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The current state of the art research and technologies on RPW management

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Presentation elements

1. Introduction.
2. Invasion.
3. The Purpose of this study.
4. Methods used.
5. Results.
6. Area heavily worked on and others not?
7. Top Institutes.
8. Top Countries.
9. Examples of Efforts.
10. What is the next step.
11. Conclusion and Recommendations.

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Red Date palm weevil

Scientific Name:

***Rhynchophorus ferrugineus* (Olivier)**

Order: C**oleoptera** .

Family: Curculionidae.

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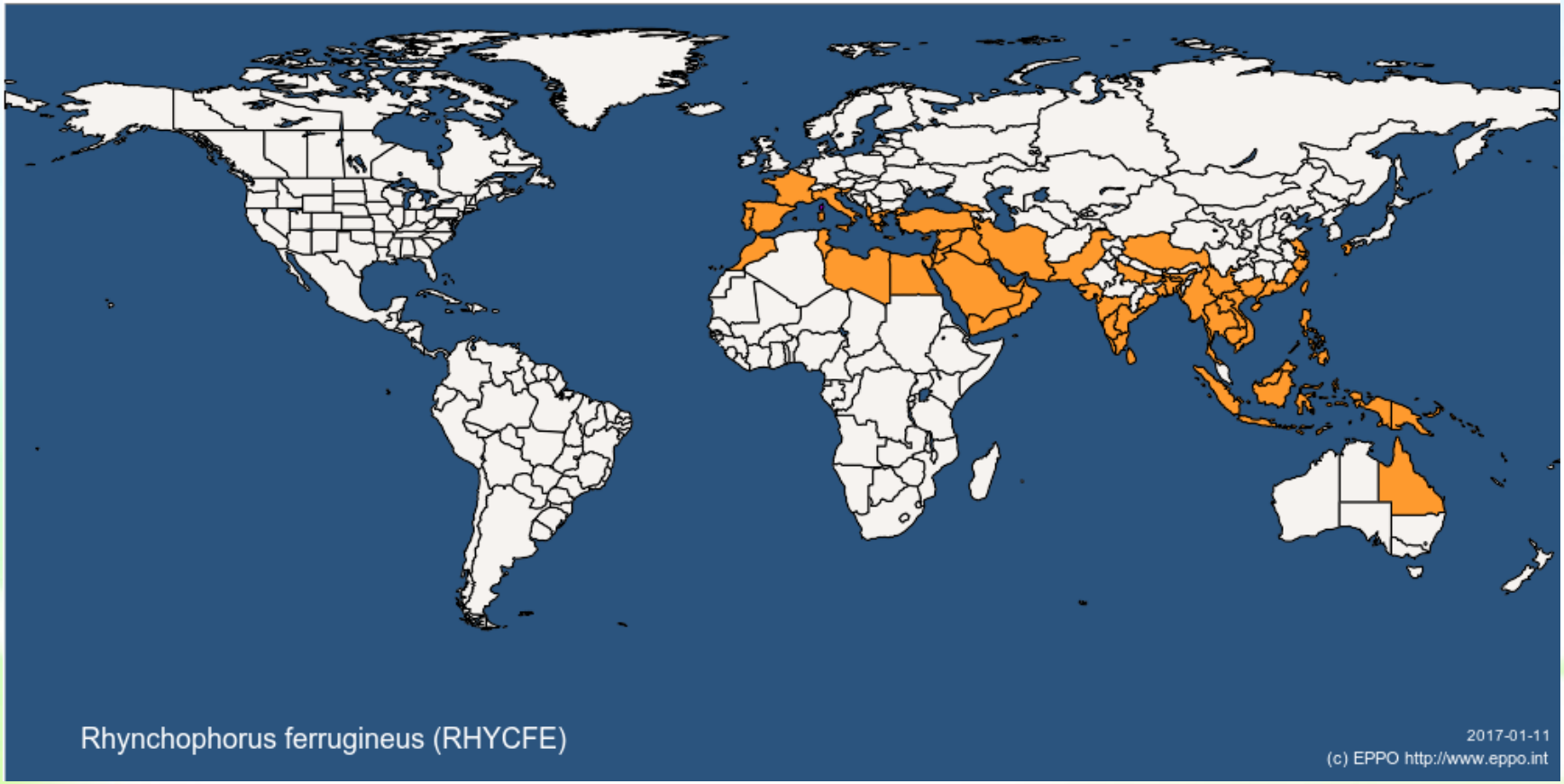
World Distribution of RPW



Global distribution of *Rhynchophorus ferrugineus* from the EPPO Global database. The detail records is provided at https://gd.eppo.int/taxon/RHYCFE/distribution

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Invasion

- Native to Indian Sub-continent
- Saudi Arabia mid 1980
- UAE mid 1980
- Egypt in 1992
- Turkey 2007
- Qatar in 1996
- Jordan, and Palestine in 1999
- China 1998
- Turkey 2005
- Spain 1993
- France, Greece and Italy in 2006
- Malta and Cyprus, 2007
- Portugal in 2008
- Cyprus 2006
- Slovenia/Georgia 2009
- California 2010

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Production of dates in major date producing countries

Country	Area (ha)	Production (million tones)
Algeria	164,695	848,199
Egypt	45,883	1,501,799
Iran	162,998	1,083,720
Iraq	125,000	1,083,720
Libya	33,877	174,040
Morocco	59,229	107,611
Pakistan	89,654	526,749
Saudi Arabia	168,962	1,065,032
Oman	32,000	269,000
Tunisia	53,000	185,000
UAE	48,000	245,000
Total	**983,298**	**6,692,261**
	(1.0 million ha)	**(7.0 million tons)**

FAOSTAT 2013. http://faostat3.fao.org/download/Q/QC/E)

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What is the purpose of this work

- To estimate how the world's research community is responding to the pressure of this pest.
  - focus areas and neglected areas.
- Identify centers of excellence or expertise.
- Identify location of the top institutes.
- Identify foundational and newly emerging technology.
- Identify technology sub-areas.
- Build a reliable strategic plane for R&D.

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Methods

Twenty Three Key Words

- Red palm weevil
- *Rhynchophorus ferrugineus*
- Pests of *Phoenix dactylifera*
- Insect pests of date palm
- Management of red palm weevil in palm plantations
- Management of red palm weevil in date palm orchards
- *Rhynchophorus ferrugineus* in Saudi Arabia
- *Rhynchophorus ferrugineus* in Middle east
- Synthetic Insecticides to control red palm weevil
- Natural insecticides for the control of red palm weevil
- Pheromones & trapping of red palm weevil
- Detection of red palm weevil
- Biological control of red palm weevil
- Rearing of red palm weevil
- Molecular aspects of red palm weevil
- Forecast of red palm weevil infestation
- Identification of red palm weevil
- Distribution of red palm weevil in Arabian peninsula and world
- Pest biology of red palm weevil
- Integrated pest management of red palm weevil
- Irradiation of red palm weevil
- Red palm weevil research articles
- Red palm weevil review articles

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Major Search Engines

- **ISI web of science**

http://thomsonreuters.com/en/products-services/scholarly-scientific-research/scholarly-search-and-discovery/web-of-science.html

- **CAB direct**

http://www.cabdirect.org/

- **Google**

www.google.com

- **Others**

1980's to February 2016 ~ 35 Years.

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Results

- One Thousands one hundred forty-nine (1149) article were collected.

- **Categories Used (12)**
  - Review articles
  - Pheromones & Traps
  - Insecticides (Synthetic & natural)
  - Biological control
  - Detection & Forecast
  - Molecular & Cell Studies
  - Rearing
  - Identification
  - Distribution & Surveys
  - Integrated Pest Management
  - Pest Biology
  - Irradiation

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  - Irradiation

- Categories Used Level 1
  - Detection & Forecast
  - Trapping
  - Pest Biology
  - Pest Prevention & Control
  - Others

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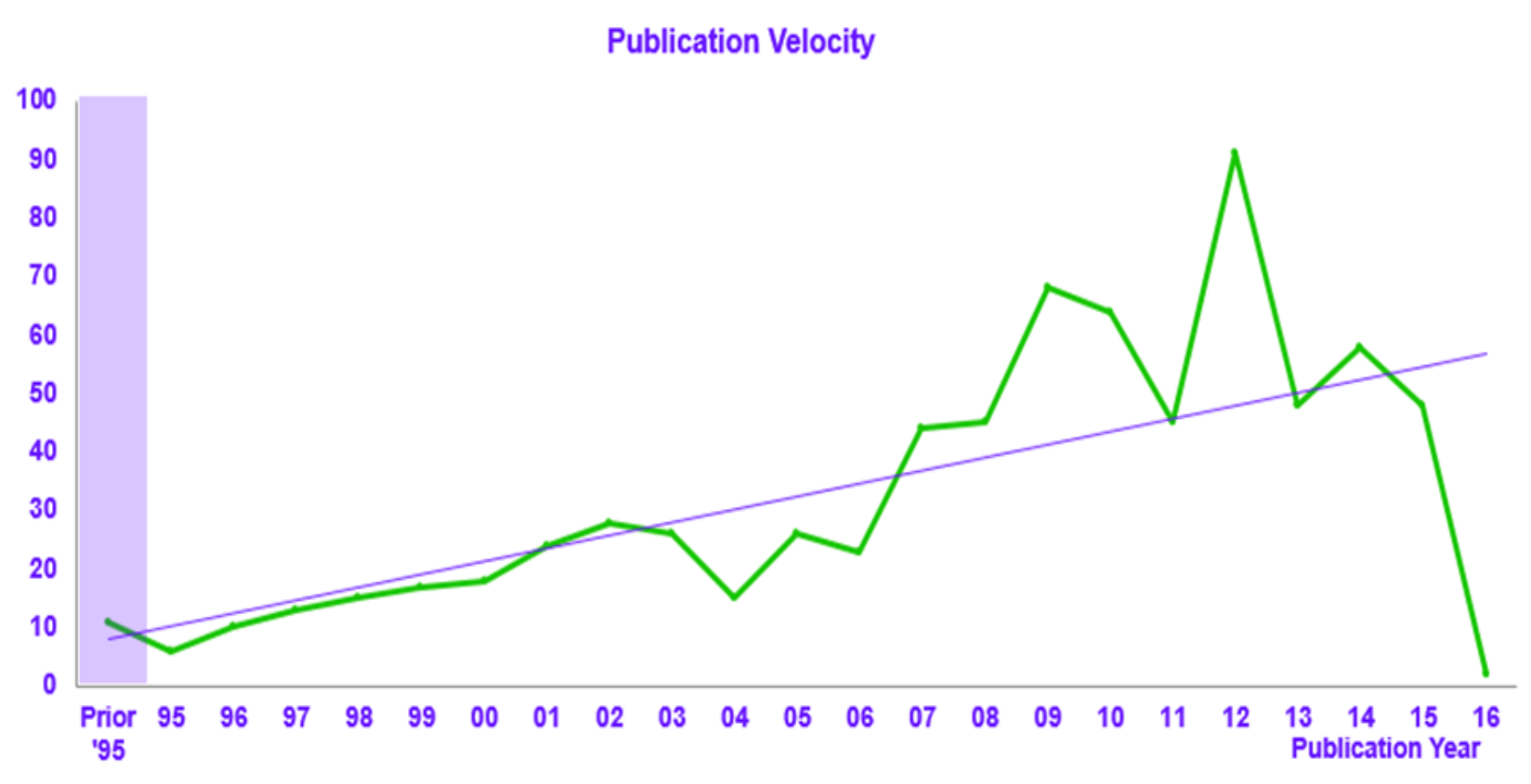
Fig 1 . Publication trends over the Study period 1980-2016



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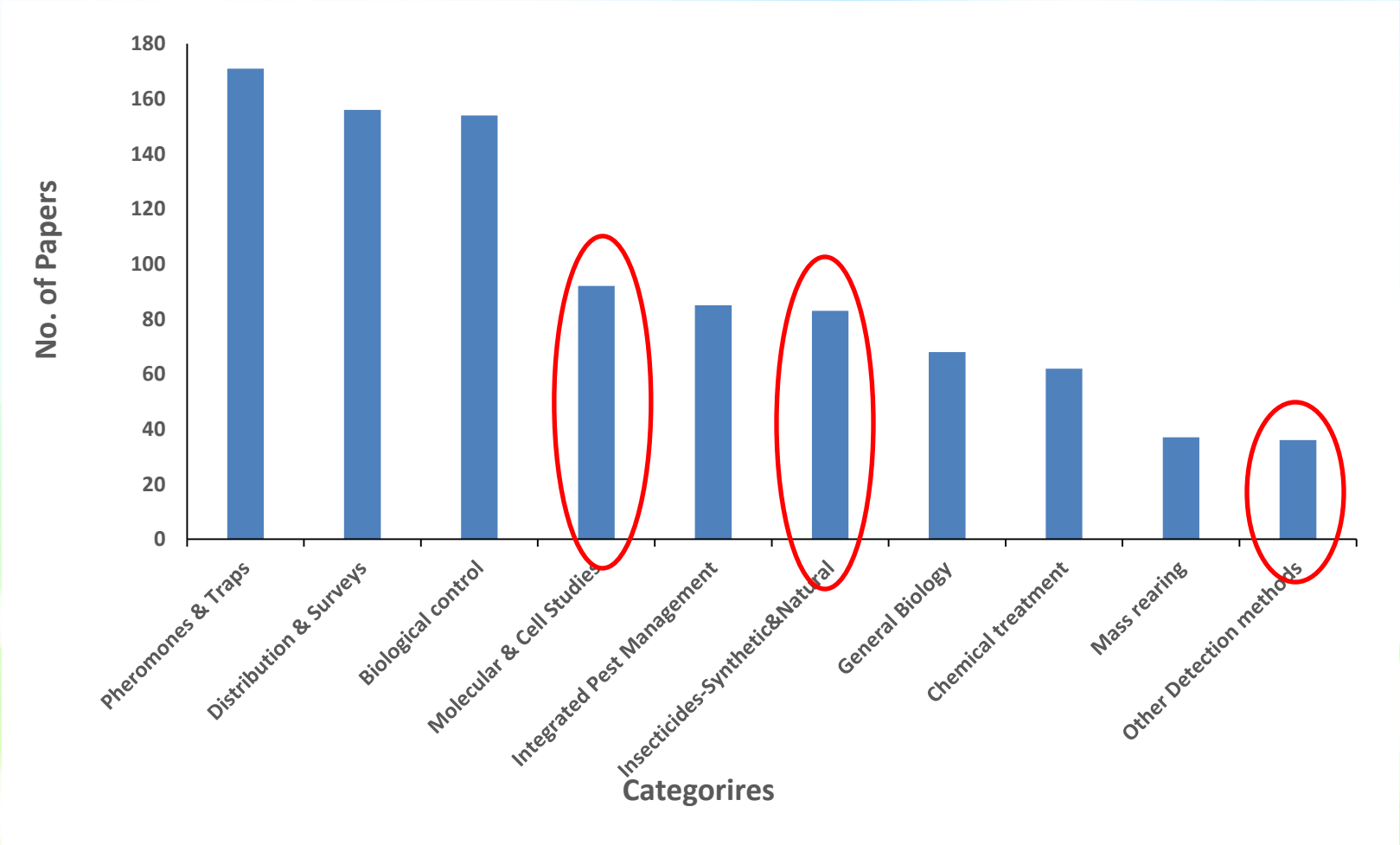
Top Ten Categories
Fig 2



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Technical categories Level 1.

Technical categories Level 1	Volume of Publications	Percentage of publication
Detection & Forecasting	71	6.17
Trapping	256	22.28
Pest Biology	190	16.53
Pest Prevention and Control	443	38.55
0thers	189	16.44
Total	**1149**	

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Technical categories Level 1&2.

Technical categories Level 1	Technical categories Level 2	Volume of Publications	Total Volume of Publications	Percentage of publication
Detection & Forecasting	Visual Symptoms Audbile Symptoms Other Methods	5 30 36	71	6.179
Trapping	Trap Designs Phermone Traps Other Trapping Methods Mass Trapping	27 171 21 37	256	22.281
Pest Biology	Molecular &Cell Studies Rearing General Biology	92 30 68	190	16.536
Pest Prevention and Control	Non-Chemical Treatments Chemic TRT. Bio-Control Insecticides –Systemic&Natura IPM Irradiation	34 62 145 83 85 25	443	38.555
0thers	Review Articles Distribution and Survey	33 156	189	16.449
Total			1149	%100

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Top Publication Countries

Publication Country	Volume of Publications
India	121
Saudi Arabia	111
Egypt	97
Italy	80
Spain	63
China	52
USA	34
Israel	21
UAE	17
Iran	16

- India records the highest volume of publications followed closely by Saudi Arabia and Egypt.

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Top Publication Organizations

Name of the Institute	Volume of Publications
King Faisal University	50
National Research Centre Egypt	29
King Saud University	28
University Jaume I	25
Chinese Academy of Tropical Agricultural Sciences	23
University Palermo	23
Plant Protection Research Institute	18
Central Plantation Crops Research Institute	17
College of Agriculture Vellayani	17
ICAR	17

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Single Vs Multiple

Authors	Percent of Publications
Single	**17%**
Multiple	**83%**

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What is the next step

Purpose

- Identify centers of excellence or expertise.
- Identify location of the top institutes.
- Identify foundational and newly emerging technology.
- Identify technology sub-areas.

Analysis

- Identify the top author and affiliations/organizations in the field.
- Identifying country of each of the top research institutes and universities.
- Highlight the key references in the field measured by citation, emphasizing significant emerging technologies when applicable.
- Segment the scientific literature references into the technical categories as closely relevant to the patent subcategories as possible.
- Identify any additional technical categories of interest covered in the scientific literature collection using any combination of data-mining techniques.

Building a strong Road Map

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Example of Directed Grants

وزارة البيئة والمياه والزراعة
Ministry of Environment, Water & Agriculture
المملكة العربية السعودية

مدينة الملك عبدالعزيز
للعلوم والتقنية KACST

RPW Research Grant Program Initiative

An Overview

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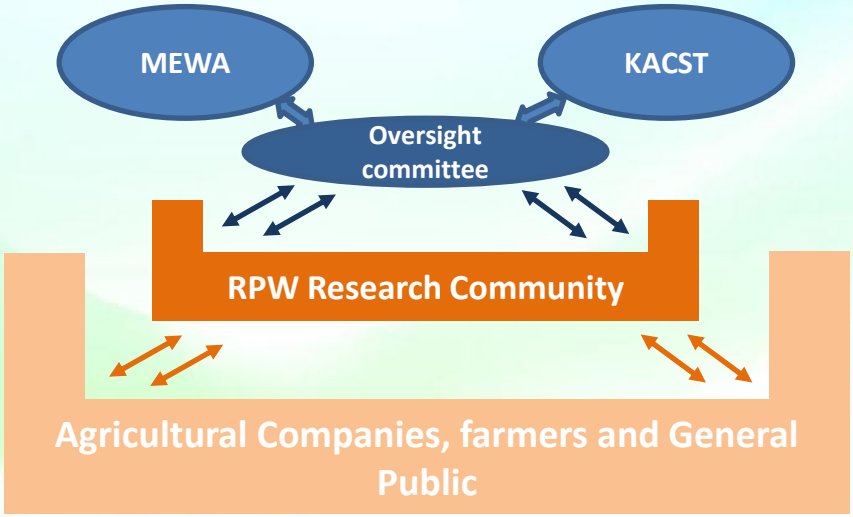
Stakeholders, Program Governance and Roles



- The Program's most important stakeholders/ enablers include:
  - MEWA
  - KACST
- Key beneficiaries include the general public, agricultural companies and farmers.
- Research community is the key contributor to the Program's success
- To ensure visible impact of the RPW RGP, each stakeholder's competencies and strengths are leveraged
- The Program is administratively supported by a Program Secretariat at KACST and governed by an Oversight Committee drawn from the key enabling stakeholders

The Program brings these stakeholders together with clearly defined roles and responsibilities to accomplish the stated mission

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Stakeholders, Program Governance and Roles

- Stakeholders with regard to transmission of the RPW
- Network of information collection and distribution
- Regional experimental fields

MEWA

- Deep experience in research support and implementation
- Management of large, multi-stakeholder R&D programs
- Central labs and networks

KACST

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Production of dates in major date producing countries (Saudi Arabia)

- 28,500,000 DP X 1/100 infes. = 285000 infes DP.
- Assume that 10% removal.
- Assume that 20-30% reduction in production due to infestations.
- Therefore, impact 30-40% deficiency in production.
- Production=285000x50kg/DP=14,250,000 kg
- 40% Loss 5,700,000 kg
- 1 kg = SR 10
- 5,700,000 X 10 = SR 57,000,000 ~ $ 15,183,803

10 years → $150,000,000

- That is only productions!

What about the control and protection cost?

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What do we need?

- We need a strong investments.
- We need to focus our efforts.

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Conclusion and Recommendation

- Applied research in the area of Early Detections and Forecasting, Systemic insecticides, Molecular and cell biology studies are the highest priority for the future.

- Building a strong scientific network is very important tool for a good research output.

- Building a road map for R&D in the area of RPW.

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Thank you