

FURTHER ADDITIONS TO THE RUST FLORA OF PAKISTAN

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Abstract

Two species of rust fungi viz., *Puccinia brachypodii* var. *arrhenatheri* (Kleb.) Cummins & H.C. Greene and *P. levis* var. *panici-sanguinalis* (Rangel) Ramachar & Cummins are newly recorded together with three new host plants for Uredinales of Pakistan.

Introduction

Approximately 400 species in 21 genera and 5 form genera of rust fungi on approximately 350 host species have been reported from Pakistan (Ahmad *et al.*, 1997). However this number is far less than the total number of host plants. In the present investigation, *Puccinia brachypodii* var. *arrhenatheri* and *P. levis* var. *panici-sanguinalis* are described and illustrated. These rust fungi are an addition to our rust flora. *Helictotrichon virescens* (Nees ex Steud.) Henr., for *P. brachypodii* var. *arrhenatheri*, *Setaria glauca* (L.) P. Beauv., for *Puccinia levis* var. *panici-sanguinalis*, *Artemisia maritima* L. for *Puccinia chrysanthemi* Roze, *Polygonum plebejum* R. Br. for *Puccinia polygami-amphibii* Pers. var. *polygami-amphibii* and *Brachiaria ramosa* (L.) Stapf., for *Uromyces setariae-italicae* Yoshino are new hosts from Pakistan.

Materials and Methods

During the survey of rust fungi of Pakistan, the areas including Lahore, North Western Frontier province (NWFP); Ayubia, Khanspur and Northern Area; Gilgit were visited. Rusted plants were collected. It was tried to collect healthy plants along with inflorescence or fruits for accurate identification. The collected specimens were pressed individually among blotting papers, properly labelled and the blotting papers were periodically changed to dry the collected rusted specimens. The samples were brought back carefully to the laboratory for their examination and they were photographed by a digital camera.

Host plants were identified by comparing with the plants already present in the herbarium of Botany Department, University of the Punjab, Lahore.

Free hand transverse sections of infected portions of material and spores were mounted in lactophenol. Semi-permanent slides were prepared by cementing cover slips with nail lacquer (Dade & Gunnell, 1969).

The sections showing rust stages were observed under a microscope (NIKON YS 100) and microphotographed with the help of digipro-Labomed camera. Drawings of spores and paraphyses were also made by using Camera Lucida (Ernst Leitz Wetzlar Germany). Spore dimensions were taken by an ocular micrometer (Zeiss eye piece screw micrometer).

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Description of species

1. *Puccinia brachypodii* var. *arrhenatheri* (Kleb.) Cummins & H.C. Greene, *Mycologia*, 58: 709 (1966) (Fig. 1 A-C; Fig. 2 A-B0)

Spermogonia, aecia and telia absent. Uredinia abaxial, golden brown, solitary, sometimes in rows, minute. Urediniospores mostly pale brown, hyaline, ellipsoid or ovoid, 20-24(-26) x (21-) 24-28 (-33) μm , wall thickness 1.6-2.3 μm , densely echinulate; germ pores up to 8, scattered, obscure; paraphyses intermixed with urediniospores, hyaline, capitate, 13-19 μm in diameter, up to 90 μm long.

Material examined: On *Helictotrichon virescens* (Nees ex Steud.) Henr., Pakistan, NorthWest Frontier Province, Khanspur, II, May 23, 2006. SHI Mycological Herbarium. # NSA-2306

The rust fungi already reported on *Helictotrichon* spp., include *P. coronata* Corda, *P. brachypodii* Otth. var. *arrhenatheri* (Kleb.) Cumm. & Greene and *P. helictotrichi* Joerst. (Cummins, 1971).

P. brachypodii var. *arrhenatheri* on *Helictotrichon virescens* is a new record from Pakistan and *H. virescens* is also a new host for rust fungi from Pakistan. No rust fungus has previously been reported on *H. virescens* from Pakistan.

2. *Puccinia levis* var. *panici-sanguinalis* (Rangel) Ramachar & Cummins, *Mycopath. Mycol. Appl.*, 25(1-2): 44 (1965) (Fig. 1 D-F; Fig. 2 C)

Spermogonia, aecia and telia absent. Uredinia amphigenous, golden brown, arranged in rows, 0.3-0.7 x 0.2-0.4 mm. Urediniospores yellowish brown; broadly ellipsoid or globose to obovoid, 19-26 x 24-31 μm , wall thickness 1.8-2.5 μm , echinulate, germ pores 2, supraequatorial.

Material examined: On *Setaria glauca* (L.) P. Beauv. Pakistan, Punjab, Lahore, II, Sep 23, 2006, SHI Mycological Herbarium, # NSA-3806

Cummins (1971) reported *P. levis* var. *panici-sanguinalis* on *Setaria* sp., *P. levis* var. *panici-sanguinalis* is a new record from Pakistan.

Ahmad (1956a) reported *Uromyces setariae italicae* (Diet.) Yoshino on *Setaria glauca* from Lahore and Sheikhpura. In Pakistan, *Setaria glauca* is being described for the first time as a host for *P. levis* var. *panici-sanguinalis*.

3. *Puccinia chrysanthemi* DC. Roze, *Bull. Soc. mycol. Fr.* 16: 92 (1900).

= *Puccinia absinthii* DC., *Encycl. Méth. Bot.* 8: 245 (1806) (Fig. 1. G-I; Fig. D-E)

Spermogonia and aecia absent. Uredinia abaxial, intermixed with telia, brownish black, 0.4-0.6 x 0.2-0.4 mm. Urediniospores ovoid or ellipsoid, sometimes globose, pale brown, 23-26 x 24-28 μm , wall thickness 1.6-2.5 (-3) μm , echinulate. Telia abaxial, intermixed with uredinia, brownish black, 0.4-0.6 x 0.2-0.4 mm. Teliospores ellipsoid or oblong, brown, 16-26 x 39-53 μm , slightly verrucose; apex rounded, 5-9 μm thick; pedicel hyaline, upto 81 μm long.

Material examined: On *Artemisia maritima* L. Pakistan, Northwest Frontier Province, Khanspur, II + III, Oct. 16, 1988. SHI Mycological Herbarium. # NSA-206.

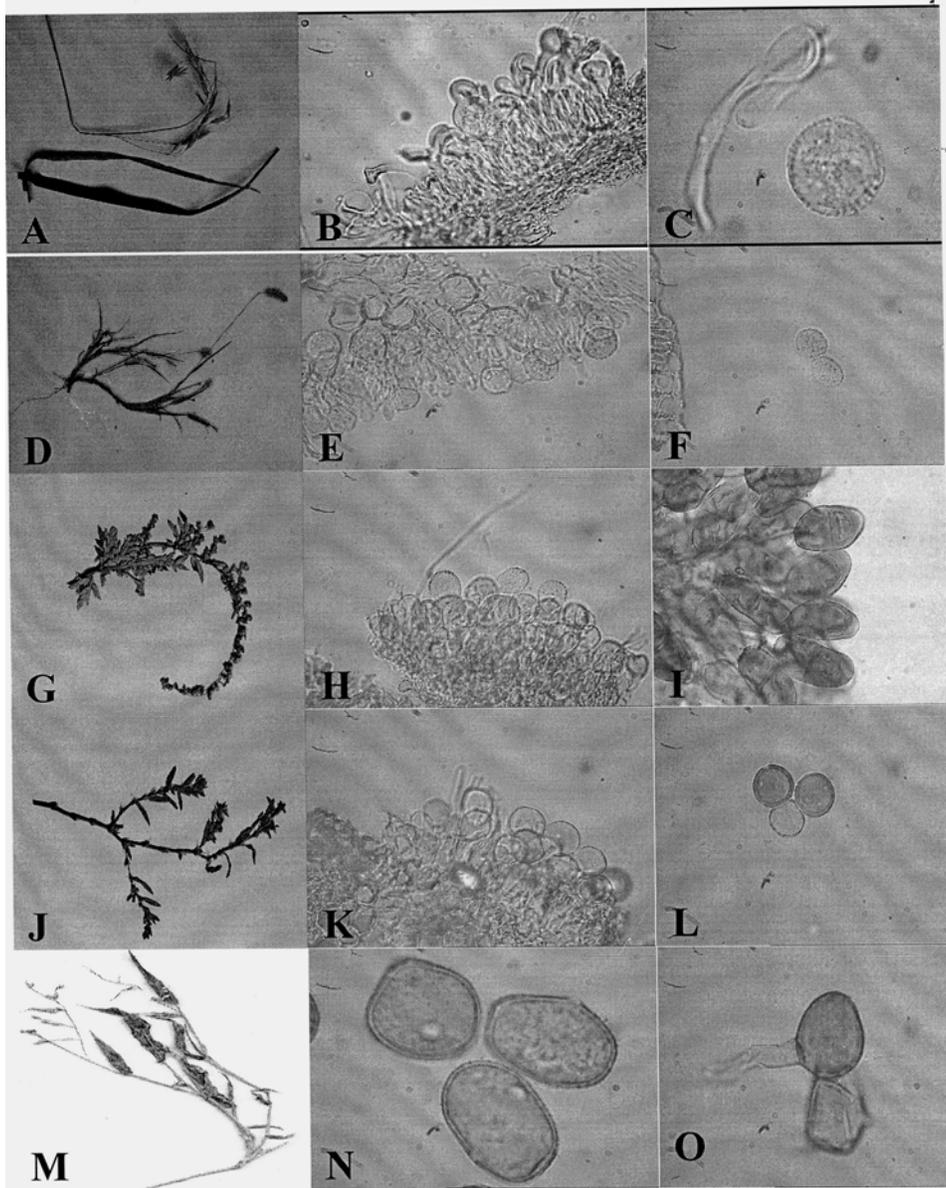


Fig. 1. (A-C). *Pabrachypodii* var. *arrhenatheri* on *Helictotrichon virescens*, (A). Infected host plant, (B). Cross section of uredinium, (C). A Urediniospore with capitate paraphyses, (D-F). *P. levis* var. *panici-sanguinalis* on *Setaria glauca*, (D). Infected host plant, (E). A cross section of uredinium, (F). Urediniospores, (G-I). *P. absinthii* on *Artemisia maritima*, (G). Infected host plant, (H). A cross section of uredinium, (I). A cross section of telium containing teliospores, (J-L). *P. polygoni-amphibii* on *Polygonum plebejum*, (J). Infected host plant, (K). A cross section of uredinium, (L). Urediniospores, (M-O). *Uromyces setariae-italicae* on *Brachiaria ramosa*, (M). Infected host plant, (N). Urediniospores, (O). Teliospores.

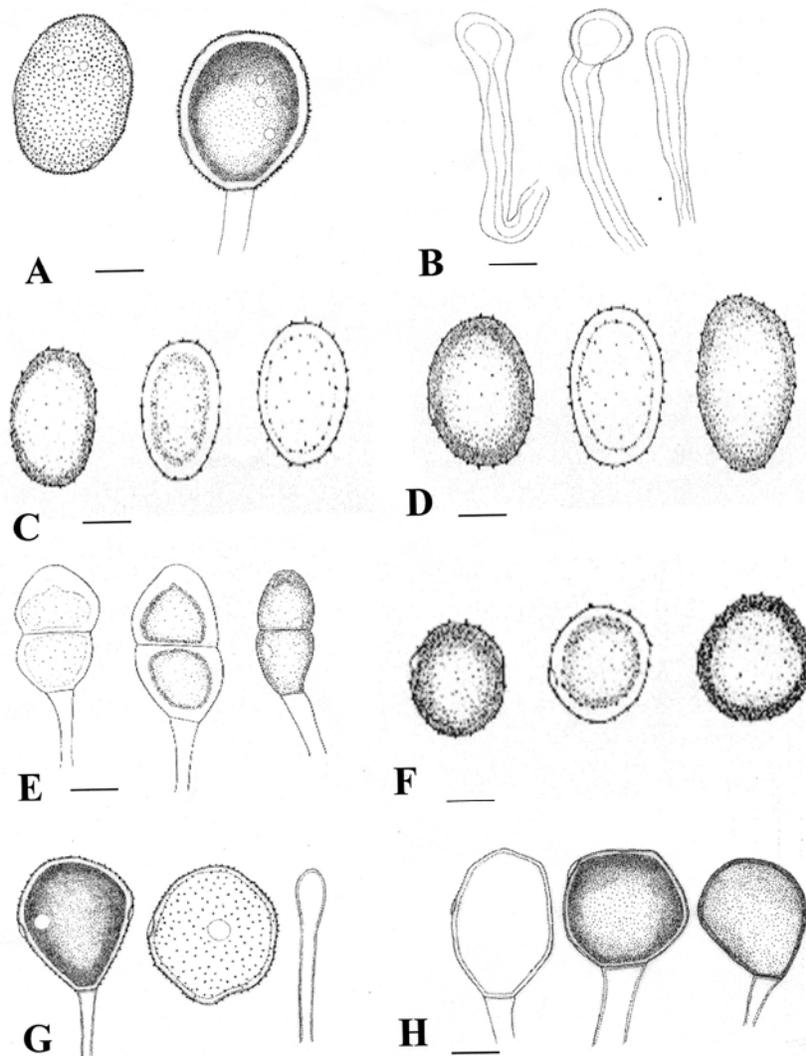


Fig. 2. A-H: Camera Lucida drawings of spores of rust fungi.

(A). Urediniospores of *P. brachypodii* var. *arrhenatheri*, (B). Capitulate paraphyses of *P. brachypodii* var. *arrhenatheri*, (C). Urediniospores of *P. levis* var. *panici-sanguinalis* (D). Urediniospores of *P. chrysanthemi*, (E). Teliospores of *P. chrysanthemi*, (F). Urediniospores of *P. polygami-amphibii* var. *polygami-amphibii*, (G). Urediniospores and paraphyses of *Uromyces setariae-italicae*, (H). Teliospores of *U. setariae-italicae*. Scale bar: For A & B = 8.5µm, 10µm; For C = 12 µm; For D & E = 7.5µm, 8.3µm; For G & H = 10µm.

Artemisia maritima is a new host for this rust fungus from Pakistan. This fungus has previously been reported on *A. persica* Boiss., and *A. parviflora* Roxb., from Quetta, Chitral and Changla Galli (NWFP); on *A. dubia* Wallich ex Besser from Swat valley and on *A. dracunculoides* L., from Kaghan valley (Ahmad *et al.*, 1997). No rust fungus has previously been reported on *A. maritima* from Pakistan.

4. *Puccinia polygoni-amphibii* Pers., Syn. meth. fung., (Göttingen) 1: 227 (1801) var. *polygoni-amphibii* (Fig. 1 J-L; Fig. 2 F)

Spermogonia, aecia and telia absent. Uredinia abaxial, brown, scattered, pulverulent, 0.1-0.3 x 0.1-0.2 mm. Urediniospores ovoid or globose, pale brown, echinulate, 24-29 μm x 24-29 μm , wall thickness 1.5-2 μm ; germ pores 2, equatorial or tending to be equatorial; pedicel minute.

Material examined: On *Polygonum plebejum* R. Br., Pakistan, Northwest Frontier Province, Nathia Galli, II, 20th Sep., 2003, SHI Mycological Herbarium, # NSA-4506.

Polygonum plebejum is a new host for this fungus. Ahmad (1956a) reported *Puccinia polygoni-amphibii* var. *polygoni-amphibii* on *Polygonum pterocarpum* Wall., from Swat and Kalam. No rust fungus has previously been reported on *Polygonum plebejum* from Pakistan.

5. *Uromyces setariae-italicae* (Diet.) Yoshino, Bot. Mag., Tokyo, 20: 247 (1906). (Fig. 1 M-O; Fig. 2 G-H)

Spermogonia and aecia unknown. Uredinia amphigenous, scattered or in rows, pulverulent, brown, 0.09-0.1 x 0.1-0.3mm. Urediniospores subglobose to ovoid or ellipsoid, brown to yellowish brown, echinulate, 23-27.5 x 23-29 μm ; wall 1.5-2.5 μm thick; germ pores up to 4, equatorial; pedicel hyaline and minute. Paraphyses numerous, clavate, hyaline, up to 40 μm long. Telia amphigenous covered by the epidermis, blackish, small and inconspicuous, striated, 0.05-0.2 x 0.09-0.2mm. Teliospores one celled, variable, mostly angularly globoid or obovoid, 16-24 x 19-28 μm , wall uniformly 1-2 μm thick, smooth, yellowish brown to chestnut brown; apex not thickened, rounded or truncate; germ pores 1-2, scattered. Pedicel hyaline, minute, collapsing, 4x 15 μm .

Material examined: On *Brachiaria ramosa* (L.) Stapf., Pakistan, Punjab, Lahore. SHI Mycological Herbarium # NSA 15. 23rd October, 2006.

Cummins (1971) reported *Puccinia orientalis* (H. Syd., P. Syd. & Butl.) Arth. & Cumm. and *P. negrensis* P. Henn. on *Brachiaria ramosa* (L.) Stapf.

Ahmad (1956) reported *Uromyces setariae-italicae* on *Brachiaria reptans* (L.) Gard. & C.E. Hubb. from Tandojam. No rust species has previously been reported on *Brachiaria ramosa* from Pakistan. So *Brachiaria ramosa* is a new host for rust fungi from Pakistan.

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