Evaluation of Blue Gum Chalcid Infestation in Eucalyptus Woodlots in Western Kenya

Otuoma, J. and Muchiri M. N.

Paper Presented at 3rd KEFRI Scientific Conference, 6th – 9th, November 2006
Kenya Forestry Research Institute
Email: jmotuoma@yahoo.com

Abstract

Blue gum chalcid (BGC), *Leptocybe invasa* (Fisher & LaSalle), is a gall-forming wasp that belongs to the insect order Hymenoptera, family Eulophidae. It attacks a wide range of *Eucalyptus* species mostly between the seedling stage and five years of age. BGC causes damage to eucalypts by forming bump-shaped galls on the leaf midribs, petioles and stems. Severe infestation is manifested by twisted and knobbed leaves. The aim of this study was to establish the spatial distribution of BGC and extent of host plant damage in *Eucalyptus* woodlots in western Kenya. The study was carried out in six permanent sampling plots in *Eucalyptus* woodlots in Busia, Bungoma, Kakamega and Nyando. Trees were assessed for crown damage by estimating and classifying the density of galls on the leaves into four levels of infestation: low (less than 50% of the foliage canopy with galls and no twisted or knobbed leaves), moderate (greater than 50% of foliage with galls and less than 50% of leaves twisted and knobbed), high (greater than 50% of the leaves twisted and knobbed, galls on the twigs and some twigs deformed) and severe (greater than 50% of the twigs deformed and regeneration foliage observed). An evaluation of the pest's infestation and extent of host plant damage indicated that, 4% of the trees had severe infestation; 5% high; 20% moderate and 70% low. Approximately 1% of the trees died as a result of loss of foliage attributable to severe infestation. Other observations from this study were that the severity of BGC infestation tended to decline as trees grew older and BGC infestation retarded tree growth.

Keywords: *Eucalyptus*, *Leptocybe invasa*, infestation, host plant damage, growth

Introduction

Cultivating fast growing and high utility exotic tree species has been identified as a possible remedy to a fast diminishing natural forest cover and an ever increasing demand for wood products in Kenya. Such species include Eucalypts whose popularity is attributed to their ability to adapt to diverse ecological habitats, fast growth and high utility. It is estimated that Kenya has about 100,000 ha of *Eucalyptus* plantations, of which 15,000 ha is managed by the Forest Department, 45,000 ha by private companies and 40,000 ha by small-scale farmers. These plantations and other *Eucalyptus* formations on farms provide 70% of rural household energy needs in western Kenya, transmission poles, pulp, and energy for curing tea and tobacco.

Eucalyptus species have been relatively free of pests and diseases. However, a new pest of *Eucalyptus*, Blue gum chalcid (GBC) and scientifically known as *Leptocybe invasa* (Fisher & LaSalle) was reported in Busia district in November 2002. It attacks a wide range of *Eucalyptus* species mostly between the seedling stage and five years of age. The pest lays its eggs on the bark of shoots or midrib of leaves, which develop into larvae within the host plant. The developing larvae induce the formation of bump-shaped galls on the leaf midribs, petioles and stems of the host plant tissue. Heavily infested trees manifest gnarled leaves with the terminal leader shoot degenerating into a lateral shoot thereby causing stunted growth. This paper outlines the results of a study by the Kenya Forestry Research Institute over the past 3 years on the spatial distribution of the pest, its population dynamics and extent of damage to host trees in western Kenya.

Materials and methods

Permanent sampling plots were established in *Eucalyptus* woodlots in Busia, Bungoma, Kakamega and Nyando. Busia had three sampling plots, while each of the other districts had one, bringing the total number of sampling plots to six. Parameters of assessment included tree crown, height and dbh. Woodlots made up of 20 rows and 10 trees per row had all the rows assessed, with at least 6 trees being assessed in each row. Woodlots made up of 30 rows and 15 trees per row had the 1st row assessed followed by every 3rd row. At least 10 trees were assessed in each row. Woodlots made up of 45 rows and 20 trees per row, had the 1st row assessed followed by every 4th row. At least 15 trees were assessed in each row. All the rows and trees that were assessed were marked and labelled for easy identification during subsequent assessment.

For each tree, the crown was assessed to determine the level of infestation by estimating the density of galls on the leaves. Infestation was recorded in four categories: low, moderate, high and severe. Low infestation was recorded for trees with less than 50% of the foliage canopy with galls with no twisted or knobbed leaves, moderate infestation for trees with greater than 50% of foliage with galls, and less than 50% of leaves twisted and knobbed, high for trees with greater than 50% of the leaves twisted and knobbed, galls on the twigs and some twigs deformed, and severe for trees with greater than 50% of the twigs deformed and some regenerating foliage. The data was analysed with Excel (MS Office, 2003). Pest distribution was mapped using GIS. Linear regression was used to evaluate the impact of pest infestation on tree growth. Exploratory statistics was used to assess the impact of pest infestation on different varieties of *Eucalyptus grandis.*

Results

Four years (by June 2006) after BGC was reported in Kenya (it was first reported in Busia district in November 2002), it had spread to all the 19 districts in western Kenya. The rate of spread was generally higher in sub-humid zones such as Kisumu, Nyando, Homa Bay and Rachuonyo; and much lower in highland areas such as Kisii, Kericho, Transnzoia and Uasin Gishu. Figure 1 below shows the spatial distribution of BGC infestation in western Kenya in June 2006.

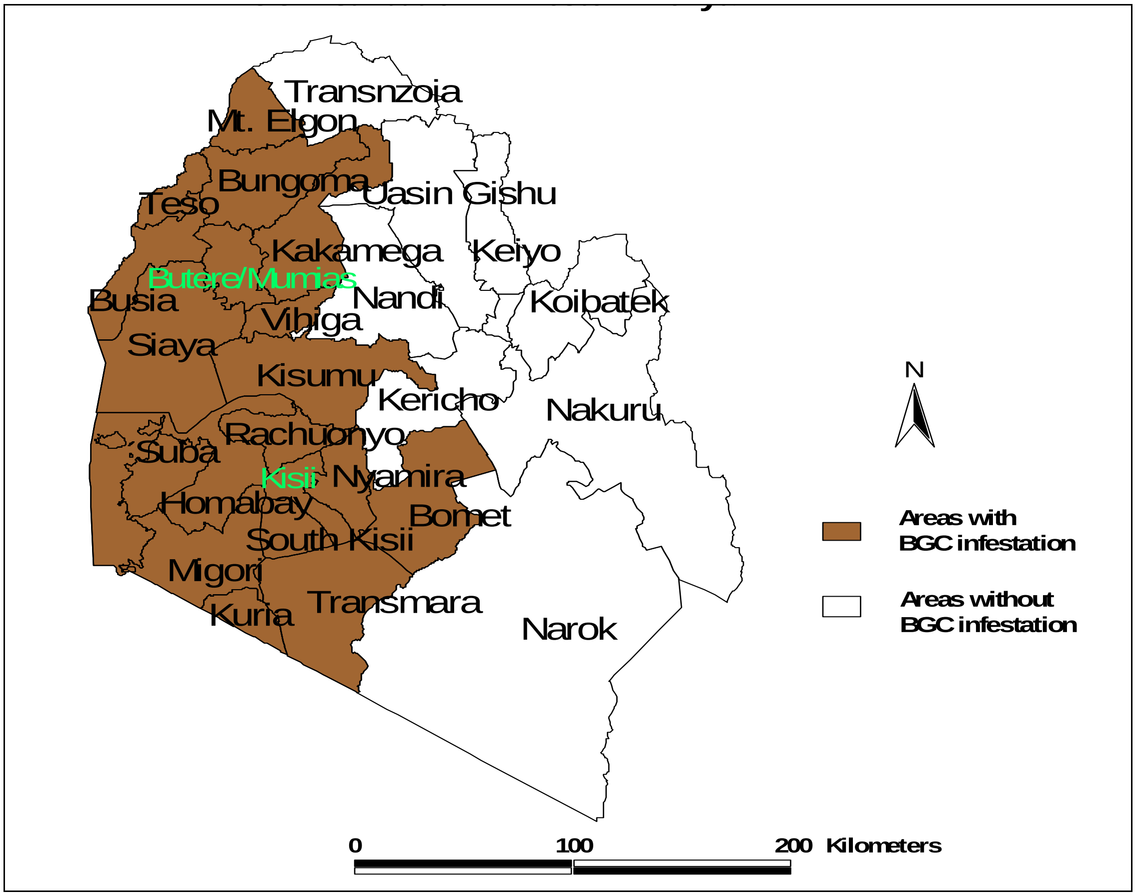

Figure 1: BGC distribution in western Kenya in June 2006

Majority of *Eucalyptus* woodlots in western Kenya manifested some level BGC infestation. However, the severity of BGC infestation was highest within the first year of establishment, with over 90% of the trees showing between moderate and severe levels of infestation. By the second year, the pest's severity tended to decline with only 4% of the trees recording severe infestation, 6% high, 20% moderate and over 70% low. The trend was similar for mature trees in which the severity of attack was noted to be higher during periods of initial attack, before reducing to negligible levels over a period of six months to one year. The pest's population tended to rise during periods of drought (Table 1). There was no significant difference in the pest's population dynamics between trees of ages 2 and 3 years. Approximately 1% of the trees that showed severe infestation at year 2 withered at year 3 due to loss of foliage. There was a noticeable rise in the severity of BGC infestation during periods of drought, particularly in sub-humid zones.

Table 1: BGC population dynamics in Busia district over 3-year period (N = 138)

	Year 1	**Year 3**
Level of infestation	**Proportion, %**	**Proportion, %**
Low	8.0	73.1
Moderate	67.0	18.1
High	19. 0	5.0
Severe	6.0	3.0
Dead trees	0	0.8
Total	**100**	**100**

BGC infestation tended to retard tree growth and the extent of retardation increased with the severity of infestation (Figure 2).

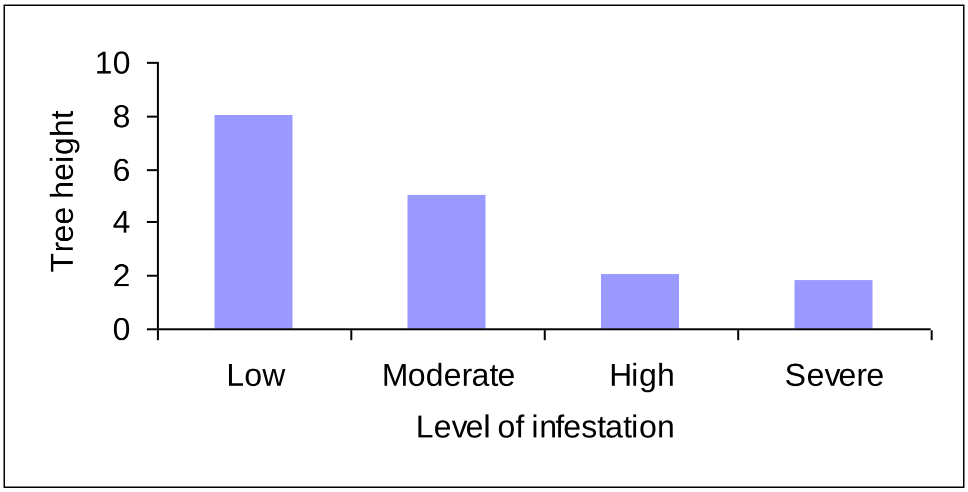

Figure 2: Impact of BGC infestation on tree height

A significant difference was observed in the growth rates of the local provenance of *Eucalyptus grandis* and its improved variety growing at adjacent sites (Figure 3). At each respective level of BGC infestation, the improved variety tended to have a much higher growth vigour compared to the local provenance. For instance, at year 3 the average height of the local provenance of *E. grandis* manifesting low infestation in Busia was 8m, while the improved variety recorded an average height of 11.5m at year 2 for the same level of infestation. The trend was similar for sampling plots in Bungoma, and Kakamega.

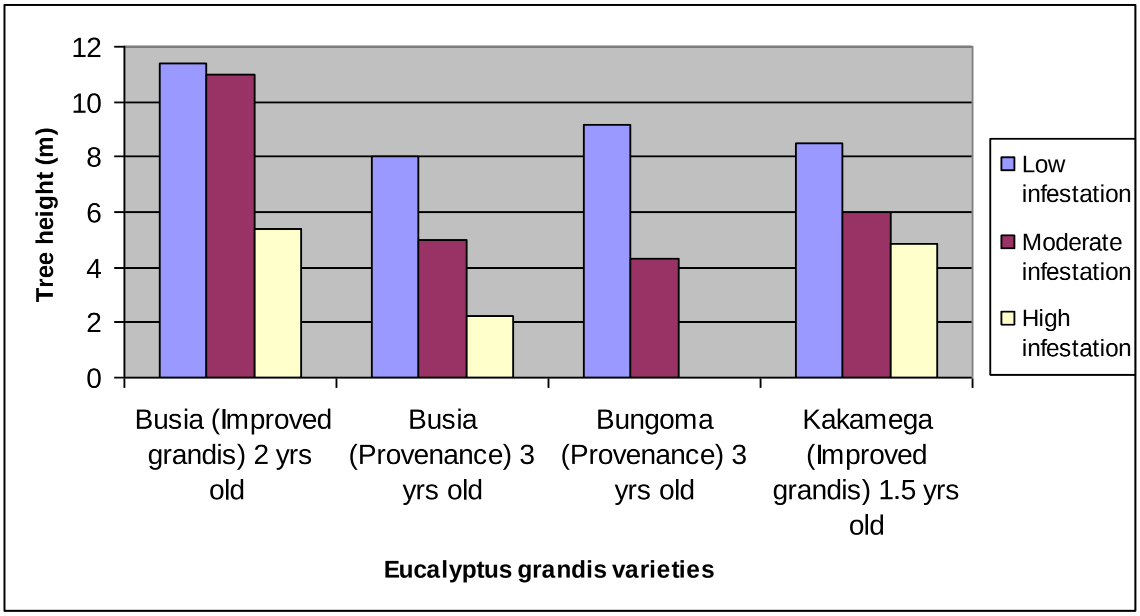

Figure 3: Height variation in *E. grandis* varieties

Discussion

Observations from this study showed that *Eucalyptus* trees are more vulnerable to BGC attack when less than one year old and during periods of initial attack. It is also during this period that most farmers tend to panic, with some resorting to uprooting and burning their infested trees. However, the decline in the pest's population and the negligible mortality rate witnessed in all the sampling plots by the third year is an indication that *Eucalyptus* trees have the capacity to cope with the pest and recover from infestation.

The rise in the pest's population and the corresponding increase in the severity of infestation during periods of drought, explains the rapid spread of BGC infestation in sub-humid areas because trees lose more water in dry weather. Thus, the development of galls on the shoots of trees in drier areas is likely to create more avenues for water loss leading to reduced photosynthetic capacity.

Conclusion

The results of this study lead to the conclusion that, BGC attack retards tree growth and the extent of retardation increases with the severity of infestation. Since the impact of BGC attack on tree growth is dependent on the species and variety of *Eucalyptus* planted, economic losses attributable to BGC infestation in western Kenya can be mitigated by selecting appropriate *Eucalyptus* species and varieties for planting.

Acknowledgement

We are grateful to Director KEFRI and the KEFRI Board of Management for funding this study with resources from the Government of Kenya. We are also thankful to Centre Director Maseno Regional Research Centre for providing field and laboratory facilities for the study and the Maseno RRC IPM team for their tireless and diligent support in data collection.

Reference

Mendel Z, Protasov A, Fisher N and J LaSalle (2004). Taxonomy and biology of *Leptocybe invasa* gen. & sp. n. (Hymenoptera: Eulophidae), an invasive gall inducer on eucalyptus. Australian Journal of Entomology 43: 101–113.