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The cause, incidence and severity of a new gall damage on *Eucalyptus* species at Oruchinga refugee settlement in Mbarara district, Uganda

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Abstract

A survey was conducted at Oruchinga refugee settlement in Mbarara district, Uganda in November 2003 to determine the cause, incidence and severity of a gall damage on *Eucalyptus* species in nursery and woodlots. *Leptocybe invasa* (Hymenoptera: Eulophidae), a tiny black wasp commonly known as blue gum chalcid, was found to be the cause of the gall damage on *Eucalyptus*. The wasp attacked field planted seedlings and saplings, but not seedlings in the nursery. The incidence and severity of the wasp attacks were markedly higher on *Eucalyptus grandis* than *E. saligna*. Research is urgently needed to develop Integrated Pest Management (IPM) strategies against the new *Eucalyptus* pest.

Key words: Alien insects, Galls, *Leptocybe invasa*, pest management, tree plantation

Introduction

Tree growing is important to many small-scale farmers and rural communities in Uganda. Fast growing exotic species such as *Eucalyptus* provide the much needed tree products, and help to protect watersheds, stabilise deforested slopes while their timber can be sold for income. Many donor projects in Uganda promote the planting of *Eucalyptus* for local farmers in order to meet this premise. For example, the Integrated Rural Development Initiative (IRDI), a non-profit making non-governmental organisation, is currently implementing a *Eucalyptus* planting programme in some refugee settlements in Uganda to protect the environment while ensuring sustainable supply of tree products in the settlements. Similarly, commercial companies such as British American Tobacco (BAT) also encourage the establishment of *Eucalyptus* woodlots as an alternative supply of timber and fuelwood. However, to succeed, such schemes require good management and good management depends on knowledge of production constraints, including pests and diseases.

A new and threatening gall damage has recently been observed on *Eucalyptus* species in Uganda. *Eucalyptus* farmers from Apac, Kasese, Rukungiri, Kanungu, Ntungamo, Jinja and Tororo have reported the gall injury as serious on their woodlots. The objective of this study was to determine the cause, incidence and severity of the gall problem in *Eucalyptus* nursery and woodlots at Oruchinga refugee settlement. This study was the first in Uganda to make an appraisal of the gall damage on *Eucalyptus* and longer-term needs for research on the damage.

Materials and methods

This study was conducted at Oruchinga refugee settlement in November 2003. The refugee settlement is located in Isingiro county, Mbarara district in southwestern Uganda. Mbarara district lies in the southern drylands agroecological zone of Uganda with annual temperatures ranging from 25-27 °C. The district receives low rainfall (mean annual rainfall averages about 1000 mm), and is characterised by short grassland where extensive grazing prevails. The rangelands are characterised by scattered *Acacia* species that provide shade for animals.

During the survey, 3-month old *Eucalyptus grandis* seedlings in one nursery, 1-year old *E. grandis* woodlot, and woodlots of *E. saligna* established in September 2001,

February 2003 and April 2003 were examined for the new gall damage. Five sampling plots each measuring 50 cm x 30 cm and comprising of 20 potted seedlings were randomly established in the nursery, which had only one transplant bed of *E. grandis* seedlings. All the woodlots were adjacent to each other with areas ranging from 1 - 7 hectares. A total of 12 plots, each measuring 8m x 6 m and consisting of 20 *Eucalyptus* trees, were randomly established in these woodlots in order to quantify the gall damage. Every tree seedling or sapling in each plot (in the nursery and woodlots) was scored for the incidence and severity of galls. For each *Eucalyptus* species and age category, gall incidence was expressed as the percentage of total plants (*Eucalyptus* seedlings or saplings) having galls. The severity of galls was scored on four scales outlined below:

- none (trees with no gall damage)
- minor (trees with galls on less than 25% of total shoots)
- moderate (trees with galls on between 25-50% of total shoots)

? severe (trees with galls on more than 50% of total shoots)

Samples of gall-infested shoots were cut from each of *E. grandis* and *E. saligna* and kept separately in two polythene bags overnight. Samples of wasps that emerged from the galls were collected from the bags and preserved in vials under 70% alcohol and sent for authoritative identification at the Royal Museum for Central Africa (RMCA) at Tevuren, Belgium. The identification of the samples from RMCA was confirmed at CSIRO Entomology, Australia.

Results and discussion

Cause of gall damage

Leptocybe invasa (Hymenoptera: Eulophidae) was identified to be the cause of the gall problem on *Eucalyptus*. Trees that were severely attacked by the wasp showed stunted growth and gnarled appearance (Figure 1). Small circular holes, indicating exit points of adults, were common on the galls. *Leptocybe invasa* has recently been described s a new taxon of Australian origin (Mendel et al., 2004). The adult of *L. invasa* is a very small (1.0 -1.4 mm long) black wasp, which lays eggs in the bark of shoots or the midribs of leaves and the developing larvae induce coalescing galls to form on the host plant tissue (Mendel et al., 2004). Such galls can cause the twigs to split, destroying the cambium (Bain, 1977).

Incidence and severity of gall damage

The gall problem occurred on woodlots of both *E. grandis* and *E. saligna* that were bought from nurseries in Mbarara town, but not on the *E. grandis* seedlings in the nursery visited at Oruchinga (Table 1). The highest incidence (69%) of galls was observed in a one-year *E. grandis* woodlot. In contrast, the incidence of galls on *E. saligna* was generally low (10 -11%) with no marked difference exhibited between the 7-month, 9-month and 2-year old woodlots of this species (Table 1). These results clearly indicate that *E. grandis* is more susceptible to the wasp than *E. saligna*. The gall problem was first observed in the woodlots only 3 months before this survey (E. Basamera, personal communication). The 69% incidence on *E. grandis* thus suggests that the damage was fast spreading on the species.

Figure 1: Healthy (left) and gall-infested (right) shoots of Eucalptus grandis.

The majority of *E. grandis* seedlings (75%) attacked by the wasp showed moderate (42%) to severe (33%) gall damage (Table 2). The few *E. saligna* trees that were attacked by the wasp mostly showed minor or moderate

gall severity. In the 2-year old woodlot, the gall damage occurred mostly on leaf midribs, resulting into curling of leaves across their midribs. Curled leaves had many galls, often coalesced, along their midribs. Because of the short duration of this study, it was not possible to determine whether or not the observed leaf curling started after the galls had coalesced. Similar wasp attack was recently observed to be severe on *E. saligna* and *E. camaldulensis* in western Kenya, but not *E. citriodora* (G. Hailu, personal communication). Israel, Mendel et al. (2004) observed no *L. invasa* attack on saplings and adults of the hybrid *E. torwood* (*E. torquata* x *E. woodwardii*) and saplings of *E. gomphocephala* and *E. occidentalis*.

Leptocybe invasa is apparently not only a new pest in Uganda, but in sub-Saharan Africa. It has is recently been reported as a pest of *Eucalyptus* in Algeria, Iran, Israel, Italy, Jordan, Kenya, Morocco, Spain, Syria, and Turkey (Mutitu, 2003, Mendel et al., 2004; P. Barklund, personal communication). Reports also exist on severe galls caused by *Epichrysocharis* species (Hymenoptera: Eulophidae) on *E. citriodora* and *Ophelimus* species (Hymenoptera: Eulophidae) on *E. globulus* in California and New Zealand respectively (Downer, 1999; Withers et al. 2000). There is, however, apparently no report on *L. invasa* infestations on *Eucalyptus* in southern Africa. Its appearance in the Mediterranean and North Africa and now in Kenya and Uganda suggests that the pest is spreading from north to southern Africa.

Table 2: Severity of galls on *Eucalyptus grandis* and *E. saligna* in Oruchinga refugee settlement, Mbarara district.

Species	Age	No. of plants* sampled	Severity (% of plants samples)			
			None	Minor	Moderate	Severe
E. grandis	Nursery	100	100.0	0.0	0.0	0.0
E. grandis	1 year	80	31.3	17.5	28.8	22.5
E. saligna	7 months	40	90.0	2.5	5.0	2.5
E. saligna	9 months	40	90.0	7.5	2.5	0.0
E. saligna	2 years	80	88.8	5.0	5.0	1.3

* plants refer to *Eucalyptus* seedlings and seedlings

Control strategies and research needs

The wasp attack at Oruchinga refugee settlement requires immediate control action. For a more targeted control application, there is a need to understand the life history (i.e. the number of generations of the wasp per year, when the eggs are laid and when adult emergence occurs) of the pest in uganda. Thus research is necessary to monitor the population dynamics of the pest. In addition, the resistance shown by *e. Saligna* in this survey is encouraging, and indicates the need for further surveys and evaluation on wider spatial and temporal scales to identify wasp susceptible and resistant *eucalyptus* species, provenances or clones. Systemic insecticides such as dimethoate and salut (active ingredients: Dimethoate and chlorpyrifos) have applied to control *l. Invasa* at oruchinga (*e. Basomera*, personal communication), but there is a need to determine the precise application rates. In addition, because of increasing concerns on the adverse effects of some chemicals on the environment, the use of insecticides in controlling *l.invasa* may be best suited in nurseries to raise healthy and vigorous seedlings for field planting.

The widespread of *l. Invasa* in the mediterranean, and now in africa, and the fact that the genus *leptocybe* is not a pest as yet in australia, suggests that in australia, natural enemies play a significant role in reducing this wasp species below the observation threshold (mendel et al., 2004). Identification of the natural enemies from australia is thus necessary for initiating studies on classical biological control in the new areas colonized by the pest. Overall, there is a need to develop integrated pest management (ipm) strategies against *l. Invasa*.

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