Huthcheson, J.A. 1992: Observations on the Effects of Volcanic Activity on the Insects and their Habitat on White Island. ***New Zealand Entomologist*** **15:72-76.**

Observations were made on the effect of volcanic activity on pohutukawa forest and its associated insect community on White Island (Whakaari), Bay of Plenty New Zealand. The group included botanists, a soil scientist, vertebrate zoologists, and an entomologist. Only 5 plant species were found of the ones listed on the island. The most common species present in area I visited was pohutukawa. Frequent volcanic activity had killed much of the forest species, with a gradual increase in survival toward the West, were fewer ash showers had fallen. In the upper tree limit zone, a few harakeke (*Phormium tenax*) were present, but were the only other species present outside the coastal zone. A list of insect species collected is present. White Island volcanic activity has prevented the insect community developing beyond what was observed.

Key words: White Island; Pohutukawa; Insects; Volcanic activity.

Observations on the effects of volcanic activity on insects and their habitat on White Island

JOHN HUTCHESON
Forest Research Institute, Private Bag, Rotorua, New Zealand

ABSTRACT

Observations are made on the effect of volcanic activity on pohutukawa forest and its associated insect community on White Island (Whakaari), Bay of Plenty, N.Z.
Keywords: White Island, pohutukawa, insects, volcanic activity.

INTRODUCTION

White Island was visited on 31 May 1990 by a group of DSIR, FRI and DOC personnel led by Dr Bruce Clarkson, Regional Botanist, DSIR. The group included botanists, a soil scientist, vertebrate zoologists, and an entomologist. The purpose of the visit was to survey vegetation and to establish permanent plots in the remnant pohutukawa (*Metrosideros excelsa*) forest and gannetry vegetation. Prior to the visit the island's largest and longest eruption episode in historic times occurred between 1976 and December 1981 (Haughton *et al*. 1983) Almost continual low level activitiy since then has been frequently interrupted by stronger volcanic episodes resulting in the vegetation species and extent being severely reduced (Fig. 1). In addition, invertebrates in the most affected area have been reduced from a rich and substantial fauna (Wise 1970) to virtual absence. Areas of the island visited by the author varied from a totally dead zone in the south (Ohauora) through to partially damaged resprouting trees in the south west towards Te Matawiwi (Fig. 1b). No observations were made in the coastal zone, gannetries or the small reasonably healthy forested area in the north east.

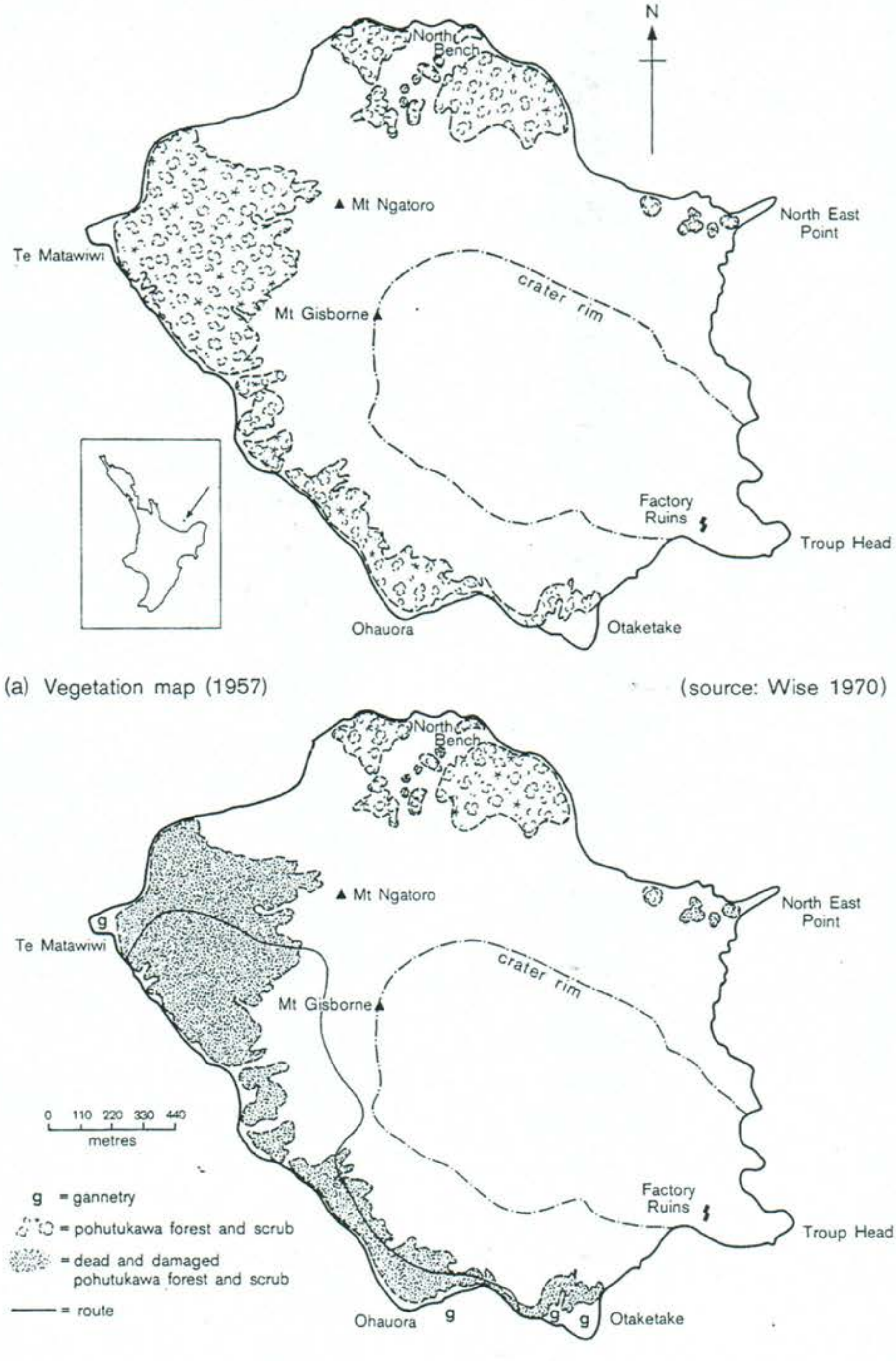
Forest condition

Hamiton (1959) recorded 14 plant species growing on White Island while Clarkson *et al*. (1989) listed 7, and only 5 were found on the present trip. In most of the area I visited, the only species alive was pohutukawa. Frequent volcanic activity, including acidic fumes and ash deposits, had killed all trees in large areas of the south, with a gradual increase in survival toward the west where fewer recent ash showers had fallen.

At the upper limit of the tree zone in the less damaged area, a few harakeke (*Phormium tenax*) bushes had resprouted after being smothered in ash. These were the only other plant species present outside the coastal zone in this part of the island. Trees in the interior of the damaged forest generally had a single upright stem with virtually no branching at the top. Those that were alive had sparse (<40 cm long) epicormic growth. Edge trees were multi-branched and often appeared to be rejuvenated regrowth from fallen stems. Hamilton (1959) noted that the main factor affecting the distribution of the pohutukawa forest was the toxic fumes emitted by the volcano. Current flush varied from nil on trees close to the dead zone to about 15% in some trees in the less damaged area.

Insect habitat

In the dead zone, stems were mostly sound despite the trees being killed in eruptions at least 10 years previously (B. D. Clarkson pers. comm.). This is unusual as unlike rata (*Metrosideros robusta* and *M. umbellata*) pohutukawa generally rots quickly once dead. Trees on the mainland often harbour heart rots such as *Phellinus* sp. while still alive. Breakdown of dead wood involving both insects and an unidentified brown cubical rot was observed in the least damaged area seen on White Island where no recent ash deposit had occurred, however in the zone of frequent ash showers, the only visible evidence of life was occasional drywood termite (*Kalotermes* sp.) workings.



(a) Vegetation map (1957) (source: Wise 1970)

(b) Vegetation map (1990) and route followed. (source: B D Clarkson pers comm.)

Fig. 1: White Island.

The lack of fungal activity suggested that the highly acidic volcanic material has a fumigant was well as a physical effect. Both hydrochloric and sulphuric acids were recorded at high levels in hot spring waters by Grange (1959). Ash showers are accompanied by steam and the material is deposited wet and coats all surfaces. When dry, the ash is extremely fine and reminiscent of talcum powder. It appears to have invaded every niche and intruded under all loose bark and into all unsound wood. Many stems have an accumulation of leaves at their base but these are encased individually in the ash. The ash was described as 'sand' by the soil scientist present (W. C. Rijkse pers. comm.) and it may act as an insecticide through physical scarification of the insect integument.

Insect fauna

Wise (1970) produced a list of 162 species of invertebrates most of which were extracted from soil and litter samples, and of which most were collected from the Crater Bay–Ohauora southern region of the island, which now forms a "dead zone".

Table 1 lists the small number of species collected during this visit. Apart from the occasional termite workings there were no insects present in the abundant debris of the dead zone. Most of the insects listed were floating on the surface of rainwater pools (pH 2.5-3.0). The insects were all very small and could have been easily transported by wind either from the more healthy areas of the island or possibly, from the mainland.

Table 1: Invertebrates found on White Island 30 May 1990

From the partially damaged forest area			
Isoptera	Kalotermitidae		*Kalotermes* sp.
Diptera	Calliphoridae	(netted)	-*Calliphora stygia* F.
			-*C. quadrimaculata* (Svederus)
		(seen)	Green calliphorid (*Lucilia* spp. or *Chrysomya rufifacies* (Macquart)
	Tachinidae		1 sp.
Collembola			1 sp.
Coleoptera	Curculionidae		? *Strongylopterus hylobioides* Redtenbacher (workings)
			Xyleborini sp. (workings)
	Cerambycidae		? *Blosyropus spinosus* (White) (workings)
			? Colletid bee pupal chambers in ground
Arachnida	Clubionidae		1 sp. in old flax leaf
From the dead forest zone			
(a) In wood samples			
Isoptera	Kalotermitidae		*Kalotermes* sp.
(b) From rainwater pool surfaces (pH 2.5-3.0)			
Hemiptera	Aphididae		3 spp.
Hymenoptera	Braconidae		1 sp.
	Alysiidae		1 sp.
	Eulophidae		1 sp.
Trichoptera	Rhyacophilidae		1 sp.
Psocoptera	Caeciliidae		1 sp.
Coleoptera	Ptiliidae		1 sp.
Diptera	Sciaridae		2 spp. (including the most numerous species present)
	Mycetophilidae		2 spp.
	Psychodidae		1 sp.
	Acalypterate flies (undet)		2 families 2 spp.
Arachnida	Zodariidae		1 sp. (all ages both sexes on pool surface preying on trapped insects

No alates or soldiers were found of the drywood termite *Kalotermes* sp., so positive identification to species could not be made. Although these may well be the indigenous kalotermitid *K. brouni* Froggatt, there is a possibility that they are the introduced Australian species *K. banksiae* Hill. The latter was first recorded from New Zealand by Hill (1942) and has since been found at several coastal locations in both the North and South Islands. It has only been recorded from coastal localities either on, or very close to, sandy beaches and its known distribution is extremely patchy (Bain & Jenkin 1983). It is possible that it has established in these areas from colonies carried in driftwood. The ability of an insect to construct a tunnelling system which can remain impermeable to seawater for weeks or possibly months would be a major advantage in surviving the devastating effect of continual volcanic activity.

In the area of lesser damage, grey faced petrel (*Pterodroma macroptera gouldi* Hutton) burrows were common, and blowflies (Calliphoridae) were present together with occasional other small Diptera. In an area with no recent grey tephra on the older yellowed clay-like material, silk lined pupal chambers of an unknown hymenopteran were found. These were possibly constructed by *Leioproctus boltoni* Cockerell, the ground burrowing colletid bee included in both Wise's (1970) list and a list of 5 invertebrates recorded in an appendix by Wodzicki & Robertson (1959) under the name *Paracolletes boltoni*.

Workings in wood in the least damaged area seen included both cerambycid and curculionid tunnelling. The only cerambycid recorded from pohutukawa on the mainland which is large enough to create the tunnelling seen, is *Blosyropus spinosus* Redtenbacher. The weevil exit holes seen correspond in size to *Strongylopterus hylobioides* (White), which has also been recorded from mainland pohutukawa. Two Xyleborini species have also been recorded from mainland pohutukawa, *Anaxyleborus truncatus* (Erichson) and *Xyleborus inurbanus* (Broun) the former being far more commonly found as large infestations similar to the workings observed.

The only foliage damage seen was necrotic spots, probably caused by acidic deposits as hot or incandescant ash is nearly always confined to the crater area according to DSIR geologists (B. Scott pers. comm.). No evidence was seen in the partially damaged areas of the insects which form particularly close associations with pohutukawa on the mainland. These include *Neomycta rubida* Broun a small leaf mining weevil, *Neocyba metrosideros* (Broun) a small subcortical feeding weevil, and the scale insects *Lecanochiton metrosideri* Maskell and *Eriococcus pohutukawa* Hoy. Nor was there any sign of damage by the occasional browsers on the tree which have been recorded from a study site in Homunga Bay, near Waihi. These include Phasmida, (*Argosarchus* sp. and *Acanthoxyla* sp.), Orthoptera (*Hemideina thoracica* White), Lepidoptera (*Ctenopseustis obliquana* Walker, *Planotortrix notophaea* Turner, *P. excessana* Walker, *Pseudocoremia sauvis* Butler), and Coleoptera (*Eucolaspis brunnea* complex spp., *E. pallidepennis* complex spp., *Stethaspis suturalis* (F.), *Pyronota festiva* (F.)).

The presence of spiders preying on trapped insects on the small rainwater pool surfaces in the dead treeless zone, suggests these predators may be early arrivals in such devastated ecosytems. This is in agreement with observations from Mount St Helens in Washington, USA (Dayton 1990) where a continual 'fall out' of very small wind blown insects (including young "ballooning" spiders) allowed scavengers and predators to establish rapidly after the eruption.

In contrast with the single major event on Mt. St Helens, the volcanic activity on White Island over recent years has been almost continual over the southern western sector, and has prevented the insect community of this area developing beyond that observed.

REFERENCES

Bain, J.; and Jenkin, M., 1983: *Kalotermes banksiae, Glyptotermes brevicornis*, and other termites (Isoptera) in New Zealand. *New Zealand entomologist 7:* 365-370.

Clarkson, B. D.; Clarkson, B. R.; Smale, M. C., 1989. Appendix I. Vegetation destruction and recovery following recent eruptions on White Island (Whakaari), Bay of Plenty, New Zealand. *New Zealand Geological Survey Bulletin 103*. Pp 137-138 *In:* B. F. Haughton & I. A. Nairn (Eds.).

Dayton Leigh., 1990: Something stirs on Mount St Helens. *New scientist* 19 May 1990, 35-38.

Grange, L. I., 1959: Volcanology 1927-29. Pp 25-31 *In:* W. M. Hamilton & R. L. Baumgart, (Compilers) *White Island. DSIR bulletin 127.*

Hamilton, W. M., 1959: Vegetation. Pp 62-69 *In:* W. M. Hamilton & R. L. Baumgart (Compilers) *White Island, DSIR bulletin 127.*

Haughton, B. F.; Scott, B. J.; Nairn, I. A.; Wood, C. P., 1983: Cyclic variation in eruption products, White Island volcano, New Zealand 1976-1979. (Note) *New Zealand journal of geology and geophysics 26:* 213-216.

Hill, G. F., 1942: *Termites (Isoptera) from the Australian region.* Melbourne, CSIRO. 479 pp.

Watt, J. C., 1982: New Zealand beetles. *New Zealand entomologist 7:* 213-221.

Wise, K. A. J., 1970: On the terrestrial fauna of White Island, New Zealand. *Records Auckland Institute and Museum 7:* 217-252.

Wodzicki, K. and Robertson, F. H. 1959: Birds, with a note on the mammal *Rattus exulans* (Peale). (Appendix) p 82 *In:* W. M. Hamilton & R. L. Baumgart (Compilers). *White Island. DSIR bulletin 127.*

Research on pastoral and horticultural pest control in Northland helps to avoid problems with insecticide use

R. H. Blank

MAF Technology, Private Bag, Whangarei, New Zealand

ABSTRACT

Applied and basic research on agricultural and horticultural pests can give considerable benefits in terms of reduced insecticide usage and improved pest control. This paper uses examples which illustrate how the correct identification of pest problems, the use of damage asessment and pest threshold studies and improvements in the pest control strategies can all assist in minising problems with insecticide use.

Keywords: Insecticides, problem avoidance, pest control, damage assessment, pest threshold.

INTRODUCTION

Insecticides are commonly used to provide both short and long term solutions to pest problems. The use of insecticides have given enormous benefits in increased food production, enhanced food quality, protection of food stuffs and other products, improved human health and have helped to prevent importation by countries of unwanted pests. Such benefits have not been achieved without some unwanted side-effects. Some well known New Zealand examples being the accumulation of organochlorine residues in the soil from the application of DDT for grass grub. *Costelytra zealandica* (White), control preventing new dairying opportunities in Canterbury (East & Holland 1990). The inducement of secondary pest problems such as phytophagous mites in apple orchards (Wearing *et al.* 1978). The occasional negligence of users of insecticides, for example, the accidental poisoning of orchard workers in Tauranga because a supervisor neglected to inform them the kiwifruit orchard had just been sprayed.

A considerable number of opinions have been expressed as to how these side effects of insecticides can be minimised particularly after release of the discussion document