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Recent studies of indigenous forest decline in New Zealand suggest insects and their damage, although highly conspicuous, at this time of rapid ecological change, are symptoms rather than causes of the process which is under-way. It is suggested that to focus on contributing rather than causative factors, not only leads to a poor understanding of the process itself but reinforces the perception of insects as damaging pests rather than beneficial agents of change.

Key words: Beech decline; Neomycta; Pohutukawa; Beneficial insects.

Seeing is not believing: Insects as symptoms not causes*

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ABSTRACT

Recent studies of indigenous forest decline in New Zealand suggest insects and their damage, although highly conspicuous at this time of rapid ecological change, are symptoms rather than causes of the process which is underway. It is suggested that to focus on the contributing rather than causative factors, not only leads to a poor understanding of the process itself but reinforces the perception of insects as damaging pests rather than beneficial agents of change.

Keywords: Beech decline, Neomycta, Pohutukawa, Beneficial insects.

INTRODUCTION

Insects often cause highly visible damage to their hosts, are present seasonably in very high numbers, and are often directly associated with ill health and decline. It is hardly surprising therefore, that superficial investigations often lead to the wrong conclusions.

As a callow youth fresh from the ministrations of Peter Johns, Bob Pilgrim, Bob Bigelow and George Knox of Canterbury University's Zoology Department, I arrived at FRI in the late 1960s and set about teaching my far more experienced colleagues how to suck eggs. Following what I thought was a particularly spirited defence of David Morgan's interpretation of the role of the buprestid *Nascioides enysii* in beech death, Bob Milligan in desperation implored me to take to heart, and if possible to brain, the old adage.

> "Although maggots are invariably associated with dead horses, it is a mistake to conclude blowflies commonly kill our four-legged friends".

The relevance of this observation to decline and dieback in our native forests has become increasingly evident to me over the past 15 years. Indigenous insects as a primary cause of death and decline in New Zealand's native forests does not make biological sense.

I propose to briefly discuss 4 examples of decline in indigenous tree species where the initial conclusion has been sadly astray. Closer examination has suggested insects as symptoms rather than causes is a more sustainable hypothesis.

Red Beech and *Inglisia fagi*

Severe defoliation of red beech occurred in the Maruia Valley along the base of the Victoria Range between the winter of 1976 and late 1977 (Hosking & Kershaw 1985). The beech scale *Inglisia fagi* was identified as the insect responsible and extensive tree mortality had occurred by May 1979. Although the scale outbreak subsequently collapsed due to the fungal parasite *Hypocrella duplex, Inglisia* was held by forest managers to be primarily responsible for the mortality.

Information on the ecology of *Inglisia* is sparse. Its primary host is red beech with adult females appearing on twigs as white conical protruberences. Honeydew produced by the insect is colonized by a soot fungus *Capnodium walteri* giving trees a typical blackening of foliage and twigs. Heavily infested trees shed green foliage which may result in total defoliation. It is not known if foliage shedding is a direct or indirect response to insect damage. Scale outbreaks were reported in the northern South Island from 1970 to 1972, although little mortality occurred, and again in the Maruia in 1990.

An analysis of tree growth rates and climatic data (Hosking & Kershaw 1985) showed a strong correlation between periods of low rainfall and insect outbreaks, with larger trees

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on moist colluvial slopes being most affected. It is suggested drought precipitated *Inglisia* outbreaks are on integral part of the dynamics of these mixed red-silver beech forests. The resulting mortality removes overmature trees growing on good sites from the population. These trees are unprepared for drought stress having always had an abundance of moisture. These factors also appear to affect the shifting boundary between the 2 beech species. In this instance *Inglisia*, and later *Platypus* and *Psepholax*, were simply the symptoms of site related drought stress.

Hard Beech and *Neomycta*

An intensive study of hard beech dieback and canopy collapse on the Mamaku Plateau (Hosking & Hutcheson 1986) revealed an intriguing association between the tree and a small native weevil, *Neomycta pulicaris* (Hosking *et al.* 1990). A comparison of healthy and unhealthy stands revealed very high populations of the insect in the latter and very low populations in the former. The leaf mining weevil lays its eggs in the mid rib of newly flushed foliage which is then shed from the tree. With the insect responsible for removal of over 30% of newly flushed foliage in severely affected stands, it was an early suspect as a primary cause of tree decline. However, the question had to be asked, assuming a long association between this indigenous insect and its host, if its role was primary why was there any hard beech left on the Plateau?

Comparison of sites carrying healthy, intermediate and severely debilitated stands revealed decline was closely correlated with a decrease in soil moisture retention, such that drought prone sites were most affected. Tree growth rate analysis revealed that while growth on all sites showed a sharp decline following periods of drought, trees on worst affected sites failed to recover.

The study establishes a strong link between drought induced tree stress and *Neomycta* populations, supporting the contention that the insect is not the primary factor in hard beech decline.

Mountain Beech Defoliation

Outbreaks of the defoliators *Proteodes carnifex* and *Epichorista emphanes* have long been a feature of New Zealand's mountain beech forests. Outbreaks of *Proteodes* in the Nelson Lakes region were studied by Horak-Kaenel (1970) in the late 1960s while outbreaks were also recorded in Fiordland in 1953-54, 1966 and 1977. The only outbreak associated with tree mortality was 1953-54. However, the association between insect defoliation and tree death was well established in the minds of foresters and the extensive collapse of mountain beech forest in the Kaweka and Ruahine Ranges in the early 1980s raised the spectre of insect epidemic with *Epichorista* thought to be responsible.

Although the decline was well advanced, and any evidence of a relationship to *Epichorista* lost, an investigation by Hosking & Hutcheson (1988) did indeed establish a relationship between insect and disease populations and increasing stand debility. However, once again it was the maggots on a dead horse situation. *Neomycta pulicaris* was more than twice as common in declining stands as in stable ones with a parallel increase in the incidence of foliage wilt associated with *Heliostibes* twig tunnelling. However, an analysis of stand structure showed those suffering dieback were in a more advanced stage in the forest cycle than unaffected stands. Hosking & Hutcheson (1988) contend the forest decline in the Kaweka Range is a natural process affecting mature and overmature stands. The role of insects is that of agents of change, accelerating the process of stand collapse and renewal rather than initiating the process.

Pohutukawa Decline

Investigations into the decline of pohutukawa were initiated by the Department of Conservation on the assumption that insects were responsible. There was wide support for this view within both the scientific and the wider community. We were unconvinced, and DoC was persuaded to take a wider perspective, and through a comprehensive survey identify the true nature and magnitude of the problem.

The conspicuousness of insect damage once again tended to focus attention on this component of the fauna. Seasonal damage to foliage, particularly young trees, by scarabaeids and chrysomelids can be spectacular but transient. In certain seasons the wilting of newly flushed foliage is associated with an insect complex including cecidomyids, tortricids and curculionids and can affect a large proportion of new shoots. However, there is no evidence of lasting effects on otherwise healthy trees. Of particular interest is *Neomycta rubida*, a close relative of the beech leaf mining weevil. This insect's behaviour is similar to its cousin in attacking and mining newly flushed leaves which are subsequently shed from the tree. The insect is restricted to a narrow window of opportunity which closes with the maturation and hardening of the new foliage. While insects feature strongly in the ecology of pohutukawa they have little significance to the decline presently being experienced throughout much of its range (Hosking *et al.* 1989). Preliminary evidence suggests trees in decline suffer greater damage from the insect and disease complex than healthy trees but the primary agent initiating decline is the introduced possum. The threat to pohutukawa, far from originating from the highly visible insect fauna, has a more insidious character. It begins with the decimation of stands during the clearing of land for farming and proceeds by the prevention of regeneration by grazing of domestic and feral animals to direct damage, particularly during bud expansion, from uncontrolled possum populations.

Despite these findings insects continue to get a bad press. An Auckland nurseryman exhorts his colleagues to spray for *Neomycta* (Commercial Horticulture August 1990) which he contends is causing as much damage to pohutukawa as possums. Despite our impassioned reply (Commercial Horticulture October 1990) the visible damage creates the myth and generates an unnecessary broad spectrum chemical attack on the undeserving insect and the entire associated community, all to little effect.

CONCLUSION

John Hutcheson's (1990) work characterizing insect communities and our joint work on beech and pohutukawa decline have demonstrated the surge of insect activity in forests and shrublands undergoing change. In the case of beech forests, stand dieback involving canopy collapse is the period of greatest change preceeded and followed by long periods of relative stablility. The insect and disease populations are part of these changes, but they do not initiate them. The incidents of beech forest decline we have studied conform well to Manion's (1981) concept of forest decline. He proposes that 3 factors operating together bring about these changes: predisposing factors such as age or site characteristics mean some stands are more at risk than others, while inciting factors such as drought, wind or floods initiate changes by inducing varying degrees of stress in these predisposed communities. Insects and disease are seen as contributing factors driving the process of change forward which may lead to the irreversable decline of stands. Stands in this transitional phase will inevitably have high insect and disease activity tempting the observer to draw the wrong conclusion.

It is therefore understandable that insects have such a miserable public image. Their inevitable alliance with damage, decay and death leads to guilt by association. To refocus both professional and public attitudes to insects, in the corporate jargon of the day, as facilitators of change rather than harbingers of death, would not only attenuate public antipathy of insects but might also direct the professional to look beyond the symptoms to an understanding of the causes, saving a great deal of misdirected effort and often inappropriate solutions.

Let me close by suggesting as a first step we spurn the use of the term "beneficial insect" as reflecting a very narrow perspective of the role of insects in our environment. We should be promoting insects in general as beneficial or in John Hutcheson's words "God's gardeners".

I look forward to the day when our school children will crouch beside the carcass of the horse to admire the work of the maggots.

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Andracalles pani n. sp. from the Three Kings Islands: evidence for copulation mechanics (Coleoptera: Curculionidae: Cryptorhynchinae)

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ABSTRACT

Andracalles pani n. sp. is described and figured. It is one of 9 species of cryptorhynchine weevil so far known from the Three Kings Islands, and like all but one of the others it has a sister-group on the main islands of New Zealand. The male and female genitalia of *A. pani* differ markedly from those of its congeners. The male possesses a very unusual large toothed sclerite in the endophallus, and the endophallus itself may be permanently everted. The female vagina is thickened posteriorly in such a fashion as to receive and limit the movement of the male aedeagus, indicating the function of the aedeagus as an intromittent organ.

Keywords: Three Kings Islands, *Andracalles pani*, genitalia.

INTRODUCTION

The Three Kings Islands are a small group some 60 kilometres north-west of Cape Reinga on the North Island of New Zealand. They are difficult to reach, and insect collecting has been limited. As part of a study of genera of New Zealand cryptorhynchine weevils (Lyal in prep.) the available material from the Three Kings Islands was studied. Most specimens were collected on the largest of the group, Great Island, although specimens of *Hadracalles fuliginosus* Broun and *Clypeolus veratrus* (Broun) have been collected from Southwest Island.

Nine species in 7 genera (*Hadracalles, Clypeolus, Psepholax, Didymus, Pachyderris, Andracalles* and a new genus including *Acalles concinnus* Broun) are known from the islands, those