

A New Zealand Insect as A Potential Biological Control Agent of Gorse Overseas

Peter W. Holder

- Entomology Department, Lincoln University, Canterbury, New Zealand ¹

Anisoplaca ptyoptera (Lepidoptera: Gelechiidae) is a stem-mining moth which attacks some members of the tribe Carmichaelieae (Fabaceae). Carmichaelieae and *A. ptyoptera* are both endemic to New Zealand. The discovery that the moth had successfully colonized the exotic weed gorse, led to interest in its potential as a biological control agent of this weed. An assessment of the suitability of *A. ptyoptera* as a biological control agent has been carried out in New Zealand. The findings of this assessment are summarized in this paper. While various factors limit its application in New Zealand, *A. ptyoptera* has been identified as a potentially useful insect in biological control programs against gorse in Hawaii, Oregon and Chile. The loosely synchronized and flexible life history strategy of *A. ptyoptera* results in damage continuing throughout the entire growth and reproductive periods of gorse, and should facilitate overseas establishment of the moth. The endemic population reaches high levels and is widespread: the potential for *A. ptyoptera* to achieve high population levels outside New Zealand appears favorable. *A. ptyoptera* can be artificially cultured. The "new host association" and the concomitant oligophagy of *A. ptyoptera* necessitates a cautious approach to assessing its suitability as a biological control agent. Host-specificity experiments are continuing, and if an acceptable degree of specificity is found, there are excellent prospects for *A. ptyoptera* to make a significant contribution to biological control of gorse growing outside New Zealand.

Introduction

Gorse (*Ulex europaeus* L.; Fabaceae: Genisteae) is a thorny perennial shrub native to western Europe. It is now widely distributed throughout the world and because of its competitiveness and invasive capacity in range land, has become a serious weed in several countries including New Zealand.

Anisoplaca ptyoptera Meyrick (Lepidoptera: Gelechiidae) is a stem-miner which attacks some members of the tribe Carmichaelieae (Fabaceae). Carmichaelieae and *A. ptyoptera* are both endemic to New Zealand. Recently it was noticed that the moth had successfully colonized gorse (Butler 1979). This discovery led to interest in the moth's potential as a

biological control agent of gorse, and the suitability of *A. ptyoptera* as a biological control agent being investigated and assessed in New Zealand (Holder 1990). The findings of this investigation are summarized in this paper.

Aspects of the biology of *A. ptyoptera* have been investigated, destruction of gorse by the moth in parts of Canterbury has been measured, a technique for artificially rearing *A. ptyoptera* has been developed, and the host-specificity of the moth is being examined.

Discussion

The potential of *A. ptyoptera* as a biological control agent in New Zealand is limited by endemic parasites, and the increased herbivore

pressure the Carmichaelieae hosts may suffer due to artificially increased or dispersed *A. ptyoptera* populations. However, the moth has been identified as a potentially useful insect in biological control programs against gorse in Hawaii, Oregon and Chile. This presents an opportunity to study the "new host association" theories of Hokkanen and Pimental (1984, 1989).

Larval feeding by *A. ptyoptera* structurally weakens the host and disrupts vascular transport; this causes dieback of branches, reduces flowering and growth, and occasionally contributes to plant death. Up to 90% of the mature plants at a site have been attacked. As much as 85% loss of foliage can be directly attributed to *A. ptyoptera* damage.

The life history strategy of *A. ptyoptera* appears to be univoltinism overlaid with seasonal/environmental opportunism. The seasonal distribution of life stages is loosely synchronized and diapause has not been detected. Adults emerge from late spring to autumn and larvae develop throughout the year. The flexible and loosely synchronized life history of *A. ptyoptera* results in damage continuing throughout the entire growth and reproductive periods of gorse and should facilitate establishment of the moth overseas. The mean potential fecundity of the moth is 196 eggs per female. The endemic population reaches high levels and is widespread, despite 33-50% of the larvae being parasitised. Two undescribed species of larval parasitoid have been isolated: the endemic *Zealachertus* sp.

(Hymenoptera: Eulophidae), and *Diadegma* sp. (Hymenoptera: Ichneumonidae) which is probably also endemic. As these parasitoids appear to be restricted to New Zealand, the potential for *A. ptyoptera* to achieve high population levels outside New Zealand appears favorable.

Carmichaelia spp., *A. ptyoptera* and gorse all occur throughout New Zealand. The widespread distribution of the moth may be taken as an indication of wide ecological tolerance. However, the *A. ptyoptera*-gorse association is only found in Canterbury and Otago (both are eastern, biologically isolated regions of the South Island). This geographical divergence in host plant use and the apparently narrow host range of *A. ptyoptera* (Holder 1990) within the chemotaxonomically distinct tribes Carmichaelieae and Genisteae (Pohill and Raven 1981), may indicate that the host shift has occurred *via* a genetic change in the shifted population (e.g., Futuyma *et al.* 1984). If this is the case, the ability to further shift hosts may be maintained (Thomas, C.D. pers. comm., 1989). An alternative possibility is that the *A. ptyoptera*-gorse association has arisen through a combination of: gorse being within the preadapted biochemical and structural dietary range of *A. ptyoptera* (gorse is a plant of generally low secondary chemical defence [Hill 1982]); the apparency (*sensu* Feeny 1976) of gorse; and the colonization of gorse by the moth has been possible and occurred only in the temperate, dry environment of Canterbury and Otago.

Table 1. Known and suspected hosts of *Anisoplaca ptyoptera*.

Taxonomy	Species	Host status
Family: Fabaceae		
Subfamily: Faboideae		
Tribe: Galegeae	<i>Clianthus puniceus</i> (G. Don) Lindl.	Suspected
Tribe: Carmichaelieae	<i>Carmichaelia</i> spp.	Known
	<i>Corallospartium crassicaule</i> (Hook f.) J.B. Armst.	Suspected
Tribe: Genisteae	<i>Cytisus scoparius</i> (L.) Link.	Known
	<i>Ulex europaeus</i> L.	Known

The destructiveness and aspects of the biology of *A. ptyoptera* indicate that it is a good biological control candidate. However, the

possible dangers associated with a "new host association" as well as the concomitant oligophagy of *A. ptyoptera* (Table 1) necessitate

a cautious approach to assessing its suitability as a biological control agent.

Host-specificity experiments are continuing (Hill, R.L., personal communication, 1992). If the mechanism(s) for the host transference can be understood and if an acceptable degree of specificity is found, there are excellent prospects for *A. ptyoptera* to make a significant contribution to biological control of gorse growing outside New Zealand.

Acknowledgments

This study was made possible by the financial support of the Hawaiian State Department of Agriculture, and the technical assistance of New Zealand DSIR Plant Protection.

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