

SOME RAMULARIA-LIKE FUNGI ON MALVACEAE

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The species *Ramularia gossypii* (Speg.) Cif., *R. malvae* Fuckel and *Cladosporium anomalum* Berk. & Curt. are redescribed. A new combination in *Pseudocercospora* is proposed for *Cladosporium anomalum*.

In the course of a screening of fungi related to *Hyalodendron fusiforme* Reddy & Bilgrami on *Gossypium* (de Hoog & Batenburg-van der Vchte, 1989), various Hyphomycetes growing on Malvaceae were studied, which are briefly discussed below.

ON GOSSYPIUM

Ramularia gossypii (Speg.) Cif. — Fig. 1

Cercosporella gossypii Speg., An. Soc. cient. Argent. 22 (1886) 209. — *Ramularia gossypii* (Speg.) Cif., Atti Ist. bot. Lab. crittig. Univ. Pavia, Ser. 5, 19 (1962) 124.

Ramularia areola Atkinson, Bot. Gaz. 15 (1890) 166. — *Sympiosira areola* (Atkinson) Sawada, Spec. Publ. Coll. Agric., natn. Taiwan Univ. 8 (1959) 232.

Teleomorph: (?) *Mycosphaerella areola* Ehrlich & F.A. Wolf, Phytopathology 22 (1933) 229.

Leaf spots hypophyllous, whitish, angular, delimited by the leaf veins. Conidiophores emerging from pseudoparenchymatous tissue through the stomata in loose fascicles, (sub)hyaline, up to 70 µm in length, sympodially proliferating, with 2–6 conspicuous scars. Stroma absent. Conidia arising in short chains, hyaline, thin-walled, punctate, fusiform, 1–2(–3)-septate, mostly 20–30 × 4 µm.

Material examined. Atkinson Pl. Crypt. No. 1740 (type of *R. areola*) and Econ. Fungi No. 407, on *Gossypium herbaceum* leaves, Auburn, Ala., Sept. 1890 (NY); Fl. Alabama, various collections on *Gossypium* sp., Auburn, Ala., L.M. Underwood, Nov. 1890 (NY); ibid., F.S. Earle, Oct. 1895 and July 1896 (NY); on *Gossypium* sp., Starkville, Miss., S.M. Tracy, Oct. 1893 and 1895 (NY); on *Gossypium* sp., Puerto Rico, F.S. Earle, July 1903 (NY); Secc. Phyt. No. 522, on *Gossypium hirsutum*, Sergipe, Brazil, H. Borborema and H.P. Krug, Nov. 1934 (NY); on *Gossypium hirsutum*, Tupy, Brazil, A.S. Costa, March 1935; Bur. Pl. Indust. No. 60181, on *Gossypium herbaceum*, Tallassee, Ala., W.A. Orton, Sept. 1905 (NY); Herb. Agric. Exp. Stn, on *Gossypium hirsutum*, Gainesville, Fla., G.F. Weber, Oct. 1923 (NY).

Recent descriptions of this causal organism of grey mildew were given by Mulder & Holliday (1976), Holliday (1979) and Watkins (1984). Many authors used the name *Ramularia areola* Atk., but we follow Holliday (1979) and others in maintaining the older name *R. gossypii* for this taxon. Rathajah (1973, 1976) described some cultural characteristics and host symptoms. The host specificity of the species was stressed by Dutta &

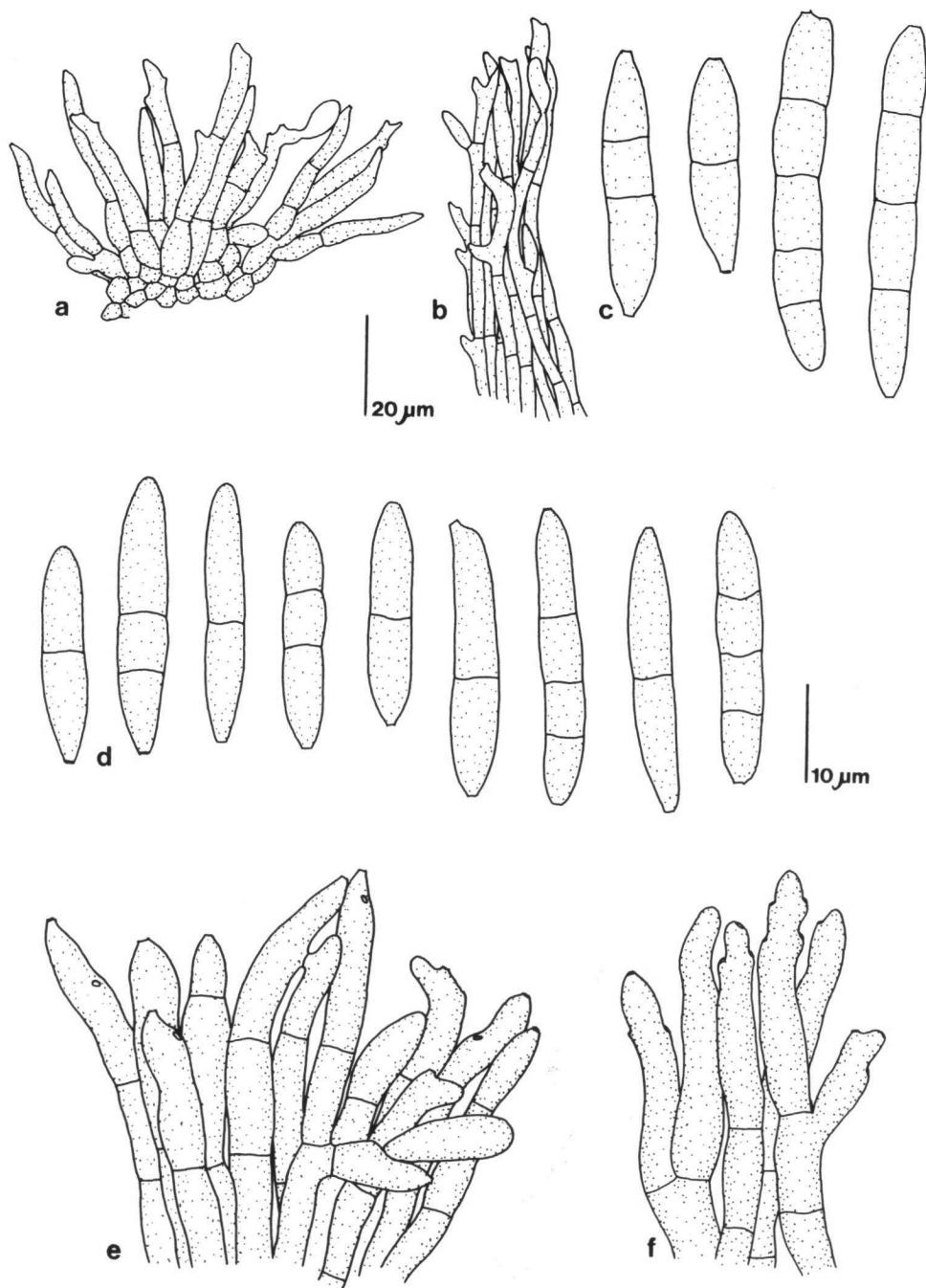


Fig. 1. *Ramularia gossypii*, various specimens on *Gossypium* (NY). a, b. Conidiophores (coll. Underwood); c, d. conidia (colls Earle and Atkinson); e, f. conidiophores (colls Atkinson and Earle).

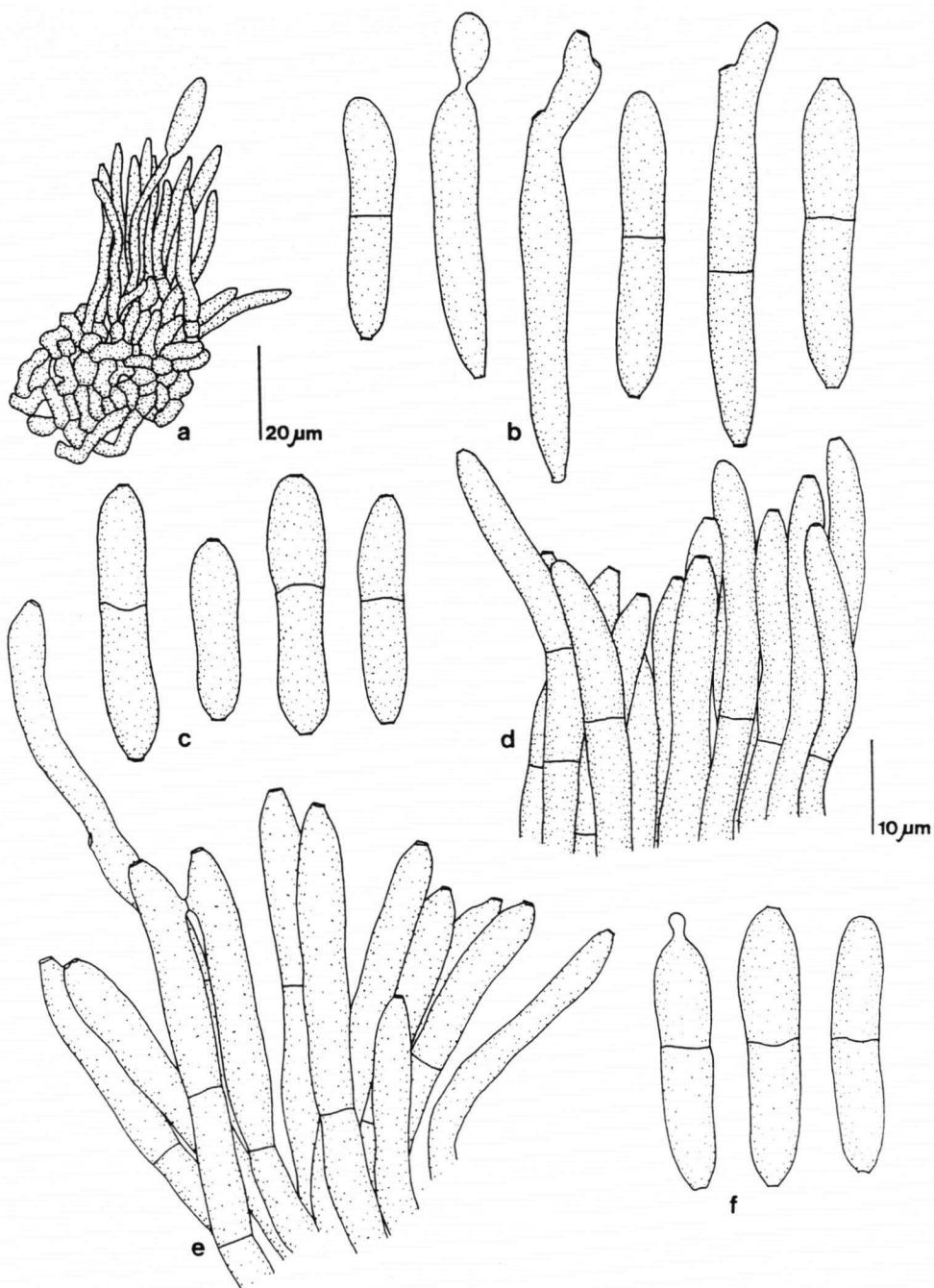


Fig. 2. *Ramularia malvae*, various specimens on *Malva*. a. Conidiophores (coll. Roivanen); b, c, f. conidia (colls Kabát and Bubák, Vestergren, Keith); d, e. conidiophores (colls Kabát and Bubák, Keith).

Jha (1979). Ehrlich & Wolf (1933) described a teleomorph in *Mycosphaerella*, but were unable to demonstrate the connection with *Ramularia gossypii* unambiguously.

Morphologically the species is closely similar to *Ramularia sidae* Olive (1948), described from leaves of *Sida* sp. (Malvaceae), but *R. gossypii* has slightly broader conidia.

Cercospora gossypina Cooke, the anamorph of *Mycosphaerella gossypina* (Cooke) Atk., was accepted in *Cercospora* by Hsieh & Goh (1990) on the basis of non-catenate conidia with dark scars. *Cercospora gossypii* Lall et al. (1962) and *C. lhuillieri* Montégut (1967), both pathogenic on *Gossypium* leaves, are further species to be maintained in *Cercospora* s. str. because of their dark, prominent scars and cylindrical, multiseptate conidia. Whether or not these two species are identical remains to be established.

No authentic material was available at the herbarium KW of *Cladosporium gossypii-cola* Pidoplichko & Denyak and its variety *minor* Denyak (Pidoplichko, 1953). A secondary strain in the CBS collection, originating from *Gossypium* seed in Israel, CBS 320.87 (= ATCC 38026 = IMI 1266640) is indistinguishable from *Cladosporium tenuissimum* Cooke. No material of *Cladosporium gossypii* Jaczewski was available at B, BM, BR, C, CMI, E, K, KW, LE, MANCH, PAD, S or W. *Cladosporium oligocarpum* Corda var. *malvacearum* Berk. was not available at K. Because of the meagre descriptions, the four taxa are regarded to be of doubtful identity.

ON MALVA

Ramularia malvae Fuckel — Fig. 2

Ramularia malvae Fuckel, Jb. nassau. Ver. Naturk. 23 (1870) 360.

Ramularia malvae Fuckel f. *malvae-alcea* Roum., F. sel. Gall. exsicc. (1890) No. 5085.

Ramularia malvae Fuckel var. *malvae-moschatae* Sacc., Syll. Fung. 4 (1886) 294. — *Ramularia malvae-moschatae* (Sacc.) Vestergren, Microm. rar. sel. Scand. (1902) No. 474.

Spots on living leaves hypophyllous, angular, delimited by the veins, c. 5 mm diam., pale, with regularly spaced, pale brown sporodochia. Stroma c. 80 µm wide. Conidiophores loosely aggregated, emerging from pseudoparenchymatous subicula which develop in deteriorated leaf tissue, subhyaline, up to 100 µm in length, mostly with a single, flat, dark apical scar. Conidia hyaline, cylindrical, 0–1-septate, mostly 20–40 × 4–6 µm, arising in short chains.

Material examined. Roumégue, Fungi sel. exsicc. No. 5085, authentic for *R. malvae* f. *malvae-alcea*, on *Malva alcea* leaves, Forêt de Charny, France, F. Fautrey, Aug. 1890 (NY); Vestergren, Microm. rar. sel. Scand. No. 474, on *Malva alcea* leaf, Gotland, Sweden, T. Vestergren, 1895 and 1901 (K); on *Malva moschata*, Forres, Scotland, Rev. J. Keith (K); Kabát and Bubák, Fungi imperf. exsicc. No. 437, on leaves of *Malva moschata*, Viborg, Jutland, Denmark, Sept. 1904 (K); on *Malva moschata*, Botanical Garden, Västerjäll, Sweden, L. and H. Roivainen, June 1961 (NY).

In contrast to *Ramularia gossypii*, where the conidiophores protrude through the stoma, *R. malvae* causes small necrotic patches on otherwise healthy leaves, and develops with stromata in strongly damaged leaf tissue. The conidiophores have a single, conspicuous apical scar and the conidia are mostly broadly rounded at both ends, rather than acuminate as in *R. gossypii*.

The type of the *R. malvae* was not available at herb. B, and neither that of var. *malvae-moschatae* at herb. PAD. However, the species is sufficiently characteristic and typical for

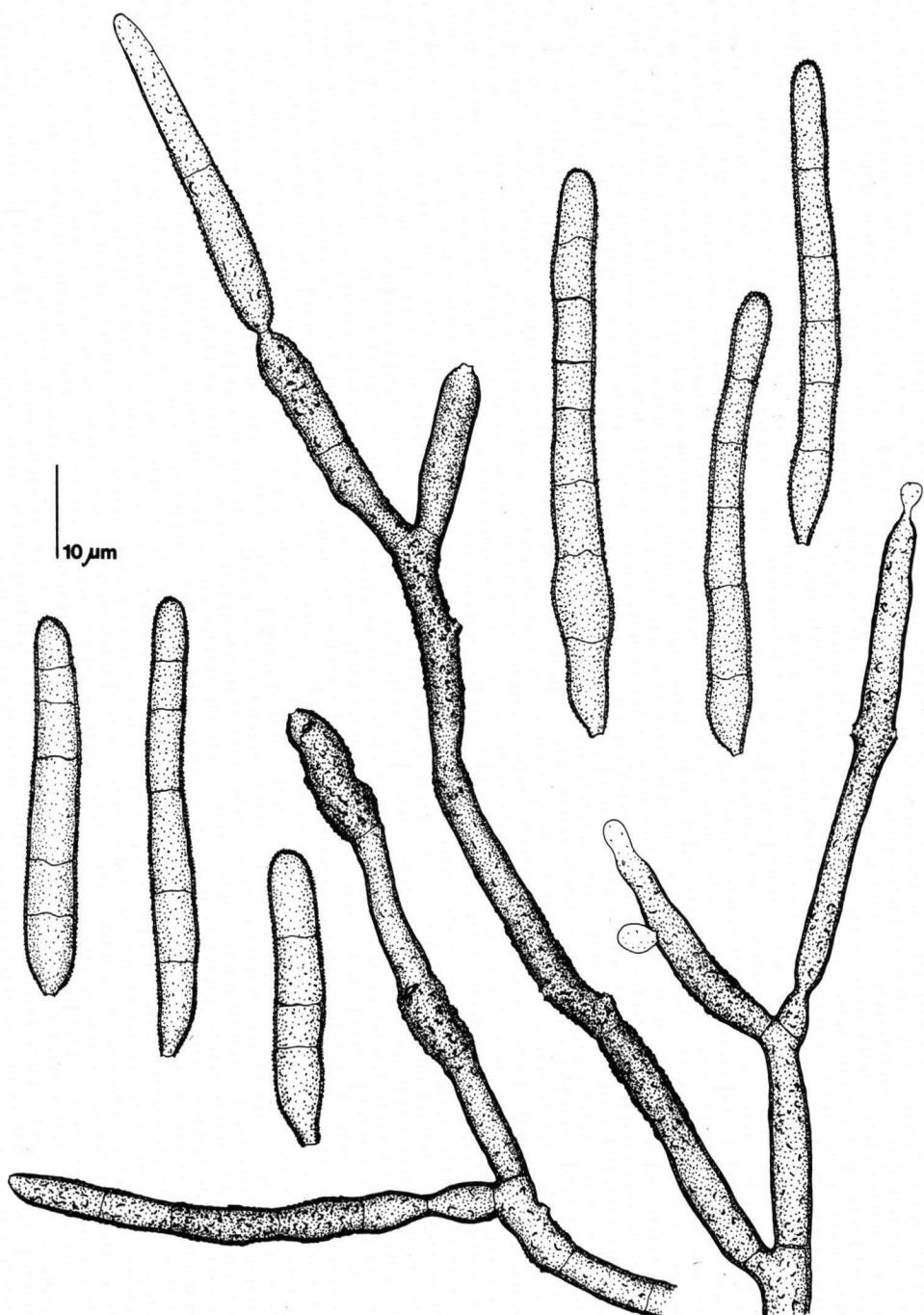


Fig. 3. *Pseudocercospora anomala*, conidiophores and conidia of type specimen (K).

Malva to be accepted as a valid taxon. Other *Ramularia* species described on *Malvaceae*, viz. *R. malvastri* Linder, *R. sidae* Olive and *R. sidarum* Petr. & Cif. all have superficial, repent hyphae with lateral conidiogenous extensions and are therefore currently classified in *Mycovellosiella* (Deighton, 1976; Braun, 1990).

Pseudocercospora anomala (Berk. & Curt.) de Hoog, *comb. nov.* — Fig. 3

Cladosporium anomalum Berk. & Curt., Cub. Fungi No. 639; Sacc., Syll. Fung. 4 (1886) 363 (basionym) [non *Ramularia anomala* Peck, Bull. N.Y. St. Mus. 167 (1913) 47].

Spots on living leaves hypophyllous, irregular, vaguely delimited; colonies forming a brownish felt between abaxial hairs. Mycelium irregularly branched; conidiophores not or slightly differentiated, terminal or intercalary. Stroma absent. Conidiogenous cells terminal becoming intercalary, sympodial, bearing up to 3 conidia; fertile portion of conidiophore becoming darker and rough-walled; scars unpigmented. Conidia concolorous, with verrucose and rather firm walls, with 3–7 septa, up to 60 µm long, with unpigmented scars.

Material examined. Type of *Cladosporium anomalum*, on leaves of *Malva* sp., Cuba, C. Wright (K).

The species is characterized by diffusely branched hyphae with integrated, intercalary conidiogenous cells. During conidiogenesis, growth of the supporting cell seems to be arrested, thicker walls and encrusted extracellular pigment being produced. Subsequently the conidiophore proliferates again to give rise to a smooth-walled, less pigmented intermission.

No *Pseudocercospora* species have as yet been described on *Malva* (Hsieh & Goh, 1990; Guo & Liu, 1989). *Pseudocercospora azanzae* (Yadav) Deighton on *Azanza* is closely similar, but has smooth-walled conidia with more or less acute ends (Yadav, 1963). *P. anomala* is similar of *Parastenella magnoliae* (Weedon) David (Morgan-Jones, 1980; David, 1991). However, its cell walls are coarsely ornamented and conidia arise in small groups from somewhat protuding scars.

The *Cercospora* (s.l.) species on *Malva* mentioned by Chupp (1953), viz. *C. malvarum* Sacc., *C. malvastri* Mendoza, *C. malvicola* Ellis & Martin (= *C. polymorpha* Bubák) and *C. sphaeralceicola* (Speg.) Chupp, all have (sub)hyaline, acicular, often curved conidia and relatively dark conidiophores, and thus should be maintained in *Cercospora* s.str. *Cercospora malvacearum* Chiddarwar (1959, Bagyanarayana et al., 1991) has conidiophores with dark scars and very long, tapering, multiseptate conidia with truncate, dark bases and is therefore also maintained in *Cercospora* s.str.

Deighton (1976) preliminarily maintained a number of closely related *Pseudocercospora* species on *Hibiscus* as a complex around *P. abelmoschi* (Ell. & Ev.) Deighton. *P. anomala* differs from *P. abelmoschi* (= *Cercospora hibisci* Tracy & Earle; Kirk, 1980) in having procumbent or suberect hyphae, producing conidia from lateral extensions of intercalary cells. *Pseudocercospora hibisci-cannabini* (Sawada) Deighton has densely fasciculate conidiophores arising from stromata (Hsieh & Goh, 1990). *Pseudocercospora hibisci-mutabilis* (Sun) Yen differs mainly from *P. anomala* in having shorter conidiophores. *Pseudocercospora hibiscina* (Ell. & Ev.) Guo & Liu belongs to the same morphological group of species with loose mycelial wefts on abaxial leaf surfaces; its conidiophores are dark brown. *Cercospora abelmoschi-cannabini* Sawada, also causing leaf spots

on *Hibiscus*, is different in having fasciculate conidiophores and long, rostrate conidia (Prasad et al., 1960). *Pseudocercospora kydiae* Singh & Kamal (1986a) and *Stenella kydiae* Singh & Kamal (1986b) on leaves of *Kydia* both have relatively long, rostrate conidia.

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