Report of *Phakopsora nishidana* (rust) Parasitic on *Ficus religiosa*, in Nepal

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ABSTRACT

During the regular survey of parasitic fungi in and around Kathmandu valley, a rust fungus was incidentally collected. Later it was identified as *Phakopsora nishidana* S. Ito (a rust fungus) found parasitic on *Ficus religiosa* L. (Peepal tree). The material was gathered from Lainchour, Kathmandu, Nepal. Among the rust fungus prevailing in Nepal, it is the first report of *Phakopsora nishidana* S. Ito (family Phakopsoraceae of Pucciniales order) parasitic on Ficus religiosa L. (a fig family plant).

Key words: Rust, Geographic distribution, Himalaya, Nepal, New record

1. INTRODUCTION

Nepal situated in the lap of the central Himalaya, embraces broad range of many interesting mycodiversity under its six diverse topographical and climatic zones. It is the zone of immense biodiversity, dominance, dynamics and the center for origin of Himalayan fungi. It stills needs more exploration and investigation on mycoflora in future also. In addition to diverse indigenous plants, numerous alien species have invaded naturally and or introduced for commercial purposes.

The present paper deals with *Phakopsora* (a rust fungus) which falls under the family Phakopsoraceae of Pucciniales (Kirk *et al, 2008* and *Species Fungorum* (2022).

Previously the rust fungi on *Ficus religiosa* (peepal tree) was known to be caused by the traditionally named *Cerotelium fici,* but the recent molecular studies have identified that *Phakopsora nishidana* is a significant, and perhaps more common, agent of fig rust (specifically on *Ficus carica* and related species). This rust infects several *Ficus* species, including *Ficus religiosa, Ficus benghalensis* and *Ficus carica.* It is characterized by small, spots on the upper leaf surface and rust-colored pustules on the lower surface. The infection often causes chlorosis, necrosis, and premature defoliation. (Boshoff *et al,* 2022). The causal

agent of rust on figs in New Zealand was determined using molecular and morphological analyses to be *Phakopsora nishidana* S. Ito and not *Cerotelium fici* (Padamsee & McKenzzie 2024).

Ficus religiosa L.is distributed in Eastern Himalaya (Bangladesh, Bhutan, Nepal, India, Pakistan), the Nicobar Islands, Thailand, Myanmar, and Peninsular Malaysia.

The checklist of rust fungi reported from Nepal record eight species of *Phakopsora* by different authors. But none of the following paper record the present rust on *Ficus religiosa* (Ono *et al,* 1995). They are as follows: *Phakopsora ampelopsidis* Diet. & Syd., on *Parthenocissus semicordata* (Durrieu, 1980; Ono *et al,* 1990); *P. artemisiae* Hirats., on *Anaphalis busua* (Durrieu, 1980; Ono, *et al,*, 1990), *A. margaritacae,* A. *triplinervis* and *Artemisia* sp. (Ono *et al,*1990); *P. cronartiformis* Diet. on *Parthenocissus semicordata* (Durrieu, 1980; Ono *et al,*1990)*; P. gossypii* (Arth.) Hirats. f., on *Gossypium arboreum* (Manandhar, 1977); *P. incompleta* (Syd. & Syd.) Cumm., on *Microstegium ciliatum* (Durrieu, 1980; Ono *et al,* 1990) *M. nudum, Microstegium* sp and *M. viminium* (Ono *et al,*1990); *P. meliosmae* Kusano, on *Meliosma dilleniifolia* (Durrieu, 1980; Ono *et al,* 1990) and *M. pungens* (Durrieu, 1980); *P. pachyrhizi* Syd. & Syd., on *Amphicarpaea ferruginea* (Ono *et al,* 1990) and *Glycine max* (Manandhar, 1977; Singh, 1968; Ono *et al,*, 1990)*; P. punctiformis* (Barcl. et Diet.) Diet., on *Galium asperifolium* (Durrieu, 1980) and *Rubia manjith* (Drrieu, 1987).

2. MATERIAL AND METHOD

During the course of investigation of parasitic fungi, a rust parasitic on *Ficus religiosa was* gathered at Lainchour, Kathmandu. Photograph was taken and the study was done in the laboratory under microscopic power of 10 x 10 and 40. The identification of the material was done in Japan (Y. Ono), at University of Tsukuba, Laboratory of Plant Parasitic Mycology, and Aime Mycology Lab at Purdue University, U.S. A. The scanning microphotograph was done in Japan [Olympus BX 51 equipped with differential interference contrast (DIC) equipment and Olympus DP21 digital camera (Olympus, Tokyo, Japan)]. The specimen has been deposited in National Herbarium and Plant Laboratory, Godavary, Lalitapur, Nepal.

3. DESCRIPTION

Phakopsora nishidana S. Ito, (1938) *Transactions of the Sapporo Natural History Society* 15 117 (1938); Padamsee, & McKenzie, 2024 *Phakopsora nishidana* is the causal agent of rust on figs in New Zealand, *Australasian Plant Disease…* DOI:10.1007/s13314-024-00528-3

Upper leaf surface: Initial symptoms appear as small, yellow or tan flecks and then develop into brown that may merge to form larger necrotic areas. Lower leaf surface: raised, bright rusty pustules (uredinia) form the underside of the leaves. These pustules contain the urediniospores. The hypophyllous uredinia were surrounded by necrotic leaf tissue, visible as dark brown to black spots on upper leaf surfaces. The hypophyllous uredinia were scattered often on reddish brown angular leaf spots.pale reddish brown, circular, up to 0.5 mm diam. with a few inconspicuous, hyaline, thin-walled, cylindric to clavate paraphyses. Urediniospores 20–32× 15.–21 µm, globose, obovoid, ellipsoidal or angular, contents very pale yellow; wall 0.5–1 µm thin, very pale yellow or hyaline, sparsely echinulate, germ pores obscure. Telia not known in Nepal.

Specimen examined - *Ficus religiosa* L.,Lainchour, 2082 6.28 (14, Oct, 2025), No 2092.8 (NHPL, Kath) **(Fig. no 1- 6)**

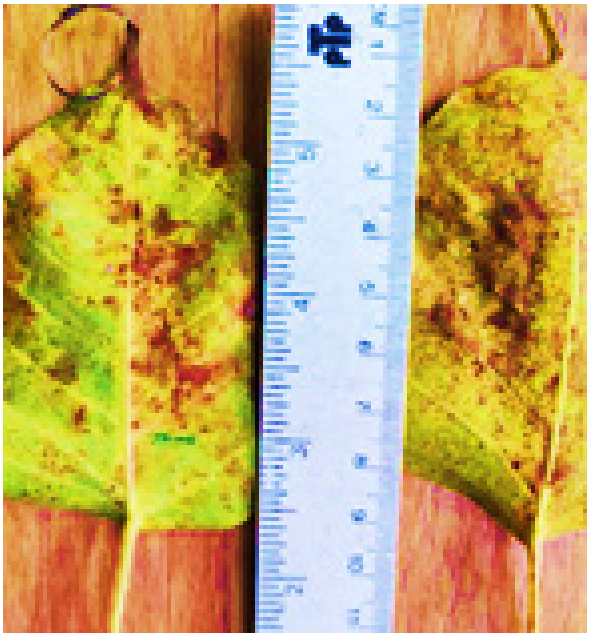

Fig 1: *showing Phakopsora sp. on Ficus religiosa.*

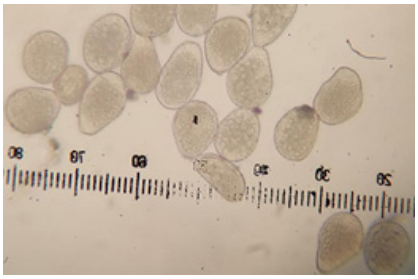

Fig 2: *Urediniospores*

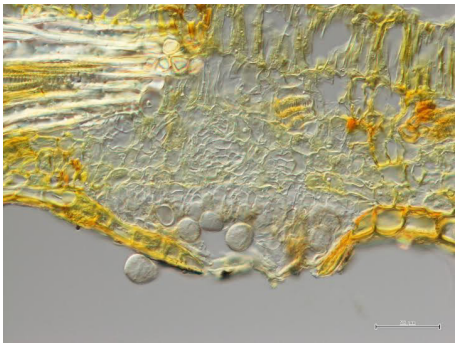

Fig 3: *SEM section through leaf*

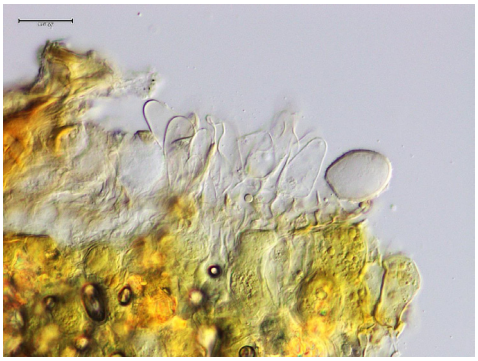

Fig 4: *showing Phakopsora sp.with thin-walled paraphyses and uredinia at hymenia and margin.*

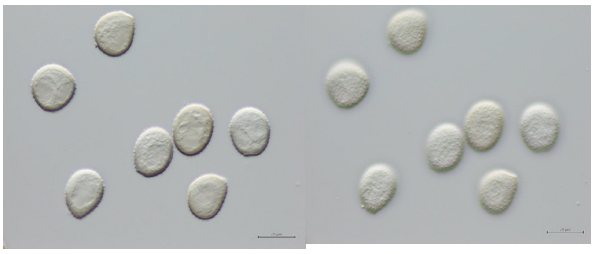

Fig 5 and 6: *Urediniospores*

4. DISCUSSION

Phakopsora nishidana has been confirmed from South Africa and New Zealand, Two recent publications, one focusing on *C. fici* on *Morus nigra* (mulberry) and another on *Phakopsora nishidana* S. Ito (Ito and Homma 1938) on *F. carica* (Boshoff *et al.* 2022), raised the question whether the rust on figs in New Zealand was *C. fici*. The DNA sequencing and the measurements of the urediniospores in *P. nishidana* in South Africa (SA) matched that of those reported for *C. fici* from Brazil but the urediniospores of the rust on *Ficus* in New Zealand, were (19.5–) 24–30 (–35) x (14–)16–20 (–22) µm, globose, obovoid, ellipsoidal or angular, wall 0.5–1 µm thick, pale, sparsely echinulate, germpores obscure in current collections, (3–4) and equatorial (Boshoff *et al.* 2022; Padamsee & McKenzie, 2024).

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