DIVERSITY IN *EUCALYPTUS* SUSCEPTIBILITY TO THE GALL-FORMING WASP *LEPTOCYBE INVASA*

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Leptocybe invasa is a gall-forming wasp attacking a variety of *Eucalyptus* species, hybrids and clones. This wasp is native to Australia and was unknown until it was noticed causing considerable damage in the Middle East and the Mediterranean region in the year 2000. Shortly after its detection, *L. invasa* was observed in southern Europe, southern Asia including Iraq, India and Vietnam; northern, eastern and southern Africa and South America.

Leptocybe invasa oviposit inside the tissue of the *Eucalyptus* plants, preferentially in the young leaves and stems. The eggs develop at the same time as the leaves and or stem leading to the formation of galled plant tissue. When large numbers of *L. invasa* are present and heavy galling occurs the leaves become deformed and growth is stunted. In instances when wasp numbers are very high, and consequently galling is severe, tree mortality may occur.

A number of potential methods are available to control *L. invasa*. However, as the wasp develops within the plant tissue and is thus protected during development, effective control methods are limited. Researchers in India tested the application of chemicals, but this resulted in little or no success in controlling the wasp. At present two strategies are feasible to control this pest: biological control and planting *Eucalyptus* species, clones or hybrids that are tolerant or resistant to *L. invasa*. Biological control has shown much promise as a control strategy. Two wasp species that are native to Australia and attack *L. invasa* in its natural environment have been used in Israel. A third parasitoid species, *Selitrichodes neseri*, was studied and released in South Africa recently. The second strategy to control *L. invasa* involves creating new *Eucalyptus* hybrids using species that show tolerance or resistance to *L. invasa* and planting these hybrids is a possible option. Our research focused on elucidating the differences between the South African *Eucalyptus* species, clones and hybrids and whether the tolerant/resistant varieties could be used in future to create hybrids tolerant to *L. invasa* attack.

During our study we investigated 50 different *Eucalyptus* varieties against *L. invasa*. One variety (GC540), which is known to be very susceptible to the wasp, was used

as a control against which the results of all other 50 *Eucalyptus* varieties could be compared to rank the level of tolerance/resistance. As *L. invasa* prefers ovipositing on the leaves and stems of young plants, actively growing young plants of 30 - 50 cm were used. Under natural conditions there are many factors that could influence the results of such a study. Therefore, in order to ensure that one can reliably attribute the level of infestation to *L. invasa* many replicates of the same *Eucalyptus* varieties were needed. Care was also taken regarding the layout of the trees during the experimental design in order that all *Eucalyptus* varieties were equally accessible to the wasp. During the experiment 14 plants of each of the 50 *Eucalyptus* varieties were used. The trees were arranged into seven different blocks. Each block was then subdivided into an inner and outer block, and contained a representative of each of the 50 *Eucalyptus* varieties, as well as the control. Arrangement of the trees within the blocks was random so that level of susceptibility of some *Eucalyptus* varieties to *L. invasa*'s could be assessed with confidence. To determine the level of susceptibility or tolerance of the 50 *Eucalyptus* varieties to the wasp, the presence/absence of galls on each leaf and stem of the plant was recorded. These results were then represented as a damage index value. Statistical analyses were conducted with the 20 (out of the 50) *Eucalyptus* varieties that showed some level of galling.

Statistical results showed that there were significant differences between the levels of galling of the *Eucalyptus* varieties. The most susceptible variety, with the most galling, was the hybrid *E. nitens* x *E. grandis* followed by *E. grandis* x *E. camaldulensis*. The hybrids *E. grandis* x *E. nitens*, *E. grandis* x *E. urophylla* and *E. saligna* x *E. urophylla* were less susceptible to *L. invasa* than the abovementioned two hybrids. Plants within the *E. grandis* group showed moderate levels of galling. *Eucalyptus dunii*, *E. nitens*, *E. smithii* and *E. urophylla* showed little or no galling.

It is interesting to note that within these hybrid groups some variation exists. For example, in the group containing hybrids of *E. nitens* x *E. grandis* not all hybrids showed equal levels of susceptibility. Variation amongst hybrids is due to different parental plants, with a different genetic make up, being used to create hybrids. This variation has important future implications as it means that the possibility to breed less susceptible plants exists. Studies conducted in Vietnam, Kenya and Uganda recorded similar trends with regards to susceptibility of certain hybrids to *L. invasa*.

When focussing on the *E. grandis* x *E. camaldulensis* group and the *E. grandis* group, we observed higher levels of infestation in *E. grandis* x *E. camaldulensis* compared to *E. grandis*. This result could possibly indicate that the *E. camaldulensis* parent in the *E. grandis* x *E. camaldulensis* hybrid is causing high levels of susceptibility. This result suggests that the effects of surrounding environmental factors, such as altitude, rainfall, soil type, on the overall level of susceptibility or tolerance of a plant should be considered.

In summary, this study showed that there is considerable variation amongst and within the *Eucalyptus* varieties used for commercial forestry in South Africa to gall formation by *L. invasa*. Resistance breeding amongst these varieties is thus clearly a viable objective to control *L. invasa*. Using a combination of approaches, such as planting of less susceptible *Eucalyptus* varieties and biological control, promises to be overall a more effective control option than a single method alone.

Gudrun Dittrich-Schröder and **Dawit Degefu** recoding the presence or absence of galls on leaf and stems of *Eucalyptus* varieties.

Brett Hurley and **Ryan Nadel** recording the results of the trial.