SURVIVAL AND GROWTH OF TWO *ARAUCARIA* SPECIES ESTABLISHED AT MATA AVER FOREST RESERVE, PERLIS

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* Araucaria cunninghamii* (hoop pine) and *A. hunstenii* (klinkii pine) were introduced to Peninsular Malaysia in 1953. These two high quality timbers species were planted in Kepong to rehabilitate degraded forest area. The trial plots were later extended to other locations in the country (Selvaraj & Muhammad 1980). The early growth of these two species in Peninsular Malaysia has been reported elsewhere (Barnard & Beveridge 1957, Appanah & Weinland 1993, Hashim 1995, Hashim *et al.* 2003). However, the performance of older plots has never been published. This paper reports the performance of these two species at age 41 years after planting. They were established at a site in the state of Perlis which experiences monsoon climate.

The study area is flat with an elevation of 50 m above mean sea level and receives between 1400 and 2100 mm annual rainfall. Little rainfall (25 to 100 mm per month) is received during the dry period, from January to March. The soil is shallow, underlying a compacted lateritic layer, which occurs at 30–45 cm below the soil surface. The soil is classified as Gajah Mati series (orthoxic tropudult), having low nutrients and cation exchange capacity. Prior to plot establishment, the site was occupied with a secondary forest, dominated by bamboo (*Gigantochloa ligulata*) clumps.

Seedlings of both *Araucaria* species were raised at the nursery of the Forest Research Institute Malaysia at Kepong. The seeds were obtained from Bulolo, Papua New Guinea. When seedlings were about 30 cm in height, they were transported to the field site in Compartment 17 of Mata Ayer Forest Reserve, Perlis (6° 40' N, 100° 15' E). The planting site was manually cleared and burned in January till February 1962. Planting was carried out in March and April the same year, at the onset of rainy season. A total of 90 seedlings of each species of *Araucaria* were transplanted at a spacing of 3.05 x 3.05 m. After transplanting was completed, separate plots of each species were demarcated using hollow PVC pegs (50 mm diameter, 2 m height). Each plot is about 0.08 ha in area and consists of 56 measured trees. The 34 border trees were left unmeasured.

Growth measurement, namely, total height and diameter at breast height (dbh) was conducted periodically. The plots were regularly weeded during the early establishment phase, i.e. during the first three years. No insecticide treatment and thinning were prescribed in these two plots. The data of the two *Araucaria* plots were analyzed and compared using *t*-test.

The survival of *A. cunninghamii* trees at Mata Ayer Forest Reserve was greater than that of *A. hunstenii* (Table 1). The total basal area of *A. cunninghamii* was almost 90% higher than that of *A. hunstenii*. Tree mortality in the plots was caused by termite (*Coptotermes curvignathus*) attacks. It seems that *A. cunninghamii* was more resistant to termite attacks than *A. hunstenii*. The greater susceptibility of *A. hunstenii* to termite attack compared with *A. cunninghamii* was also reported in Papua New Guinea, where *C. elisae*, a native termite species, prefers *A. hunstenii* over *A. cunninghamii* (Kirton & Brown 2000). In Malaysia, *C. curvignathus* is considered a noxious forest pest and attacks healthy trees.
Table 1  The survival and growth of two Araucaria species at Mata Ayer Forest Reserve at age 41 years

<table>
<thead>
<tr>
<th>Species</th>
<th>N</th>
<th>G</th>
<th>S</th>
<th>$H_G$</th>
<th>$H_{dom}$</th>
<th>$D_G$</th>
<th>$D_{dom}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. cunninghamii</td>
<td>262</td>
<td>32.94</td>
<td>24.4</td>
<td>23.3a</td>
<td>25.0a</td>
<td>40.0a</td>
<td>49.3a</td>
</tr>
<tr>
<td>A. hunstenii</td>
<td>145</td>
<td>17.42</td>
<td>14.4</td>
<td>23.1a</td>
<td>23.5a</td>
<td>39.1a</td>
<td>42.5a</td>
</tr>
</tbody>
</table>

Note: Means with a same letter within a column are not significantly different at P = 0.05

N = stocking (trees ha$^{-1}$)
G = basal area (m$^2$ ha$^{-1}$)
S = survival (%)
$H_G$ = mean stand height (m)
$H_{dom}$ = mean dominant (100 trees ha$^{-1}$) height (m)
$D_G$ = mean diameter at breast height (cm)
$D_{dom}$ = mean diameter at breast height for 100 trees ha$^{-1}$ (cm)

Early signs of termite infestation on Araucaria trees are difficult to discern as the attack starts underground. It is too late by the time noticeable signs of termite attack are discovered, and the infected trees could not be saved. Thus, regular checking of trees, removal of old stumps and prescription of suitable pesticides are important in Araucaria plantation. Dielrex® and Heptachlor®, two effective insecticides against termites, are no longer used now due to their persistence in soil and high toxicity. Thus, alternative chemicals need to be recommended for termite control in Araucaria plantations.

Only dominant diameter of trees was found significantly different ($t = 7.684$, df = 7, p < 0.001). A. cunninghamii achieved greater dominant diameter than A. hunstenii.

The distribution of diameter of trees in the growth plots are depicted in Figure 1. Unlike A. hunstenii, trees in A. cunninghamii plot had a greater range of diameter size. Most of the trees were in diameter classes greater than 35 cm. In contrast, most of the lower diameter trees in A. hunstenii plot had died, thus, providing greater growing space for higher diameter trees.

Better height and diameter growth exhibited by A. cunninghamii at Mata Ayer Forest Reserve compared with A. hunstenii indicate that A. cunninghamii has adapted well to the locality. It is possible that A. cunninghamii has a greater ability to tolerate water stress and other unfavorable site conditions than A. hunstenii. Moreover A. cunninghamii is also more resistant to C. curvignathus attack than A. hunstenii. Thus, species-site matching and pest resistant trait should be important considerations in species choice for plantation establishment.

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Figure 1  Diameter class distribution of *Araucaria cunninghamii* (AC) and *A. hunstenii* (AH) plots at Mata Ayer Forest Reserve, Perlis after 41 years

References


