

A Rust Disease on *Gendarussa vulgaris* Nees. Caused by *Puccinia thwaitesii* Berk.

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Keywords: Leaf rust disease; medicinal plant; *Puccinia thwaitesii*.

ABSTRAK

Gendarussa vulgaris Nees., suatu tanaman herba perubatan yang biasa ditemui, telah didapati teruk dijangkiti oleh penyakit karat. Ciri-ciri/pertanda penyakit ini dapat dilihat pada lesion-lesion cekung atau cembung yang berwarna kelabu-ungu, dikelilingi oleh halo kuning yang luas di atas permukaan adaksial daun dan lesion-lesion cembung atau cekung yang sepadan dipermukaan abaksial yang bertentangan. Daun-daun yang berpenyakit gugur sebelum matang. Agen penyebab telah dikenalpasti sebagai *Puccinia thwaitesii* Berk. Kulat ini mengeluarkan kedua-dua uredospora dan teliospora di atas pustul yang sama dan adalah merupakan karat autesiuis mikrosiklik (hemi-form).

ABSTRACT

Gendarussa vulgaris Nees., a common medicinal herb, was found to be severely infected by a rust disease. The disease was characterised by well defined, concave or convex, purplish-gray, discoloured lesions surrounded by a wide yellow halo on the adaxial surface and corresponding convex or concave lesions on the opposite abaxial surface. Infected leaves abort prematurely. The causal agent was identified as *Puccinia thwaitesii* Berk. The fungus produced both uredospores and teliospores on the same pustule and is a microcyclic (hemi-form), autoecious rust.

INTRODUCTION

Gendarussa vulgaris Nees (syn. *Justicia gendarussa* L.), a monotypic genus of the family Acanthaceae, and colloquially known as 'gandarusa' ('ghanda' in sanskrit meaning fragrance and 'rusa' in Malay meaning deer) is a common medicinal herb and is also used as an ornamental hedge plant. The plant is renowned as a traditional cure for many ailments, such as stomach swelling, lunacy, snake-bite, rheumatism, debility, and as a decoction for worms (Burkill 1966). It is also used as a protective charm to ward off evil by superstitious folks. The crop plant in the Universiti Pertanian Malaysia (UPM) herbarium garden was recently found to be severely infected by a leaf rust disease. This paper reports on the symptomatology, identification and characterisation of the

pathogen. Some aspects of the epidemiology of the rust are also discussed.

MATERIALS AND METHODS

Rus infected leaves of *G. vulgaris* were collected from the medicinal plant herbarium in UPM campus for microscopic examination and histopathological investigations. Histopathological sections of the infected leaves with varying degrees of rust pustule development were made following standard histological methods of Sass (1958). Adjacent plants and undergrowth which included weeds near *Gendarussa* host plants were also examined thoroughly for rust incidence. Fallen diseased leaves and plant host debris in the immediate vicinity were also collected for study.

RESULTS AND DISCUSSION

Symptomatology

The rust causes well-defined, discoloured, purplish-gray, necrotic lesions, 6-15 mm in diameter, surrounded by a distinct yellow halo on the upper leaf surface (Fig. 1). Such lesions may be convex (bulged) or concave (sunken) on the upper leaf surface and correspondingly concave or convex on the opposite leaf surface.



Fig. 1. Upper leaf surface showing the distinct concave or convex, discoloured, necrotic lesions and yellow halo.

Severely diseased leaves often become distorted because of such lesions. When adjacent lesions coalesce, the yellow peripheral area enlarges. Subsequently the whole leaf turns yellow with discrete pockets of purplish-gray islands (Fig. 2). One to 16 lesions can occur on any one leaf. Infected leaves abort prematurely in great numbers.

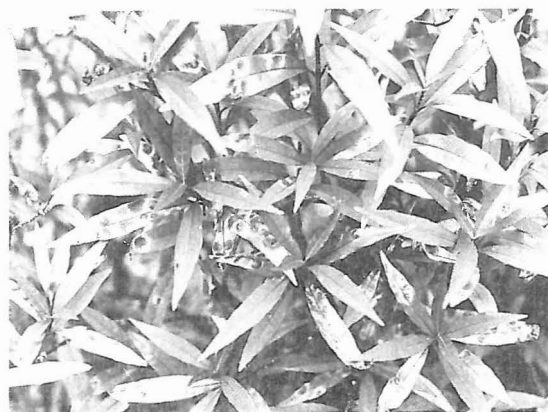


Fig. 2. Gendarussa plants severely infected by *Puccinia thwaitesii*.

Telia are most frequently observed on the lesions. They appear as minute, pin-size, powdery, brownish-black specks which are formed in well defined clusters on the undersurface of the lesions surrounded by a light green halo on the abaxial leaf surface (Fig. 3). On some lesions, uredia can be seen surrounding the telia forming tiny light-brown blisters usually in a concentric ring or rings around the cluster of telia on the same lesion or sometimes scattered amongst the telia. Both telia and uredia are frequently found to be overgrown by a *Fusarium* mycoparasite which imparts a whitish, cottony growth over the purplish-brown rust pustules (Fig. 3). The parasitism of this mycoparasite will be discussed in a separate paper.



Fig. 3. Lower leaf surface showing the purplish-brown rust pustules, some of which are parasitized by a *Fusarium* mycoparasite which produced a white turf of mycelia over the pustules.

Transverse sections of the infected leaves reveal that the hyphae of the fungus proliferate between the cells of the mesophyll and palisade. The rust pustules protrudes through the lower leaf surface through stomatal openings.

Pathogen

The rust fungus is identified as *Puccinia thwaitesii* Berk. Two stages of the rust fungus can be observed on some necrotic lesions on the leaves viz. teliospores (Fig. 4) and urediospores (Fig. 5). However, teliospores are more frequently and abundantly produced. Teliospores are dark-brown, two-celled, ellipsoidal, or clavate, slightly constricted at the septum and slightly attenuated below, $36.8 \pm 4.8 \times 19.7 \pm 1.7$ μm . The teliospore wall is smooth and very

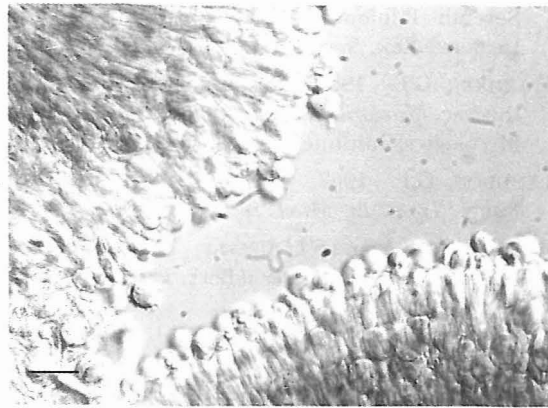
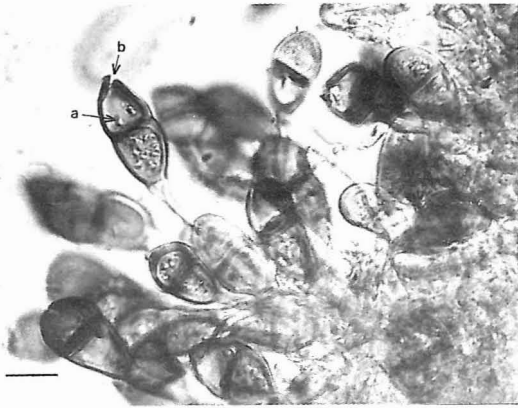


Fig. 4. Micrograph of a telia showing the thick-walled, two-celled teliospores. Note the two nuclei (arrowed a) and the pore (arrowed b). Bar = 18 μ m.

Fig. 5. Micrograph of a uredia showing the echinulated thin-walled uredospores borne on closely-packed pedicels. Bar = 42 μ m.

finely reticulate of approximately $2.6 \pm 0.2 \mu$ m thick at the side and $3.65 \pm 1.1 \mu$ m thick above, with one or more pores; pedicels are basal and persistent, paler than the spores, smooth, with variable length of $74.2 \pm 17.0 \mu$ m. Teliospores always give rise to basidiospores (Laundon 1967). However, this was not observed on the host lesions. Uredia are amphigenous, occurring in concentric rings in association with telia on some lesions. Urediospores are pale-brown, ellipsoidal to obovoidal, unicellular, and echinulate, $21.2 \pm 2.0 \times 24.4 \pm 2.5 \mu$ m, usually 2 pores at the equatorial region. The uredospore wall is amber, and 1.5 μ m thick. Uredospores are borne singly on pedicels which arise in compact clusters.

This rust was first reported by Parandekar and Ajrekar (1932) in India on the same host. They observed that this rust fungus produced only teliospores which germinated immediately. This was also reported by Laundon (1963). Payak (1952) reported that the diploidisation process in the telial primordia of *Puccinia thwaitesii* occurred through cell fusion rather than by nuclear migration. However, in rusts, telia can originate from aeciospores or uredospores (Laundon, 1967).

Epidemiology

The rust fungus has a microcyclic life cycle (Hawksworth *et al.* 1983), producing uredospores and teliospores which will produce basidiospores. No pycnial or aecial stages were present. Using the terminology of Peterson

(1974), this rust can be regarded as hemi-form as it possesses stage II (uredospores), stage III (teliospores) and stage IV (basidiospores). Since only *G. vulgaris* was infected and not the weed species in the immediate vicinity, the fungus appears to be autoecious without an alternate host. Teliospores were more abundantly produced than uredospores. Most of the diseased leaves which fell to the ground contained more teliospores than urediospores indicating teliospores to be more important in disease spread. Fallen infected leaves appeared to serve as an important inoculum source. Disease spread within plants was observed to be by water splash and crawling insects, but between plants, wind may be more important.

Many of the telia and uredia were found to be naturally parasitized by a mycoparasite which formed whitish tufts of mycelia over the rust pustules. The *Fusarium* mycoparasite may play an important role in the secondary spread of the rust pathogen. However, further studies are needed to confirm the identity of the mycoparasite and its relationship and importance to the epidemiology of the rust disease.

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(Received 15 September, 1988)