

# REVISED PERDOMO 4.27.2016

## NEW HOST RECORDS FOR *PUCCINIA GRAMINIS*, BLACK STEM RUST, IN PAKISTAN

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**ABSTRACT:** *Puccinia graminis* var. *stakmannii* is reported on a new host, *Glyceria tonglensis* from Pakistan. It is also a new record for *Nathia gali* (KPK). Moreover, *P. graminis* subsp. *graminicola* is a new record for Khanspur (KPK) and *Elymus semicostatus* is a new host for this fungus in Pakistan.

**KEY WORDS:** BLACK STEM RUST, POACEAE, RUST FUNGI.

### INTRODUCTION

The black stem rust fungus, *Puccinia graminis* Pers. (Pucciniales) is a common heteroecious species with plant species of Berberidaceae as aecial hosts and members of the Poaceae as telial hosts [1]. Cummins [2] lists hosts of 77 genera of Poaceae (primarily in subfamily Pooideae but also a few in panicoideae) containing species that harbor *Puccinia graminis*. It is a complex species consisting of numerous biologically specialized *formae speciales*, and has been divided into infraspecific taxa that differ mainly in urediniospore length. Urban's [3] morphological species concept is generally acknowledged as definitive. For example, Abbasi et al. [4] classified specimens according to urediniospore length and also found differences in number of germ pores. Urban further divided *P. graminis* into two subspecies, *P. graminis* subsp. *graminis* and *P. graminis* subsp. *graminicola* Z. Urb. Urban also divides the type subspecies into two varieties namely *P. graminis* subsp. *graminis* var. *graminis* and *P. graminis* subsp. *graminis* var. *stakmannii* [1]. From Pakistan, *Puccinia graminis*, *P. graminis* subsp. *graminicola* and *P. graminis* var. *stakmannii* have previously been recorded. In the present study, *P. graminis* var. *stakmannii* is reported on a new host, *Glyceria tonglensis* from Pakistan. Similarly, *Puccinia graminis* subsp. *graminicola* is a new record for Khanspur (KPK) and *Elymus semicostatus* is a new host for this fungus in Pakistan.

### MATERIALS AND METHODS

Rust infected plants were collected from different areas of Pakistan. 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. Drawings of spores and paraphyses were made using a Camera Lucida (Ernst Leitz Wetzlar, Germany). Spore dimensions were taken by an ocular micrometer. At least 25 spores were measured for each spore stage. The rusted specimens have been deposited in the herbarium of the Botany Department, at the University of the Punjab, Lahore (LAH).

### RESULTS & DISCUSSION

#### Description of species:

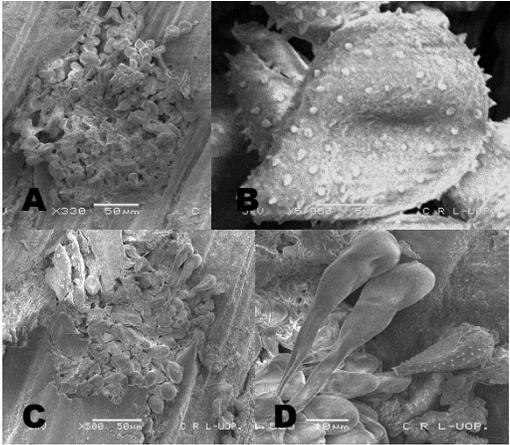
*Puccinia graminis* var. *stakmannii* A. L. Guyot, Massenot & Saccas ex Z. Urb., Česká Mykol. 21: 14 (1967).

FIGS. A–D

SPERMOGONIA and AECIA unknown. UREDINIA amphigenous, covered by the epidermis, light brown to golden brown, 0.09–0.2 × 0.1–0.4 mm. UREDINIOSPORES ovoid to obovoid or ellipsoid, 13–20 × 21–29 (–32) μm (mean 16.58 × 26.34 μm); wall 1.5–2 μm thick, pale brown to cinnamon brown, echinulate; germ pores 2–4 (–6), scattered, obscure; pedicel hyaline, 7–9 μm wide and up to 20 μm long. TELIA amphigenous, covered by the epidermis, dark brown to blackish brown, 0.1–0.5 × 0.2–0.8 mm. TELIOSPORES oblong to clavate or ellipsoid; wall 1.5–2 μm thick, cinnamon brown to chestnut brown but paler basally, mostly smooth; 15–21(–27) × 32–53 μm (mean 18.74 × 44.24 μm); apex mostly truncate, sometimes rounded to slightly conical, 6–10 μm thick; germ pores obscure; pedicel hyaline to light brown, 5–8 × 45–60 μm.

**MATERIAL EXAMINED:** PAKISTAN, KHYBER-PAKHTUNKHAWAH (KPK), Nathia Gali, at 2545 m a.s.l., on *Glyceria tonglensis* C.B. Clarke, stage II & III, 12 October, 2007, N.S.Afshan, NSA #B14 (LAH NSA1056).

COMMENTS: *Puccinia graminis*, *P. graminis* subsp. *graminicola* Z. Urb. and *P. graminis* var. *stakmannii* have previously been recorded on *Triticum aestivum* L. and *Bromus japonicus* from Swat state, Miana, Khanspur-Ayubia; on *Agropyron semicostatum* Nees. from Miana; on *Hordeum munroana* Aitch. & Hemsl. from Kaghan valley; on *Hordeum vulgare* L. from Faisalabad, and on *Cynodon dactylon* Pers. from Quetta [5-6, 7, 8]. *Puccinia graminis* var. *stakmannii* is a new record for Nathia gali (KPK) and *Glyceria tonglensis* is also a new host for this rust fungus in Pakistan.



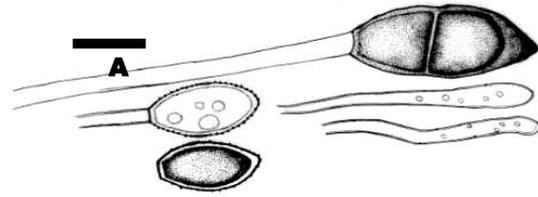
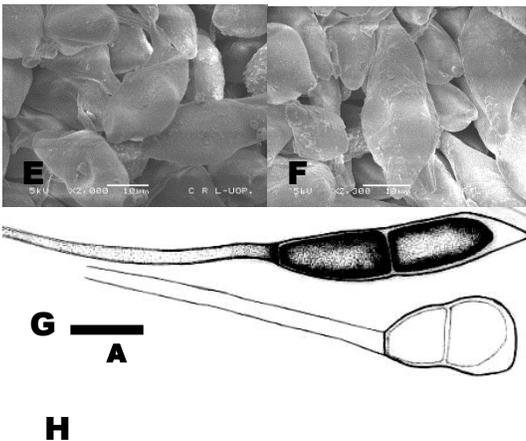
FIGS. A–D: *Puccinia graminis* var. *stakmanii*. SEM photographs A uredinium. Scale bar = 50  $\mu$ m. B: Mature urediniospores showing echinulate wall ornamentation. Scale bar = 5  $\mu$ m. C: Telium. Scale bar = 50  $\mu$ m. D: mature teliospores with a urediniospore. Scale bar = 10  $\mu$ m.

***Puccinia graminis* subsp. *graminicola* Z. Urb., Česká**

Mykol. 21: 14 (1967). FIGS. E–H

SPERMOGONIA and AECIA unknown. UREDINIA intermixed with telia, dark brown to black, mostly on the stalks and leaf sheaths. Urediniospores ovoid to ellipsoid, 13–18  $\times$  23–29  $\mu$ m (mean 15.2  $\times$  26.1  $\mu$ m), wall 1–2.5  $\mu$ m thick, hyaline to light brown, sparsely echinulate; germ pores 1–4, with hyaline papilla, equatorial. TELIA amphigenous, on stalks and sheaths, erumpent, black. TELIOSPORES oblong to ellipsoid, 15–24  $\times$  38–81  $\mu$ m (mean 18.3  $\times$  58.7  $\mu$ m); germ pore 1 in each cell, apical or sometimes sub-apical in the upper cell and near the septum in the lower cell; wall up to 2  $\mu$ m thick, light brown to chestnut brown, smooth; apex conical and 6–17  $\mu$ m thick. PARAPHYSES cylindrical to clavate, hyaline to light brown, 4–5  $\mu$ m wide and up to 47  $\mu$ m long. Pedicel long, light brown, persistent, 5–9  $\times$  80–135  $\mu$ m.

MATERIAL EXAMINED: PAKISTAN, KHAIBER PAKHTUNKHAWAH (KPK), Khanspur-Ayubia, at 2575 m a. s. l., on *Elymus semicostatus* (Nees ex Steud.) Melderis, with II + III stages, 15<sup>th</sup> September, 2006. NSA # 159061. (LAH Herbarium No. NSA 1054)



FIGS. E–H: *Puccinia graminis* subsp. *graminicola*. E–F: SEM photographs of teliospores. Scale bars E & F = 10  $\mu$ m. G: Lucida drawing of mature teliospores. H: Urediniospores and apices of paraphyses. Scale bars for G & H = 10  $\mu$ m.

COMMENTS: *Puccinia graminis* subsp. *graminicola* is a new record for Khanspur and *Elymus semicostatus* is a new host for this fungus in Pakistan.

**ACKNOWLEDGEMENTS**

I am thankful to Dr. Abdul Nasir Khalid and Dr. Abdul Rehman Niazi for their help and guidance during this research work. I am also highly obliged to Dr. Omar Paño Perdomo (Dominican Society of Mycology, Santo Domingo, Dominican Republic) for acting as reviewer and giving valuable suggestions to improve the manuscript.

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