

MANAGEMENT PROGRAMS & CHALLENGES IN RPW CONTROL IN EUROPE

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PALMS IN EUROPE



Palm trees are widely planted as amenity trees in the whole
EU- Mediterranean area

MAIN PALM TREES IN EUROPE

Date Palm /World Heritage



Cretan date palm (*P. theophrasti*)
Endemic in Crete



Natural Landscape 'Canary islands'

- Palms in cities, private gardens, resorts
- High environmental, economic and cultural importance
- Public is very concerned about their preservation.

MAIN PALM TREES IN EUROPE



Phoenix dactylifera

Date palm



Phoenix canariensis

Canary Island palm



Borassus flabellifer

Palmyra palm



European mainland

Chamaerops humilis

Mediterranean
dwarf palm



GLOBALIZED WORLD Increase in trade over the last decades

Beginning of the 2000, EU countries introduced annually thousands of palms, mostly *P. dactylifera*



Increasing the risk of introducing new pests & diseases

Favorable weather
Ecological conditions,
Lack of natural enemies



Lead to environmental changes /palm trees damages

INTRODUCTION OF THE RED PALM WEEVIL IN THE EC



LIFE CYCLE

Harmefull stage



**Tunnels
& large cavities**

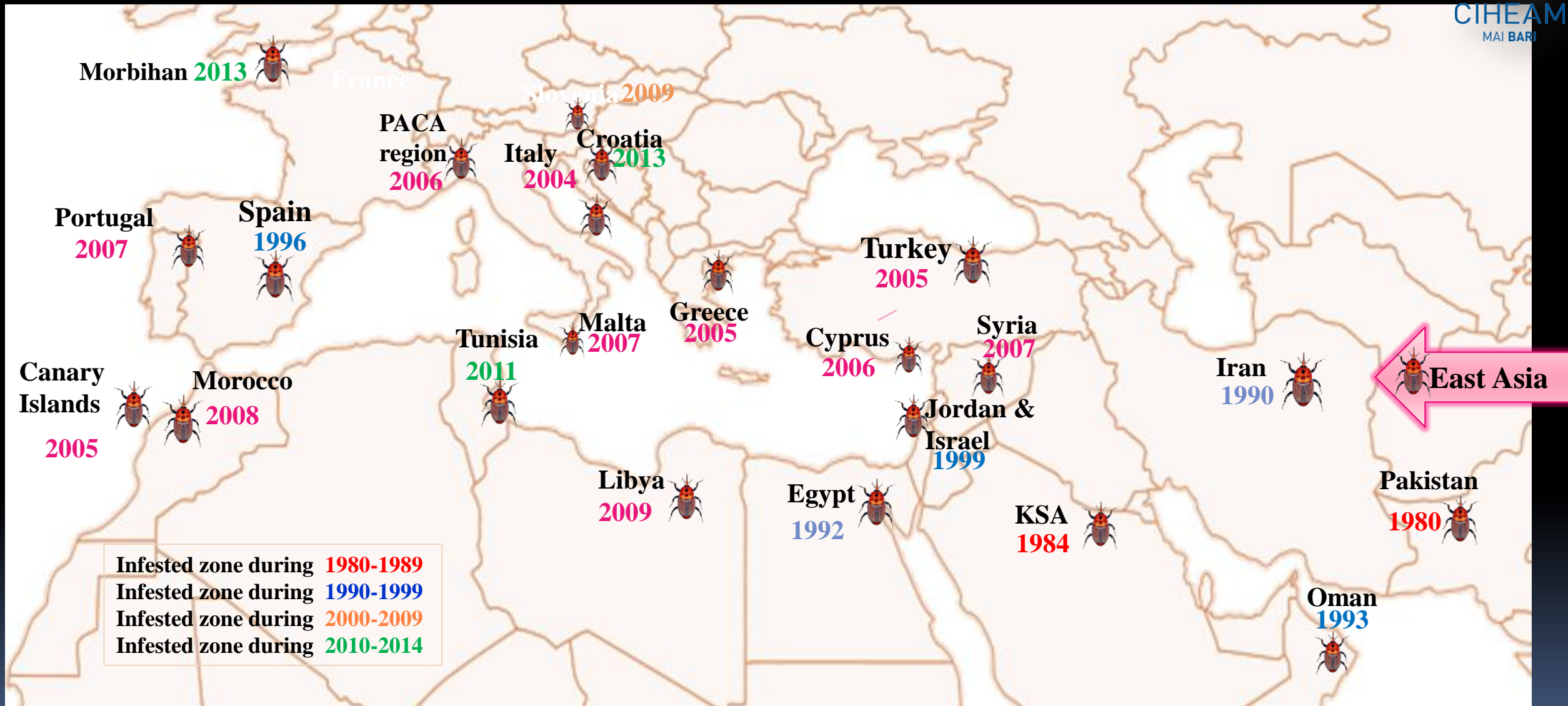


**Destruction of new vegetation
and the bending of old leaves**

Chewed-up fibres are ejected

The insect does not threaten plants with a stem diameter smaller 5 cm/ base

RAPID SPREAD



The international trade of plants: major pathway for the spread of RPW

LETHAL SYMBIOSIS



Damaged/Toppled crown



ENVIRONMENTAL & SOCIAL IMPACT

Thousands of palm trees destroyed

Economic losses and an increase in the use of pesticides.

OTHER ORNAMENTAL PALMS IN EUROPE / LESS AFFECTED

Date Palm, Catania Hospital, 2007



March



July



Chamaerops humilis



Washingtonia spp.

Measures to prevent their further introduction & spread ?

EU POLICIES

Commission Decision 2007/365/EC on emergency measures to prevent the introduction into and the spread within the Community of *Rhynchophorus ferrugineus* (Olivier)



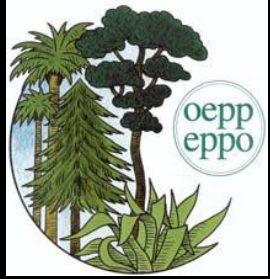
EU POLICIES

RPW Rapid spread the EU Commission adopted in 2007 emergency measures to prevent the introduction into and the spread within the Community of *Rhynchophorus ferrugineus*

Following International conference on RPW in Spain (2010). EU Commission amended the decision 2007/365/EC. incorporated into national, regional and local laws.

Revised Decision provides for stricter measures to combat the RPW.

EUROPEAN PLAN ACTION



The pest is considered as a quarantine pest that should be regulated in EPPO countries as it is considered of limited distribution (A2 pest). Diagnostics standards (PM 7)

The emergency measures included

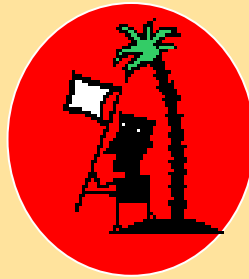
- Listing of susceptible hosts:
- Specific requirements for the imports into the EU
- Specific requirements for the internal movements within the EU
- Surveys to check for the presence of red palm weevil
- Demarcation areas, where red palm weevil is present

NPPO responsibilities in accordance with the International standards (ISPM)

ESTABLISHMENT OF DEMARCATED AREAS

BUFFER ZONE

At least 10 km
apart from the
infested zone



INFESTED ZONE. Presence of
the plant pest confirmed &
includes all susceptible
plants showing symptoms
caused by the plant pest,

THE UNION'S FINANCIAL ASSISTANCE

Solidarity provision

1. In cases of RPW introduction/spread within the EC.

Member States receive from the Community a financial contribution for “plant health control” to cover expenditure relating directly to the necessary measures, which have been taken or are planned for the purpose of combating the organism

2. Assistance for research

Foster and coordinate research projects and development of programs focused on the early detection, biology and on the control and eradication of the pest.

EUROPHYT

European Union notification system for plant health interceptions



More than half of the new findings notified in 2014, involved a limited number of harmful organisms which **every year** represent a **substantial proportion** of the notifications of new findings, including *Rhynchophorus ferrugineus*

CONTROL OF THE RPW IN EU INFESTED COUNTRIES

Experimentation and limited applications of various preventive and curative control actions, based on traditional and innovative technologies.

EARLY DETECTION/ SCREENING

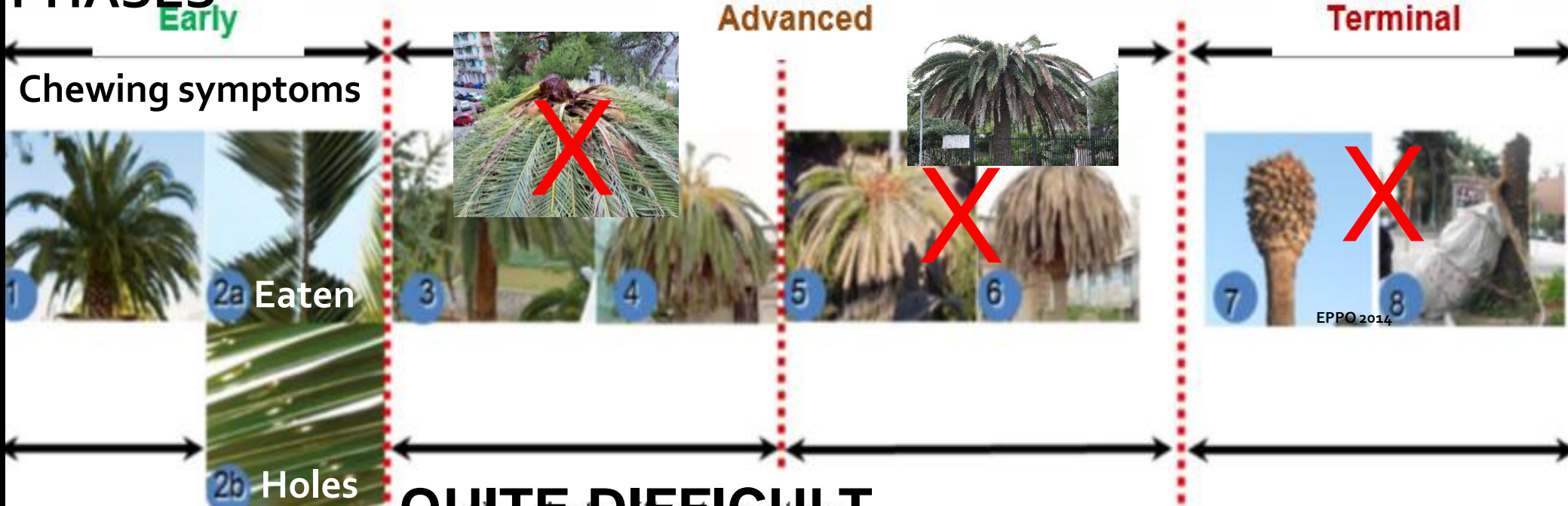
Early detection of infestation is crucial in palms at very first infestation step, with apical meristem not yet damaged & with the trunk still stable

Appearance of symptoms  Too late to save the tree

Large number of trees, in an inspected region, of various species, ages and growth conditions which need to be routinely monitored for pest infestation.

EARLY DETECTION

PHASES



QUITE DIFFICULT

VISUAL INSPECTIONS

1. Symptomless
2. Affected shape of the leaves
3. 4. Crown partially collapsed
5. 6. Crown leaves collapsed "umbrella" shape
7. 8. stipe without leaves/ collapsed

Asymmetric inner
leaf growth

VISUAL INSPECTIONS

Conventional early detection of RPW infestation laborious, time consuming, costly and yet inaccurate

Inspection at the crown required substantial equipment such as platforms, large workforce & trained personnel .



Gloeosporium vermoeseni



Fusarium oxysporum



Paysandisia archon



CHEMICAL/OLFACTORY DETECTION

Weevil infested palms emit characteristic **volatile signal**

“liquid composed of chewed plant tissue with fermenting odor oozing from the wounds in the infested palm”

NOT YET IDENTIFIED



Chemical detection successfully used

1 Rottweiler & 2 Golden Retrievers accurately detect various numbers of RPW larvae and/or adults, buried at the base of different palm species (i.e. *Phoenix spp.*, *Chamaerops sp.*, *Washingtonia spp.*, etc....).

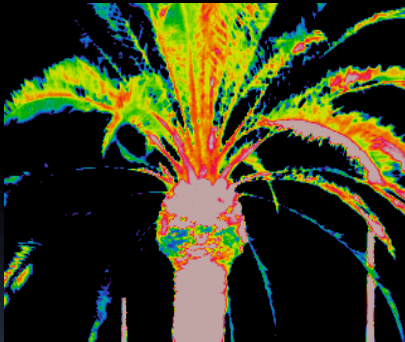
Dog-assisted detection fit well for palm inspection at nurseries, ports of entry and/or quarantine facilities.

ACOUSTIC & THERMOGRAPHY DETECTION

Detection of the noise emitted by the larvae chewing & moving



Both human & machine accurately detect red palm weevil inside young palms.



Larvae chewing and oozing, increasing internal T°

Potentially feasible

- Necessity of controlled environment (No interference).
- Only individual tree detection (Offshoots/ quarantine facilities) for the acoustic and thermography detection

CONTROL METHODS

Treatment measures as an alternative to the destruction of the palm trees

- Mass trapping with pheromone/kairomones
- Microwave treatments
- Curative treatment with insecticides
- Biological treatment
- Trunk injection
- Mechanical sanitation

TRAPPING,

Assess and forecast distribution of red palm weevil

The RPW seems to be attracted by 'ferrugineol' (4-methyl-5-nonanol), an aggregation pheromone that especially has an effect on females.

acts synergistically with host palm specific kairomones, typically early fermentation associated volatiles



Longo, 2008



Traditionnal & Commercial traps

COSTRAINTS

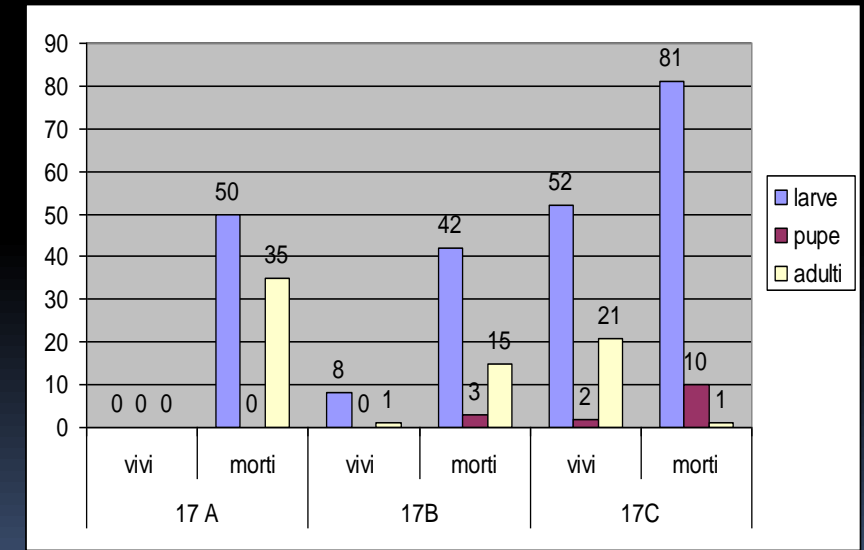
- Problem to evaluate the density of the traps to be set up, in order to detect primary infestation is still to be determined.
- Problem to ensure trap structure and quality of the components
- Costs,

In Greece. Traps are operated only for a limited time and period in a year (Aggelakopoulos et al., 2012).

MICROWAVE TREATMENTS



ECOPALM
Machine with a Circular Belt
endowed with electric generators of MICROWAVES



PESTICIDES USE

The use of insecticides remains even recommended to prevent future infestation

Urban areas, Gardens.
Restricted number of
active substances of
EU DIR 2009/128 EEC

- ABAMECTINA
- CYFLUTHRIN
- CLORPIRIFOS
- CLOTHIANIDIN
- EMAMECTIN
- PHOSMET
- THIAMETHOXAM
- IMIDACLOPRID

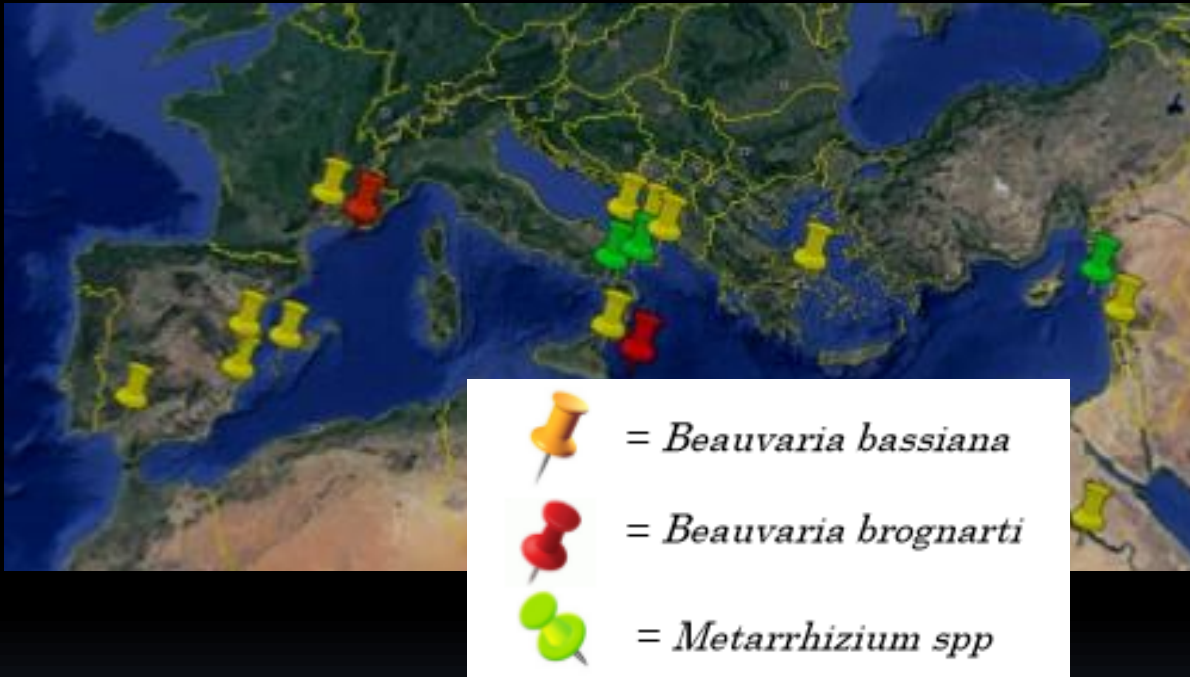
Toxicity to vertebrates.
Non-environmentally friendly
Not sufficiently effective against the larvae



In Spain, 2-4 micro-sprinklers fixed on the stipe / reaching the palm tree crown;

ENTOMOPATHOGENIC AGENTS

Palm protect project, 2014)



AUTHORISATIONS ?
Costs & T° limitations ?

Lack of effective natural enemies under field conditions that could contribute to the reduction of the weevil population.

Nematode *Steinernema carpocapsae*



TREE INJECTION

Injecting a cocktail of insecticides in the palm



Hole 15-25 cm long in the trunk/ catheter

- Trunk injection devices to improve delivery of insecticide within the palm through better formulations and to eliminate damage to palm tissues.
- Protect the environment, avoiding pollution
- **Efficient where the infestation was not high**



CIHEAM
MAI BARI

CURATIVE TREATMENT



Tissues excised



Tree surgery



MECHANICAL SANITATION



EFFECTIVE IN EARLY INFESTATION

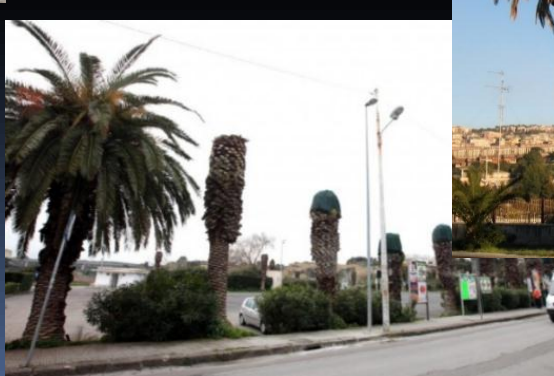
Sprout

Sicily, 50 palm trees

PROBLEM/REINFESTATION

DESTRUCTION OF PALM PATRIMONY

- Palms introduction from infected areas
- Heterogeneous situations, difficulties to implement regulations
- Inadequate involvement of stakeholders
- Difficulties to involve homeowners in the IPM process
- Limited human resources
- No fully efficient protocols



SOCIO ECONOMICAL IMPACT

Outside of date-producing areas, RPW has killed thousands of palms (mainly *P. canariensis*) in the **plant nurseries & urban landscapes**
Significant impacts in famous tourist resorts France, Italy, Spain

Estimated costs

Across several regions (France, Spain, Italy)

> €45M on eradication and control (plant nurseries, urban landscapes)

In France, the direct cost for removing and replacing dead palms has been estimated at more than €500 million (Ferry , 2010).

BARI DOWNTOWN (2011-2013)

	164 Eliminated Palm (value)	phytosanitary control
€ Estimation	2.022.528,00	105.100,00

PROMISING STRATEGIES

1. CANARY ISLANDS

Eradication of RPW since 2013, the last foci declared free during May, 2016.

The strategy was supported with :

- Adequate resources,
- Right planning and efficient organization
- Good coordination
- Involvement of all stakeholders
- Data collection and spatial analysis managed by a mobile app
- GIS implementation
- IPM Program, divulgation, awariness
- Legislation

1. CANARY ISLANDS



Visual Inspections



MONITORING



FAST ERADICATION & PACKAGING



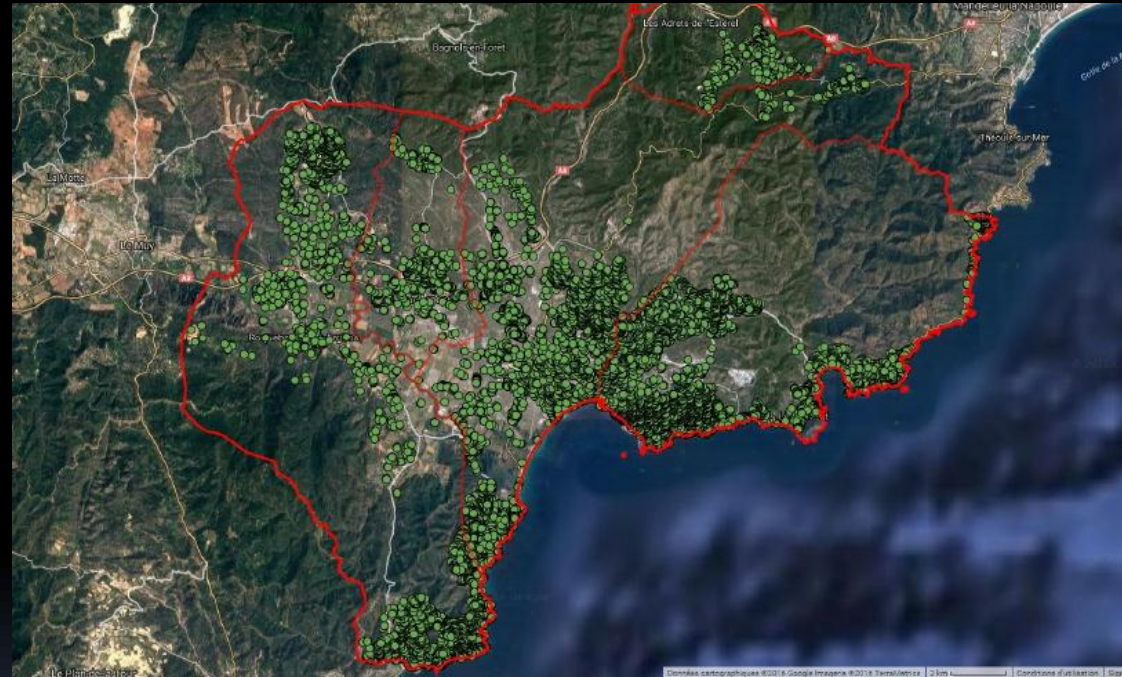
Canary Islands Eradication program team
PREBURIED, CRUSHED
TREATMENTS



GIS & MOBILE
APPLICATION

2. Recent Strategy in France

Regional Collective Network Plan for RPW eradication (CAVEM - South-East France)

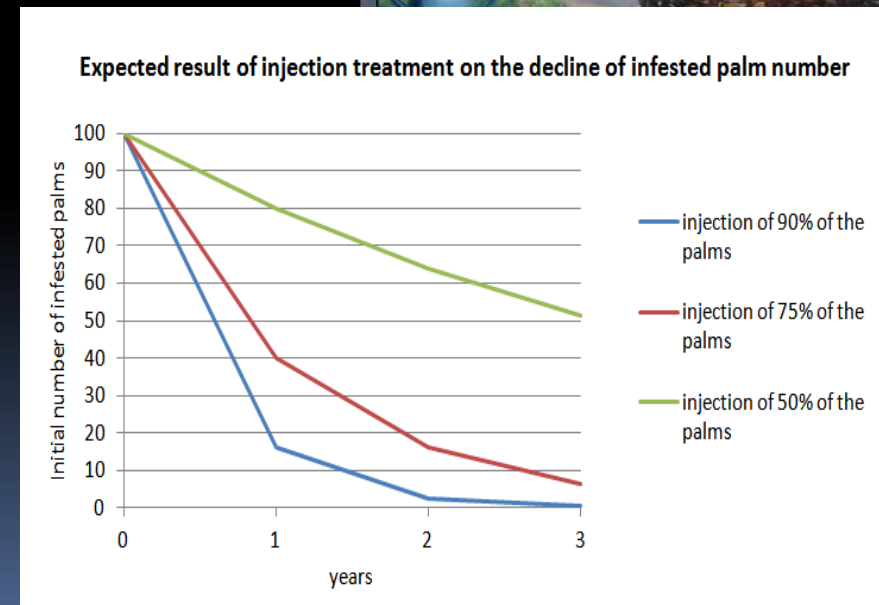


Approach to eradicate RPW by organizing the grouped, rapid and low cost treatment of Canary palms, under the supervision of the PPO and by boosting palms owners cooperation.

- Application of a injection treatment:
- Drilling 4 shallow holes in the palm trunk and filling them with a simple device (injection by infusion),
- Protects the palms for one year
- Similar emamectin insecticide formulation

Quick regression of the number of infested palms if enough palms have been treated

Not to be applied on palms for fruit production (residues)



3. CIHEAM Bari

16 *P. canariensis* CIHEAM Bari campus

Starting point 2007



Pruning/ cleaning trees every two years

2007 - 2010 Tree injection each 3 months

2010 - 2017 Tree injection 7 - 8 months -

Sprinkling each month

TREE INJECTION



Drilling



Filling



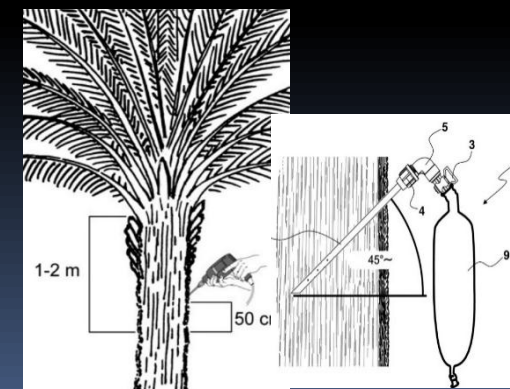
Injection



Removal



Closing



PATENT. BA2009A000014 int. code A 01 G 29 00

PRESENT SITUATION IN THE CIHEAM CAMPUS

14 *P. canariensis* present

1 *P. canariensis* eliminated for scientific scope

1. *P. canariensis* died by frozing after successful tree surgey

Around the Institute more than 90 % of the *P. canariensis* *destruced by RPW*

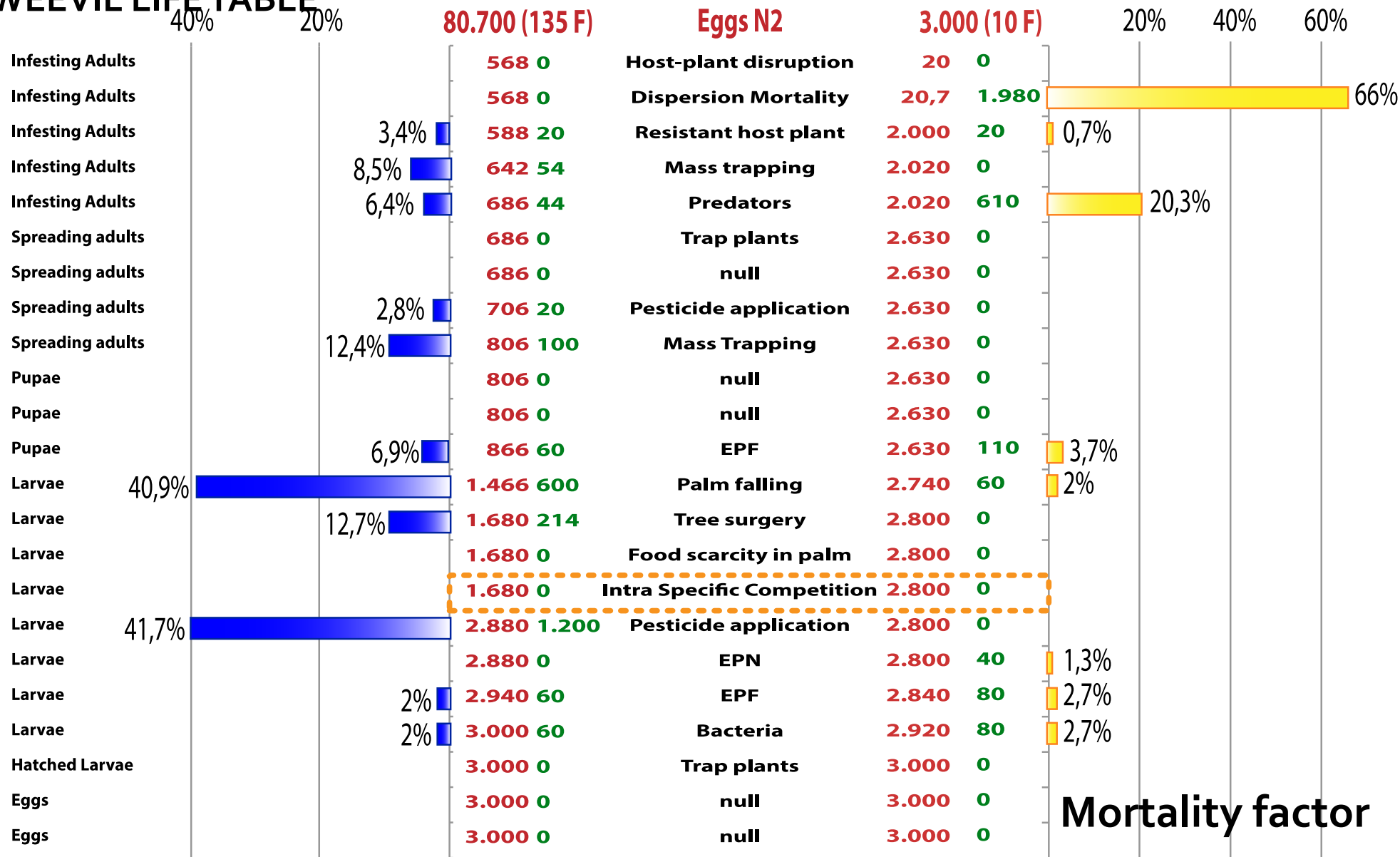


Control strategy shall originate from preventive & protective actions

Integrated strategy

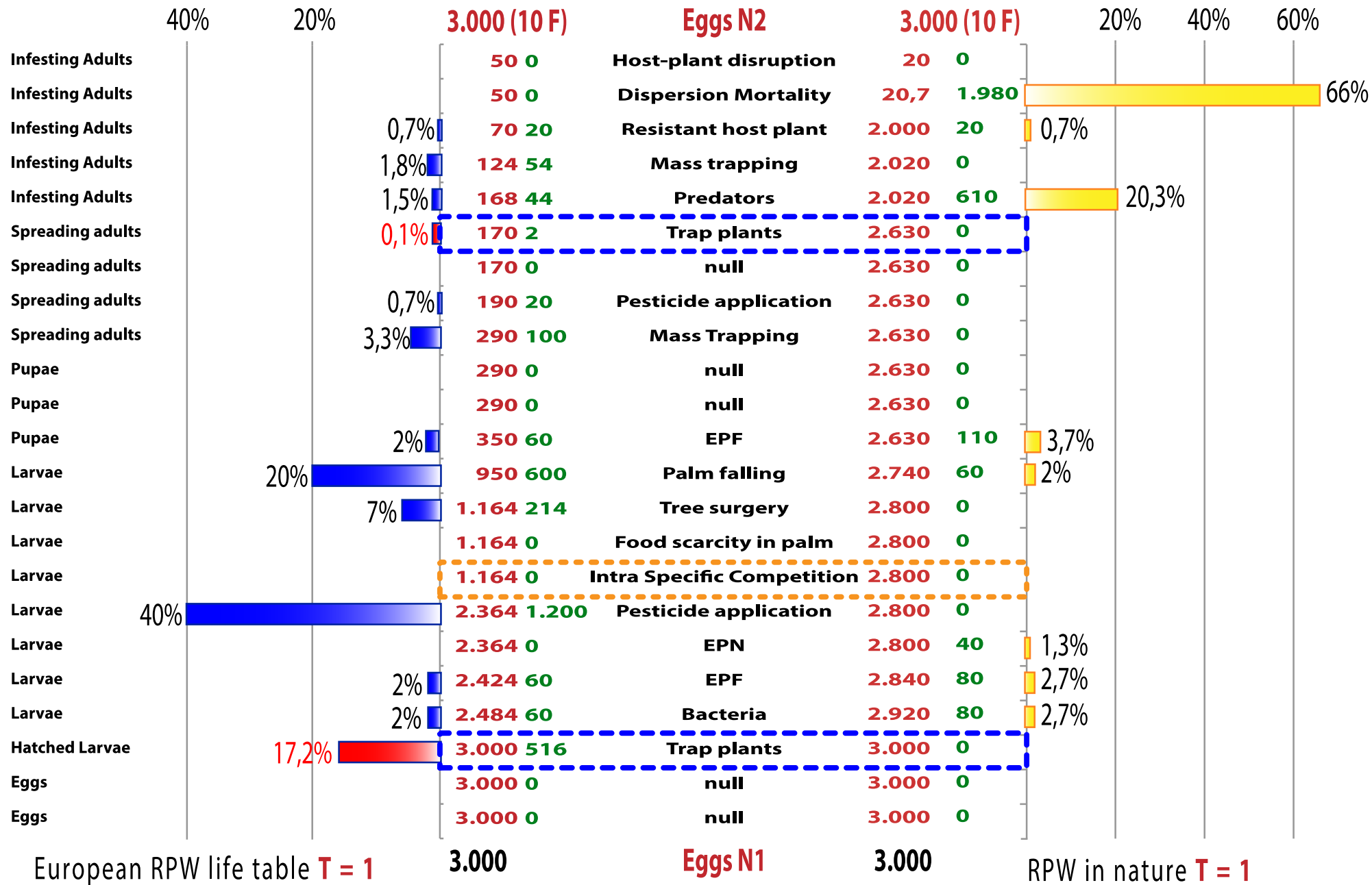
Target the pest by strengthening the phytosanitary measures, improving the early detection, considering the key-point analysis in **the weevil life-table, evaluating the pest population density and dynamic, the host plant density and the RPW ability to induce a protective environment.**

WEEVIL LIFE TABLE



European RPW life table **T = 26,9** **3.000** **Eggs N1** **3.000** RPW in nature **T = 1**

Mortality factor



Thanks for your attention



CIHEAM



MAIN INFESTED AREAS

