



## Diversity of rust fungus *Puccinia* on *Justicia* Kumar S<sup>1</sup>, Singh R<sup>2</sup> and Gond DK<sup>3</sup>

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### Abstract

*Puccinia bagyanarayanii* sp. nov. was discovered on living leaves of *Justicia betonica* (*Acanthaceae*) in Madhya Pradesh, India. This species is described, illustrated, and compared with similar taxa. *Puccinia bagyanarayanii* has a longer pedicle and smooth-walled teliospores compared to similar species known on *Justicia*. A key to similar species of *Puccinia* found on *Justicia* is provided. Descriptions and nomenclatural details are deposited in Mycobank.

**Key words** – foliicolous rust fungi – fungal diversity – morphotaxonomy – new species – *Puccinia*

### Introduction

Amarkantak is situated at 22°41' N latitude and 81°46' E longitude in the Anuppur district of Madhya Pradesh, India, at an altitude of 1065 m. The climatic condition of the Amarkantak is humid, mesothermal and mesophytic throughout the year, and it is one of the richest sites for biodiversity in India.

During a periodic survey for an inventory of foliicolous fungi from Amarkantak, in 2011, a new species of rust fungus was collected on living leaves of *Justicia betonica* (*Acanthaceae*). Only the telial stage was found. It is characterized by the presence of brown to dark brown, stalked, spindle-shaped, smooth-walled spores. The new rust fungus is described and presented here in detail.

### Materials & Methods

Specimens with distinct disease symptoms on living leaves were collected near the forest of Amarkantak, Madhya Pradesh, India during the course of field trip. The samples were carried to the laboratory and processed by following standard techniques (Hawskworth 1974, Savile 1962). The sun dried and pressed leaf specimens were placed in air tight polyethylene bags and then kept in paper envelopes along with collection details. Photographs of infection spots on leaves were taken using a Sony DSC–5730 camera. Specimens for microscopic observation were prepared by hand sectioning and scrapings. Morphological descriptions are based on slide preparations mounted in clear glycerin from infected area of leaves. Observations were made with an Olympus BX–51 light microscope. Specimens were also examined by scanning electron microscopy (SEM) at the Birbal Sahni Institute of Palaeobotany, Lucknow, India. The specimens were coated with a thin layer of gold-palladium using a POLARON Sputter coater (180 seconds in nitrogen atmosphere of 20 mA,

30 mm distant from the electrode) and examined using a LEO-430 scanning electron microscope. The microphotographs were stored in electronic format and selected photos were merged together and arranged into a single photograph for each specimen in Photoshop (ver. 7.0). Detailed observations of morphological characters and line drawings were carried out at different magnifications through light microscopy and scanning electron microscopy. Measurements were made of 25 spores, with the extremes given in parentheses. The holotype has been deposited in Ajrekar Mycological Herbarium (AMH), Agharkar Research Institute (ARI), Pune, India and an isotype was retained in the herbarium of Birbal Sahni Institute of Palaeobotany (BSIP), Lucknow, India. Description and nomenclatural detail were deposited in MycoBank (www.MycoBank.org). The systematics of the taxon is given in accordance with Cannon & Kirk (2007), Kirk et al. (2008), and the Index Fungorum (www.indexfungorum.org; accessed 30 April 2015).

## Results

### Taxonomic description

*Puccinia bagyanarayanii* Sham. Kumar, R. Singh & D.K. Gond, **sp. nov.**

Figs 1–3

MycoBank No: MB 801938

**Etymology** – Species epithet honours Prof. (Dr.) G. Bagyanarayana, a renowned mycologist, for his enthusiastic support for the study of fungi of India particularly rust fungi.

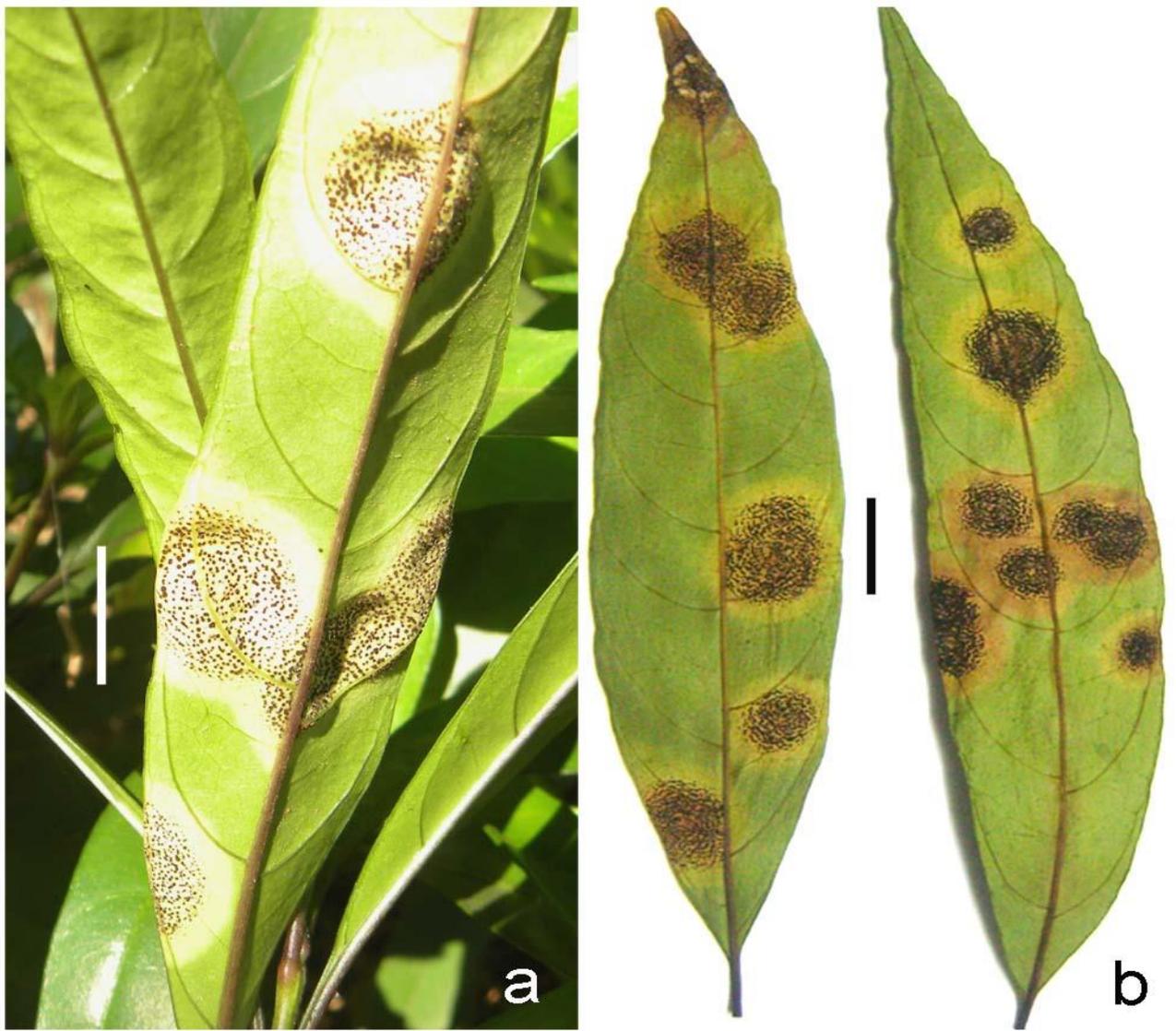
**Infection spots** on lower side of leaf, circular, subcircular to irregular, brown to dark brown, crust like, granular, 10–25 mm diam. (Fig. 1a, b). *Spermagonia* and *aecia* unknown. *Uredinia* not seen. *Telia* hypophyllous, grouped to compactly arranged and dispersed, becoming erumpent (Fig. 3a, b), 140–170 µm in height and (170–)330–400 µm in diam. (Figs 2c, 3a, b), bursting through epidermis of leaves (Fig. 3a, b), especially abundant on young and newly emerging leaves. Teliospores (25–)30–50(–68) × (15–)17–23(–28) µm, 2-celled, ellipsoid to cylindrical, moderately constricted at septum, conic-acute to round above, attenuate below, wall (1.5–)3–5(–5.5) µm thick, smooth, brown to dark brown (Figs 2d–f, 3c, d); pedicel commonly persistent, up to 180 µm long, 5–8 µm wide, sometimes obliquely attached, attenuate, hyaline to olivaceous (Fig. 2e, f).

**Material examined** – India, Madhya Pradesh, Amarkantak, near the origin of Narmada River, Forest Guest house, on living leaves of *Justicia betonica* L. (*Acanthaceae*), 3 November 2011, coll. Shambhu Kumar, AMH 9524 (**holotype**), BSIPMH 0001 (**isotype**).

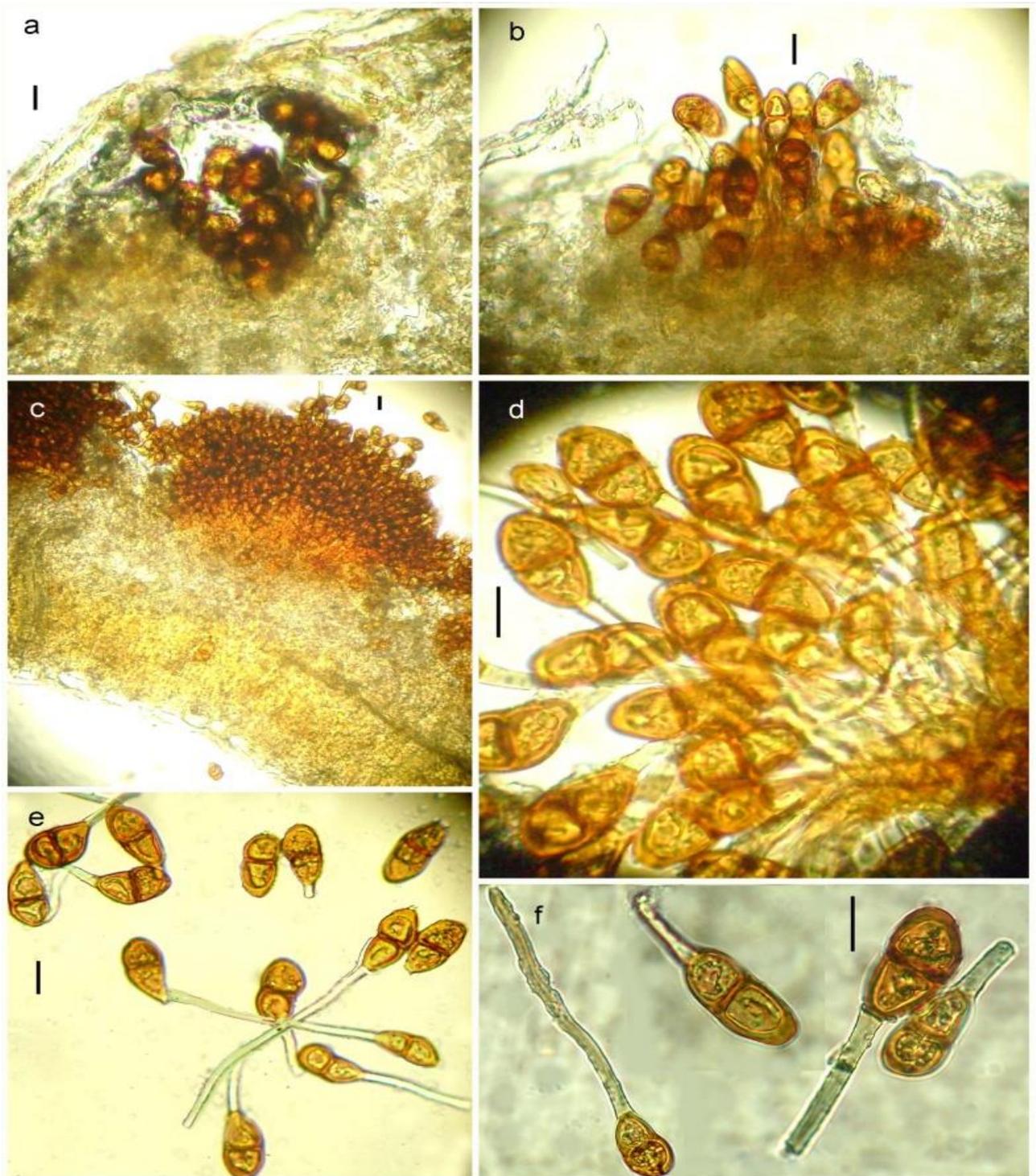
### Discussion

There are almost 20 species of *Puccinia* reported on *Justicia* (Farr & Rossman 2015). *Puccinia bagyanarayanii* is easily distinguishable from closely similar species viz., *P. justiciae* Puttemans (in Hennen et al. 2005), *P. thwaitesii* Berk. (Berkeley & Broome 1874) and *P. thwaitesii* var. *novo-guineensis* Henn. (in Saccardo 1902) reported on *Justicia pectoralis* Jacq., *J. gendarussa* Burm.f. and *Justicia* sp., respectively. The telia of *P. bagyanarayanii* are similar in size to those of *P. justiciae*, *P. thwaitesii* and *P. thwaitesii* var. *novo-guineensis* but the teliospores and their pedicels are longer. In addition, *P. justiciae* has verruculose/echinulate teliospores whereas those of *P. bagyanarayanii* are smooth.

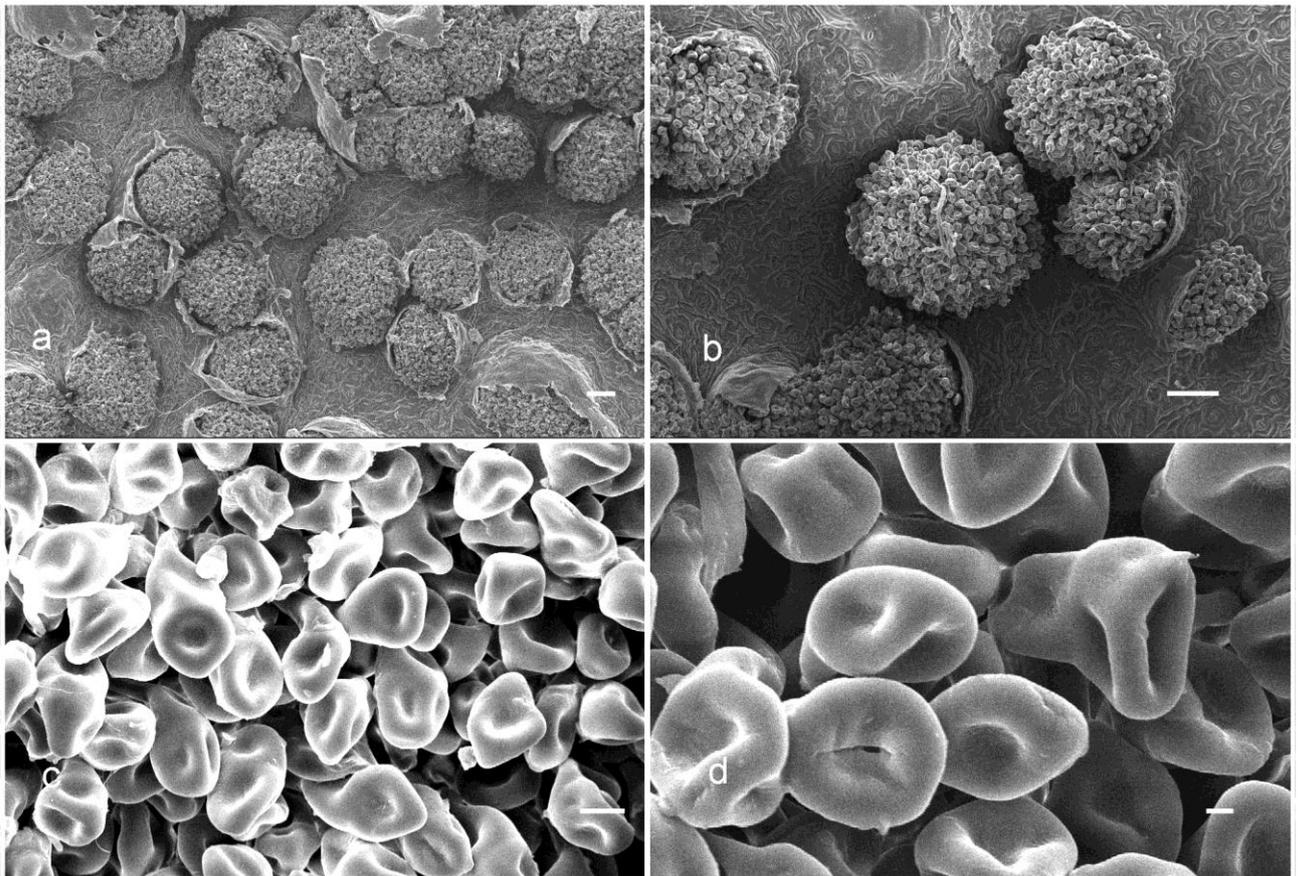
*P. bagyanarayanii* is also comparable to *P. thwaitesii* reported from India on *Justicia gendarussa* as a new record (Yadav & Sharma 2006). Unfortunately, the width of teliospores of *P. thwaitesii* is not given in the original publication (Yadav & Sharma 2006) so it was not possible to compare the novel species with this species. Moreover, *P. thwaitesii* Yadav & Sharma is found on different species of same host genus. Therefore, on the basis of comparative analyses *P. bagyanarayanii* is treated as a new species.



**Fig. 1** – *Puccinia bagyanarayanii* (AMH 9524, holotype) symptoms on leaves. a. Lower side of leaf. b. Early and late symptoms on lower side of leaves. Scale bars a, b = 20 mm.



**Fig. 2** – *Puccinia bagyanarayanii*, microscopic characteristics (AMH 9524, holotype). a. Immature teliospores below the epidermis. b. Semi-mature teliospores exposed outside by rupturing of epidermis. c–d. Fully developed telia. e–f. Mature teliospores. Scale bars a–f = 20  $\mu$ m.



**Fig. 3** – *Puccinia bagyanarayanii*, SEM characteristics (AMH 9524, holotype). a–b. Ruptured epidermis due to pressure of developing teliospores in telia. c–d. Teliospores at different magnification. Scale bars a, b = 100  $\mu\text{m}$ , c = 10  $\mu\text{m}$ , d = 3  $\mu\text{m}$ .

**Key to similar *Puccinia* species reported on *Justicia* spp.**

1. Uredinia present (0.2–0.5 mm diam), urediniospores 25–30  $\times$  20–26  $\mu\text{m}$ ; teliospores verruculose to echinulate, 31–44  $\times$  28–33  $\mu\text{m}$ , pedicel 40  $\mu\text{m}$  long, colourless.....*Puccinia justiciae* 1\*  
 1\*. Uredinia unknown.....2
2. Teliospores (25–)30–50(–68)  $\times$  (15–)17–23(–28)  $\mu\text{m}$ , smooth; pedicel up to 180  $\mu\text{m}$  long, colourless to olivaceous..... *Puccinia bagyanarayanii*  
 2\*. Pedicel shorter, up to 56  $\mu\text{m}$  long.....3
3. Teliospores 36–38  $\mu\text{m}$  long, smooth; pedicel 15  $\mu\text{m}$  long, brown..... *Puccinia thwaitesii*  
 3\*. Teliospores 20–50  $\times$  17–28  $\mu\text{m}$ , smooth; pedicel 30–56  $\mu\text{m}$  long, flavo-brown to hyaline.....*Puccinia thwaitesii* var. *novo-guineensis*

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