Report to Auckland Botanical Society on the Results of Research into *Ecklonia radiata* Dieback - Lucy Cranwell Student Field Grant Award Holder 1994

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Results of Investigation into *Ecklonia radiata* Dieback and Associated Virus Particles

This study has investigated the role of viral pathogens in *Ecklonia radiata* dieback. Initial investigation using TEM indicated the presence of two types of virus-like particles (VLPs) exclusively in diseased tissue, and no other pathogen was identified. The two types of VLPs were similar to viruses infecting terrestrial plants. The spread and distribution of the dieback through several depth strata, its progressive nature and the variability of symptom expression indicated a transmissible cause of the dieback. The results of this research showed that the etiology of *Ecklonia radiata* dieback closely parallels that of terrestrial plant virus diseases.

The dieback observed in late 1992-1993 appeared to correspond to an epidemic situation, as over 90% mortality occurred in some areas (Babcock and Cole, 1993). It is possible that the anomalous environmental conditions of 1992 caused an epidemic situation of a disease already present at a low level in the population. Babcock and Cole (1993) reported that dieback occurred on a small scale at the front of the beach at Goat Island Bay in 1991. Widespread dieback was not seen to occur until late in 1992, after more than 6 months of abnormally low sea temperatures and during an exceedingly large and prolonged microalgal bloom. This bloom lasted for two months and coincided with strongly discoloured seawater which affected light penetration. This microalgal bloom would have had a significant effect on light levels in the sea environment for some time and thus also would have effected the photosynthetic ability of marine macroalgae. It is unlikely that these unusual environmental conditions were the sole cause of the severe dieback episode first reported in November 1992, as not all plants were affected, and plants at different depths at different sites were affected, while other plants in close proximity were unaffected. With the improvement in environmental conditions, particularly light levels, over the following months the susceptibility to the virus of plants not already infected would be considerably reduced. However those plants already infected and undergoing early stages of dieback would be likely to continue to a terminal status.

Serological studies using the potyvirus group specific antiserum indicated that a potyvirus was associated with 68% of dieback affected plants tested. In this study some evidence of latent infection in apparently healthy individuals was collected. Some apparently healthy plants collected at the Marine Reserve, were brought down to the Auckland laboratory. After 3 weeks in culture these plants started to develop dieback symptoms. When serological tests using the potyvirus group antiserum were first made these plants tested negative. However when they were retested when symptoms started to develop, and subsequent to this they gave increasingly positive results, until the plants died. One possible explanation for this phenomenon is that stress imposed upon the plants during transport, and the subsequent culture conditions, resulted in a latent infection manifesting itself due to an increase in host susceptibility.

Based on the observations of previous researchers (Don, 1975; Babcock and Cole, 1993, 1994) and of this worker, it appears that *Ecklonia radiata* dieback is a normal feature of *Ecklonia radiata* ecology. The repeated occurrence of the dieback, although previously on a smaller scale than the recent 1992-93 episode, and its ongoing presence in some *Ecklonia radiata* forests, indicate that it is likely to be present at some level in many populations. The severity of the most recent large scale dieback episode may be related to the adverse environmental conditions experienced during 1992-1993. The low sea temperatures and the presence of a large algal bloom in the spring of 1992 may have caused a large degree of environmental stress in the *Ecklonia radiata* population in affected areas. This could have resulted in a decrease in the resistance of the host plants to the virus, resulting in a large scale epidemic. The presence of a localised area of dieback affected plants at the front of the beach in Goat Island Bay (Babcock and Cole, 1994) indicates that a ready source of inoculum was available for spread through the marine reserve.

It is likely therefore that there is a level of infection present normally in *Ecklonia radiata* populations. Adverse environmental conditions, which favour the pathogen, can result in larger scale infestations or epidemic situations, to which older plants are more susceptible. These can lead to mass mortalities of mature plants, allowing a new generation of recruits to establish themselves. It is probable therefore, that *Ecklonia radiata* dieback has a role in turnover of the forest and in renewing populations, as the density of the forest normally precludes any large scale recruitment.

From this research it appears that viruses are associated with *Ecklonia radiata* dieback, however these are not easily transmissible. They are associated with environmental triggers, the specifics of which are unknown, and may play an important ecological role within the marine ecosystem.

References

Babcock R. C.. and Cole R. G. 1993: The extent of die-back of the kelp *Ecklonia radiata* in the Cape Rodney to Okakari Pt. Marine Reserve. *Conservation Advisory Science Notes No. 44.* Department of Conservation, Wellington. 27pp.

Babcock R. C. and Cole R. G. 1994: Mass mortalities of the kelp *Ecklonia radiata* in northeastern New Zealand. Submitted to *Marine Ecology Progress Series.*

Don G. L. 1975: *The effects of grazing by Evechinus chloroticus (Val.) on populations of Ecklonia radiata (Ag.).* Unpublished MSc Thesis. University of Auckland.

Work Prepared during Thesis Production

MSc (Environmental Science/Botany) Thesis Title
Ecklonia radiata Dieback: The Role of Viral Pathogens.

Publications
Virus-like particles in the brown alga *Ecklonia radiata.* In preparation for Marine Ecology Progress Series.
Detection of a potyvirus in the brown alga *Ecklonia radiata* using a commercially available antibody. In preparation for Diseases of Aquatic Organisms.

Conference and other presentations
Poster Paper for Marine Sciences Society Annual Meeting.
Seminar for Environmental Science, University of Auckland.
Seminar for Plant Science Research Group, University of Auckland.

Special Recognition
Student Prize for Best Poster Paper, Marine Sciences Society Annual Meeting.

Reports
Department of Conservation - 22 April 1994; 17 October 1994; 6 March 1995.
Lotteries Science - 10 March 1995.

Field Trip, Pukenui, Far North 25 - 30 January 1995

Phil Gardner

If, after Maureen Young has done a fantastic job of organising 36 people for six days of botanising, she asks you sweetly to write a chatty article for the Journal - how can one refuse?

On January 25 the Forest and Bird Arethusa Cottage at Pukenui became the centre of a tent city. Next morning we motored to the Shenstone Block at Te Paki. Notes were kept of species observed and a number of new recordings were added to the existing species list. Particularly noteworthy was