Sci.Int.(Lahore),28(3),3083-3087, 2016 ISSN 1013-5316;CODEN: SINTE 8

NEW HOST RECORDS FOR PATHOGENIC FUNGI IN PAKISTAN

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ABSTRACT: *During present investigation, five plant species infected with pathogenic rust fungi were collected. Among these,* ***Lolium persicum*** *for* ***Puccinia striiformis*** var. ***striiformis****,* ***Melica persica*** *for* ***P. poarum****,* ***Bothriochloa ischaemum*** *for* ***P. cesatii****,* ***Festuca pratensis*** *for* ***P. coronata*** var. ***himalensis*** *and* ***Sonchus asper*** *for* ***P. sonchi*** *are reported as new host plants for these rust fungi in Pakistan.*

Key Words: Swat, Shangla, Pathogenic fungi, Rust host

INTRODUCTION

The Swat valley is a part of Malakand Division of Khyber Pakhtunkhwa (KP), Pakistan covers estimated 5,737 square kilometer. The elevation of the valley is 630 to 3,000 m above sea level. Swat is located at a distance of 170 km from Peshawar and 270 km from the Federal capital of Islamabad [1]. In all, floristic composition comprised of 209 species of vascular plants belonging to 167 genera and 75 families [2]. Adjacent to Swat Valley in East, Shangla District is located. The total area of the Shangla is 1,586 square kilometers. The general elevation of the district is 1,300 to 3,000 meters above sea level [3]. Vegetation of Shangla comprising 172 plant species, distributed across 65 families and 139 genera [4].

The rust fungi belongs to the order Uredinales of class Basidiomycetes and comprise a large group of obligate biotrophic parasites. They cause rusty pustular spots on different plant parts especially leaves and stem of the wide range of host plants including ferns, conifers and wild and cultivated flowering plants [5].There is specific relationship between plants and rust. The host-parasite association between plants and rust is an outcome of a long evolutionary process of continuous mutual adaptation [6]. Rust fungi are among the most economically important disease causing agents of many native and cultivated plants. However, they typically cause only minor damage to a population of wild host plants in an area belonging to their natural range of distribution [7]. With respect to rust flora, Swat and Shangla are poorly explored, only 56 species of rust fungi reported from Swat, which belongs to 7 genera found on 26 famlies of plants [8]. While Shangla is still unexplored in the field of pathogenic fungi.

MATERIAL AND METHOD

Plant Collection

Plants were collected from two sites, Shangla and Swat district, KP, Pakistan. The samples were pressed through plant presser then dried and preserved for further studies. The study area lies between 34°31′ to 33°08′ north latitudes and 72° 33′ to 73°01′ east longitudes, the average altitude from 850-2350 m. The climate of the area is mild in summer and cold in winter. The annual rainfall is approximately 1,415.9 mm [9,10].

Microscopic analysis

The rust sori were seen under stereomicroscope (MEIJI TECHNO, EMZ-5TR, Japan) and slide was made in lactic acid for microscopic analysis. Different morphological characters including shape, size, ornamentation of teliospores, urediniospores, pedicel, and germ pores were studied. Line drawings were made with the help of LUCIDA Camera (Ernst Leitz Wetzlar, Germany). Measurements are made with an ocular micrometer (LOMO Filar Eyepiece Micrometer AM9-2 15x microscope ZEISS) in 40x or 100x with oil immersion objective. For photography microscopic camera (HDCE-5X digital camera 5.0MP) was used.

RESULT AND DISCUSSION

Puccinia striiformis* var. *striiformis Westend, Bull. Acad. R. Sci. Belg., Cl. Sci. 21(2): 235 (1854)

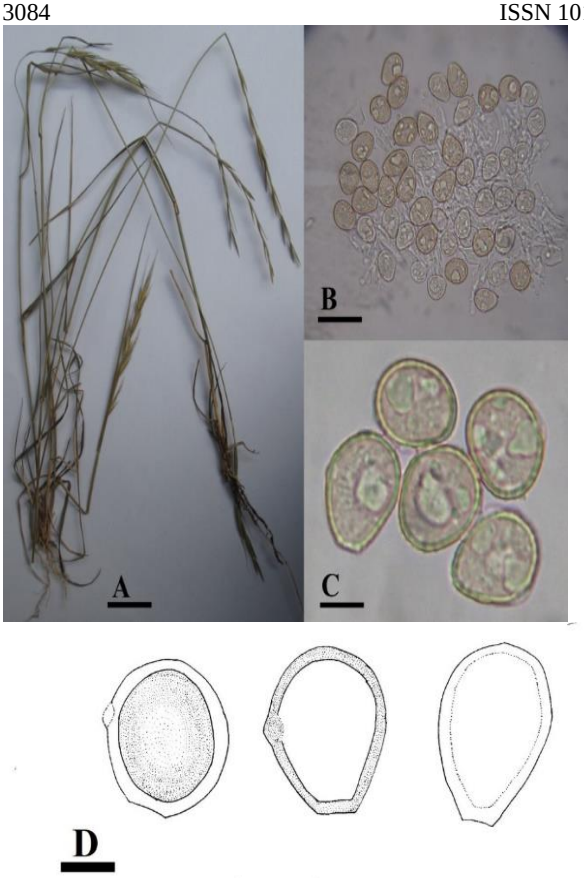
SPERMOGONIA and AECIA unknown. TELIA absent. UREDINIA amphigenous, light brown to black. UREDINIOSPORES globoid or broadly ellipsoid, 18−21 × 22−28 µm, echinulate, germ pores 1−4, equatorial to sub-equatorial, wall 1.5−3 µm thick, pale yellow to brown in color.

> **Material examined:** On *Lolium persicum* Boiss. & Hohen, with II stage, Pakistan, Khyber Pakhtunkhwa, Swat district, Kozshawar at 1421 m.a.s.l, 15th July, 2015. MU# 10.

Puccinia striiformis var. *striiformis* has previously been reported on *Dactylis glomerata* L., *Leersia oryzoides* (L.) Sw., *Triticum aestivum* L., *Hordeum vulgare* L. and *Poa* sp. from Quetta, Kalat, Tandojam, Rawalpindi, Nathia Gali, Khanspur-Ayubia (NWFP), Shogran (Kaghan valley), Fairy Meadows, Lahore [11-18].

Lolium persicum is a new host for *Puccinia striiformis* var. *striiformis* from Pakistan.

3084 ISSN 1013-5316;CODEN: SINTE 8 Sci.Int.(Lahore),28(3),3083-3087, 2016



FIGS. A–D: ***Puccinia striiformis* var. *striiformis*** (A). Infected host plant ***Lolium persicum*** (B–C).Urediniospores (D). Lucida drawings of urediniospores**.** Scale bar for A= 1.5 cm, B= 41.6 µm, C= 12.5 µm, D= 7.35 µm.

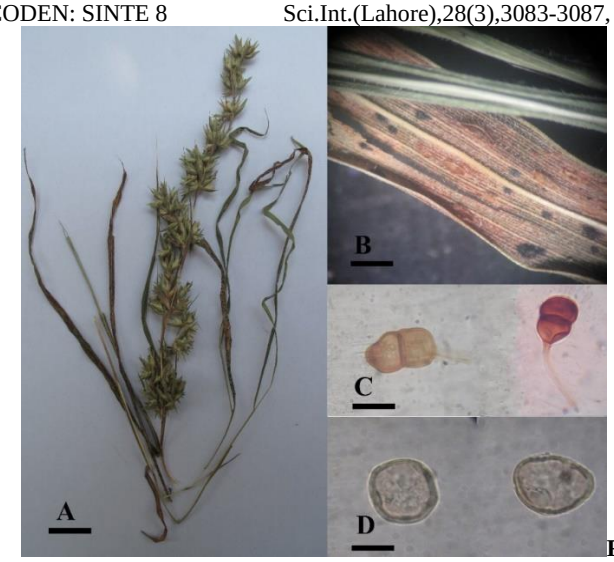
Puccinia poarum Nielsen, Bot. Tidsskr. 3(2): 34 (1877)

SPERMOGONIA and AECIA not found. UREDINIA present on abaxial surface, irregularly distributed, brown in color. UREDINIOSPORES globose to sub-globose and ellipsoidal, 19.3–25 × 22.8–28 µm; wall 1.5–5 µm thick, yellow brown in color, echinulate, 1–3 germ pores, apical and equatorial to sub-equatorial. TELIA on abaxial surface, intermixed with uredinia. TELIOSPORES bicelled, 23–31 × 29–45 µm; wall 1.5–2.5 µm thick, apical thickness 4–7 µm, pedicel hyaline to light brown, 7–2 µm wide and upto 32 µm long.

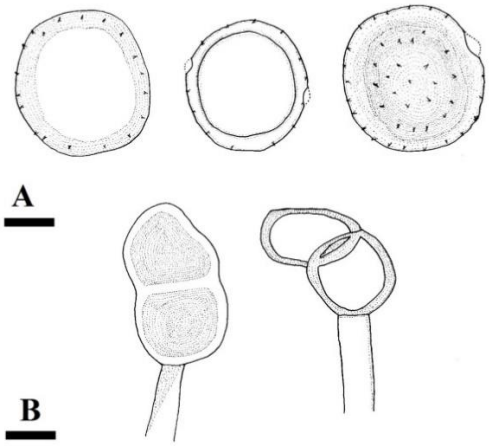
Material examined: On *Melica persica* Kunth., with II& III stages, Pakistan, Khyber Pakhtunkhwa, Shangla district, at 1,820 m.a.s.l, 5th August, 2015. MU# 13.

Puccinia poarum has been reported on *Poa annua* L. from Lahore [11] [12]. On *Agrostis* sp. from Kaghan valley and Azad Jammu & Kashmir [16]. On *Poa pratensis* L. from Fairy Meadows, Northern areas of Pakistan [19].

Melica persica is a new host for *Puccinia poarum* from Pakistan.



FIGS. A–D: ***Puccinia poarum*** (A–B). Infected host plant, ***Melica persica*** (C). Teliospores (D). Urediniospores. Scale bar for A= 1.45 cm, B= 0.44 mm, C= 2.17 µm, D= 14.11 µm.



FIGS. A–B: Lucida drawings of ***Puccinia poarum*** (A). Urediniospores (B). Teliospores. Scale bar = 10µm.

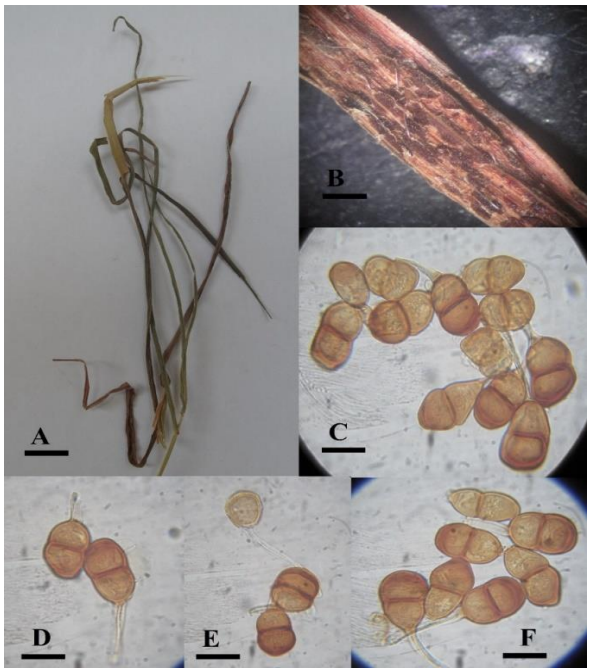
Puccinia cesatii J. Schröt., in Cohn, Beitr. Biol. Pfl. 3: 70 (1879)

SPERMOGONIA, AECIA and UREDINIA not found. TELIA hypophyllous, in cluster form, dark brown to black in color. TELIOSPORES mostly two-celled, one-celled teliospores also present, ovoid to ellipsoid, 19.14–33.21 × 38–50.2 µm; wall 1.5–3.6 µm thick, 4.5–6.7 µm apical thickness, pedicel light yellow to hyaline, 3–9µm wide and up to 62 µm long.

Material examined: On *Bothriochloa ischaemum* (L.) Keng, with III stage, Pakistan, Khyber Pakhtunkhwa, Shangla district, at 1,820 m.a.s.l, 5th August, 2015. MU# 16.

Puccinia cesatii is reported previously on *Bothriochloa bladhii* (Retz.) S.T. Blake and *Dicanthium annulatum* L. from Rawalpindi, Peshawar & Shogran [11,12,16,20,21].

Bothriochloa ischaemum is reported here as a new host record for *P. cesatii* from Pakistan.



FIGS. A−F: ***Puccinia cesatii*** (A−B). Infected host plant *Bothriochloa ischaemum* (C−F).Teliospores. Scale bar for A= 3 cm, B= 3.77 mm, C= 2.75 µm, D= 24.4 µm, E= 29.3 µm, F= 27.5 µm.

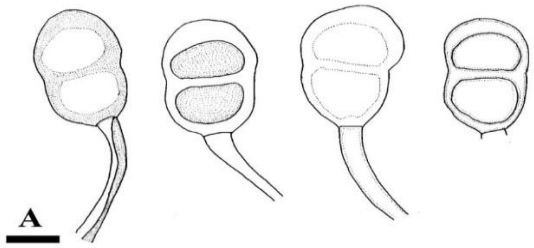


Fig. A: Lucida drawings of ***Puccinia cesatii*** (A). Teliospores. Scale bar for A= 12.2 µm.

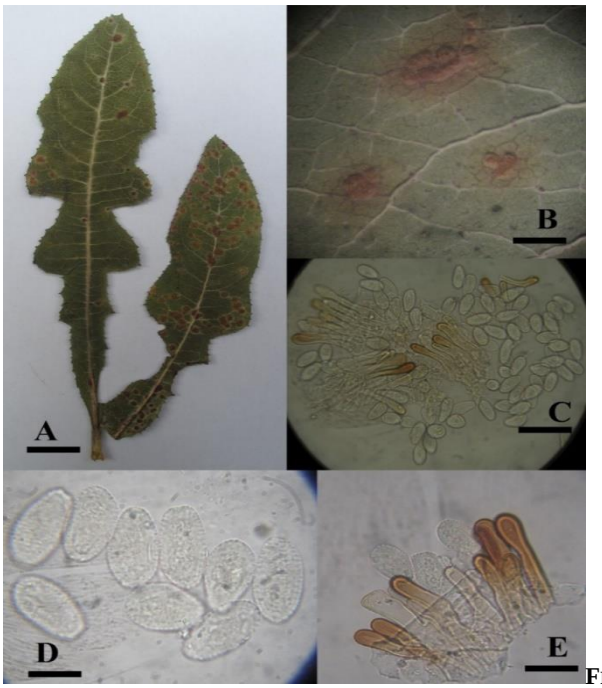
Puccinia sonchi Roberge ex Desm.,Annls Sci. Nat., Bot., sér. 3 11(2): 274 (1849)

SPERMOGONIA, ASIA and TELIA not found. UREDINIA hypophyllous on leaves or veins, orange to brown, irregularly scattered. UREDINIOSPORES sub-globose to broadly ellipsoid, hyaline to light yellow in color, 23.83−29.86 × 41.05−47.06 µm, wall; hyaline, 4.42−7.42 µm thick, obscure, echinulate, rarely 1 germ pore; paraphyses present, light orange to dark brown in color, width from upper part 10−18 µm, in the middle 18−22 µm, while 114−128 µm in length, 2−6 µm apical thickness, wall 5−6 µm.

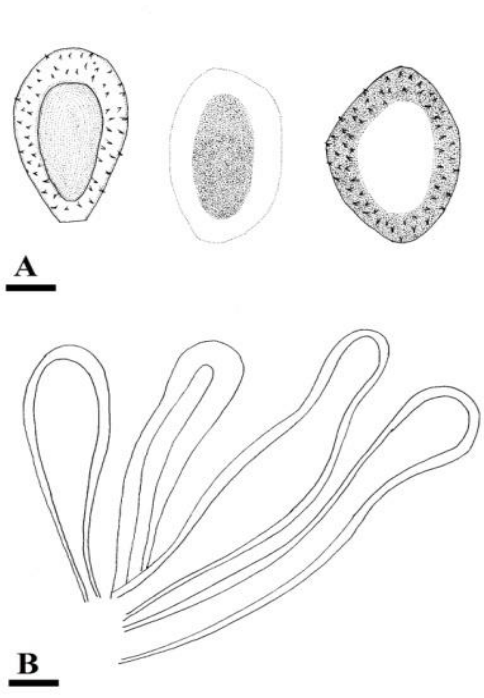
Material examined: On *Sonchus asper* Hill, with II stage, Pakistan, Khyber Pakhtunkhwa, Shangla district, at 1,820 m.a.s.l, 5th August, 2015. MU# 21.

Puccinia sonchi has been previously reported on *Sonchus arvensis* from Quetta, Upper Topa, Murree and Hazara [11-15].

Sonchus Asper is a new host record for *Puccinia since* from Pakistan.



FIGS. A−E: ***Puccinia sonchi*** (A−B). Infected host plant ***Sonchus asper*** (C−D) Urediniospores (E). Paraphyses and aeciospores. Scale bar for A= 1.17 cm, B= 10.42 mm, C= 110 µm, D= 20.97 µm E= 33.84 µm.



FIGS. A−B: Lucida drawings of ***Puccinia sonchi*** (A). Urediniospores (B). Paraphyses. Scale bar = 10 µm.

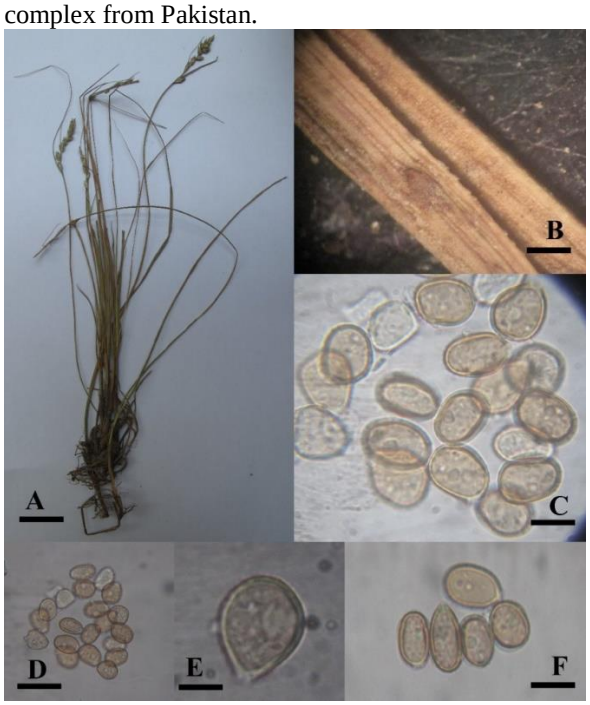
FIG. A: Lucida drawings of ***Puccinia coronata* var. *himalensis*** (A). Urediniospores. Scale bar for A= 6.20 µm.

Puccinia coronata* var. *himalensis Barclay,Trans. Linn. Soc. London 3(4): 227 (1891) Peturson, Can. J. Bot. 32: 42 (1934) SPERMOGONIA and AECIA unknown. TELIA absent. UREDINIA on abaxial surface, orange to dark brown, irregularly scattered. UREDINIOSPORES globose to sub globose and ellipsoid, 12−19 × 16.97−21.51 µm; germ pores 1−2, obscure, equatorial to sub equatorial, wall 1−2 µm thick, pale yellow to brown in color, echinulated.

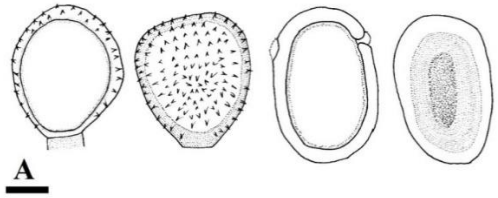
Material examined: On *Festuca pratensis* Schreb., with II stage, Pakistan, Khyber Pakhtunkhwa, Swat district, Kozshawar at 1421 m. a. s. l, 15th July 2015. MU# 22.

Puccinia coronata var. *himalensis* has been reported *Piptatherum vicarium* (Grigorj.) Roshev. (= *Oryzopsis microcarpa* Pilg.) and *Sporobolus coromandelianus* (Retz.) Kunth from Neelum valley, Muchal and Sharan (KP) [22].

Festuca pratensis is a new host for *P. coronate* species complex from Pakistan.



FIGS. A-F: ***Puccinia coronata* var. *himalensis*** (A−B). Infected host plant ***Festuca pratensis,***(C-F). Urediniospores. Scale bar for A= 2.2 cm, B= 0.5 mm, C= 12.8 µm, D= 38.48 µm, E= 7.69 µm, F= 16.03



µm.

CONCLUSION

Pakistan is highly enriched in wild flora which is continuously under the stress of different fungal pathogen among which rust fungi is common one. Host identification and host range plays key role in taxonomy of rusts because these are host specific. This study increase the host range of few uredinales in Pakistan. This data can be used to control the wild plants which are acting as weed in worldwide by using this rust.

ACKNOWLEDGEMENTS

We are highly obliged to Dr. Muhammad Fiaz, university of Hazara, Mansehra and Dr. Omar Paíno Perdomo (Dominican Society of Mycology, Santo Domingo, Dominican Republic) for acting as reviewers and giving valuable suggestions to improve the manuscript.

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