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ASPECTS OF THE BIOLOGY AND UTILISATION
OF PTEROCLADIA AND GRACILARIA

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requirements for the degree of Doctor of
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ABSTRACT

Pterocladia lucida (R. Br.) J. Ag. is the principal raw material for agar production in New Zealand. Since collection commenced in 1943 the annual harvest has never stabilised and over recent years there has been a general decline, which has inhibited expansion of the indigenous industry.

Field and laboratory studies have been made in order to obtain information on the biology of *P. lucida*. Form variability is considered in detail and a relationship between external morphology and wave exposure of the habitat is proposed. The culture of *P. lucida* from spores in a running seawater system is described in detail. Results on carpospore and tetraspore germination, and sporeling growth under light and temperature regimes are presented. Germination of both spore types was inhibited at 10°C while at higher temperatures germination was greatest under 4 klux. Spore germination and sporeling development in culture is described. Only sterile prostrate thalli possessing rhizoidal haptera were obtained and a hypothesis relating the appearance of surface haptera to the direction of irradiation is proposed.

The development of an outdoor wave tank for culturing is described and the growth rate and development of sporelings is

discussed with reference to water movement. Sporelings were maintained in culture for up to 22 months. Cultured sporelings have also been transplanted into different habitats. Creeping axes established from carpospores produced erect fronds, which produced tetraspores after seven to ten months *in situ*. This confirmed part of a *Polysiphonia*-type life history for the first time in a Gelidioid species. Axis elongation rate *in situ* was estimated to be less than 10cm year^{-1} at Leigh. It was concluded that the collection of attached weed could not be sustained annually, but controlled harvesting in specific areas every two years is advocated.

Seasonal variation in agar yield and gel strength from wave exposed and sheltered populations of *P. lucida* was studied. Agar levels varied throughout the year, being greatest in spring and summer, while gel strengths showed a similar trend.

The feasibility of utilising indigenous *Gracilaria secundata* Harvey forma *pseudoflagellifera* May has been studied. The yield and gel properties of agar were determined from different alkali pretreatments. There was a marked increase in gel strength when weed was pretreated in alkali, the maximum gel strength being obtained from a weed treatment of 3 percent NaOH for three hours at 80°C . The gel properties of agar from *G. secundata* f. *pseudoflagellifera* are compared with agar from other sources. The agar was suitable for commercial use,

but exhibited a greater resilience than that from *Pterocladia lucida*.

The vegetative regeneration of *G. secundata* f. *pseudoflagellifera* in the Manukau Harbour has been studied and an experimental harvest of 0.68t is described. During spring 100 percent regeneration from hand cleared and raked areas occurred after eight to thirteen weeks. Based on regeneration results, mechanical harvesting four times a year of *Gracilaria* mats in the Manukau Harbour is advocated.

The predicted sustainable yield is 1084-1304t year⁻¹.

The extraction and gel properties of agar from *Melanthalia abscissa* (Turn.) Hook. et Harv. are reported for the first time, but the commercial collection of this species is not advocated.

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