Journal of Yeast and Fungal Research Vol. 3(5), pp. 65-73, November, 2012
Available online at http://www.academicjournals.org/JYFR
DOI: 10.5897/JYFR12.024
ISSN 2141-2413 ©2012 Academic Journals

Full Length Research Paper

Some new rust fungi (Uredinales) from Fairy Meadows, Northern Areas, Pakistan

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Accepted 9 September, 2012.

***Puccinia opizii* on *Carex curta* is reported here as a new record for Pakistan. Furthermore, *Coleosporium lycopi, Cronartium ribicola, Melampsora epitea, Peridermium thomsonii, Phragmidium rosae-moschatae, Puccinia carthami, Puccinia chrysanthemi, Puccinia circaeae, Puccinia graminis, Puccinia komarovii* and *Uromyces trifolii* are additions to the rust flora of Fairy Meadows, Northern Areas, Pakistan.**

Key words: Byal camp, *carex curta*, fairy meadows, Hunza, Nanga Parbat, Northern areas.

INTRODUCTION

This paper is a continuation of the enumeration of rust fungi of Fairy Meadows, Pakistan. Previously, about 73 species of rust fungi have been reported from Northern Pakistan (Afshan et al., 2011), with only 22 taxa from Fairy Meadows, including one species each of *Aecidium*, *Chrysomyxa*, *Cronartium*, *Hyalopsora*, *Melampsora* and *Pucciniastrum*, two species of *Uromyces* and fourteen species of *Puccinia*. During surveys of the rust flora of Fairy Meadows, sixteen plants infected with rust fungi were collected. Among these, *Puccinia opizii* on *Carex curta* is a new record for Pakistan. In addition, *Coleosporium lycopi* on *Campanula benthamii, Cronartium ribicola* on *Ribes orientale, Melampsora epitea* on *Salix flabellaris, S. hastata* and *S. tetrasperma, Puccinia carthami* on *Centaurea calcitrapa, P. chrysanthemi* on *Artemisia brevifolia, A. dracunculus* and *A. maritima, P. circaeae* on *Circaea alpina, P. komarovii* on *Impatiens brachycentra* and *Uromyces trifolii* on *Trifolium resupinatum* are new records for Fairy Meadows, Northern Areas, Pakistan. The uredinial stage (II) of *Phragmidium rosae-moschatae* on *Rosa webbiana* and aecidial stage (I) of *Puccinia graminis* on *Berberisvulgaris* are also additions to the rust flora of this area of Pakistan. Although *Peridermium thomsonii* on *Picea smithiana* has previously been reported from Fairy Meadows, it is re-described here to illustrate important morphological features. With these additions, the number of rust fungi known from Fairy Meadows, Pakistan is raised to 31.

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MATERIALS AND METHODS

Freehand sections of infected tissue and spores were mounted in lactophenol and gently heated to boiling. The preparations were observed under a NIKON YS 100 microscope and photographed with a digipro-Labomed and JSM5910 scanning electron microscope. Drawings of spores and paraphyses were made using a camera lucida (Ernst Leitz Wetzlar, Germany). Spore measurements were made with the use of an ocular micrometer. At least 25 spores were measured for each spore stage. In addition to comparisons using light microscopy, images were obtained of the rust spores using a scanning electron microscope (SEM). The rusted specimens have been deposited in the herbarium of the Botany Department at the University of the Punjab, Lahore (LAH).

Enumeration of taxa

Puccinia opizii Bubák, *Zentbl. Bakt. ParasitKde*, Abt. II 9: 925 (1902) (Figure 1) Ξ *Puccinia dioicae* var. *opizii* (Bubák) U. Braun, *Feddes Repert. Spec. Nov. Regni Veg.* 93(3-4): 264 (1982).

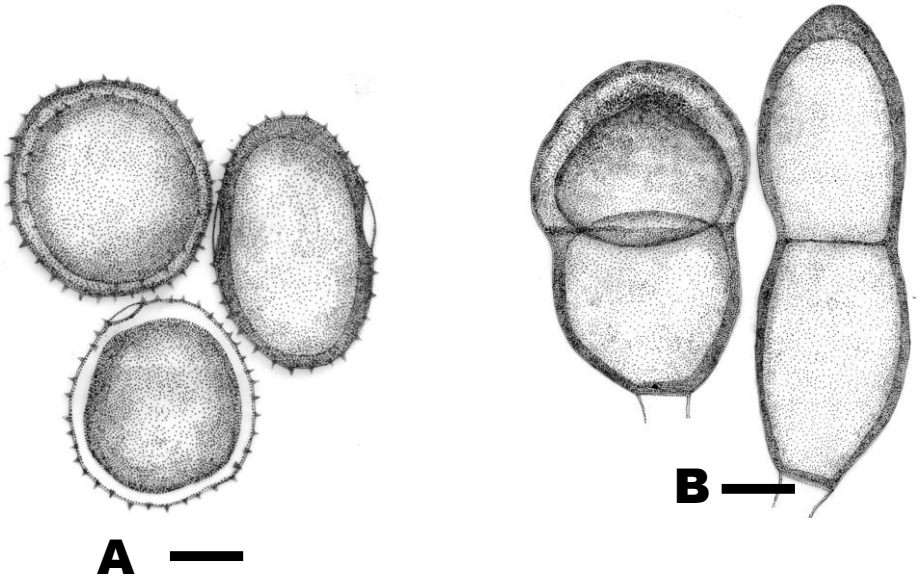

Figure 1. Lucida drawings of *Puccinia opizii.* (A) Echinulated urediniospores; (B) Teliospores. Scale bar for A = 2 cm, B = 8 µm & C = 9 µm.

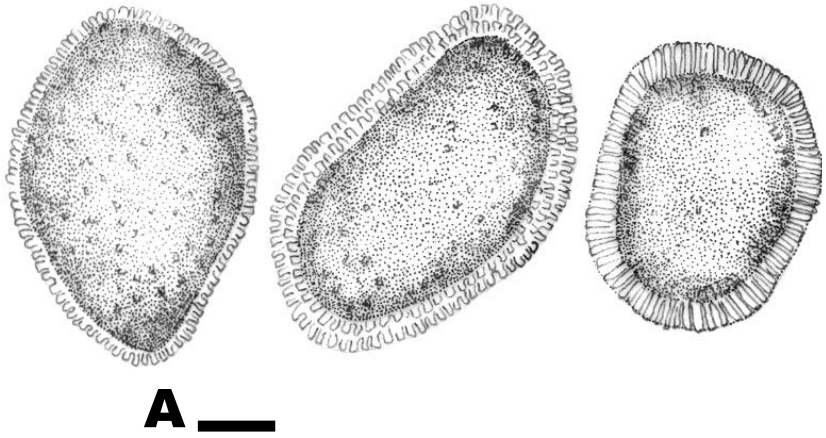

Figure 2. Lucida drawing of urediniospores of *Coleosporium lycopi*. Scale Bar = 4 µm. *Cronartium ribicola* J.C. Fisch., *Hedwigia* 11: 182 (1872).

Spermogonia and aecia unknown. Uredinia hypophyllous, on leaves and culms, covered by epidermis, yellowish brown to dark brown, 0.09 to 0.2 × 0.1 to 3.0 mm. Urediniospores globose to ellipsoid, 17 to 22 × 21 to 24 µm; wall up to 2 µm thick, pale brownto cinnamon brown, finely echinulate; germ pores 1 to 2, equatorial; pedicel hyaline, short. Telia mostly hypophyllous, sometimes amphigenous, intermixed with uredinia, dark brown to blackish brown, 0.2 to 0.4 × 0.2 to 0.5 mm. Teliospores clavate to oblong, constricted at the septum, 1523 × 37–49 µm (mean 19.9 × 44.2 µm); wall 2–3 µm thick, chestnut brown to golden brown, smooth; apex mostly rounded, 8–12 µm thick; germ pores obscure; pedicel hyaline to light brown, thin walled, 7–10 × 60–70 µm.

Material examined

On *Carex curta* Gooden, with II and III stages, Pakistan, Northern Areas, Fairy Meadows, 3036 m a. s. l., 12 Aug 2007, N. S. Afshan, NSA 72. (LAH NSA 1074).

Puccinia opizii is a new record for Pakistan. Rust fungi previously reported on *Carex* spp. from Pakistan include *Puccinia caricina* DC. and *P. caricis-filicinae* Barclay on *Carex filicina* Nees, *P. dioicae* Magnus and *P. pakistani* S. Ahmad on *Carex nubigena* D. Don, *P. bolleyana* Sacc. on *Carex flacca* Schreb., *P. subepidermalis* Afshan, Khalid and S.H. Iqbal on *Carex curta* Gooden, *P. caricis-kouriyamensis* on *Carex karoi* Freyn, *P. caricis-pocilliformis* on *Carex* sp. and *P. extensicola* var. *linosyridis-caricis* on *Carex divulsa* Stokes (Khalid and Saba, 2011).

Coleosporium lycopi Syd. & P. Syd., *Annls. mycol.* 11(5): 402 (1913) (Figure 2).

Spermogonia, aecia and telia not found. Uredinia on adaxial surface, cup- shaped, scattered, light yellow to yellowish orange,

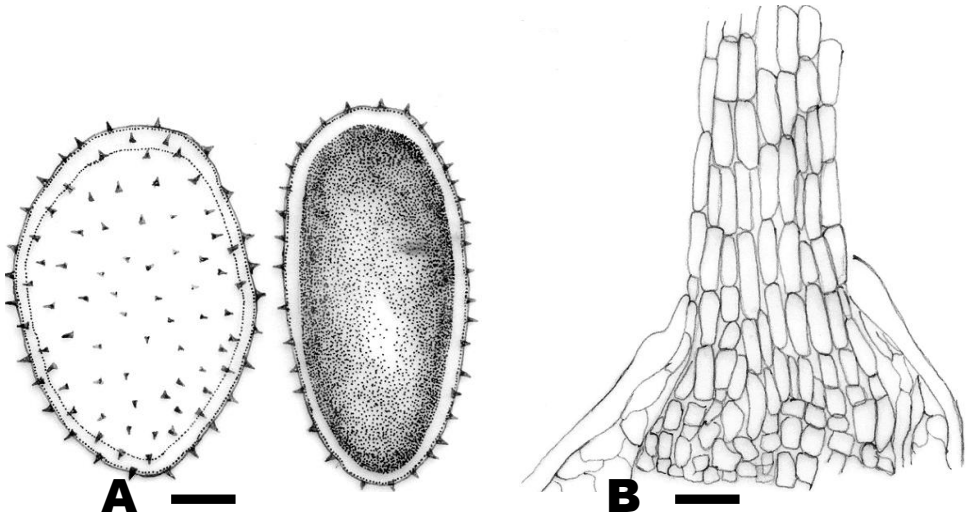

Figure 3. Lucida drawing of *Cronartium ribicola.* (A) Urediniospores; (B) Telium containing teliospores. Scale Bar = 6 µm.

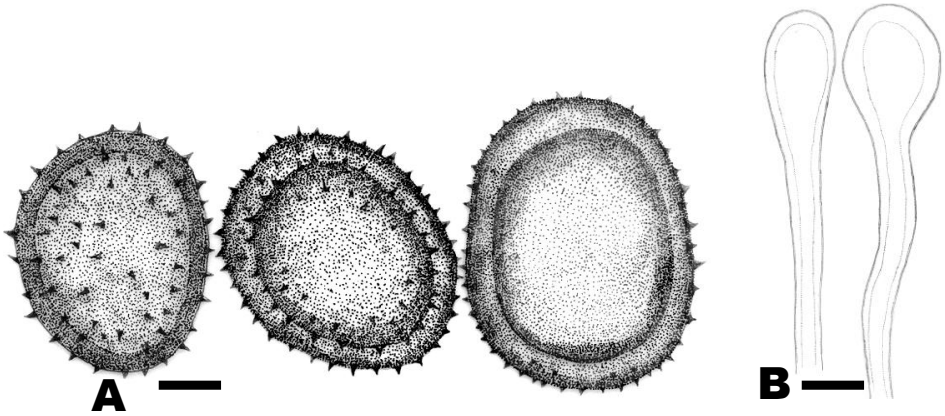

Figure 4. Lucida drawings of *Melampsora epitea.* (A) Urediniospores; (B). Capitate paraphyses. Scale Bar for D = 8 µm and E = 14 µm.

pulverulent. Urediniospores globose to subglobose, ovoid or ellipsoid, 15 to 20 × 19 to 25 µm; wall thickness 1.5 to 2 µm, annulate to verrucose, hyaline to light yellow with orange granules;germ pores obscure.

Material examined

On *Campanula benthamii* Wall., with II stage, Pakistan, Northern Areas, Fairy Meadows, Byal Camp (Nanga Parbat base camp), at 3036 m a. s. l., 12 Aug, 2007, N.S.Afshan, NSA G 39. (LAH NSA 1010).

Coleosporium lycopi is a new record from the Northern Areas, Fairy Meadows and Byal Camp. *Cronartium ribicola* J.C. Fisch., *Hedwigia* 11: 182 (1872) (Figure 3) Uredinia hypophyllous, forming groups, yellow, surrounded by a delicate peridium, opening by a central pore. Urediniospores ellipsoid to obovoid, sharply echinulate, yellow to yellowish orange, 12 to 19 × 20 to 27 µm, wall hyaline, (1.5 to) 2 to 3 µm thick. Telia hypophyllous, crowded, mostly along veins of leaf, arising in Uredinia, orange to yellowish brown, producing columns of teliospores up to 3 mm long and 122 to 156 µm thick. Teliospores ellipsoid to broadly ellipsoid or cylindric, 10 to 20 × (27 to) 30 to 75 µm, wall hyaline, smooth, (1.5 to) 2 to 3 µm thick.

Material examined

On *Ribes orientale* Desf., with II and III stages, Pakistan, Northern Areas, Fairy Meadows, 3036 m a. s. l., 12 Aug 2007, N.S. Afshan and A.N. Khalid, NSA G 20. (LAH NSA 1011).

Cronartium ribicola has been reported on *Ribes emodense* Rehder, *R. aff. himalensis* Royle ex Decne and *R. aff. orientale* Desf. from Kaghan valley, Hazara and Naran by Malik and Khan (1944), Ahmad (1956a, b) and Ono (1992). It is a new record for Fairy Meadows. *Melampsora epitea* Thüm., *Mittheil. Ver. Österr.* 2: 38 and 40 (1879) var. *epitea* (Figure 4) Telia not found. Uredinia hypophyllous, mostly scattered, sometimes in the form of groups, yellow to orangish yellow.

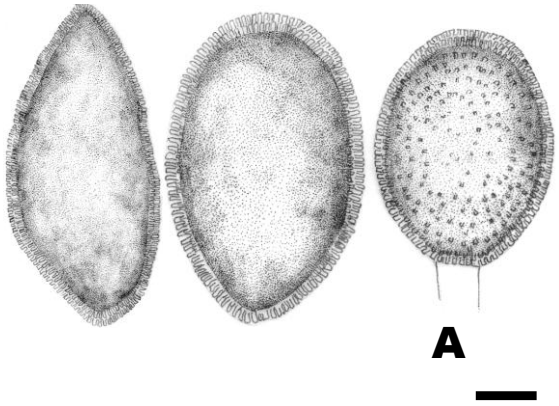

Figure 5. Lucida drawing of aeciospores of *Peridermium thomsonii*. Scale Bar = 10 µm.

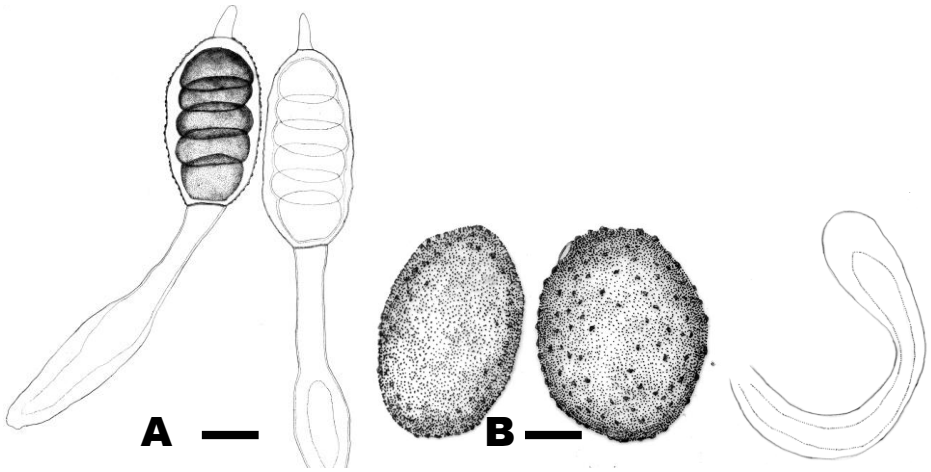

Figure 6. Lucida drawings of *Phragmidium rosae-moschatae.* (A) Teliospores; (B) Urediniospores and paraphysis. Scale Bar for A = 32 µm and B = 8 µm.

Urediniospores globose to obovoid or broadly ellipsoid; 18 to 21 × 21 to 24 µm; wall 1.5 to 2 µm thick, echinulate, hyaline to yellowish brown; germ pores obscure. Paraphyses abundant, capitate, hyaline to light yellow, 16 to 19 µm wide at apex, 7 to 8 µm thick at base and up to 70 µm long.

Material examined

On *Salix flabellaris* N. J. Andress*, S. hastata* L., *S. tetrasperma* Roxb., with II stage, Pakistan, Northern Areas, Fairy Meadows, 3036 m a. s. l., 12 Aug 2007, N. S. Afshan, NSA G 40. (LAH NSA 1018).

Melampsora epitea has been reported on *Salix* sp., *S. tetrasperma* Roxb., *S. hastata* L. and *S. flabellaris* N. J. Anderson from Kaghan valley, Swat, Choa Saiden Shah, Naltar, Byal camp and Bashu Jungle by Sultan (2005). *Melampsora epitea* is first time reported from Fairy Meadows.

Peridermium thomsonii Berk., Indian Forester, 3: 94 (1852) (Figure 5) subcuticular, conspicuous, 0.2 to 0.24 × 0.1 to 0.2 mm, hemispherical. Aecia on cone scales and needles; on needles, mostly epiphyllous, causing hypertrophy, peridermioid, cylindric to flat; on scales amphigenous, causing destruction of seed, peridia firm; peridial cells ellipsoid, hyaline; aecidium 0.3 to 0.4 × 0.3 to 0.5 mm; aeciospores 23 to 32 × 28 to 42 µm, wall 1 to 1.5 µm thick excluding verrucae, densely verrucose, hyaline with yellow contents.

Material examined

On *Picea smithiana* (Wall.) Boiss., with 0 & I stage, Pakistan, Northern Areas, Fairy Meadows and Byal camp, 3036 m a. s. l., 12-13 Aug, 2007, N.S. Afshan & A.N. Khalid, NSA # G 15. (LAH NSA 1021).

Peridermium thomsonii has previously been reported on *Picea smithiana* from Kaghan valley and Fairy Meadows by Ahmad (1956a, b) and Sultan (2005).

Phragmidium rosae-moschatae Dietel, *Hedwigia* 44: 132 (1905) (Figure 6) Spermogonia and aecia not found. Uredinia hypophyllous, scattered, minute. Urediniospores globose to subglobose or broadly ellipsoid, 16 to 21 × 17 to 24 µm; wall yellow

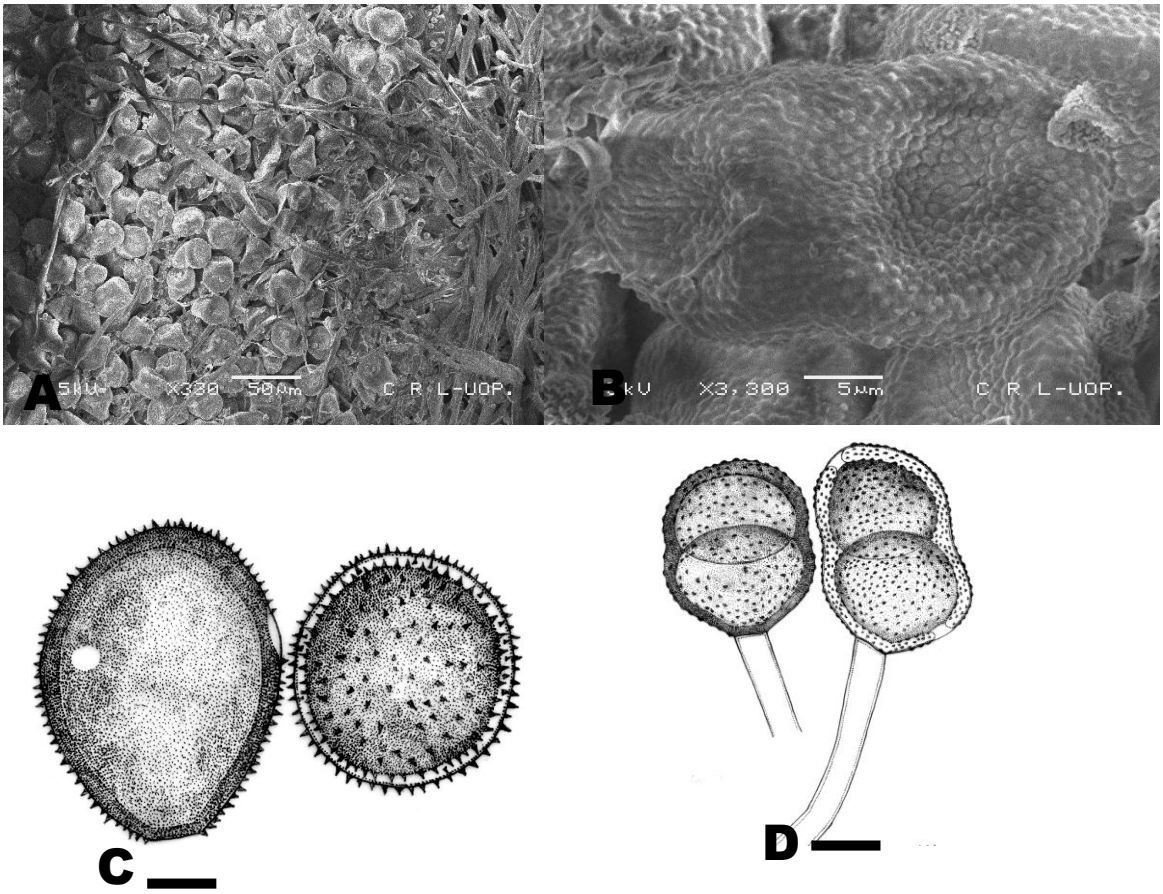

Figure 7. *Puccinia carthami* (A) SEM photograph of a telium. (B) SEM photograph of a teliospore showing verrucose wall ornamentation. (C) Lucida drawings of Urediniospores; (D) Teliospores. Scale bar for C = 7 µm and D = 12 µm.

to light brown, 2–2.5 µm thick, verrucose. Telia hypophyllous, scattered, minute, black. Teliospores 5 to 7 (to 8) celled, cylindric, 28 to 35 × (55 to) 63 to 84 µm excluding apiculus (mean 32.4 × 69.9 µm); apiculus 10 to 20 µm high; wall dark brown to chestnut brown, 2 to 3 µm thick, verrucose; pedicel hyaline to light yellow, 8 to 10 × 94 to 110 µm, thickened to 20 µm at the base.

Material examined

On *Rosa webbiana* Wall., with II and III stages, Pakistan, Northern Areas, Fairy Meadows, 3036 m a. s. l., 12 Aug 2007, N.S. Afshan, NSA G 41. (LAH NSA 1025).

Phragmidium rosae-moschatae has been reported on *Rosa brunonii* Lindl. (= *R. moschata*), *R. lacerans* Boiss. & Buhse, *R. webbiana* Wallich ex Royle, and *R. centifolia* from Quetta, Murree, Peshawar, Tarnab, Swat, Kaghan valley and Tatu-Fairy Meadows by Malik and Khan (1944), Ahmad (1956a, b), Malik et al. (1968), Malik and Virk (1968), Ono and Kakishima (1992), Ono (1992), Kakishima et al. (1993a, b) and Sultan (2005).

Sultan (2005) reported only the telial stage of *Phragmidium rosae-moschatae* from Fairy Meadows, thus discovering of the uredinial stage of *Phragmidium rosae-moschatae* is new from Fairy Meadows.

Puccinia carthami Corda, *Icon. fung.* (Prague) 4: 15 (1840) (Figure 7) = *Puccinia calcitrapae* var. *centaureae* (DC.) Cummins, *Mycotaxon* 5(2): 402 (1977)=*Puccinia centaureae* DC., in de Candolle & Lamarck, *Fl. franç.*, Edn 3 (Paris) 5/6: 59 (1815)

Spermogonia and aecia unknown. Uredinia amphigenous, scattered, soon naked, pulverulent, brown, 0.1 to 0.2 × 0.2 to 0.4 mm. Urediniospores globose to broadly obovoid or broadly ellipsoid, 22 to 28 × 25 to 30 µm (mean 25.2 × 28.3 µm); wall 1.5 to 2 (to 3) µm thick, golden brown to cinnamon brown, echinulate; germ pores 2–4, equatorial, with slight or no caps; pedicel hyaline, short, 6 to 8 × 10 to 15 µm.

Telia amphigenous, dark brown to blackish brown, 0.08 to 0.1 × 0.2 to 0.8 mm. Teliospores ellipsoid to broadly ellipsoid, rounded at both ends, not or slightly constricted at septum, 23 to 29 × 30 to 41 µm (25.8 × 36.7 µm); wall 2 to 3 µm thick, verrucose, chestnut brown; germ pore 1 per cell, pore of upper cell apical or usually depressed, pore of the lower cell near septum, with slight or no caps; pedicel hyaline, deciduous, 4 to 6 × 47 to 120 µm.

Material examined

On *Centaurea calcitrapa* L., with II + III stages, Pakistan, Northern Areas, Fairy Meadows, 3036 m a. s. l., 12 Aug, 2007, N.S. Afshan,

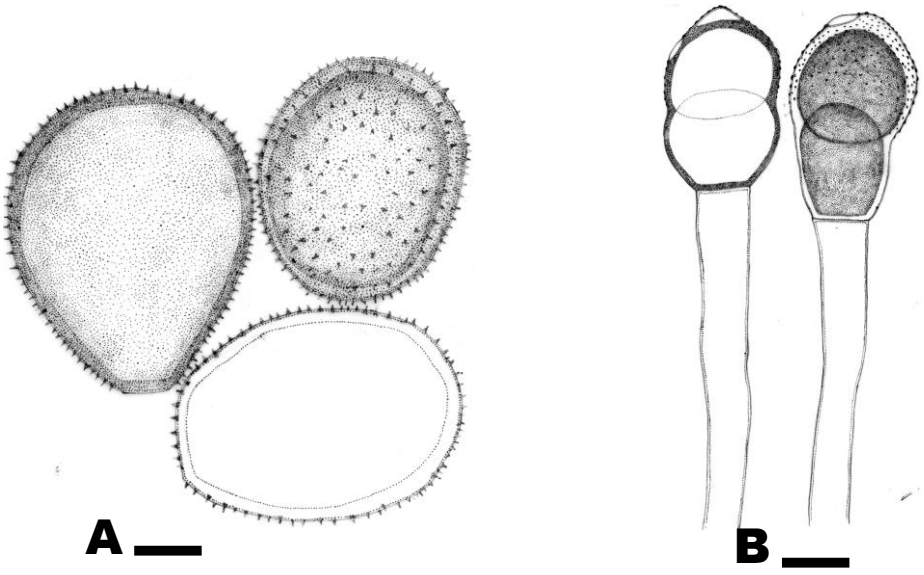

Figure 8. Lucida drawings of *Puccinia chrysanthemi.* (A) Lucida drawings of Urediniospores; (B) Teliospores. Scale bar for A = 7 µm and B = 10 µm.

NSA G 03. (LAH NSA 1036).*Puccinia carthami* has previously been reported on *Carthamus oxyacantha* M. B. and *C. tinctorius* L. from Faisalabad, Swat and Lahore by Ahmad (1956a, b) and Khan and Kamal (1968); as *P. calcitrapae* var. *centaureae* (= *P. centaureae*) on *Centaurea bruguieriana* (DC.) Bornm. ex Rech. f., *C. candolleana* and *Schischkinia albispina* (Bunge.) Iljm from Peshawar; as *P. carduorum* Jacky on *Carduus edelbergii* Rech. f. from Kaghan valley and Swat by Ahmad (1956a, b); as *P. cirsii* DC. On *Cirsium argyracanthum* DC., *C. wallichii* DC. and *Cnicus* sp. from Swat, Changla gali (NWFP) and Kaghan Valley by Ahmad (1956a, b), Ono (1992) and Kakishima et al. (1993b).

Puccinia carthami is a new record for Fairy Meadows, Northern Areas.

Puccinia chrysanthemi Roze, *Bull. Soc. mycol. Fr.* 16: 92 (1900) (Figure 8) = *Puccinia absinthii* DC., *Encycl. Méth. Bot.* 8: 245 (1806) Spermogonia and aecia unknown. Uredinia amphigenous, light brown, scattered, 0.09 to 0.2 × 0.2 to 1.0 mm. Urediniospores ovoid or obovoid to ellipsoid, light yellow to pale brown, 20 to 24 × 26 to 34 µm; germ pores 1 to 2, equatorial, without a papilla; echinulate, wall 1.5 to 2 µm thick at sides; pedicel hyaline, short, not persistent. Telia amphigenous, on leaves, small pustules, roundish, dark brown to black, scattered, 0.09 to 0.1 × 0.3 to 1.0 mm. Teliospores ellipsoid to broadly ellipsoid or obovoid, not or slightly constricted at septum, attenuated towards base, 19 to 24 × (39 to) 51 to 55 µm, chestnut brown, wall 3 to 3.5 µm thick at sides, 4 to 8 µm thick apically, apex conical or rounded, verruculose at apex, smooth at lower side; germ pores 2, apical or subapical in distal cells and close to septum in proximal cells, with hyaline papilla; pedicel hyaline, persistent, 8 to 12 × 105 to 142 µm.

Material examined

On *Artemisia brevifolia* Wall., with II + III stages, Pakistan, Northern Areas, Fairy Meadows, at 3036 m a.s.l., 12 August, 2007, N.S. Afshan, NSA # G 47. (LAH NSA 1037); On *A. dracunculus* L., with II stage, Pakistan, Northern Areas, Fairy Meadows, at 3036 m a.s.l., 13 August, 2007, N.S. Afshan & A.N. Khalid, NSA # G 47A; On *A. maritima* L., with II + III stages, Pakistan, Northern Areas, Fairy Meadows, at 3036 m a.s.l., 12 August, 2007, N.S. Afshan, NSA # G 47B.

Puccinia chrysanthemi has previously been reported on *A. persica* Boiss. and *A. parviflora* Buch.-Ham. ex Roxb. from Quetta, Chitral, and NWFP., on *A. dubia* Wall. from Swat and on *A. dracunculus* from Kaghan valley (Ahmad et al., 1997). *P. chrysanthemi* is a new record for Fairy Meadows.

Puccinia circaeae Pers., *Roemer's Neues Magazin für die Botanik*: 119 (1794) (Figure 9)
=*Leptopuccinia circaeae* (Pers.) Syd., (1922).= *Micropuccinia circaeae* (Pers.) Arthur and Jacks., (1921). Spermogonia, aecia and uredinia not found. Telia hypophyllous, on yellow spots, scattered or circinate, brown, 0.2 to 0.4 × 0.2 to 0.6 mm. Teliospores fusoid or oblong, slightly constricted at the septum, attenuated towards base; wall 1.5 to 2 µm thick, smooth, yellowish brown; 10 to 13 × 28 to 43 µm (mean 11.85 × 35.73 µm); apex rounded or conical, 4 to 10 µm thick; pedicel hyaline, persistent, 5 to 7 × 40 to 50 µm.

Material examined

On *Circaea alpina* L. (= *Circaea pricei* Hayata), with III stage, Pakistan, Northern Areas, Fairy Meadows, at 3036 m a.s.l., 12 August, 2007, N.S. Afshan, NSA # G 14. (LAH NSA 1038).

Puccinia circaeae has been reported on *Circaea alpina* from Changla Gali and Kaghan valley (Ahmad et al., 1997). *Puccinia circaeae* is reported for the first time from Fairy Meadows.

Puccinia graminis Pers., *Roemer's Neues Magazin für die Botanik*: 119 (1794) (Figure 9). Plate 55, Figure. A–F) Spermogonia, uredinia and telia not found. Aecia adaxial, cup shaped, light yellow to yellowish orange spots with brown margins, mostly grouped, sometimes scattered, 0.3 to 0.5 × 0.4 to 0.6 mm. Aeciospores globose to subglobose or ovoid, catenulate, 17 to 20 ×20 to 26 µm;

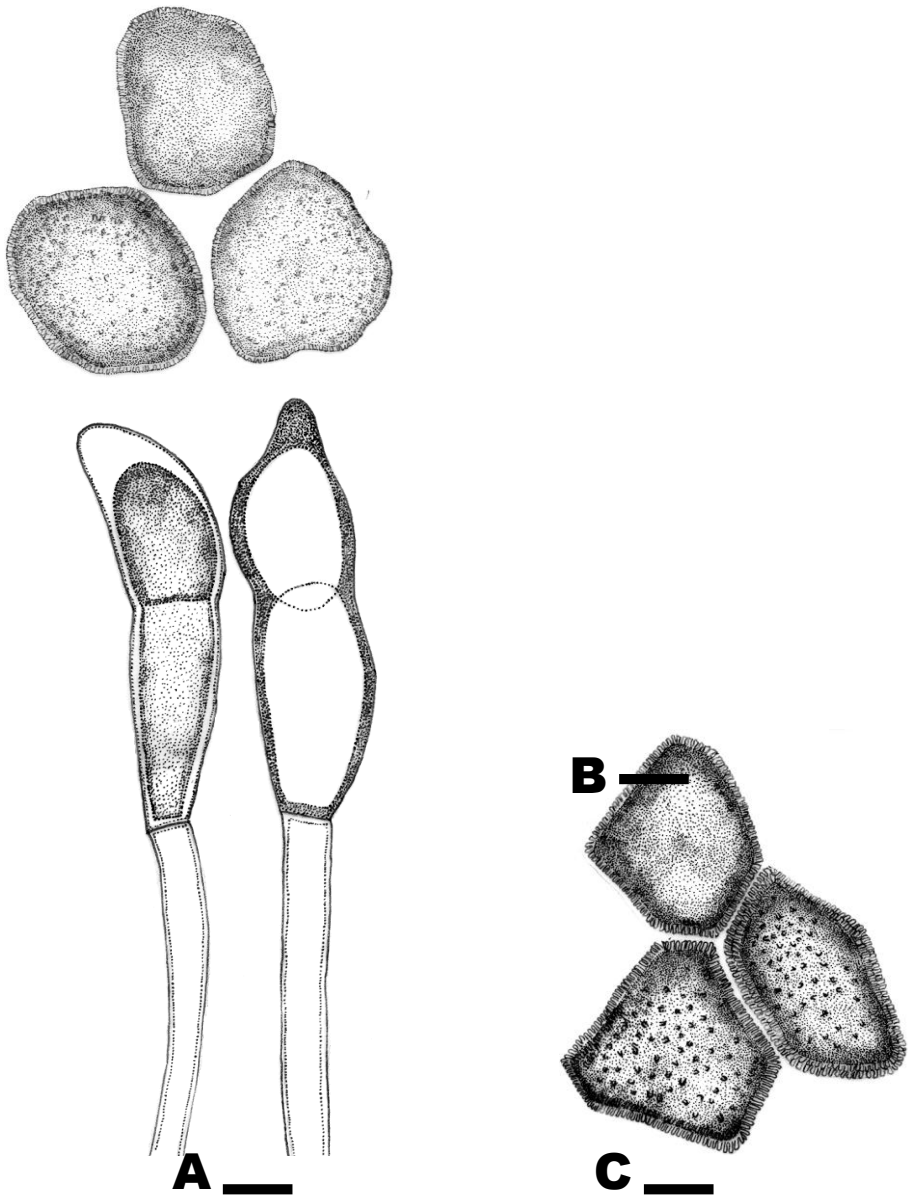

Figure 9. (A) Lucida drawings of Teliospores of *Puccinia circaeae.* (B) Lucida drawing of aeciospores of *Puccinia graminis*; (C) Peridial cells of *Puccinia graminis*. Scale bar for A = 12 µm, B and C = 10 µm.

wall 1–1.5 µm thick, hyaline to light yellow, verrucose. Peridial cell rhomboidal to irregular in shape, hyaline to light yellow, 20 to 28 × 25 to 30 µm

Material examined

On *Berberis vulgaris* Aitch., with I stage, Pakistan, Northern Areas, Fairy Meadows, at 3036 m a. s. l., 12 August, 2007. N.S. Afshan, NSA # G 42. (LAH NSA 1057).

Aecidial stage (I) of *Puccinia graminis* has been reported on *Berberis vulgaris* from Naltar by Sultan (2005) but it is being reported first time from Fairy Meadows.

Puccinia komarovii Tranzschel, *Annls mycol.* 34: 59 (1936).

(Figure 10) Spermogonia and aecia unknown. Uredinia hypophyllous, scattered or circinate, pulverulent, cinnamon brown, 0.1–0.2 × 0.2–0.4 mm. Urediniospores subglobose to obovoid or ellipsoid, 15–20 × 22–29µm; wall 1.5–2 µm thick, pale brown to cinnamon brown, sparsely echinulate; with a single apical germ pore, apex 3-4 µm thick; pedicel hyaline, short, 7–8 × 15–20 µm. Telia similar, chestnut brown to blackish brown, 0.08-0.1 × 0.2-0.8 mm.

Teliospores ellipsoid ovate or subclavate, rounded at both ends or sometimes attenuated downwards, not or slightly constricted at the septum, 18–24 (–27) × (28–) 31–38 µm; wall 2–3 µm thick, smooth, cinnamon brown to chestnut brown; apex 4–8 µm thick, with a hyaline papilla, pale in color; germ pore 1 per cell, pore of upper cell apical or sub apical, of the lower at septum; pedicel

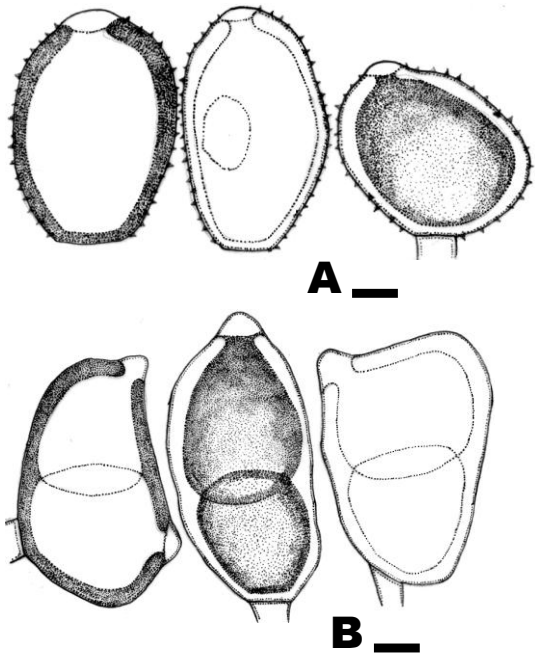

Figure 10. Lucida drawings of *Puccinia komarovii.* (A) Urediniospores showing germ pores; (B) Teliospores. Scale bar for A = 8 µm and B = 10 µm.

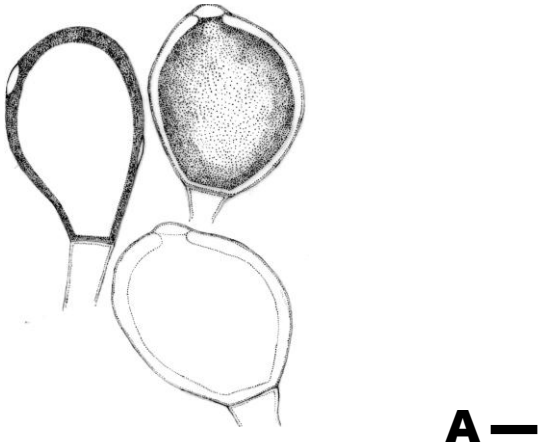

Figure 11. Lucida drawings of teliospores of *Uromyces trifolii*. Scale bar = 7 µm.

short, hyaline, deciduous, 5-7 × 24-30 µm.

Material examined

On *Impatiens brachycentra* G. M. Schulze & Launert, with II & III stages, Pakistan, Northern Areas, Fairy Meadows, at 3036 m a.s.l., 12 August, 2007. N.S. Afshan, NSA # G09. (LAH NSA 1009). *Puccinia komarovii* has previously been reported on *Impatiens* sp. from Poonch and Changla Gali (Ahmad, 1956b). It is a new record for Fairy Meadows.

Uromyces trifolii (R. Hedw.) Lév., Annls Sci. Nat., Bot., sér. 3 8 : 371 (1847) (Figure 11)

=*Uromyces flectens* Lagerh., *Svensk bot. Tidskr.* 3: 36 (1909)
=*Uromyces nerviphilus* (Grognot) Hotson, *Publ. Puget Sound Biol. Sta. Univ. Wash.* 4: 368 (1925).

Spermogonia, aecia and uredinia not found. Telia mostly hypophyllous, sometimes epiphyllous, rounded, scattered, first covered by the epidermis, then naked, pulverulent, surrounded by the ruptured epidermis, dark brown to blackish brown, 0.08 to 0.2 × 0.1 to 0.3 mm. Teliospores globose to subglobose or ellipsoid to

obovoid, 15 to 24 × 21 to 30 µm (mean 19.58 × 26.02 µm), the apex rounded with minute hyaline papilla; wall 1 to 2 µm thick, brown to chestnut brown, smooth or with minute scattered warts; apex 3 to 4 µm thick; germ pore 1, obscure; pedicel hyaline, 4 to 8 µm wide and up to 24 µm long.

Material examined

On *Trifolium resupinatum* L., with III stage, Pakistan, Northern Areas, Fairy Meadows, at 3036 m a. s. l., 12 August, 2007, N.S. Afshan & A.N. Khalid, NSA # G81. (LAH NSA 1112). *Uromyces trifolii* is a new record from Fairy Meadows. It has previously been reported on leaves of *Trifolium repens* L., *T. resupinatum* L. and *T. alexandrianum* L. from Quetta, Peshawar, Sargodha, Sangla Hill and Kaghan valley by Malik and Khan (1944), Ahmad (1956a, b), Malik et al. (1968), Khan and Kamal (1968) and Malik and Virk (1968).

DISCUSSION

Fairy Meadows located at the base of Nanga Parbat, which, at 8126 m, is the 9th highest mountain in the world and second in Pakistan afer K2. Te Fairy Meadows are lush green alpine pastures situated in the middle of a pine forest at an altitude of 3306 m. The pine forests skirting Fairy Meadows are one of the virgin forests in the North of Pakistan and home to a number of species of wild flowers, birds, and wildlife (Singh et al., 2004). Te altitudinal range of the Fairy Meadows vegetation belt is defined as montane belt. Although the montane belt on Fairy Meadows/Nanga Parbat is by far the richest in species number and potential differentiation of vegetation types, it is floristically depauperate as compared to the outer Himalayan slopes (Troll, 1939). Being rich in plant diversity, these forests harbor a large number of rust fungi that are obligate parasites of plants from which they obtain nutrients, and on which they reproduce and complete their life cycles. Although the fungal flora of Pakistan has been explored by several workers in the past, a very important group of fungi has largely been neglected resulting in the paucity of literature and very fragmentary knowledge of these fungi, particularly in Fairy Meadows, Pakistan. Keeping in view these facts, the present study was undertaken to explore and assess the diversity and distribution of rust fungi along with their respective host plants in this floristically rich area. During a recent survey of the rust fungi in the Northern Areas of Pakistan, specifically Fairy Meadows, sixteen species of rusts were encountered. Previously, 22 species of rust fungi have been reported from this area (Afshan et al. 2011). This work has raised the number of reported rust fungi from Fairy Meadows to 31.

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