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## Some new records of *Uredinales* from Khyber Pakhtunkhwa, Pakistan

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**ABSTRACT** — *Uromyces ferulae* and the telial stage of *Cerotelium fici* were collected from Khyber Pakhtunkhwa and are new records for Pakistan. *Puccinia exhausta* on *Clematis grata* and *P. ustalis* on *Ranunculus hirtellus* are reported as new host records for these rusts in Pakistan.

**KEY WORDS** — Oghi forest, *Pucciniales*, rust fungi

### Introduction

During the exploration of *Uredinales* of Khyber Pakhtunkhwa, Pakistan, rust-infected plants were collected from different localities and examined macro-microscopically. Among the specimens, *Heracleum cachemiricum* was found infected with *Uromyces ferulae*, which is a new record for Pakistan. The telial stage of *Cerotelium fici* on *Ficus carica* and *F. palmata* is an addition to the already reported stages of this rust from Pakistan. *Puccinia exhausta* on *Clematis grata* and *P. ustalis* on *Ranunculus hirtellus* are new host records for these rusts in Pakistan. This work brings the total of rust taxa recorded from Khyber Pakhtunkhwa to 174. Previously about 173 species of rust fungi have been reported from this area (Afshan & Khalid 2008, 2009; Afshan et al. 2008a,b,c,d, 2010; Ishaq et al. 2013).

### Materials & methods

Freehand sections & scrape mounts of infected plant materials were made in lactic acid. The plants were photographed and infected portions were observed under a stereomicroscope. Twenty spores representing each spore state were examined under a Nikon YS 100 microscope, and paraphyses and spore were measured using a Zeiss

eyepiece screw micrometer. Sections, paraphyses and spores were microphotographed by Digiporo-Labomed. Spores and paraphyses were drawn with the aid of a camera lucida (Ernst Leitz Wetzlar Germany). Specimens are conserved in the Herbarium, Hazara University, Dhodial, Pakistan (HUP).

### New records

*Uromyces ferulae* Juel, Bull. Soc. mycol. France 17: 259. 1901.

PLATE 1

SPERMOGONIA and AECIA were not found. UREDINIA and TELIA are mixed in the same sori, amphigenous and petiicolous, rounded, in dense clusters, especially on the leaflets, dark brown  $0.09\text{--}0.26 \times 0.25\text{--}0.41$  mm. UREDINIOSPORES globose or subglobose,  $22.4\text{--}24.1 \times 26.9\text{--}27.9$   $\mu\text{m}$  (mean  $23.4\text{--}27.6$   $\mu\text{m}$ ), hyaline to golden brown, echinulate; germ pores 2–4, equatorial; pedicel hyaline, deciduous. TELIOSPORES globose to subglobose or ovoid to ellipsoid,  $17.7\text{--}23.7 \times 29.3\text{--}37.8$   $\mu\text{m}$  (mean  $22.2\text{--}33.4$   $\mu\text{m}$ ), apex rounded; wall  $1.4\text{--}2.6$   $\mu\text{m}$ , light brown to chestnut brown, smooth; apex  $2.8\text{--}5.2$   $\mu\text{m}$  thick, germ pore mostly at the apex, pedicel hyaline, deciduous.

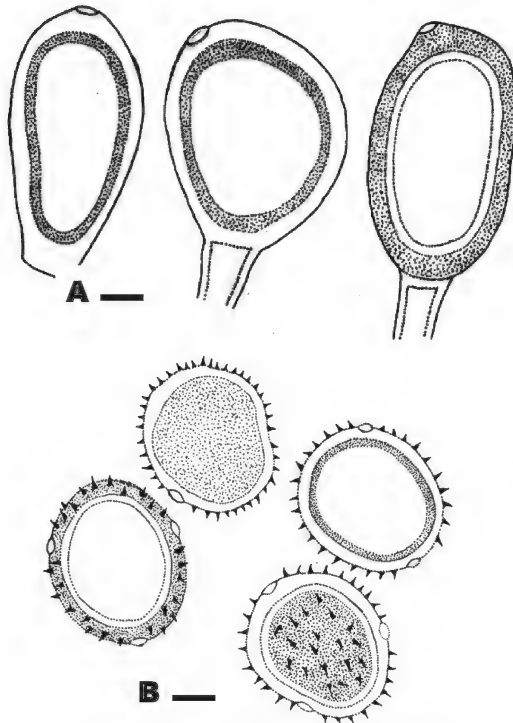


PLATE 1: *Uromyces ferulae* (HUP MFR-281):  
A. Teliospores. B. Urediniospores. Scale bars = 10  $\mu\text{m}$ .

MATERIAL EXAMINED: PAKISTAN, KHYBER PAKHTUNKHWA, District Mansehra, Oghi, Khabbal Paen, at 2046 m a.s.l., on *Heracleum cachemiricum* C.B. Clarke (*Umbelliferae*), stages II + III, May 2010, M. Fiaz #FR-208 (HUP MFR-281).

COMMENTS: *Uromyces ferulae* has been reported on different *Ferula* species from North Africa, southern Europe, Australia, and Asia (Iran) (Saccardo & Saccardo 1905: 248; Mercé 1975; Denchev 1995). In Pakistan, no species of *Uromyces* has previously been recorded on *Umbelliferae*. This is the first report from Pakistan, and *Heracleum cachemiricum* represents a new host for *Uromyces ferulae*.

*Cerotelium fici* (Castagne) Arthur, Bull. Torrey Bot. Club 44: 509. 1917. PLATE 2  
SPERMOGONIA and AECIA are unknown. UREDINIA hypophyllous, scattered over the whole surface, minute, sometimes in large irregular groups, slightly

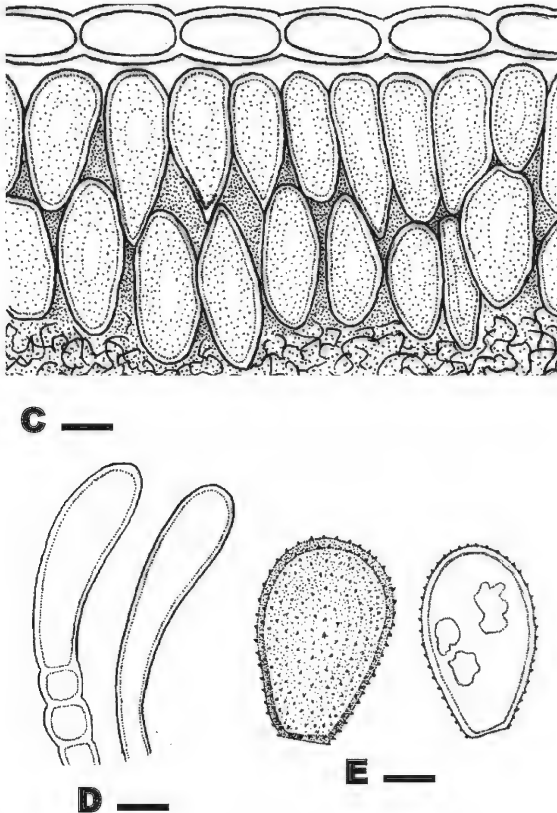


PLATE 2: *Cerotelium fici* (HUF MFR-252): C. Subepidermal telium. D. Incurved paraphyses. E. Urediniospores. Scale bars: C = 9 cm; D = 8.5  $\mu$ m; E = 6  $\mu$ m.

erumpent, pulverulent, reddish brown, surrounded by peripheral, incurved and basally united paraphyses. UREDINIOSPORES subglobose or broadly ellipsoid to obovoid or ovate, densely echinulate, yellowish brown,  $16\text{--}21.7 \times 17\text{--}31.2 \mu\text{m}$ , wall  $1\text{--}1.6 \mu\text{m}$  thick, germ pores scattered, obscure. TELIA hypophyllous, subepidermal, scattered, minute,  $190\text{--}270 \mu\text{m}$  in diam. TELIOSPORES one-celled, cylindrical, broadly ellipsoid or oblong, smooth,  $8.7\text{--}11.4 \times 14.6\text{--}20.8 \mu\text{m}$ , catenulate, in two or three superimposed layers, walls uniformly thin, colorless.

MATERIAL EXAMINED: PAKISTAN, KHYBER PAKHTUNKHWA, District Mansehra, Bherkund, at 849 m a.s.l., on *Ficus carica* L. (*Moraceae*), stages II + III, Nov. 2010, M. Fiaz #FR-093 (HUP MFR-252); District Mansehra, Gulebagh, at 920 m a.s.l., on *Ficus palmata* Forssk., stage II, Oct. 2009, M. Fiaz #FR-089 (HUP MFR-253).

COMMENTS: The telial stage of *Cerotelium fici* is a new record for Pakistan. The uredinial stage of *Cerotelium fici* has been reported on *Ficus carica*, *F. palmata*, and *F. religiosa* L. from Lahore, Change Manga, Sangla Hill, Tandojam, Malir (Karachi), and Rawalpindi (Ahmad 1956a,b, Hasnain et al. 1959, Khan & Kamal 1968, Ghaffar & Kafi 1968, Kaneko 1993).

*Puccinia exhausta* Dietel, Bot. Jb. 28: 283. 1900.

PLATE 3

SPERMOGONIA are usually epiphyllous, subcutaneous, chestnut-brown, spherical or ellipsoid,  $74\text{--}117 \times 79\text{--}126 \mu\text{m}$ . AECIA and UREDINIA not found. TELIA amphigenous, small, rounded, scattered or in circular groups, dark brown to blackish, erumpent or covered by epidermis. TELIOSPORES mostly ellipsoid, sometimes 1-celled and elongated, conical or rounded at the apex, base mostly roundish, apical wall may be thickened up to  $3 \mu\text{m}$ , sometimes 2-celled, not thickened, slightly constricted or non-constricted at the septum, smooth, hyaline to yellowish and chestnut brown,  $17\text{--}24 \times 26\text{--}47 \mu\text{m}$  (mean =  $21 \times 39 \mu\text{m}$ ), wall  $1.4\text{--}2.5 \mu\text{m}$ , germ pore apical in upper cell, adjacent to the pedicel or basal in lower cell, distinct colorless papilla over the germ pore, sometimes up to  $4 \mu\text{m}$ ; pedicels hyaline, deciduous, rarely up to  $80 \mu\text{m}$  long.

MATERIAL EXAMINED: PAKISTAN, KHYBER PAKHTUNKHWA, District Mansehra, Dhodial, at 978 m a.s.l., on *Clematis grata* Wall. (*Ranunculaceae*), stages 0 + III, Aug. 2010, M. Fiaz #FR-003. (HUP MFR-266).

COMMENTS: *Puccinia exhausta* is cosmopolitan and reported on different *Clematis* species (Hiratsuka & Chen 1991, Hiratsuka et al. 1992, Kobayashi 2007). From Pakistan, it has previously been reported on *Clematis montana* Buch.-Ham. ex DC. from the Kawai and Malakandi forests (Kaghan valley) by Ono & Kakishima (1992) and Ono (1992). *Clematis grata* represents a new host record for *P. exhausta* in Pakistan.

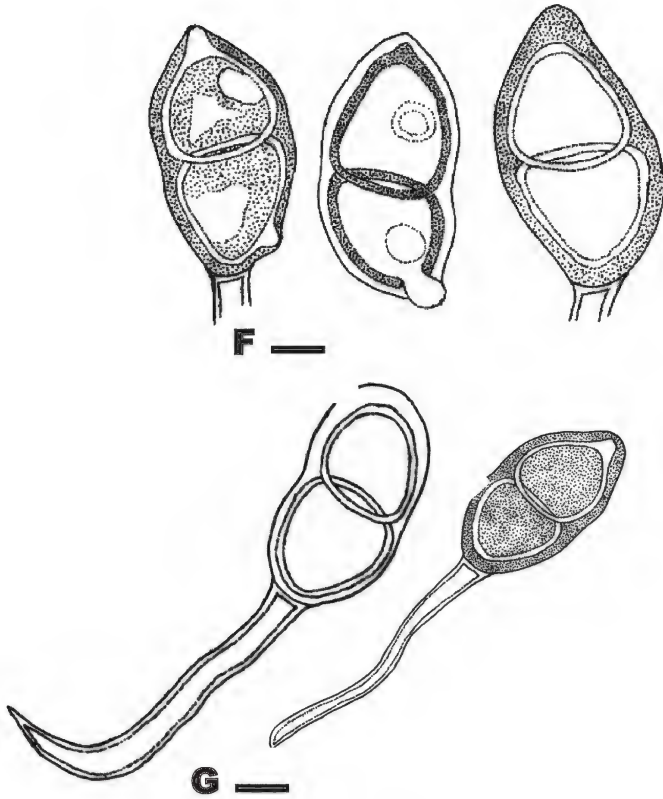


PLATE 3: *Puccinia exhausta* (HUP MFR-266): Teliospores. Scale bar = 10  $\mu\text{m}$ .

*Puccinia ustalis* Berk. Hooker's J. Bot. Kew Gard. Misc. 6: 207. 1854.

PLATE 4

SPERMOGONIA, AECIA and UREDINIA are unknown. TELIA usually hypophyllous as dark brown to blackish spots, scattered or aggregated in large groups, compact. TELIOSPORES mostly 2-celled, occasionally 1- or 3-celled teliospores co-exist, ellipsoid, oblong to cylindrical or irregular, conical or rounded above and narrowed below, constricted at the septum, yellowish brown, pale brown basally; 2-celled spores  $10\text{--}16 \times 33\text{--}63 \mu\text{m}$ , smooth,  $1\text{--}1.5 \mu\text{m}$  thick at side, apically  $2\text{--}8.6 \mu\text{m}$  thick; germ pore one per cell, apical or sub apical in distal cell, in basal cell near the septum or obscure; 1-celled spores  $8\text{--}11 \times 17\text{--}33 \mu\text{m}$ , at side  $1\text{--}1.5 \mu\text{m}$ , apices  $2\text{--}5.4 \mu\text{m}$  thick; 3-celled spores  $10\text{--}13 \times 48\text{--}52 \mu\text{m}$ ,  $1\text{--}1.5 \mu\text{m}$  at sides and  $2\text{--}6 \mu\text{m}$  at the apices. Pedicel pale yellow to hyaline, deciduous,  $7\text{--}10 \mu\text{m}$  long.

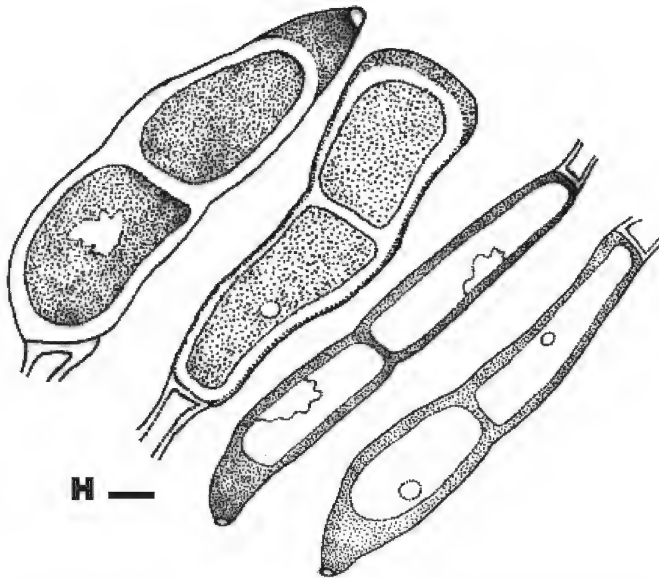


PLATE 4: *Puccinia ustalis* (HUF MFR-272): Teliospores. Scale bar = 12  $\mu$ m.

MATERIAL EXAMINED: PAKISTAN, KHYBER PAKHTUNKHWA, District Mansehra, Balakot, Nadibanglaw, at 2515 m a.s.l., on *Ranunculus hirtellus* Royle (*Ranunculaceae*), stage III, Jul. 2011, M. Fiaz #FR-005. (HUP MFR-272).

COMMENTS: *Puccinia ustalis* is cosmopolitan and reported on different species of *Anemone*, *Clematis*, *Aquilegia*, *Pulsatilla*, *Ranunculus*, *Thalictrum*, and *Trautvetteria* (Hiratsuka et al. 1992). From Pakistan, it has been reported on *Anemone obtusiloba* D. Don from Changla Gali and Nathia Gali (Ahmad 1956a,b) and on *Ranunculus diffusus* DC. from Dunga Gali (Okane et al. 1992) and the Kaghan Valley (Ono 1992). *Ranunculus hirtellus* represents a new host record for *Puccinia ustalis* in Pakistan.

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