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PALM PROTECT Report Summary

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Periodic Report Summary 1 - PALM PROTECT (Strategies for the eradication and containment of the invasive pests Rhynchophorus ferrugineus Olivier and Paysandisia archon Burmeister)

Project Context and Objectives:

The interdisciplinary, international PALM PROTECT consortium aims to develop reliable methods, for use by national plant protection organisations (NPPO), inspection services, growers and other end-users, for early detection, eradication, control and containment of the red palm weevil, Rhynchophorus ferrugineus Olivier (Coleoptera, Curculionidae) and the moth Paysandisia archon Burmeister (Lepidoptera, Castniidae). The methods will be developed for use at origin, point of entry, in transit and on-site to combat these invasive pests of palm trees. The methods will support stakeholders and end-users in the implementation of Council Directives 2000/29/EC, 2007/365/EC, 2008/776/EC, 2009/7/EC and 2010/467/EU.

The consortium has identified the major challenges to achieve these goals and has 4 main project objectives:

1. To provide a more comprehensive understanding of the biology of R. ferrugineus and P. archon to facilitate decision making for risk assessment and optimisation of monitoring and control methods.

2. To combat the spread and establishment of R. ferrugineus and P. archon by the development of technologies for the early detection and monitoring of these pests.

3. To develop methods to eradicate, control and contain R. ferrugineus and P. archon, to restrict their further invasion of EU territories.

4. To disseminate the findings of this work both within and outside the EU community, through working with NPPOs, the European Plant Protection Organisation (EPPO) and other stakeholders.

The project will address the gaps in current technology for the detection, eradication and containment of R. ferrugineus and P. archon, thereby helping to minimise the economic and environmental impact of these pests.

Project Results:

Biology

Adult dispersal has been evaluated using radio tagging, release and recapture of males using pheromone traps. Monitoring insects in semi field conditions and tethered insects on flight mills have been used to assess flight capabilities of both R. ferrugineus and P. archon and their responses to scented and visual targets.

Life cycles and palm tree host ranges of R. ferrugineus and P. archon are currently under investigation in different countries. The effect of cold tolerance on development and survival has been assessed.

Identification of odorants that trigger major olfactory guided behaviours is critical for monitoring and control strategies. However, the identification of an attraction pheromone in P. archon is a major challenge. Palms kairomones have been identified and the search for a R. ferrugieus pheromone synergist is ongoing. Repellent molecules reduce visits of R. ferrugieus to pheromone traps (semi-field conditions) and egg laying (laboratory conditions).

The search for a P. archon egg parasitoid have so far proved unsuccessful, despite extensive egg collections from the field and attempts to parasitise eggs under laboratory conditions.

Detection and monitoring

a. Quarantine

Dogs can be used to detect R. ferrugineus in palms in quarantine. Their abilities to discriminative odours and detect infestations in different palm species is being investigated.

The detection of R. ferrugineus larvae in palms using acoustic devices showed that a laser vibrometer and a tactile microphone performed with similar accuracy, but the latter can be inserted into the trunk improving detection, and is cheaper. No significant differences were measured between R. ferrugineus infested and un-infested palm trees using thermal imaging (infrared camera).

b. Area wide

Protocols being developed for area wide detection of R. ferrugineus include trapping; optimising their distribution in urban areas and date plantations, visual inspection and thermal imaging.

Preliminary data show that a newly developed Picusan® trap is most effective and optimal release rate of pheromone has been determined Enhancement by palm kairomones is being investigated

The spread of R. ferrugineus from an infected urban area into an uninfected agricultural (date) area is being monitored.

A Location Aware System (CPLAS) is being optimised for use in large areas.

Control

Control methods against R. ferrugineus and P. archon have been reviewed.

Physical and chemical methods for the control of R. ferrugineus in quarantine are being evaluated.

Standard protocols for testing effects and efficacy of chemical insecticides have been developed, and lethal doses against R. ferrugineus determined. These will help optimise delivery methods in the field. Endoterapia Vegetal have developed a new trunk injection prototype and formulation specifically for palm trees. The residual effect of insecticides after injection and spraying has been assessed in various palm species.

Insecticidal secondary metabolites from entomopathogenic fungi have been identified. Injections into palm trees are underway to check for phytotoxicity and to evaluate field efficacy.

Highly virulent fungal strains isolated from R. ferrugineus and strains from P. archon or R. ferrugineus in different regions have been characterised to test as biological control agents.

Semiochemical based techniques are dependent on compounds indentified in WP2. A prototype 'attract and infect' device that performs well against R. ferrugineus has been developed, and semi-field assays are in progress.

Evaluating what is at risk and estimating impact

An economic evaluation of the benefits of applying new management measures that emerge from Palm Protect requires an understanding of the value of palms at risk and information about actions taken and associated costs.

A comprehensive literature review identified two principle economic markets; date fruit and trade in live plants.

Date production in southern Mediterranean countries is a major economic activity and Egypt is the single largest producer of dates in the world. Annual production consistently exceeds 1.3 million tonnes, worth over €375 M. Live palm plant trade generates income and provides employment, and has been largely responsible for the spread of the palm pests.

A report on ecosystem services provide by palms has been completed. Palms are high value landscape amenity trees generating a variety of important ecosystem services. These include the historic palm groves in Spain, Italy and Greece, highly valued collections in botanic gardens which also help conserve threatened palm species.

Potential Impact:

Expected results of research work packages

Work Package 2 (Biology) will provide critical experiments to fill in the knowledge gaps on the biology and ecology of R. ferrugineus and P. archon, and document the traits of the life histories of both pests that allowed them to successfully invade the Euro-Mediterranean region. Research will establish the relationships between the pest species, host palm species and climate and the dispersal capabilities of the pests. The major odorants and visual cues that modulate population dynamics (mate and host plant finding) and the parasitoids adapted to P. archon will also be identified. This work package will also provide improved and novel tools for the detection (work package 3) and control (work package 4) of R. ferrugineus and/or P. archon.

The expected outcome of work package 3 (detection and monitoring) is to prevent the spread and establishment of R. ferrugineus and P. archon within and between countries by the development of effective non-invasive tools for (early)

detection of infested palms. These tools will be developed for detection of pests in quarantine (trade points) and in open areas, te latter by development of a location aware and decision support system for are wide control of R. ferrugineus

Work package 4 (control) will provide a critical data review and new research on the identification, development and validation of different control methods aimed at the containment and/or eradication of R. ferrugineus and P. archon under the European / Mediterranean conditions.

This work package will also develop scientifically based protocols for (1) quarantine treatment of palms in transit, (2) for eradication /containment including preventive and curative techniques, and (3) proper disposal of infested material.

Valuing what is at risk and estimating impacts (work package 5) will develop an understanding of the socio-economic value of the natural resources threatened by Rhynchophorus ferrugineus and Paysandisia archon, assessing the value of palms and palm products from market and environmental points of view. Risk assessment methods will be used to estimate the potential economic impact that the pests could have under given scenarios. The cost of implementing pest management and control options that emerge from Work package 4 will be estimated in order to inform decision makers who may face a choice of different management strategies and will need support to select appropriate and proportionate management measures against R. ferrugineus and P. archon.

List of Websites:

www.palmprotect.eu

Contact

Audsley, Neil (Senior Scientist) Tel.: +00441904462628

THE SECRETARY OF STATE FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS United Kingdom

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