

# **SCIENCE PRESENTATION SERIES**

**BY**

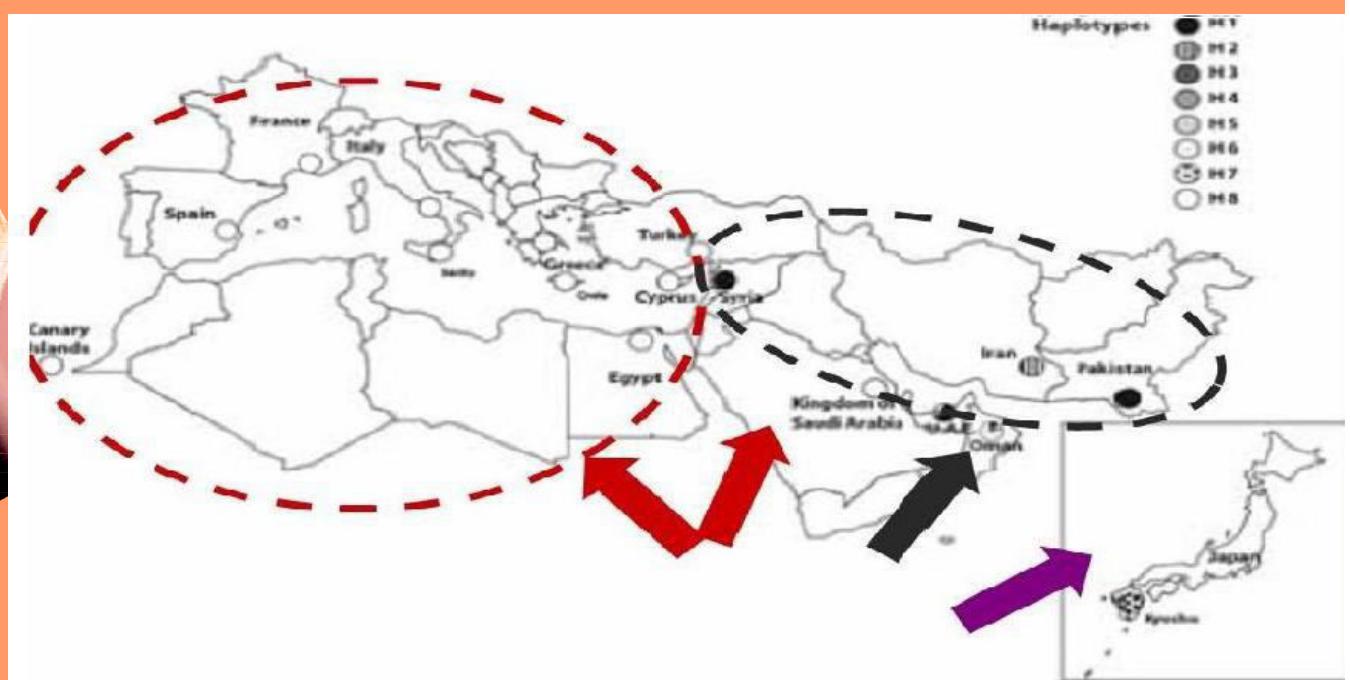
**Dr. Rabab A.A. El-Mergawy**

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# GENETIC VARIATION AND INVASION HISTORY OF DIFFERENT INVASIVE *RHYNCHOPHORUS* *FERRUGINEUS* POPULATIONS AND GENETIC RELATIONSHIPS AMONG THIS SPECIES AND OTHER *R.* SPECIES

BY

Dr. Rabab A.A. El-Mergawy



## REFERENCES

**Rabab A.A. El-Mergawy (2011).** Studies on the molecular diversity and geographical distribution of the invasive species

*Rhynchophorus ferrugineus*. Ph.D. Thesis, Molecular Biology Department, Genetic Engineering and Biotechnology Research Institute (GEBRI), Minoufia University: Egypt p. 126.

**Rabab A.A. El-Mergawy (2013).** Genetic Variation Studies on Five *Rhynchophorus* Species and Different *R. ferrugineus* Populations, the 61th Annual Meeting of the Entomological Society of America (ESA), The Menace of Palm Weevils: Challenges and Strategies, Austin, TX, USA, 10-13 November, 2013.

**Rabab A.A. El-Mergawy (2013).** Genetic Variation of Different Invasive *Rhynchophorus ferrugineus* Populations and Genetic Relationships between this species and Other Four *R.* Species. 5th Symposium at King Faisal University, Biotechnology in Date Palm Protection, Alahsa, Saudi Arabia , 3-5 November, 2013.

## *Rhynchophorus* genus

Order: Coleoptera

Family: Curculionidae

10 species (Wattanapongsiri 1966):

4 New World:

*R. palmarum* (Linnaeus)

*R. cruentatus* (Fabricius)

*R. ritcheri* (Wattanapongsiri)

*R. quadrangulus* (Queden)

1 African:

*R. phoenicis* (Fabricius)

5 Tropical Asian:

*R. bilineatus* (Montrouzier)

*R. distinctus* (Wattanapongsiri)

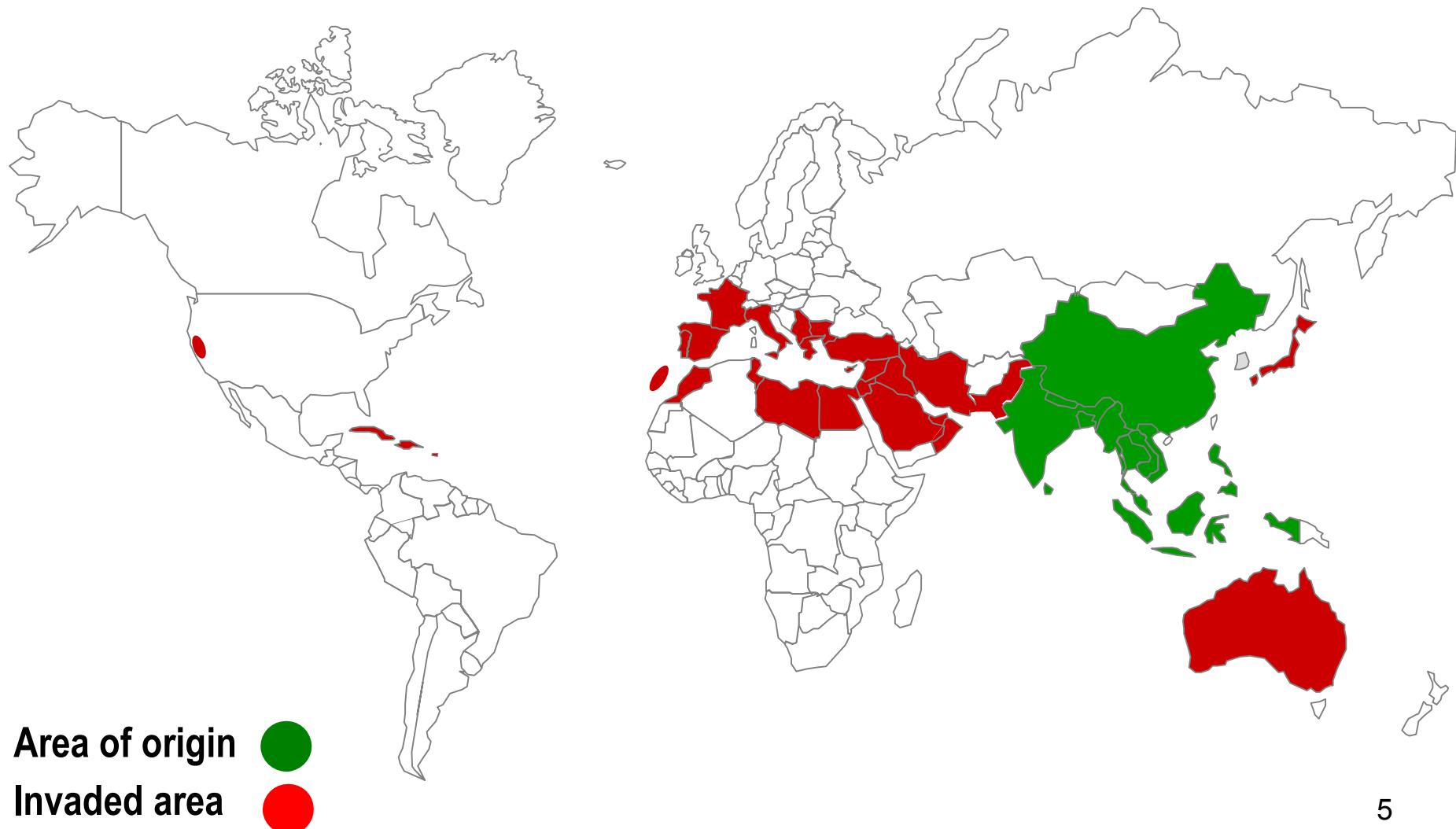
*R. lobatus* (Ritsema)

*R. vulneratus* (Panzer)

*R. ferrugineus* (Olivier), Red Palm Weevil

**GEOGRAPHIC DISTRIBUTION OF RPW:** Look at the map (El-Mergawy, 2011).

**ECONOMIC IMPORTANCE OF RPW:** RPW attacks different palm trees/economic damages, annual average estimated by 1.9, 90 % of the attacked palms were lost in Arab peninsula, the production dropped from 0.7 to 10tonne/hectar (Zaid 1999; Moore 2000; Gush 1997).

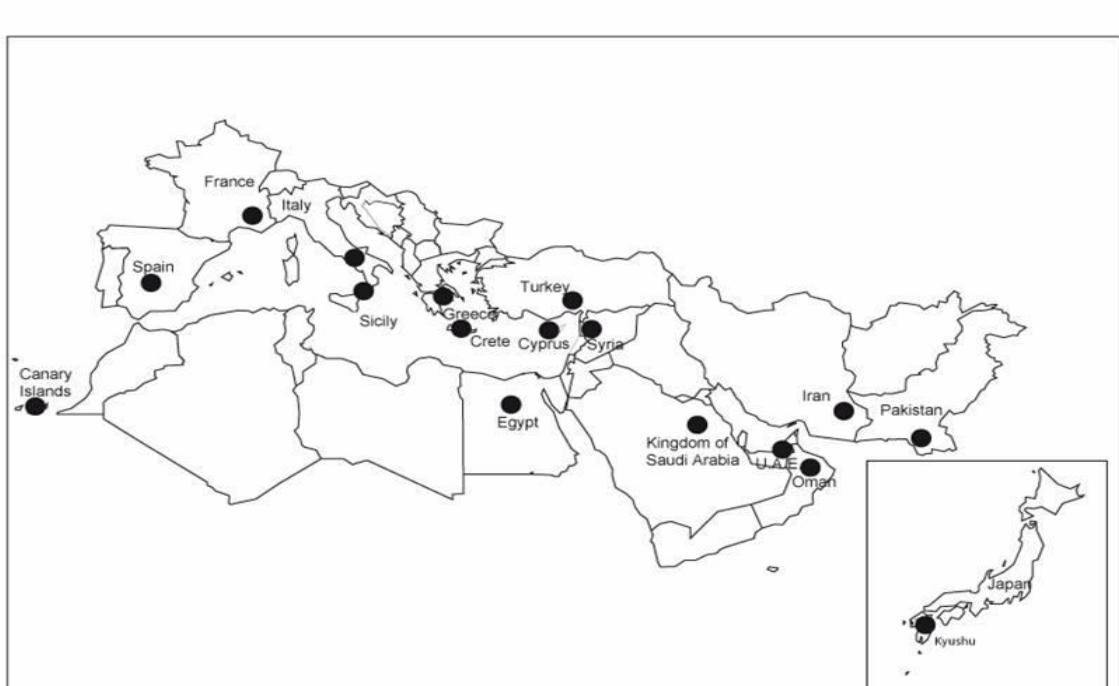


## **GENETIC VARIATION OF THE INVASIVE SPECIES ...WHY ???**

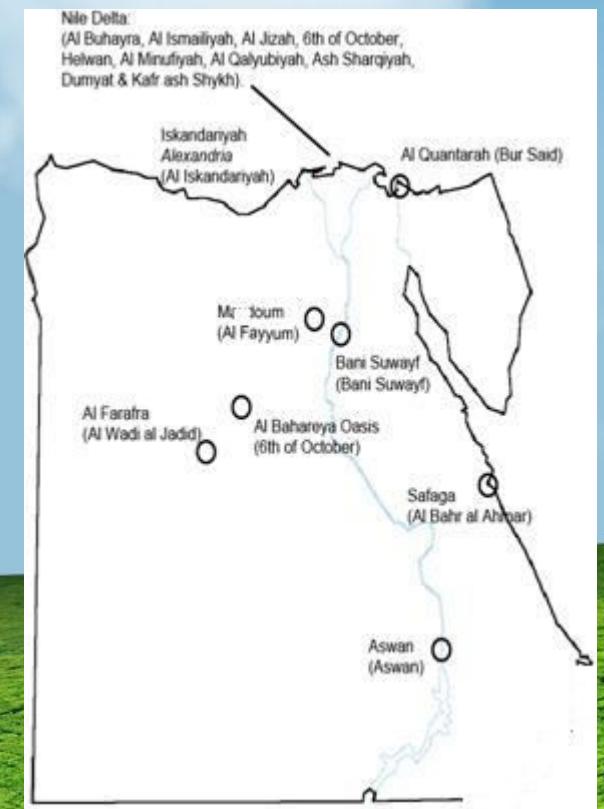
**A necessary step before investigating the genetic basis of its rapid adaptation and consequently its invasion success (Keane & Crawley 2002; Sakai *et al.* 2001; Wolfe 2002).**

**An essential topic before developing an effective management strategy (Grapputo *et al.* 2005; Marimuthu *et al.* 2006; Monnerat *et al.* 2006; Sharma *et al.* 2009).**

# GENETIC VARIATION OF RPW POPULATIONS



World map showing the RPW 14 sampling countries

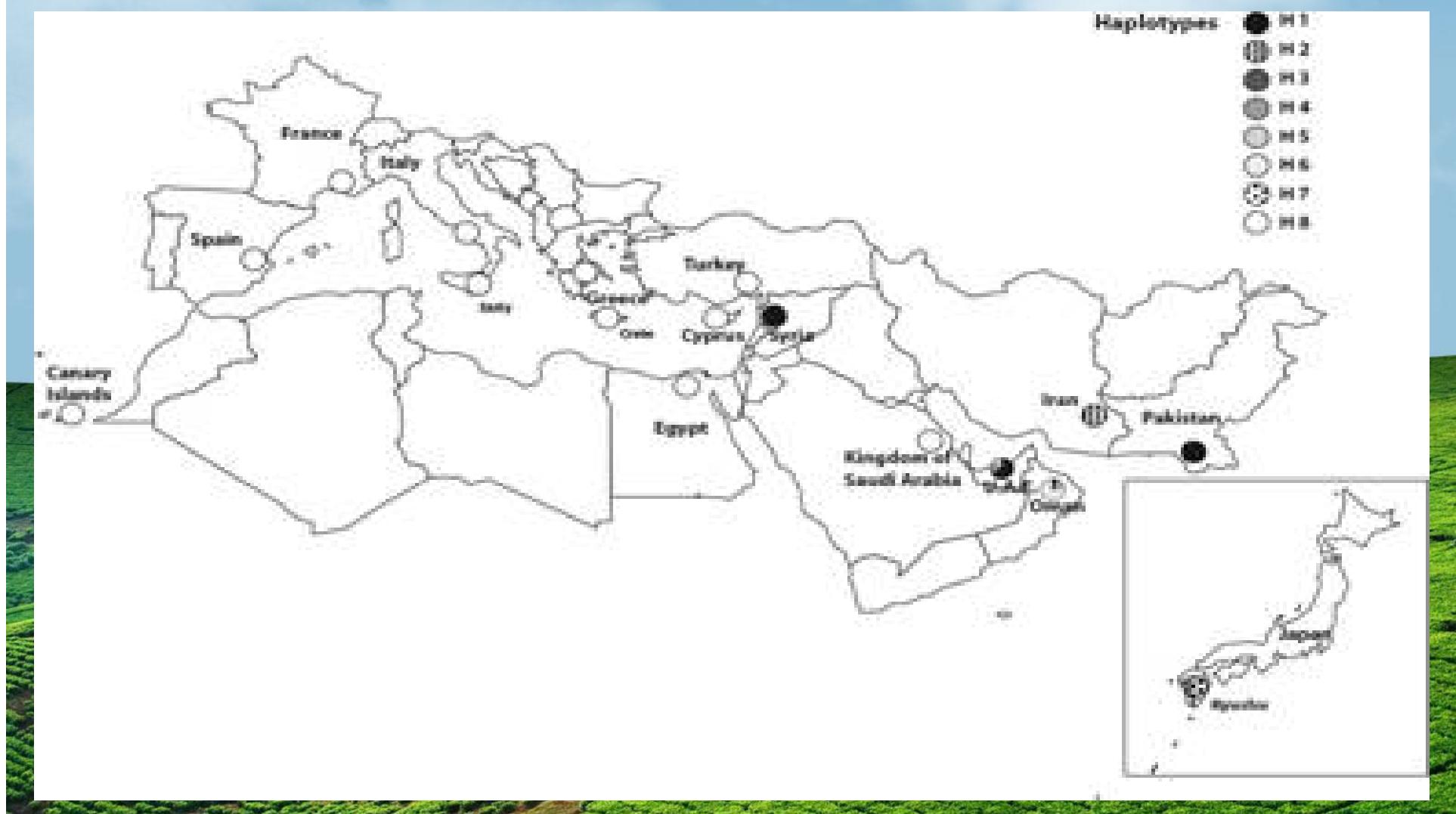


Egypt map showing the RPW  
17 sampling governorates  
(26 localities)

## Mitochondrial Genetic Variation of RPW

(El-Mergawy, 2011)

- Mitochondrial genes: *Cytochrome oxidase c subunit 1 (CO1)*&*Cytochrome b (Cytb)*
- 4.2% nucleotide substitutions    8 haplotypes (H1-H8)    Genetic Similarity: 98.7-99.2%
- Intra-population variation in UAE (4 haplotypes) and Oman (3 haploypes)/(1-4 nt substitutions)
- Haplotypes\more than one country:H8, H1 & H5---- haplotypes in one country: H3, H4, H6, H2 & H
- Multiple haplotypes    Fixed haplotypes    Fixed haplotype in local population



## Nuclear Genetic Variation of RPW Using ITS2-rDNA (El-Mergawy, 2011)

No GV: a strong concerted evolution

### RAPD Genetic Variation Of RPW

#### Population Level

Geographic Population Level (RPW individuals from each country)

13 countries: Egypt, KSA, UAE, Oman, Syria, Turkey, Iran, Pakistan, Cyprus, Greece, Spain, Italy, France and Japan (El-Mergawy, 2011): 20-70 % similarity KSA & Japan and KSA & UAE

**OTHER STUDIES:** Egypt, KSA and Indonesia (Abulyazid et al. 2002): 0-70 % similar:  
KSA & Indonesia : 70% similarity, Egypt and both KSA & Indonesian : No similarity

#### Local Population Level (RPW individuals from each locality in a specific country)

Egypt: 15 governorates (26 localities) (El-Mergawy, 2011): 30-80 % similarity

**OTHER STUDIES:** UAE: 7 localities (Gadelhak & Enan 2005) 38-94 % similarity

#### Individual Level

Comparison Among Individuals From Different Countries

13 countries: Egypt, KSA, UAE, Oman, Syria, Turkey, Iran, Pakistan, Cyprus, Greece, Spain, Italy, France and Japan (El-Mergawy, 2011): 0-80 % similarity.

Minimum: Egypt (BurSaid ) & Turkey Maximum: Egypt (AlMinufiyah) & Japan.

Comparison Among Individuals From The Same Country

1) 13 countries: Egypt, KSA, UAE, Oman, Syria, Turkey, Iran, Pakistan, Cyprus, Greece, Spain, Italy, France and Japan (El-Mergawy, 2011): 0-80 % similarity.

2) Egypt: 15 governorates (26 localities) (El-Mergawy, 2011): 20-80 % similarity.

# GENETIC VARIATION OF DIFFERENT RPW FORMS

**Mitochondrial Genetic Variation of Different RPW Forms**

(El-Mergawy, 2011)

No GV

**Nuclear Genetic Variation of Different RPW Forms Using ITS2-rDNA**

(El-Mergawy, 2011)

No GV

➤ Other studies:

➤ RAPD Genetic Variation of Different RPW Forms

➤ 3 Morphological forms/ Egypt (Salama & Sakr 2002):

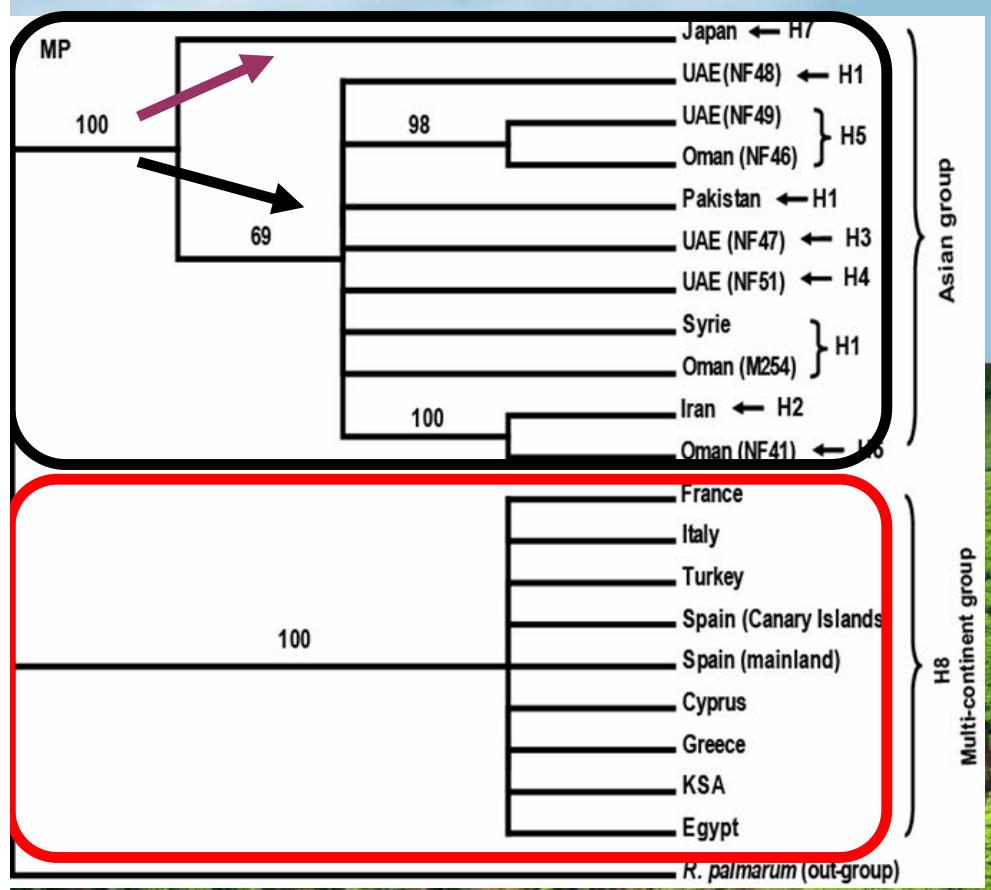
Black spotted forms were more related than the non spotted form

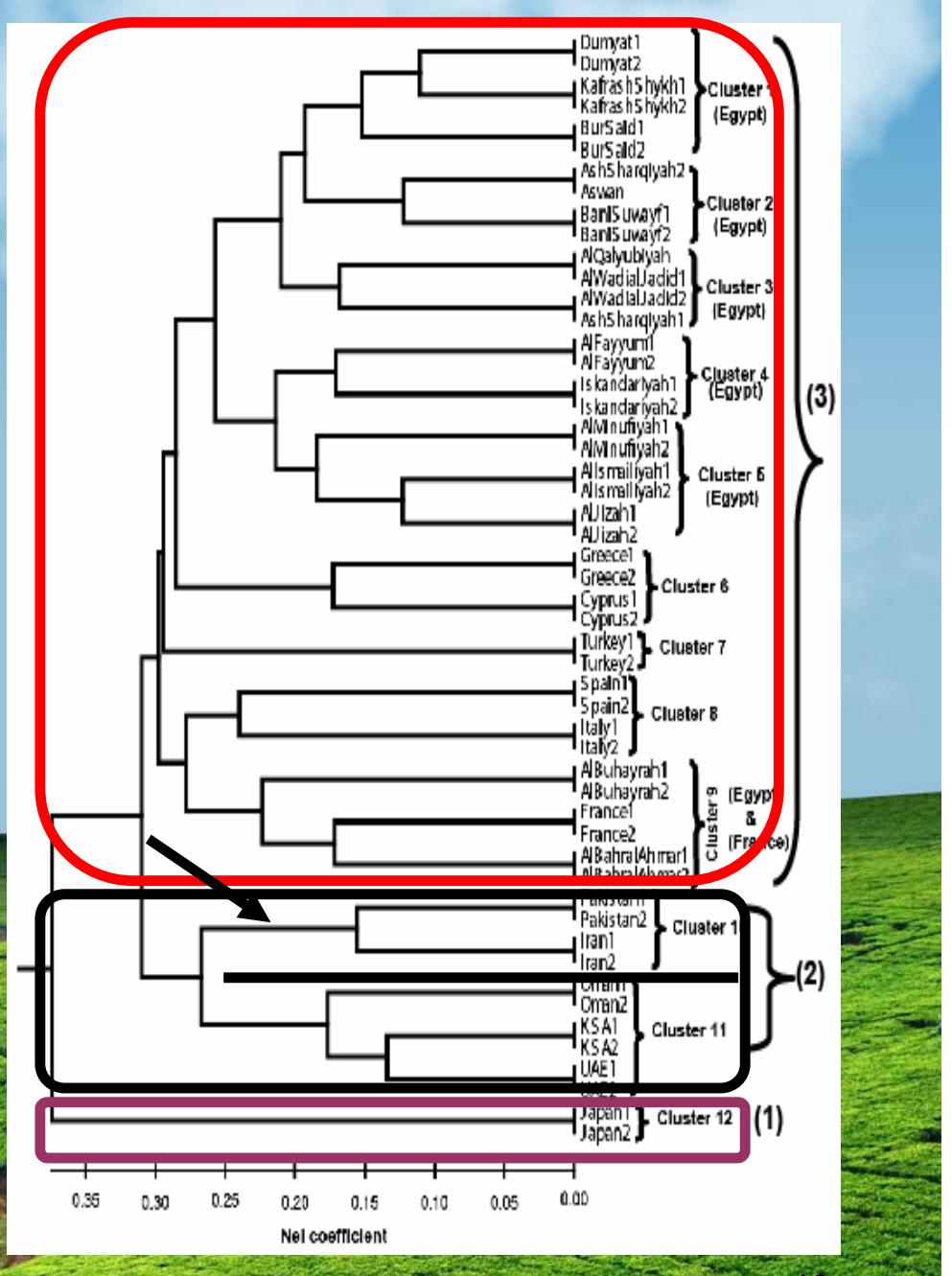
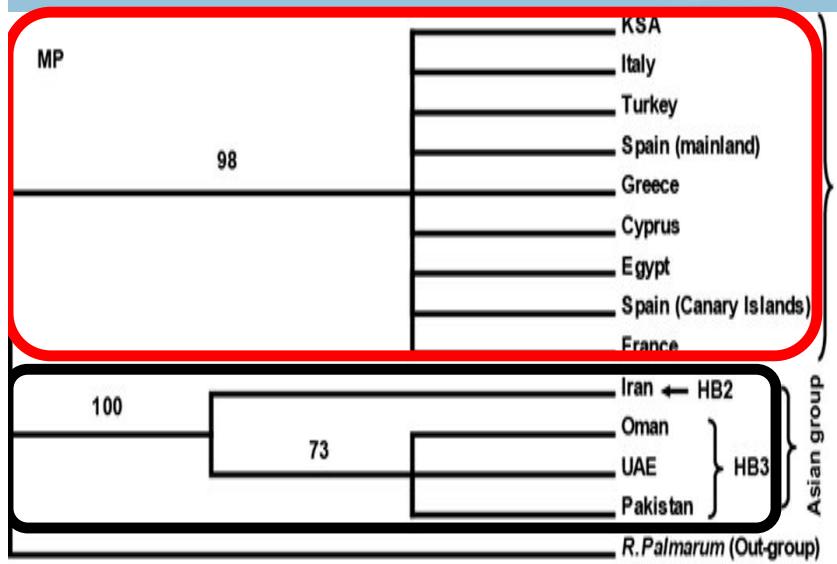
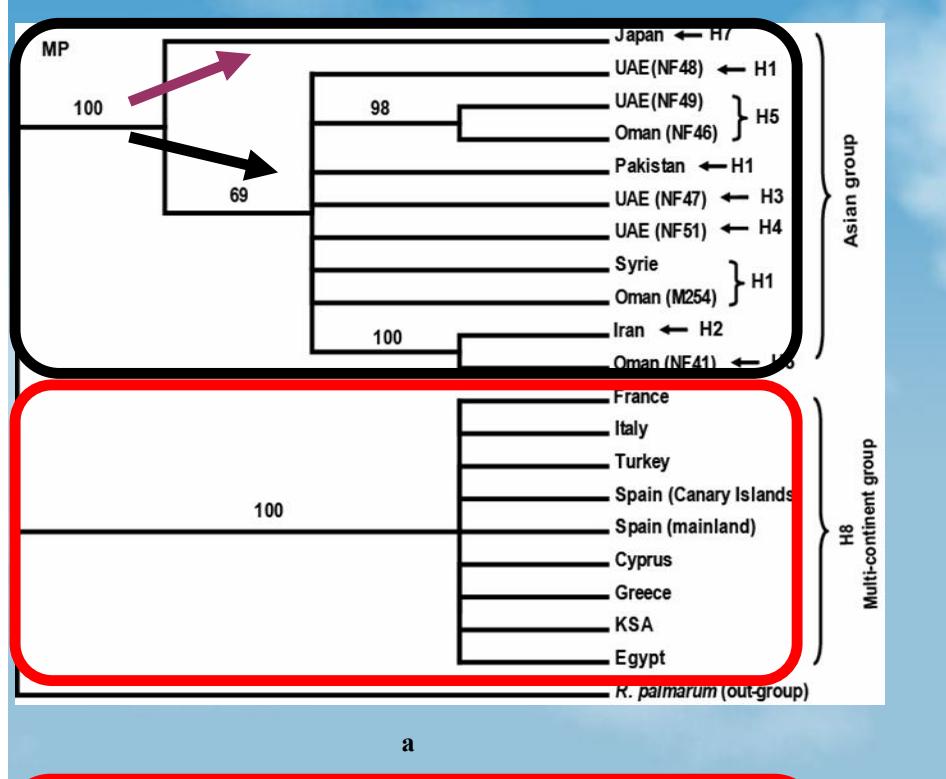
➤ 3 Morphological forms/ KSA (Al Ayied et al. 2007):

Brown forms with & without black spots were more related than black non spotted form

# PHYLOGENETIC ANALYSIS AND GENETIC RELATIONSHIPS AMONG RPW GENOTYPES

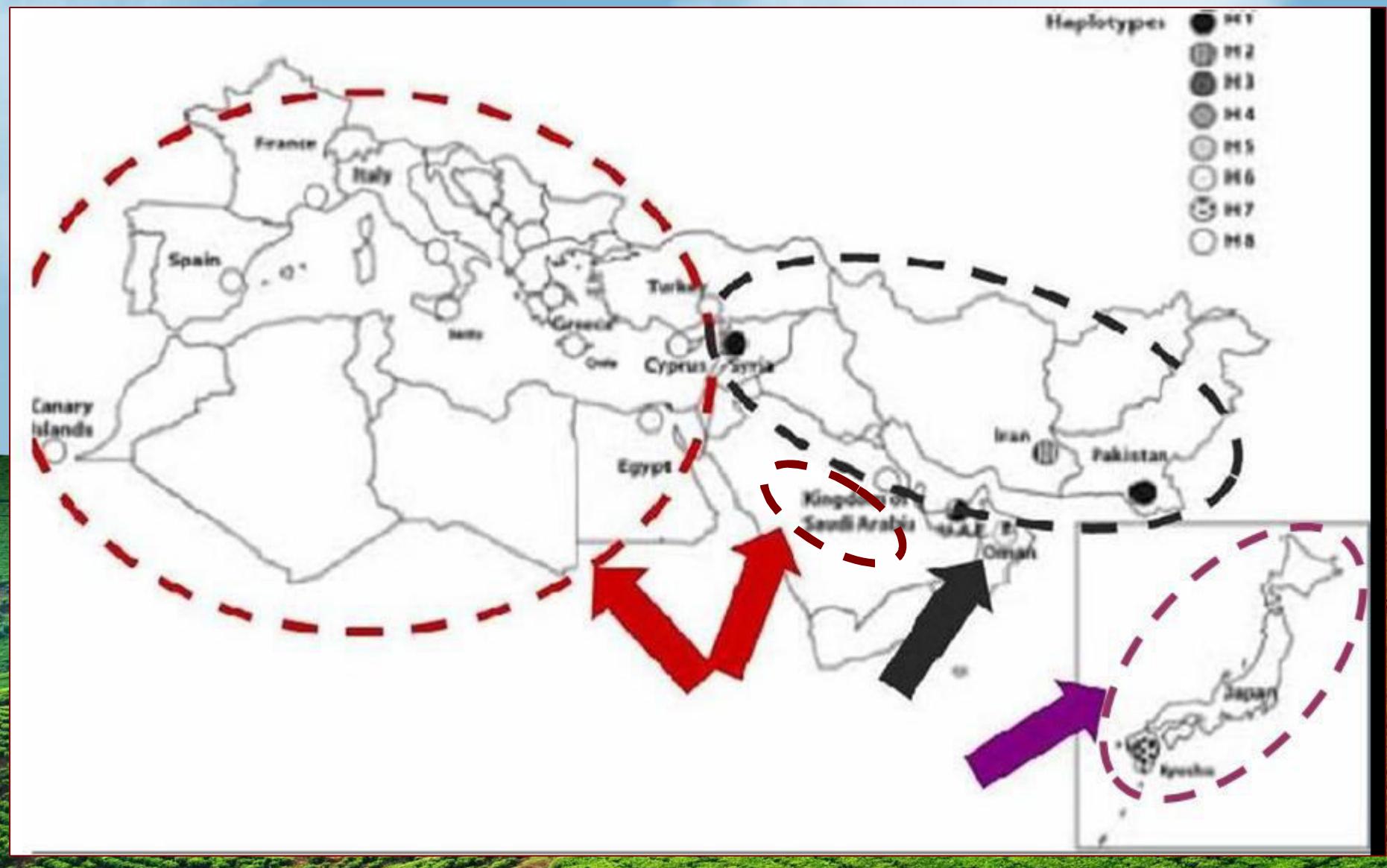
(El-Mergawy, 2011)





# INVASION ROUTES OF RPW

(El-Mergawy, 2011)



## GENETIC COMPARISON AMONGR. *FERRUGINEUS* AND OTHER *RHYNCHOPHORU* SPP.

CO1- (El-Mergawy, 2011):

*R. palmarum* (Linnaeus), *R. cruentatus* (Fabricius), *R. phoenicis* (Fabricius) and *R. bilineatus* (Montrouzier)- RPW was more closely related to *R. bilineatus*, while it was more distantly related to *R. palmarum*.

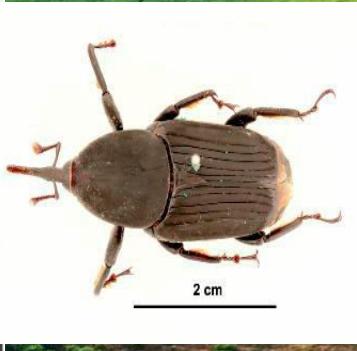
Other studies:

1) RAPD- (Abulyazid et al. 2002): Genetic similarity was found among *R. ferrugineus* (Egypt, KSA & Indonesia), *R. cruentatus* (Florida-USA) & *R. palmarum* (Costa Rica).  
No similarity was found between *R. ferrugineus* & *R. vulneratus*.

2) RAPD & CO1- (Hallett et al. 2004): *R. ferrugineus* & *R. vulneratus* > colour morphs



*R. ferrugineus*



*R. bilineatus*



*R. phoenicis*



*R. cruentatus*



*R. palmarum* 4



## CONCLUSIONS AND FUTURE PROSPECTIVE

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A wide-angle photograph of a rural landscape. In the foreground, there are several fields of crops, likely tea or coffee, arranged in long, narrow, dark green strips that follow the contours of the hills. The middle ground shows more of these fields stretching towards the horizon. The background consists of a bright blue sky filled with wispy, white, cumulus-like clouds. The overall scene is peaceful and suggests a rural, agricultural setting.

**THANK YOU**