



PC 219

Risk Assessment and Chemical
Ecology of the Red Lily Beetle,
Lilioceris lili (Scop.).

Final report 2007

Project Title Risk Assessment and Chemical Ecology of the Red Lily Beetle, *Lilioceris lili* (Scop.).

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AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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Grower Summary

Headline

This project has investigated and provided clarity on some aspects of the biology and ecology of the lily beetle (*Lilioceris lili*). Spread of the pest is on the increase in the UK and future control strategies are likely to be based on developing resistant varieties and chemical based traps.

Background and expected deliverables

The scarlet or red lily beetle (*Lilioceris lili*), is a bright red leaf beetle which has become a pest of lilies (*Lilium*: Liliaceae) in the UK and parts of North America. *Lilioceris lili* has one generation a year and a limited host range (*Lilium*, *Fritillaria* and *Cardiocrinum*). It is native to much of Eurasia and an established alien in North America and the UK. In the UK the beetle spread slowly across southeast England from 1939 to 1989, followed by a rapid increase in distribution; it is now found throughout England, is widespread in Wales and established in parts of Scotland and Northern Ireland. This study was prompted by this increasing spread of lily beetle across the UK, its devastation of host plants in garden and amenity plantings, and concomitant increasing threat to commercial lily production systems, and the unsatisfactory nature of current control measures (manual removal or the use of broad spectrum insecticide).

The project had four main objectives:

- To investigate the biology and ecology of the red lily beetle.
- To use this information to assess the risk to the lily industry relating to pot plants, cut flowers and bulb production.
- To investigate the chemical ecology of both the lily beetle and its parasitoids.
- Using the results gained to develop integrated pest management strategies for the control of the red lily beetle for the amateur gardener, amenity horticulturist and the horticultural industry.

Summary of the project and main conclusions

- Both the adult and larval stages of the lily beetle can cause foliar damage to host plants throughout the growing season (March to October). No stage in the beetle's life cycle attacks or is attached to the bulb.
- The beetle has one generation a year. Inaccurate older literature stating that there is more than one generation should be discounted.

- Plants at risk are limited to *Lilium*, *Fritillaria* and *Cardiocrinum* (referred to as lilies), despite statements in earlier literature listing up to 20 genera.
- Lily beetle is distributed throughout Eurasia. It is an alien pest in North America and the UK. It has been established in England since 1939, but has only become common outside the south-east during the past 17 years. It has recently become established in parts of Scotland and Northern Ireland, and is becoming widespread in Wales. The evidence suggests that the beetle is likely to become established throughout the UK and so poses an increasing threat to the commercial lily production sector of the horticultural industry.
- Data from the Royal Horticultural Society indicates that *L. lili* is the most important pest on lilies for the amateur gardener.
- Survey based data indicates that the lily beetle can be a serious problem for the professional grower of lilies.
- There are four species of parasitic (parasitoid) wasp that attack and kill lily beetle larvae in Europe. Three have been released in the USA in a biological control programme, as there is evidence from studies in mainland Europe that a combination of three or more parasitoids can reduce lily beetle populations below damaging levels. Two species now occur in the UK, having arrived here naturally or through accidental introductions.
- It has been suggested that the deliberate introduction of a further parasitoid species to the UK may have an effect on the lily beetle problem, based on experience from mainland Europe and the introduction programme in the USA. However the research required to satisfy the necessary safety tests and legislation would take many years and the cost of work under quarantine conditions is likely to be prohibitive.
- A field trial indicated that lilies vary in their susceptibility to the lily beetle. *Lilium regale* was more resistant to the beetle than were five hybrid lilies. Additional trials over a longer term, and with a wider range of lily hybrids and species, are required to further quantify these differences and to fully assess the potential for selective breeding of more resistant lines for use in management of this pest.
- Investigations into the beetles chemical ecology indicate that they use chemical cues (semiochemicals) to help find host plants and mates. A range of laboratory techniques has been used successfully to identify some of the volatile chemicals produced by lily plants that appear to attract the beetles.
- The project has demonstrated that it should be possible to develop semiochemical based control measures against *L. lili*, resulting in reduced reliance on broad-spectrum insecticides. However further work is required to elucidate and identify the most

effective combination of chemicals involved in beetle attraction. This may enable the development of synthetic blends of chemicals which can be used to manipulate the behaviour of the beetle, for example by placing semiochemical-baited traps at glasshouse entry points to prevent beetle invasion of commercial production systems.

- It was originally planned to investigate the chemical ecology of lily beetle parasitoids but following discussions with scientists at CAB International (formerly the Commonwealth Agricultural Bureau) field station in Switzerland it became apparent that much of this work had recently been done by them and so priority was given to the chemical ecology of the beetle itself.

Financial benefits

- There are no immediate financial benefits to be gained by growers from this work, except that the risk of financial losses due to lily beetle damage in commercial production systems can be minimised by following the recommendations to inspect any imported growing lily material for beetle presence before introduction into growing systems.
- Future development of control strategies based on the breeding of increased resistance into commercial hybrid lilies and the development of semiochemical-based traps would have the potential to provide financial benefits.

Action points for growers

- It is recommended that lily providers and professional gardeners remain vigilant and take action against the beetle as necessary. For lily providers, currently the most successful action is likely to be the use of a broad spectrum foliar insecticide; this may need repeating throughout the natural growing season of susceptible plants.
- Steps should be taken to minimise the risk of accidental introductions of beetles into commercial production systems. Standard precautions such as screening of potential entry points such as glasshouse vents should be taken but more importantly, any importation of growing material should be rigorously inspected for the presence of beetles, especially larvae and eggs. The beetle does not occur on dormant bulbs and these need not be inspected.
- Providers who supply lilies in pots should take care that all outgoing stock is free of the beetle and its damage. This is especially important for those providers supplying lilies to large retail outlets where contamination with beetles can result in significant economic penalties and rejected shipments.

Science Section

This has been reported in the form of a PhD thesis detailing all the work carried out during the project.