



PROJECT PROPOSAL

**Development Oxitec RIDL[®] strains of
the red palm weevil, *Rhynchophorus ferrugineus***

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Introduction

Oxitec's RIDL technology is an insecticide-free, highly targeted pest control tool. The red palm weevil (RPW), *Rhynchophorus ferrugineus*, is currently devastating commercial and ornamental palm trees in the Mediterranean region, and no current control option provides an effective solution. RPW is highly amenable to control by RIDL, which relies on the mate-seeking behaviour of the male insect, and is therefore highly effective at controlling a pest that is difficult to seek by other means.

This document outlines how a RIDL product strain would work, and be developed, including resources requirements and projected timescales. We propose a two-phase development project with regular milestones.

Background

Oxitec is a British company which is pioneering the development of RIDL technology in controlling insects that spread disease and damage crops. RIDL technology originally arose from Oxford University, and Oxitec was created in 2002 to develop and commercialise this highly promising line of research. RIDL is a highly targeted and cost-effective form of biological control, which is safe to other species and causes no lasting impact on the environment.

RIDL insects carry a genetic modification that causes their offspring to die, but can live and reproduce normally when the larvae are fed a diet containing a supplement. This allows the insects to be produced as normal in captivity, but means that they cannot reproduce in the wild. Released RIDL males find and mate with wild females, whose progeny will die. Releases of male RIDL RPW over a sufficient time will suppress, or even eliminate, the target pest population.

This technology is particularly suitable for application against RPW, because it can be difficult for control personnel to locate the presence of the insect until a palm tree starts to die. Released RIDL males would be able to do this job much better: adult RPW release pheromones to attract other weevils to their location on a palm tree.

Oxitec believe its technology is particularly suitable for combatting invasive pests - as the approach is species specific and environmentally sound.

Key benefits of RIDL technology:

1. Species-specific, so no off-target effects
2. Insecticide-free
3. Compatible with other integrated pest management (IPM) options, including pheromones, natural predators and insecticides
4. Highly effective and non-damaging as a preventative treatment, or when pest levels are low
5. Self-limiting, so RIDL strains are not able to establish in the wild
6. RIDL is easy to monitor, as product strains carry a fluorescent marker to easily distinguish them from wild counterparts.

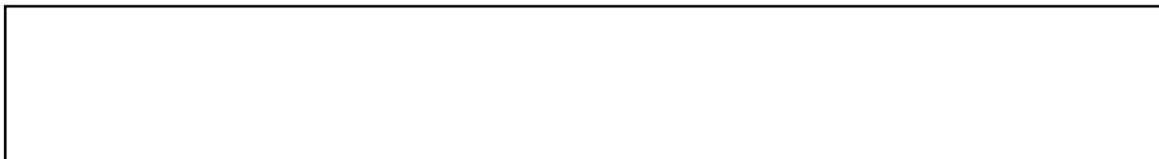
Project outline

The generation time of RPW is long - 45-140 days. In captivity, this will likely be around 100 days. Development of RIDL relies on work over consecutive generations of the insect, so project duration is directly affected by this aspect of the target insect's biology. We therefore propose that initial proof-of-concept work is conducted in a beetle with a much shorter generation time, and in which significant previous genetic transformation work has been conducted. This will allow for the initial genetics to be assessed in a relatively short period of time. Meanwhile a colony of RPW can be established in the laboratory, and initial optimisation of rearing and transformation can be conducted. Transfer of genetics into the RPW can then take place, with RIDL strains developed in the second phase of the

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experiment, in tandem with development of mass-rearing methods to ensure cost-effectiveness of a RIDL product.

In summary:



Broad timings of the proposed project activities are outlined below, with Phase I in blue and Phase II in green.

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Transform red flour beetle							
RIDL in red flour beetle							
RPW rearing and transformation							
RIDL in RPW							
Develop RPW product strain							
Develop RPW mass-rearing							

On completion of the project, a RIDL strain of RPW, together with mass-production protocols, will be available for field testing.

Potential partners

Oxitec are the clear world leader in insect genetics and transformation, and in applying these techniques to pest control. Core activities for strain development - building genetic constructs, transformation, biological and molecular strain analysis - will, therefore, be conducted at Oxitec laboratories in the UK. Oxitec sees a clear need for involvement of other parties in the proposed project, with expertise in the insect and with the pest situation in the affected regions. Oxitec have links with scientists in CIRAD, who would likely be able to provide assistance in sourcing and establishing a colony of RPW, and with development of mass-rearing. Parallel work by such parties, modelling application of RIDL against current and future target populations of RPW, and also RIDL’s position in a successful future IPM programme, would be highly appropriate additional contributions. Oxitec have a long history of successful research collaborations with overseas partners, for example, Institut Pasteur, Paris; the US Department of Agriculture; the Malaysian Ministry of Health; and the Shanghai Institute of Plant Physiology and Ecology.

Budgetary estimates

Based on the resources required for activities outlined above, Oxitec would estimate the following in costs:

- Phase I (2 years),
- Phase II (5 years)



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As outlined, the project has been broken down into two main phases. However, more frequent decision milestones can be built into the project, with associated step-wise payment of funding, if preferred.

These costs, which are indicative at this stage, include all research and development labour and materials, but exclude regulatory input from Oxitec, which can be included if required. For example, if field trials are envisaged immediately at project end, Oxitec regulatory specialists and other project partners will be required to draft permit applications.