleistothecia containing one ascus **P. fusca** (105)
- 1b Conidia without fibrosin bodies; cleistothecia rare, containing several asci **G. orontii** (70)

Dipsacaceae

- 1a Conidiophores of Pseudoidium type; appressoria lobed; conidia solitary, without fibrosin bodies; cleistothecia containing several asci **E. knautiae** (34)
- 1b Conidiophores of Euoidium type; appressoria nipple-shaped; conidia in chains, with fibrosin bodies; cleistothecia containing only one ascus; on *Dipsacus* **P. dipsacearum** (97)

Eleagnaceae

Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; appendages of the cleistothecia acicular, ampulliform at the base; on *Hippophaë rhamnoides* **Ph. hippophaës** (90)

Ericaceae

1a Conidiophores of Pseudoidium type; appressoria lobed; cleistothecial appendages ending with 2-5 dichotomous divisions **E. azaleae** (8)

1b Conidiophores of Euoidium type **2**

2a Conidia in chains, without fibrosin bodies; generally only anamorph present; on *Calluna* and *Erica* **G. orontii** (70)

2b Conidia in chains, with fibrosin bodies; cleistothecia containing one ascus; appendages ending with dichotomous divisions; on *Vaccinium* **3**

3a Appendages 1,5-6 x as long as the cleistothecial diameter **P. myrtillina** var. **myrtillina** (110)

3b Appendages 5-10 x as long as the cleistothecial diameter **P. myrtillina** var. **major** (110)

Euphorbiaceae

Conidiophores of Euoidium type; appressoria nipple-shaped; secondary mycelium generally well developed; conidia in chains, with fibrosin bodies, 24-34 x 12,5-16,5 (-18) μm ; on *Euphorbia* **P. euphorbiae** (101)

Fabaceae

1a Cleistothecia with simple appendages \pm branched **2**

1b Cleistothecia with appendages ending with one or more dichotomous divisions **3**

2a Cleistothecia with more than 10 % branched appendages; on *Lathyrus* and *Ononis*

. **E. pisi** var. **cruchetiana** (46)

2b Cleistothecia with less than 10 % branched appendages; on the majority of the other genera

. **E. pisi** var. **pisi** (46)

3a Appendages flexuose, more than 3 x longer than the cleistothecial diameter **4**

3b Appendages rigid, less than 3 x longer than the cleistothecial diameter, ending with 5-8 dichotomous divisions, sometime trichotomous; on *Caragana* **E. palczewskii** (44)

4a Cleistothecia with less than 20 % of the appendages ending with one or several dichotomous divisions;

top of the ultimate branchlets straight or spatulate, not recurved **5**

4b Cleistothecia with all appendages ending with dichotomous divisions; top of the ultimate branchlets recurved or uncinata **7**

5a On *Astragalus* and *Oxytropis* or on *Vicia* **6**

5b On other genera **E. trifolii** (58)

6a On *Astragalus* and *Oxytropis* **E. astragali** (6)

6b On *Vicia* **E. baumleri** (9)

7a On *Chamaecytisus* and *Laburnum* **E. guarinonii** (28)

7b On *Baptisia* and *Spartium* **E. raysiae** (50)

Fagaceae

1a Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; appendages of the cleistothecia acicular, ampulliform at the base **2**

1b Species only ectoparasitic; conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with appendages ending with dichotomous divisions **3**

2a Cleistothecial diameter: 250-350 (-400) μm ; on *Quercus* **Ph. roboris** (92)

2b Cleistothecial diameter: 150-250 μm ; on *Castanea*, *Fagus* and *Quercus* **Ph. guttata** (89)

3a The powdery mildew infection can be recognized from a long distance; mycelium on the leaves first epiphyllous, than amphigenous, persistent, effuse or patchy, often covering the entire leaf surface; leaves often deformed, distorted and necrosed; conidia ellipsoid, ovoid, doliiiform, 20-40 x 10-25 μm ; on *Castanea*, *Fagus* and *Quercus* . . . **E. alphetoides** (4)

3b The powdery mildew infection can be recognized only from a very short distance (less than one meter); mycelium hypophyllous, rarely amphigenous, thin, effuse, evanescent; infected leaves not deformed or necrosed; conidia cylindric-ellipsoid, 25-48 (-60) x 10-21 μm ; on *Quercus* **E. hypophylla** (33)

Fumariaceae

Conidiophores of Pseudoidium type; appressoria lobed; conidia solitary, without fibrosin bodies; cleistothecia with simple, mycelioid appendages; on *Corydalis* and *Fumaria* **E. cruciferarum** (18)

Gentianaceae

On *Swertia perennis*

- 1a Conidiophores of Pseudoidium type; appressoria lobed; conidia solitary **E. aquilegiae** (5)
- 1b Conidiophores of Euoidium type; appressoria nipple-shaped or indistinct; conidia in chains **G. orontii** (70)

Geraniaceae

- 1a Conidiophores of Pseudoidium type; appressoria lobed; cleistothecial diameter shorter than 100 µm, with simple, mycelioid appendages. **E. geraniacearum** (26)
- 1b Conidiophores of Euoidium type; conidia in chains **2**
- 2a Conidia without fibrosin bodies; appressoria lobed; cleistothecia containing several asci, mature only after overwintering; cleistothecial diameter: 80-170 µm **N. galeopsidis** (77)
- 2b Conidia with fibrosin bodies; cleistothecia containing one ascus **3**
- 3a Width of the foot-cells progressively increasing from base to top, rarely cylindrical; basal septum situated 7-12 µm above the branching point on the hypha (fig. 106); on *Geranium* **P. fugax** (103)
- 3b Foot-cells cylindrical, sometimes constricted at the base; basal septum at the level of the branching point on the hypha (fig. 104); on *Erodium* . . . **P. erodii** (100)

Gesneriaceae

Conidiophores of Euoidium type; cleistothecia rare or unknown

- 1a Conidia without fibrosin bodies; cleistothecia rare **G. orontii** (70)
- 1b Conidia with fibrosin bodies; on *Saintpaulia*. **O. saintpauliae** (86)

Grossulariaceae

- 1a Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; appendages of the cleistothecia acicular, ampulliform at the base; on *Ribes nigrum*. **Ph. guttata** (89)
- 1b Species only ectoparasitic. **2**
- 2a Mycelium effuse on leaves, secondary mycelium absent; conidiophores of Pseudoidium type; appressoria lobed; conidia without fibrosin bodies; cleistothecia containing several asci; appendages ending with dichotomous divisions. **E. grossulariae** (27)

- 2b Secondary mycelium abundant, dense; conidiophores of Euoidium type; conidia in chains, with fibrosin bodies; cleistothecia containing one ascus; appendages simple, mycelioid . **P. mors-uvae** (109)

Hippocastanaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia abundant, with two types of appendages : long appendages (>100 µm) undulate to helically twisted, ending with a crook (hook) or a spirale ; short appendages (< 35 µm), straight, rarely curved, acute at the apex; on *Aesculus* **E. flexuosa** (24)

Hydrangeaceae

- 1a Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia unknown **2**
- 1b Conidiophores of Euoidium type; appressoria nipple-shaped; conidia in chains; cleistothecia rare **G. orontii** (70)
- 2a On *Deutzia* **E. deutziae** (19)
- 2b On *Hydrangea*. **O. hortensiae** (81)

Hypericaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia containing several asci; appendages ending rarely with 1-2 dichotomous divisions; on *Hypericum* **E. hyperici** (32)

Lamiaceae

Conidiophores of Euoidium type; conidia without fibrosin bodies

- 1a Appressoria lobed; asci mature only after overwintering **N. galeopsidis** (77)
- 1b Appressoria nipple-shaped; asci mature during the same year **G. biocellatus** (64)

Lauraceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia unknown; on *Laurus nobilis* **O. lauracearum** (83)

Limnanthaceae

Conidiophores of Pseudoidium type; appressoria lobed; only anamorph present; on *Limnanthes douglasii*. **E. cruciferarum** (18)

Linaceae

Conidiophores of Euoidium type; appressoria nipple-shaped or indistinct; conidia in chains; on *Linum usitatissimum* and *L. viscosum*. **G. orontii** (70)

Lythraceae

Conidiophores of Pseudoidium type; appressoria lobed

- 1a Mycelium discrete, on leaves and stems; cleistothecia frequent at the end of the season; appendages simple, mycelioid; on *Lythrum*. **E. lythri** (38)
- 1b Mycelium on leaves and inflorescences, white, dense, turning yellow-brown by aging; cleistothecia absent in Europe; on *Lagerstroemia*. **E. australiana** (7)

Magnoliaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia containing several asci; appendages simple, mycelioid; on *Magnolia liliiflora*. **E. aquilegiae** (5)

Moraceae

- 1a Conidiophores of Euoidium type; conidia in chains, with fibrosin bodies; cleistothecia containing one ascus; on *Cannabis* and *Humulus* **P. macularis** (108)
- 1b Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia unknown; on *Maclura pomifera*. **Oidium sp.** (124)

Oleaceae

- 1a Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; appendages of the cleistothecia acicular, ampulliform at the base; on *Fraxinus* and *Syringa*. **Ph. fraxini** (88)
- 1b Species only ectoparasitic; conidiophores of Pseudoidium type; appressoria lobed; cleistothecial appendages ending with dichotomous divisions; on *Ligustrum* and *Syringa*. **E. syringae** (55)

Onagraceae

- 1a Conidiophores of Euoidium type; conidia in chains, with fibrosin bodies; cleistothecia containing one ascus; appendages simple, mycelioid; on *Epilobium*. **P. epilobii** (99)
- 1b Conidiophores of Pseudoidium type; conidia solitary; cleistothecia with several asci. **2**
- 2a Conidia cylindrical to ovoid (25-42,5 x 11-14 µm); cleistothecia abundant; on *Circaea* **E. circaeae** (15)
- 2b Conidia ellipsoid, ovoid to doliiform (23-32 x 12-18 µm); cleistothecia absent on the genus *Oenothera*, rare on *Zauschneria californica*. **E. howeana** (31)

Oxalidaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecial appendages ending with dichotomous divisions; on *Oxalis corniculata* and *O. fontana*. **E. russellii** (51)

Paeoniaceae

Conidiophores of Pseudoidium type; appressoria lobed

- 1a Foot-cells of the conidiophores cylindrical, straight, constricted at the base; cleistothecia with coral-shaped appendages; on *Paeonia* **E. paeoniae** (43)
- 1b Foot-cells thin, cylindrical, straight or flexuous; cleistothecial appendages ending with dichotomous divisions; on *Paeonia lutea*. **E. hypophylla** (33)

Papaveraceae

- 1a Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with simple, mycelioid appendages; on *Eschscholzia*, *Glaucium*, *Meconopsis* and *Papaver*. **E. cruciferarum** (18)
- 1b Conidiophores of Euoidium type; appressoria nipple-shaped; conidia in chains, without fibrosin bodies; cleistothecia rare; appendages simple, mycelioid; on *Papaver*. **G. orontii** (70)

Plantaginaceae

- 1a Conidiophores of Euoidium type; conidia in chains, with fibrosin bodies; cleistothecia with one ascus. **P. plantaginis** (114)
- 1b Conidia without fibrosin bodies; appressoria nipple-shaped and lobate; foot-cells of the conidiophores curved at the base; cleistothecia containing several asci. **G. sordidus** (72)

Platanaceae

Only the anamorph present; conidiophores of Pseudoidium type, 70 to 200 µm length; appressoria lobed; conidia 32-50 x 14-22 µm; on *Platanus*. **E. platani** (47)

Plumbaginaceae

Conidiophores of Pseudoidium type; appressoria lobed; conidia solitary, cylindrical, sometimes doliiform, rarely ellipsoid, 30-47 x 9-16 µm; teleomorph absent; on *Limonium*. **E. limonii** (35)

Poaceae

Conidiophores of Euoidium type; appressoria nipple-shaped or indistinct; foot-cells of the conidiophore ampulliform at the base (fig. 7); haustoria digitate (fig. 1g2). **B. graminis** (2)

Polemoniaceae

Conidiophores of Euoidium type; appressoria nipple-shaped; cleistothecia with simple, mycelioid appendages and large peridial cells. (diam.: 10-50 µm); on *Phlox* and *Polemonium*. **G. magnicellulatus** (69)

Polygonaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with simple, mycelioid appendages; on *Polygonum* and *Rumex* **E. polygoni** (48)

Primulaceae

Conidiophores of Euoidium type; conidia in chains, without fibrosin bodies; cleistothecia rare, with simple, mycelioid appendages; on *Cyclamen* **G. orontii** (70)

Ranunculaceae

- 1a Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia containing several asci and with simple, mycelioid appendages. **E. aquilegiae** (5)
- 1b Conidiophores of Euoidium type; conidia in chains, with fibrosin bodies; cleistothecia containing one ascus; on *Thalictrum*. **P. thalictri** (117)

Rhamnaceae

Conidiophores of Pseudoidium type; appressoria lobed; cleistothecial appendages ending with dichotomous divisions

- 1a Appendages flexuous, 2-7 x longer than the cleistothecial diameter; distance between the first and the second dichotomous division generally long; on *Frangula alnus* **E. divaricata** (20)
- 1b Appendages stiff, straight or slightly curved, 1-2 x longer than the cleistothecial diameter, ending with 3 – 5 dichotomous divisions; on *Rhamnus* **E. friesii** (25)

Rosaceae

- 1a Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; appendages of the cleistothecia acicular, ampulliform at the base **Ph. mali** (91)
- 1b Species only ectoparasitic. **2**
- 2a Conidiophores of Pseudoidium type; appressoria lobed. **3**
- 2b Conidiophores of Euoidium type; conidia in chains, with fibrosin bodies **4**

- 3a Cleistothecial appendages ending with a crook; on *Prunus* **E. prunastri** (49)
- 3b Cleistothecial appendages simple, mycelioid; on *Filipendula*. **E. ulmariae** (59)
- 4a Cleistothecial appendages ending with dichotomous divisions; *Podosphaera* sect. *Podosphaera* **5**
- 4b Cleistothecial appendages simple, mycelioid, rarely branched; *Podosphaera* sect. *Sphaerotheca* **7**
- 5a All appendages ending with dichotomous divisions **6**
- 5b Long appendages, straight, inserted at the top of the cleistothecia, rarely ending with 1-2 dichotomous divisions; on *Malus*, *Photinia* and *Pyrus* **P. leucotricha** (107)
- 6a Numerous appendages (4-25), 0,75-3,5 x longer than the cleistothecial diameter, inserted in equatorial position; on *Amelanchier*, *Crataegus*, *Cydonia*, *Mespilus* and *Sorbus* **P. clandestina** (96)
- 6b Few appendages (1-8, generally 2-6), 1-6 x longer than the cleistothecial diameter, inserted at its top; on *Prunus* **P. tridactyla** (118)
- 7a Appendages rare, sometimes totally absent, shorter than the cleistothecial diameter **8**
- 7b Appendages normally developed **9**
- 8a On *Dryas* **P. volkartii** (119)
- 8b On *Sorbus* **P. niesslii** (111)
- 9a Appendages 1-6 x longer than the cleistothecial diameter **10**
- 9b Appendages 0,25-2 x longer than the cleistothecial diameter **11**
- 10a Mycelium responsible for deformations of the host organs; on *Filipendula* and *Spiraea* **P. spiraeae** (116)
- 10b No deformation caused by the mycelium; on *Sanguisorba*. **P. ferruginea** (102)
- 11a On *Prunus* and *Rosa* **P. pannosa** (112)
- 11b On a large number of herbaceous Rosaceae belonging to the following genera: *Alchemilla*, *Aphanes*, *Aremonia*, *Fragaria*, *Geum*, *Potentilla*, *Rubus* and *Sibbaldia* **P. aphanis** (94)

Rubiaceae

- Conidiophores of Euoidium type
- 1a Appressoria lobed; ascospores formed only after overwintering; on *Galium* **N. galii** (78)

- 1b Appressoria nipple-shaped; ascospores mature before winter; on *Galium verum* **G. riedlianus** (71)

Salicaceae

- 1a Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; appendages of the cleistothecia acicular, ampulliform at the base; on *Populus* and *Salix* **Ph. guttata** (89)
- 1b Species only ectoparasitic. **2**
- 2a Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with several asci; appendages ending with a crook; on *Populus* and *Salix* **E. adunca** (3)
- 2b Conidiophores of Euoidium type; conidia in chains, with fibrosin bodies; cleistothecia containing one ascus; appendages inserted at the top of the cleistothecia, stiff, less than 20 % ending with 1-2 dichotomous divisions; on *Salix viminalis*, very rare **P. schlechtendalii** (115)

Santalaceae

- Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia with simple, mycelioid appendages; on *Thesium* **E. thesii** (56)

Saxifragaceae

- Conidiophores of Euoidium type; conidia in chains, with fibrosin bodies; cleistothecia containing one ascus; appendages simple, mycelioid; on *Heuchera*, *Saxifraga*, *Tiarella* and *Tolmiea* **P. alpina** (93)

Scrophulariaceae

- 1a Conidiophores of Euoidium type; appressoria nipple-shaped or indistinct **2**
- 1b Conidiophores of Pseudoidium type; appressoria lobed; telomorph unknown; on *Veronica urticifolia*. **Oidium sp.** (126)
- 2a Conidia in chains, without fibrosin bodies; cleistothecia containing several asci. **3**
- 2b Conidia in chains, with fibrosin bodies; cleistothecia containing one ascus **4**
- 3a Foot-cells straight or curved, 70-160 µm long, 6-8 µm large at the basis, becoming suddenly larger (9-11 µm) at variable height; on *Verbascum* (fig. 76) **G. verbasci** (74)
- 3b Foot-cells cylindrical or becoming progressively or suddenly larger from the basis, sometimes constricted or curved at its base, (40-) 50-80 (-100) µm

long and 8-15 µm large (fig. 72); on *Antirrhinum*, *Cymbalaria*, *Linaria*, *Misopates*, *Penstemon* and *Veronica*. **G. orontii** (70)

- 4a Conidia ellipsoid to cylindric, doliiform, 24-35 x 9,5-12 µm; on *Veronica* **P. fuliginea** (104)
- 4b Conidia ellipsoid to ovoid, doliiform, 24-35 (-50) x 14-20 (-25) µm; on *Bartsia*, *Euphrasia*, *Melampyrum*, *Odontites*, *Pedicularis*, *Rhinantus* and *Scrophularia* **P. fusca** (105)

Solanaceae

- 1a Conidiophores of Pseudoidium type; appressoria lobed; conidia solitary, ellipsoid to ovoid, oblong cylindric; teleomorph absent. **2**
- 1b Conidiophores of Euoidium type; appressoria nipple-shaped or indistinct **3**
- 2a On *Lycopersicon esculentum* **O. neolycopersici** (85)
- 2b On *Nierembergia* **Oidium sp.** (125)
- 3a Conidia in chains, with fibrosin bodies; cleistothecia frequent, containing one ascus; on *Physalis alkekengi* **P. fusca** (105)
- 3b Conidia in chains, without fibrosin bodies; cleistothecia rare or absent. **4**
- 4a Conidiophores very long (100-300 µm), 5-7 µm large at the base, becoming suddenly larger (9-11 µm) at the level of the foot-cell or of one of both following cells; on *Petunia* sp. cult. and *Solanum melongena* **O. longipes** (84)
- 4b Conidiophores clearly shorter; foot-cells less than 100 µm long **5**
- 5a Conidia cylindric to ellipsoid, 24-32 (-36) x 10-18 µm; on *Lycium* **A. mougeotii** (1)
- 5b Conidia ellipsoid to ovoid, doliiform, cylindric, 25-45 x 14-22 µm; on *Nicotiana*, *Nierembergia*, *Petunia* and *Solanum* **G. orontii** (70)

Staphyleaceae

- Endo- and ectoparasitic species. Conidiophores of Ovulariopsis type; appendage of the cleistothecia acicular, ampulliform at the base; on *Staphylea* **Ph. guttata** (89)

Ulmaceae

- Conidiophores of Pseudoidium type; appressoria lobed; cleistothecia containing several asci; appendages ending with a crook; on *Ulmus* **E. clandestina** (16)

Urticaceae

- 1a Conidiophores of Pseudoidium type; appressoria lobed; conidia solidary; cleistothecia containing several asci; appendages simple, mycelioid; on *Urtica* **E. urticae** (60)
- 1b Conidiophores of Euoidium type; appressoria nipple-shaped or indistinct **2**

- 2a Conidia in chains, with fibrosin bodies; cleistothecia containing one ascus; appendages simple, mycelioid; on *Parietaria* **P. parietariae** (113)
- 2b Conidia in chains, without fibrosin bodies; cleistothecia rare, containing several asci; on *Pilea cadieri* **G. orontii** (70)

Valerianaceae

- Conidiophores of Euoidium type; conidia without fibrosin bodies
- 1a Foot-cells curved at its base, inserted on the side of the hypha; appressoria nipple-shaped; cleistothecia abundant; on *Centranthus* and *Valeriana* **G. valerianae** (73)
 - 1b Foot-cells of variable form: straight or flexuous, becoming progressively or suddenly larger from the base to the apex, sometimes constricted or curved at the base; on *Valerianella* **G. orontii** (70)

Verbenaceae

- Conidiophores of Euoidium type
- 1a Conidia with fibrosin bodies; cleistothecia containing one ascus; appendages simples, mycelioid, on *Verbena* **P. xanthii** (120)
 - 1b Conidia, without fibrosin bodies; cleistothecia containing several asci, rarely present; on *Verbena officinalis* and on the cultivars of *V. hortensis* **G. orontii** (70)

Violaceae

- Conidiophores of Euoidium type; conidia in chains, without fibrosin bodies; cleistothecia containing several asci, rarely present; on *Viola arvensis*, *V. tricolor* and *V. wittrokiana* **G. orontii** (70)

Vitaceae

- 1a Endo- and ectoparasitic species; conidiophores of Ovulariopsis type; appendages of the cleistothecia acicular, ampulliform at the base; on *Vitis vinifera* cultivar Gamay **Ph. guttata** (89)
- 1b Only ectoparasitic species **2**

- 2a Conidiophores of Pseudoidium type, 40-400 µm long; foot-cells flexuous, often twisted; cleistothecia with appendages ending in crook; on *Vitis* **E. necator** (41)
- 2b Conidiophores of Euoidium type; conidia in chains without fibrosin bodies; on *Cissus* **G. orontii** (70)

12.2 Identification keys for the genera

12.2.1 Identification key based on the teleomorph

- 1a Mycelium developed internal and at the surface of the host organs; species endo- and ectoparasitic **2**
- 1b Mycelium developed only at the surface of the host organs; species ectoparasitic only **3**

- 2a Cleistothecial appendages acicular, ampulliform at the base, disposed like spokes on a wheel (fig 3h); conidiophores of Ovulariopsis type (fig. 1c) **Phyllactinia**
- 2b Cleistothecial appendages simple, mycelioid, generally not branched; conidiophores of Oidiopsis type (fig. 1d) **Leveillula**

- 3a Cleistothecia containing one ascus; conidiophores of Euoidium type (fig. 1b); conidia in chains with fibrosin bodies **Podosphaera**
- 3b Cleistothecia containing several asci **4**

- 4a Conidiophores of Pseudoidium type (fig. 1a); conidia solitary; appressoria lobed **Erysiphe**
- 4b Conidiophores of Euoidium type (fig. 1b); conidia in chains **5**

- 5a Conidia with fibrosin bodies; appendages ending with one or several crooks **Sawadaea**
- 5b Conidia without fibrosin bodies **6**

- 6a Foot-cells of the conidiophores bulbous at the base (fig. 7); haustoria digitate (fig. 1g2); on *Poaceae* **Blumeria**
- 6b Foot-cells of the conidiophores not bulbous at the base; haustoria globulose (fig. 1g1) **7**

- 7a Cleistothecial appendages dichotomously branched; on *Lycium* **Arthrocladiella**
- 7b Cleistothecial appendages simple, mycelioid, sometimes irregularly branched **8**

- 8a Appressoria mostly lobed; external wall of the conidia striate (only visible with Scanning Electronic Microscope, SEM) **Neoerysiphe**
 8b Appressoria nipple-shaped or indistinct; external wall of the conidia reticulate (SEM) **Golovinomyces**

12.2.2 Identification key based on the anamorph

- 1a Mycelium developed internal and at the surface of the host organs; species endo- and ectoparasitic **2**
 1b Mycelium developed only at the surface of the host organs; species only ectoparasitic **3**
- 2a Conidiophores hypophyllous, of Ovulariopsis type (fig. 1c) **Phyllactinia**
 2b Conidiophores amphigenous, growing through the stomata, often branching, of Oidiopsis type (fig. 1d) **Leveillula**
- 3a Conidiophores of Pseudoidium type (fig. 1a); conidia solitary; appressoria lobed **Erysiphe**
 3b Conidiophores of Euoidium type (fig. 1b); conidia in chains; appressoria nipple-shaped or indistinct **4**
- 4a Conidia with fibrosin bodies **5**
 4b Conidia without fibrosin bodies **6**
- 5a Conidia more or less octagonal; microconidia present; on *Acer* **Sawadaea**
 5b Conidia ellipsoid, ovoid or doliiform **Podosphaera**
- 6a Foot-cells of the conidiophores bulbous at the base (fig.7); haustoria digitate (fig. 1g2); on *Poaceae* **Blumeria**
 6b Foot-cells of the conidiophores not bulbous at the base; haustoria globulose (fig. 1g1) **7**
- 7a Appressoria mostly lobed **Neoerysiphe**
 7b Appressoria nipple-shaped or indistinct **8**
- 8a Conidiophores more or less curved; on *Lycium* **Arthrocladiella**
 8b Conidiophores straight, on other hosts **Golovinomyces**

12.3 Identification keys for the species

12.3.1 Species of the genus *Erysiphe*

- 1a Appendages ending with dichotomous divisions or with one or more crooks **2**
 1b Appendages simple, mycelial, sometimes branched (fig. 3a-c) (***Erysiphe*** sect. ***Erysiphe***) **3**
- 2a Appendages ending with dichotomous divisions (fig. 3f) (***Erysiphe*** sect. ***Microsphaera***) **9**
 2b Appendages ending with one crook (fig. 3d) (***Erysiphe*** sect. ***Uncinula***) **27**
- 3a Cleistothecia with more than 10 % of the appendages branched **4**
 3b Cleistothecia with less than 10 % of the appendages branched **6**
- 4a Appendages coralliform, on *Paeonia* (fig. 3b) ***E. paeoniae*** (43)
 4b Appendages mycelioid (fig. 3 a, c) **5**
- 5a On Apiaceae ***E. heraclei*** (30)
 5b On Asteraceae (*Cirsium* and *Cicerbita*) ***E. mayorii*** (40)
 5c On Caricaceae (*Carica*) ***E. caricae*** (14)
 5d On Chenopodiaceae (*Beta*) ***E. betae*** (12)
 5e On Convolvulaceae (*Calystegia*, *Convolvulus* and *Ipomoea*) ***E. convolvuli*** (17)
 5f On Fabaceae (*Lathyrus* and *Ononis*) ***E. pisi*** var. ***cruchetiana*** (46)
 5g On Plumbaginaceae (*Limonium*) ***E. limonii*** (35)
 5h On Polygonaceae (*Polygonum* and *Rumex*) ***E. polygoni*** (48)
 5i On Rosaceae (*Filipendula*) ***E. ulmariae*** (59)
- 6a Appendages more than 2 x longer than the cleistothecial diameter **7**
 6b Appendages less than 2 x longer than the cleistothecial diameter **8**
- 7a On Brassicaceae, Capparidaceae, Limnanthaceae, Fumariaceae and Papaveraceae ***E. cruciferarum*** (18)
 7b On Crassulaceae ***E. sedi*** (53)
 7c On Dipsacaceae ***E. knautiae*** (34)
 7d On Lythraceae (*Lythrum*) ***E. lythri*** (38)
 7e On Onagraceae (*Circaea*) ***E. circaeae*** (15)
 7f On Onagraceae (*Oenothera* and *Zauschneria*) ***E. howeana*** (31)

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- 7g On Ranunculaceae, occasionally on Gentianaceae (*Swertia*) and Magnoliaceae (*Magnolia*) **E. aquilegiae** (5)
- 7h On Santalaceae (*Thesium*) **E. thesii** (56)
- 8a On Bignoniaceae (*Incarvillea*) **E. scholzii** (52)
- 8b On Boraginaceae (*Anchusa*) **E. lycopsidis** (37)
- 8c On Caryophyllaceae **E. buhrrii** (13)
- 8d On Geraniaceae (*Geranium*) **E. geraniacearum** (26)
- 8e On Fabaceae **E. pisi** var. **pisi** (46)
- 8f On Urticaceae (*Urtica*) **E. urticae** (60)
- 9a Appendages flexuous, more than 3 x longer than the diameter of the cleistothecium **10**
- 9b Appendages stiff, less than 3 x longer than the diameter of the cleistothecium **17**
- 10a Cleistothecia with less than 20 % of the appendages ending in one or more dichotomous divisions . **11**
- 10b Cleistothecia with more than 50 % of the appendages ending in one or more dichotomous divisions . **12**
- 11a On Cornaceae (*Cornus*) **E. tortilis** (57)
- 11b On Fabaceae (*Astragalus* and *Oxytropis*) **E. astragali** (6)
- 11c On Fabaceae (*Vicia*) **E. baeuimeri** (9)
- 11d On Fabaceae, other genera **E. trifolii** (58)
- 11e On Hypericaceae (*Hypericum*) **E. hyperici** (32)
- 11f On Oxalidaceae (*Oxalis*) **E. russellii** (51)
- 12a On Celastraceae (*Euonymus*) **13**
- 12b On other families **14**
- 13a Cleistothecia at the surface of the host organs, 85-115 µm diameter; appendages ending in 3-4 (-5) dichotomous divisions **E. euonymi** (22)
- 13b Cleistothecia buried in a dense, yellow-white stroma, 100-145 µm diameter; appendages ending in 1-3 dichotomous divisions **E. euonymi-japonici** (23)
- 14a On Fabaceae **15**
- 14b On other families **16**
- 15a On *Laburnum* and *Chamaecytisus* **E. guarinonii** (28)
- 15b On *Spartium* **E. rayssiae** (50)
- 16a On Bignoniaceae (*Catalpa*) **E. elevata** (21)
- 16b On Caprifoliaceae (*Lonicera*) **E. magnusii** (39)
- 16c On Rhamnaceae (*Frangula*) **E. divaricata** (20)
- 17a Appendages with dichotomous divisions ending with spatulate or straight segments, not curved **18**
- 17b Appendages with dichotomous divisions ending with curved or coiled segments **20**
- 18a Conidia 35-60 µm long. Appendages with 1-3, rarely 4 septa, on *Begonia* **E. begoniicola** (10)
- 18b Conidia shorter, 20-38 µm long **19**
- 19a On Berberidaceae **E. berberidis** (11)
- 19b On Caprifoliaceae (*Lonicera*) **E. loniceriae** (36)
- 19c On Caprifoliaceae (*Sambucus*) **E. vanbruntiana** (61)
- 19d On Caprifoliaceae (*Symphoricarpos*) **E. symphoricarpi** (54)
- 19e On Fabaceae (*Caragana*) **E. palczewskii** (44)
- 19f On Grossulariaceae (*Ribes*) **E. grossulariae** (27)
- 20a On Betulaceae **21**
- 20b On other families **22**
- 21a On *Alnus* **E. penicillata** (45)
- 21b On *Betula* **E. ornata** (42)
- 22a On Caprifoliaceae (*Viburnum*) **23**
- 22b On other families **24**
- 23a Conidia size: 35-37 x 15-17 µm; diameter of the cleistothecia: 75-125 µm **E. viburni** (62)
- 23b Conidia size: 25-35 x 15-20 µm; diameter of the cleistothecia: 65-95 µm **E. hedwigii** (29)
- 24a On Fagaceae **25**
- 24b On other families **26**
- 25a Conidia numerous, ellipsoid to ovoid, doliiform, 20-40 x 10-25 µm; on Fagaceae occasionally on Anacardiaceae (*Cotinus*) **E. alphitoides** (4)
- 25b Conidia rare, cylindrical to ellipsoid, 25-48 (-60) x 10-21 µm; on Fagaceae, genus *Quercus*, occasionally on Paeoniaceae (*Paeonia lutea*) **E. hypophylla** (33)
- 26a On Ericaceae **E. azaleae** (8)
- 26b On Hydrangeaceae (*Deutzia*) **E. deutziae** (19)
- 26c On Oleaceae (*Ligustrum* and *Syringa*) **E. syringae** (55)
- 26d On Platanaceae (*Platanus*) **E. platani** (47)
- 26e On Rhamnaceae (*Rhamnus*) **E. friesii** (25)
- 27a Cleistothecia with long (> 100 µm) and short (< 35 µm) appendages (old genus *Uncinuliella*) **28**
- 27b Cleistothecia with only long appendages (old genus *Uncinula*) **29**

- 28a On Lythraceae (*Lagerstroemia*) . . . **E. australiana** (7)
 28b On Hippocastanaceae (*Aesculus*) . . . **E. flexuosa** (24)
- 29a Foot-cell of the conidiophores flexuous or twisted;
 on Vitaceae **E. necator** (41)
 29b Foot-cell of the conidiophores straight, sometimes
 flexuous, never twisted. **30**
- 30a On Rosaceae (*Prunus*) **E. prunastri** (49)
 30b On Salicaceae (*Populus* and *Salix*) . . . **E. adunca** (3)
 30c On Ulmaceae (*Ulmus*) **E. clandestina** (16)

12.3.2 Species of the genus *Golovinomyces*

This identification key is essentially based on the morphological characters of the anamorph, particularly those of the foot-cell, as well as on the host plants. Morphological characters of the teleomorphs are too similar to allow for a clear distinction of the 12 species recorded in Switzerland. Certain characters are the same for all species (number of ascospores per ascus), others are too variable within the same species (diameter of the cleistothecia : 80 - 170 µm). Most of the species have no teleomorph under our conditions, or only on a few rare host plants. To facilitate the identification of the Swiss species, the user should consider Table 12 and Figure 63.

- 1a Conidiophores long (200-500 µm) **2**
 1b Conidiophores clearly shorter (less than 100 µm) **4**
- 2a Sudden enlargement of the conidiophore at the level
 of the foot-cell; on Scrophulariaceae (*Verbascum*). . .
 **G. verbasci** (74)
 2b Sudden enlargement of the conidiophore at the level
 of the foot-cell or of one of the two next cells; on
 Asteraceae **3**
- 3a On *Arctium*, *Centaurea*, *Onopordum* and
Stemmacantha. **G. depressus** (67)
 3b On *Echinops* **G. echinopsis** (68)
- 4a Development of the 5 types of foot-cells on the
 same individual (tab. 12, fig. 63): cylindric (type
 A), constricted (type B), curved at the base (type C),
 enlarging from the base progressively (type D) or
 suddenly (type E) to the apex. **5**
 4b One or several of these five types of foot-cells missing
 or very rare **7**

- 5a On Asteraceae **6**
 5b On several host plants belonging to twenty other
 families **G. orontii** (70)
- 6a On *Artemisia* **G. artemisiae** (63)
 6b On other Asteraceae **G. cichoracearum** (65)
- 7a Foot-cells generally curved at the base **8**
 7b Foot-cells not curved at the base **10**
- 8a Majority of the foot-cells curved at the base; on
 Plantaginaceae **G. sordidus** (72)
 8b Minority of the foot-cells curved at the base **9**
- 9a Foot-cells curved or progressively enlarging towards
 the apex; on Valerianaceae . . . **G. valerianae** (73)
 9b Foot-cells curved or cylindrical; on *Galium*
 (Rubiaceae) **G. riedlianus** (71)
- 10a Foot-cells enlarging progressively or suddenly
 towards the apex **11**
 10b Majority of the foot-cells cylindrical, often constricted
 or progressively enlarging towards the apex; on
Phlox and *Polemonium* (Polemoniaceae)
 **G. magnicellulatus** (69)
- 11a Foot-cells often cylindrical and constricted; on
 Lamiaceae **G. biocellatus** (64)
 11b Foot-cells sometimes cylindrical, never constricted;
 on Boraginaceae **G. cynoglossi** (66)

12.3.3 Species of the genus *Leveillula*

- 1a Primary conidia cylindrical to cylindro-ovoid; when
 not cylindrical the largest part is located between the
 centre and the apex of the conidium; on Asteraceae
 (*Picris*) **L. picridis** (75)
 1b Primary conidia lanceolate to ovoido-lanceolate,
 the largest part is located between the centre and
 the base of the conidium; on several host plants
 belonging to fourteen different families in Europe .
 **L. taurica** (76)

12.3.4 Species of the genus *Neoerysiphe*

Both species found in Switzerland are morphologically very similar. They can be distinguished by the

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number of ascospores per ascus, only visible after overwintering.

- 1a Asci containing (2-) 3-6 (-8) ascospores; on Acanthaceae, Bignoniaceae and Lamiaceae **N. galeopsidis** (77)
- 1b Asci containing 2-4 ascospores, generally 2; on Rubiaceae **N. galii** (78)

12.3.5 Species of the genus *Oidium*

- 1a Conidiophores of *Euoidium* type; conidia in chains; appressoria nipple-shaped **2**
- 1a Conidiophores of *Pseudoidium* type; conidia solitary at the apex; appressoria lobed **4**
- 2a Conidia with fibrosine bodies; on *Saintpaulia ionantha* (Gesneriaceae) **O. saintpauliae** (86)
- 2b Conidia without fibrosine bodies **3**
- 3a Appressoria rare; conidia 35-50 (-80) x 16-22,5 (-30) µm; on *Dendranthema* (Asteraceae) **O. chrysanthemi** (80)
- 3b Appressoria numerous, single or serial; conidia 28-38 x 13-18,5 µm; on *Solanum melongena* and *Petunia x hybrida* (Solanaceae) **O. longipes** (84)
- 4a Conidiophores short (40-65 µm) **5**
- 4b Conidiophores longer (45-120 µm) **8**
- 5a Foot-cells enlarging towards the apex; rarely cylindrical; on *Carpinus* (Betulaceae) **O. carpini** (79)
- 5b Foot-cells cylindrical **6**
- 6a Foot-cells straight, seldom flexuous; conidia ellipsoid-ovoid **7**
- 6b Foot-cells flexuous, seldom straight; conidia cylindrical-ovoid; on *Maclura pomifera* **Oidium sp.** (124)
- 7a On *Hydrangea* (Hydrangeaceae) **O. hortensiae** (81)
- 7b On *Vinca minor* (Apocynaceae) **O. vincae** (87)
- 8a Foot-cells cylindrical, straight; conidia cylindrical-ellipsoid; on *Crassula* and *Kalanchoë* (Crassulaceae) **O. kalanchoës** (82)
- 8b Foot-cells cylindrical, straight or flexuous; conidia ellipsoid-ovoid to subcylindrical **9**
- 9a Conidia ellipsoid-ovoid to subcylindrical **10**

- 9b Conidia ellipsoid-ovoid to subcylindrical and doliform **11**
- 10a On *Asclepias* **Oidium sp.** (123)
- 10b On *Laurus nobilis* (Lauraceae) **O. lauracearum** (83)
- 11a On *Veronica urticifolia* **Oidium sp.** (126)
- 11b On Solanaceae **12**
- 12a On *Lycopersicon esculentum* **O. neolycopersici** (85)
- 12b On *Nierembergia hippomanica* **Oidium sp.** (125)

12.3.6 Species of the genus *Phyllactinia*

- 1a Asci containing normally 2 ascospores **2**
- 1b Asci containing 2-4, generally 3 ascospores; on Oleaceae (*Fraxinus* and *Syringa*) **P. fraxini** (88)
- 2a Cleistothecial diameter larger than 250 µm **3**
- 2b Cleistothecial diameter smaller than 250 µm **4**
- 3a Diameter of the cleistothecia between 250 and 350 µm; on Fagaceae (*Quercus*) **P. roboris** (92)
- 3b Diameter of the cleistothecia between 250 and 275 µm; on Eleagnaceae (*Hippophaë*) **P. hippophaës** (90)
- 4a On woody Rosaceae **P. mali** (91)
- 4b On hosts belonging to twenty other families **P. guttata** (89)

12.3.7 Species of the genus *Podosphaera*

- 1a Cleistothecia with appendages ending in dichotomous divisions (*Podosphaera* sect. *Podosphaera*) **2**
- 1b Cleistothecia with simple, mycelioid appendages, rarely branched (*Podosphaera* sect. *Sphaerotheca*) **7**
- 2a Insertion of the appendages ± equatorial **3**
- 2b Insertion of the appendages at the tip of the upper surface of the cleistothecium **5**
- 3a Appendages long, 5-10 x longer than the cleistothecial diameter; on Ericaceae (*Vaccinium*) **P. myrtilina** var. **major** (110)
- 3b Appendages short, 1-6 x longer than the cleistothecial diameter **4**

- 4a On Ericaceae (*Vaccinium*) ***P. myrtilina*** var. ***myrtilina*** (110)
- 4b On Rosaceae (*Amelanchier*, *Crataegomespilus*, *Crataegus*, *Cydonia*, *Mespilus* and *Sorbus*) ***P. clandestina*** (96)
- 5a Few appendages (1-5), stiff, erect, ending with 4-5 dichotomous divisions, on Rosaceae (*Prunus*) ***P. tridactyla*** (118)
- 5b Appendages numerous, ending with 1-2 dichotomous divisions **6**
- 6a On Salicaceae (*Salix*) ***P. schlechtendalii*** (115)
- 6b On Rosaceae (*Malus* and *Pyrus*) . ***P. leucotricha*** (107)
- 7a Peridial cells of the cleistothecia not clearly delimited, poorly visible, small (6-25 µm diameter) (subsect. *Sphaerotheca*) **8**
- 7b Peridial cells clearly visible, large (15-55 µm diameter); less than 12 peridial cells present on one face of the cleistothecium (subsect. *Magnicellulatae*) **21**
- 8a Appendages rare, short, sometimes absent; on Rosaceae (*Dryas*) ***P. volkartii*** (119)
- 8b Appendages normally developed **9**
- 9a Secondary mycelium abundant, first grey-yellow, becoming brown-black by aging; cleistothecia ± buried in a stroma. **10**
- 9b Secondary mycelium absent or poorly visible . . **14**
- 10a Appendages numerous, 1-5 x longer than the cleistothecial diameter **11**
- 10b Few appendages, same length or shorter than the cleistothecial diameter **12**
- 11a On Geraniaceae (*Geranium*) ***P. fugax*** (103)
- 11b On Moraceae (*Humulus* and *Cannabis*) ***P. macularis*** (108)
- 12a Hyphae of the secondary mycelium thin, 3–5 µm large; conidia cylindrical, slender, 12-17 µm large; on Euphorbiaceae (*Euphorbia*) . . . ***P. euphorbiae*** (101)
- 12b Hyphae of the secondary mycelium large, 3-9,5 µm; conidia not cylindrical, on other hosts **13**
- 13a On Rosaceae (*Prunus* and *Rosa*), occasionally on *Cotinus* (Anacardiaceae) and *Forsythia* (Oleaceae). ***P. pannosa*** (112)
- 13b On Grossulariaceae (*Ribes*) ***P. mors-uvae*** (109)
- 14a Appendages inserted ± equatorially or at the upper surface of the cleistothecia **15**
- 14b Appendages inserted only at the lower surface of the cleistothecia **16**
- 15a Mycelium responsible for deformations of the host organs; on Rosaceae (*Filipendula* and *Spiraea*) ***P. spiraea*** (116)
- 15b Deformations of the host organs absent; on Rosaceae (*Sanguisorba*) ***P. ferruginea*** (102)
- 16a Appendages irregular, curved, sometimes branched, 0.5-2.5 x longer than the diameter of the cleistothecia; on Geraniaceae (*Erodium*) ***P. erodii*** (100)
- 16b Appendages straight, not curved, nor branched, 0.5-4 (-5) x longer than the diameter of the cleistothecia **17**
- 17a Cleistothecial diameter: 50-60 µm; on Rosaceae (*Sorbus*) ***P. niesslii*** (111)
- 17b Cleistothecial diameter: 60-110 (-160) µm **18**
- 18a Cleistothecial diameter: 60-105 µm. **19**
- 18b Cleistothecial diameter: 75-110 (-160) µm **20**
- 19a On Onagraceae (*Epilobium*) ***P. epilobii*** (99)
- 19b On herbaceous Rosaceae ***P. aphanis*** (94)
- 20a On Dipsacaceae (*Dipsacus*) . . . ***P. dipsacearum*** (97)
- 20b On Urticaceae (*Parietaria*) ***P. parietariae*** (113)
- 21a Polyphagous species, parasitic on a large number of hosts belonging to different families ***P. fusca*** (105)
- 21b Parasitic species of one or several hosts of the same family **22**
- 22a Length of the appendages: 0.5-4.0 (-6) x the cleistothecial diameter **23**
- 22b Length of the appendages: 0.5-1.0 x the cleistothecial diameter **27**
- 23a On Balsaminaceae (*Impatiens*) ***P. balsaminae*** (95)
- 23b On plants from other families. **24**
- 24a On Brassicaceae (*Arabis* and *Draba*) ***P. drabae*** (98)
- 24b On plants from other families. **25**
- 25a On Cistaceae (*Helianthemum*) ***P. helianthemii*** (106)
- 25b On plants from other families. **26**
- 26a On Plantaginaceae (*Plantago*) ***P. plantaginis*** (114)

Les Oïdiums de Suisse (Erysiphacées)

26b On Ranunculaceae (*Thalictrum*) . . . **P. thalictri** (117)

27a On Saxifragaceae (*Saxifraga*, *Heuchera*, *Tiarella* et *Tolmiea*) **P. alpina** (93)

27b On plants from other families **28**

28a On Scrophulariaceae (*Veronica*) **P. fuliginea** (104)

28b On Verbenaceae (*Verbena*) **P. xanthii** (120)

12.3.8 Species of the genus *Sawadaea*

1a Mycelium amphigenous on leaves, diffuse, or forming not clearly delimited white spots; cleistothecia with more than 50 % of the appendages ending with 2 (-8) crooks **S. bicornis** (121)

1b Mycelium first hypophyllous, forming small, clearly delimited white spots, later becoming confluent and covering both leaf surfaces; cleistothecia with more than 50 % of the appendages ending with one crook **S. tulasnei** (122)

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