

NEW RECORDS OF GRAMINICOLOUS RUST FUNGI FROM PAKISTAN

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Abstract

Puccinia substriata EII. & Barth. var. *insolita* (P. Syd. & H. Syd.) Ramachar & Cumm., *Puccinia coronata* Corda var. *gibberosa* (Lagerh.) Joerst., *Puccinia coronata* Corda var. *avenae* Fraser & Ledingham and *Uromyces vossiae* Barclay are described and illustrated. These taxa are new records from Pakistan.

Introduction

Rust fungi (Uredinales) are one of the largest natural taxa within the kingdom Eumycota. More than 7000 species belonging to 100-125 genera and 14 families are accepted currently. Although species infecting Gramineous hosts are economically important and belong to the best studied fungi, little or nothing is known about the life cycle and taxonomic placement of many species. The largest genus, *Puccinia* Pers., contains ca. 4000 spp., 650 of which occur on Poaceae (Abbasi, 1996).

The Poaceae in Pakistan is represented by 158 genera and 492 species (Cope, 1982). Among these, 128 species of the Poaceae are found infected with more than 100 species of Uredinales. Forty-six species of *Puccinia* Pers., and 14 species of *Uromyces* Link, have been reported on members of Poaceae from different areas of Pakistan (Ahmad *et al.*, 1997).

A contribution is made to the graminicolous rust fungus flora of Pakistan. *Puccinia coronata* Corda var. *avenae* Fraser & Ledingham on *Elymus repens* (Linn.) Gould, *Puccinia coronata* Corda var. *gibberosa* (Lagerh.) Joerst., on *Phalaris minor* Retz., *Puccinia substriata* EII. & Barth. var. *insolita* (P. Syd. & H. Syd.) Ramachar & Cumm., and *Uromyces vossiae* Barclay are new records for Pakistan.

Materials and Methods

During the survey of Graminicolous rust fungi of Pakistan, rusted plants were collected along with inflorescence for correct identification. The collected specimens were pressed individually among blotting papers, properly labelled and the blotting papers were periodically changed to dry the specimens. Host plants were identified by comparing with the plants already present in the herbarium of Botany Department, University of the Punjab, Lahore, Pakistan.

Infected portions were photographed under stereomicroscope at magnification of 25-50x, hand made 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).

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The sections showing rust stages were observed under a microscope (NIKON YS 100) and microphotographed by Canon AE-I. Illustrations were also made by using Camera Lucida (Ernst Leitz Wetzlar Germany). Spore dimensions were taken by an Ocular micrometer (zeiss eye piece screw micrometer).

Description of the taxa

1. *Puccinia substriata* Eil. & Barth. var. *insolita* (P. Syd. & H. Syd.) Ramachar & Cumm. *Mycopath. Mycol. Appl.*, 25: 31. 1965.

Fig. 1, A-C; Fig. 2, A

Spermogonia, Aecia and Telia unknown. Uredinia on abaxial surface, brown-yellowish brown, covered by the epidermis, striated, sori 0.2-0.4 x 0.1-0.3 mm. Urediniospores ovoid-ellipsoid or globose, often angular, 23-32 x 29-42 μ m, echinulate, cinnamon brown or pale brown, wall 1.5-2.5 μ m thick, germ pores 1-4, mostly 3, equatorial with germ pores. Pedicel hyaline, persistent, 7 μ m wide and up to 82 μ m long. Paraphyses hyaline, clavate, 7-8 μ m wide and up to 71 μ m long.

On *Panicum antidotale* Retz., with II stage, Munchinabad, SHI Mycological Herbarium # NSA 11. 19 April, 2006.

Uromyces superfluous H.P. Syd., has been reported on *Panicum antidotale* from Changa manga and Karachi (Ahmad *et al.*, 1997).

Puccinia substriata var. *insolita* is reported for the first time from Pakistan.

2. *Puccinia coronata* Corda var. *gibberosa* (Lagerh.) Joerst. Avh. Norske Videnskaps-Akad. Oslo I. 1948: 9. 1949.

Fig. 1, D-G; Fig. 2, B

Spermogonia and Aecia unknown. Uredinia amphigenous, brown, 0.2-0.4 x 0.09-0.1mm. Urediniospores globose-subglobose or ovoid, pale yellow to nearly colorless, 20-24 x 21-29 μ m, verrucose, wall 1.5-2 μ m thick 2-6 germ pores, scattered, obscure. Pedicel minute, deciduous. Paraphyses capitate to clavate, cap 12-13 μ m wide while 7-9 μ m thick below, up to 50 μ m long.

Telia amphigenous, long covered by the epidermis, or only tardily exposed, blackish brown, sori 0.3-0.5 x 0.09-0.1 mm. Teliospores golden to brown, 14-24 x 35-59 μ m, wall up to 2 μ m thick at sides while about 2-5 μ m thick apically excluding digitations, apex coronate with digitations, 3-7 μ m long. Pedicel short, yellowish brown to brown.

On *Phalaris minor* Retz., with II, III stages, Mianwali, SHI Mycological Herbarium # NSA 12. 15 April, 2006

Puccinia coronata has been reported on *Lolium persicum* Boiss. & Hohen. ex Boiss., and *Agrostis pilosula* Trin., from Swat, on *Rhamnus virgatus* Roxb., and *Festuca* L., from Kaghan valley and on *Rhamnus dahuricus* Pall., from Peshawar. *Puccinia coronata* var. *coronata* has been reported on *Agrostis* L., and *Festuca* sp., from Swat (Ahmad *et al.*, 1997).

Puccinia coronata var. *gibberosa* has been reported on *Festuca altissima* All., by Cummins (1971).

Puccinia coronata var. *gibberosa* is being reported for the first time from Pakistan. *Phalaris minor* is also a new host for *P. coronata* var. *gibberosa* from Pakistan.

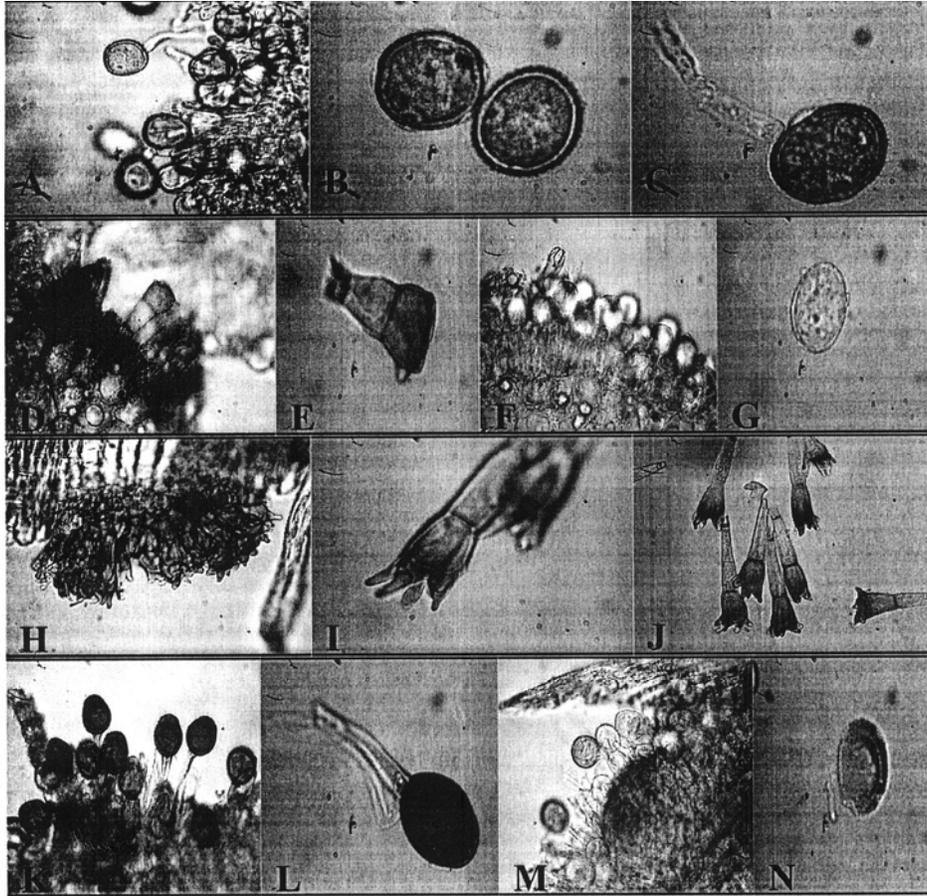


Fig. 1. A-N: (A). A cross section of the uredinium of *Puccinia substriata* var. *insolita* showing urediniospores with clavate paraphyses, (B-C). Urediniospores showing 1-4 equatorial germ pores, (D). A cross section of the telium of *Puccinia coronata* var. *gibberosa* (E). A Teliospore with coronate apex (F). A section of uredinium of *Puccinia coronata* var. *gibberosa* (G). A urediniospore showing 2 equatorial germ pores (H) A cross section of telium of *Puccinia coronata* var. *avenae* (I-J). Teliospores with coronate apex & digitations (K) A section of telium of *Uromyces vossiae* (L). A teliospore showing apical thickening (M). A section of uredinium showing urediniospores with clavate paraphyses (N). A urediniospore with 2 equatorial and 1 apical germ pore.

3. *Puccinia coronata* Corda var. *avenae* Fraser & Ledingham. *Sci. Agr.*, 13: 322. 1933. Fig. 1, H-J; Fig. 2, C

Spermatogonia, Aecia and Uredinia unknown. Telia amphigenous, dark brown-blackish brown, persistent, striated, sori 0.09-0.14 x 0.07-0.1 mm. Teliospores clavate-ellipsoid, constricted at the septum, attenuated towards base, 12-20 x 40-71 μ m, wider at the apex, becoming thin towards base i.e., 5-7 μ m, apex coronate with digitations, digitations 3-several, 4-18 μ m long and 16-31 μ m wide, brown to chestnut brown at the apex while hyaline or light brown at the base, wall 1-1.5 μ m thick. Pedicel short, persistent, 3-4 μ m wide and upto 10 μ m long. Paraphyses present but seldom abundant, clavate, hyaline to light brown, 9-11 μ m wide and upto 60 μ m long.

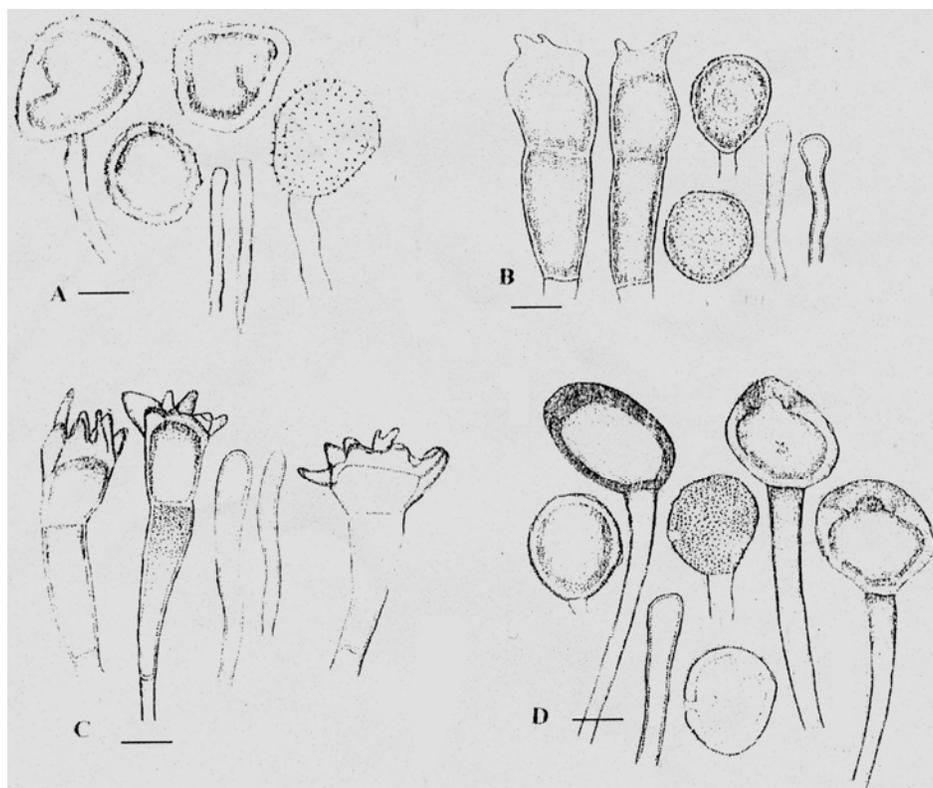


Fig. 2. **A-D:** Camera Lucida drawings of Uredo and Teliospores of new records of rust fungi from Pakistan, **(A)**. Uredospores and Paraphyses of *Puccinia substriata* var. *insolita* showing 2-4 equatorial germ pores, **(B)**. Uredospores, Teliospores and Paraphyses of *Puccinia coronata* var. *gibberosa* showing coronate apex of Teliospores, **(C)**. Teliospores and Paraphyses of *Puccinia coronata* var. *avenae* showing coronate apex with 5-10 digitations, **(D)**. Uredospores, Teliospores and Paraphyses of *Uromyces vossiae*.

On *Elymus repens* (Linn.) Gould, with III stage, Khanspur, NWFP, SHI Mycological Herbarium # NSA 13, 29th July, 2006.

Puccinia coronata var. *avenae* has been reported on species of *Avena* and occasionally on other grasses. But it is common where oats (*Avena sativa* L.) are grown (Cummins, 1971).

Puccinia coronata var. *avenae* is first time reported from Pakistan. *Elymus repens* is also a new host for *Puccinia coronata* var. *avenae* from Pakistan.

4. *Uromyces vossiae* Barcl. *J. Asiat. Soc. Bengal*, 59: 76, 1890.

Fig. 1, K-N; Fig. 2, D

Spermogonia and Aecia unknown. Uredinia hypophyllous, dark brown, sori 0.2-0.4 x 0.09-0.1 mm. Urediniospores globose-subglobose or ovoid, light yellow to brown, 18-24 x 20-27 μ m, wall 0.7-3.5 μ m thick, densely verrucose or striolate verrucose, germ pores 2-3, 2 equatorial or supra-equatorial while 1 apical. Paraphyses clavate, 6-8.5 μ m wide and up to 55 μ m long.

Telia black, scattered, amphigenous, sori 0.1-0.2 x 0.05-0.1 mm. Teliospores dark brown to cinnamon brown, 18-27 x 21-35 μm , ovoid to ellipsoid, minutely verrucose, mostly at the apex, wall 1-3.3 μm thick at sides while 4-9 μm thick apically, germ pore 1, equatorial. Pedicel long, hyaline, persistent, 6-7 μm wide and up to 90 μm long.

On *Phacelurus speciosus* (Steud.) C.E. Hubbard, with II, III stages, Khanspur village (NWFP), SHI Mycological Herbarium # NSA 14. 15 July, 2006.

Uromyces vossiae has already been reported on *Phacelurus speciosus* from Kaghan by Ahmad (1969) but it is first time reported from Khanspur (NWFP).

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References

- Abbasi, M. 1996. Contribution to the knowledge of *Puccinia* species in Iran. *Iran. J. Plant Path.*, 32: 244-267.
- Ahmad, S., S.H. Iqbal and A.N. Khalid. 1997. *Fungi of Pakistan*. S.A. Mycol. Soc., Lahore.
- Ahmad, S. 1969. *Fungi of West Pakistan*. Monograph No.5, Biol. Soc. Pakistan, Lahore, 110 pp.
- Cope, T. A. 1982. *Flora of Pakistan, Poaceae*. (Ed.): E. Nasir and S.I. Ali. Shamim Printing Press, Karachi.
- Cummins, G.B. 1971. *The Rust Fungi of Cereals, Grasses and Bamboos*. Springer Verlag Berlin. Heidelberg, New York.
- Dade, H.A. and J. Gunnell. 1969. *Classwork with fungi*. Commonwealth Mycological Institute Kew, Surrey, England.

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