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

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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 ‘ganda rusa’ (‘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 renown 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
Rust 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 ± 4.8 x 19.7 ± 1.7 μm. The teliospore wall is smooth and very
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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 μm.

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

finely reticulate of approximately 2.6 ± 0.2 μm thick at the side and 3.65 ± 1.1 μm thick above, with one or more pores; pedicels are basal and persistent, paler than the spores, smooth, with variable length of 74.2 ± 17.0 μm. Teliospores always give rise to basidiospores (Laundon 1967). However, this was not observed on the host lesions. Urediospores are pale-brown, ellipsoidal to obovoidal, unicellular, and echinulate, 21.2 ± 2.0 x 24.4 ± 2.5 mm, usually 2 pores at the equatorial region. The uredospore wall is amber, and 1.5 μm thick. Urediospores 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 primodia of *Puccinia thwaitesii* occurred through cell fusion rather than by nuclear migration. However, in rusts, telia can originate from aeciospores or urediospores (Laundon, 1967).

*Epidemiology*

The rust fungus has a microcyclic life cycle (Hawksworth et al. 1983), producing urediospores 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 urediospores. 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.

*REFERENCES*


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