



# Large scale biological control implementations on mealybugs

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# Citrus and Pomegranate growing area



# Turning Point of Citrus Mealybug Biocontrol in Turkey

- In 1970 Plant Protection Institutes (Adana and Antalya) belong to Ministry of Agriculture imported the *Cryptolaemus montrouzieri* and *Leptomastix dactylopii* from USA.



# Citrus Mealybug

- Since 2004 Biological Agriculture Consulting and Engineering Co. (BIYOTAR) have been rearing beneficial insects for Citrus mealybug, *Planococcus citri* (Hom., Pseudococcidae).



# Rearing Facilities

- BIYOTAR rearing capacity is 15 million predators and 20 million parasitoids annually.





# Citrus and pomegranate are one of the main agricultural export products in Turkey

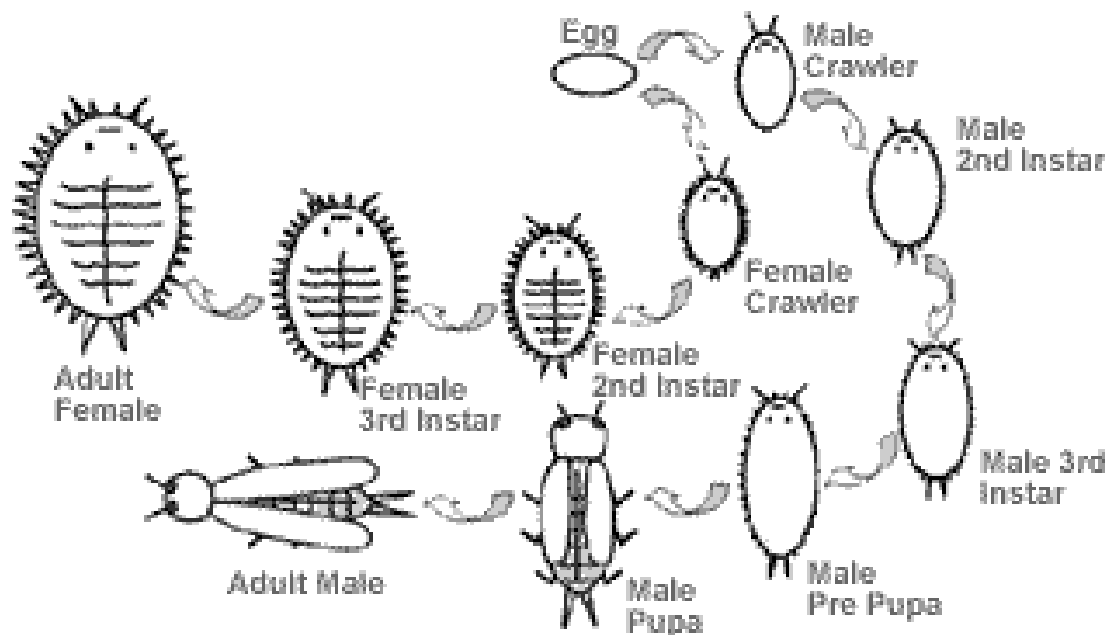


# Citrus mealybug

- Damage



# Citrus mealybug biology





# Economic importance



# Mealybug scouting

- Beginning of May the overwintering adults start to move upwards of tree
- In June mealybug start to settle down under sepal leaves



## Mealybug damage

- After June depends on variety and population of mealybug damage will be increase



## Biocontrol on Citrus and Pomegranate

- Lemons – easy to control mealybug
- Mandarins – easy to control mealybug
- Oranges – easy to control mealybug
- Grapefruits –DIFFICULT to control mealybug
- Pomegranate – easy to control mealybug



# BiyoArı S (*Leptomastix dactylopii*)

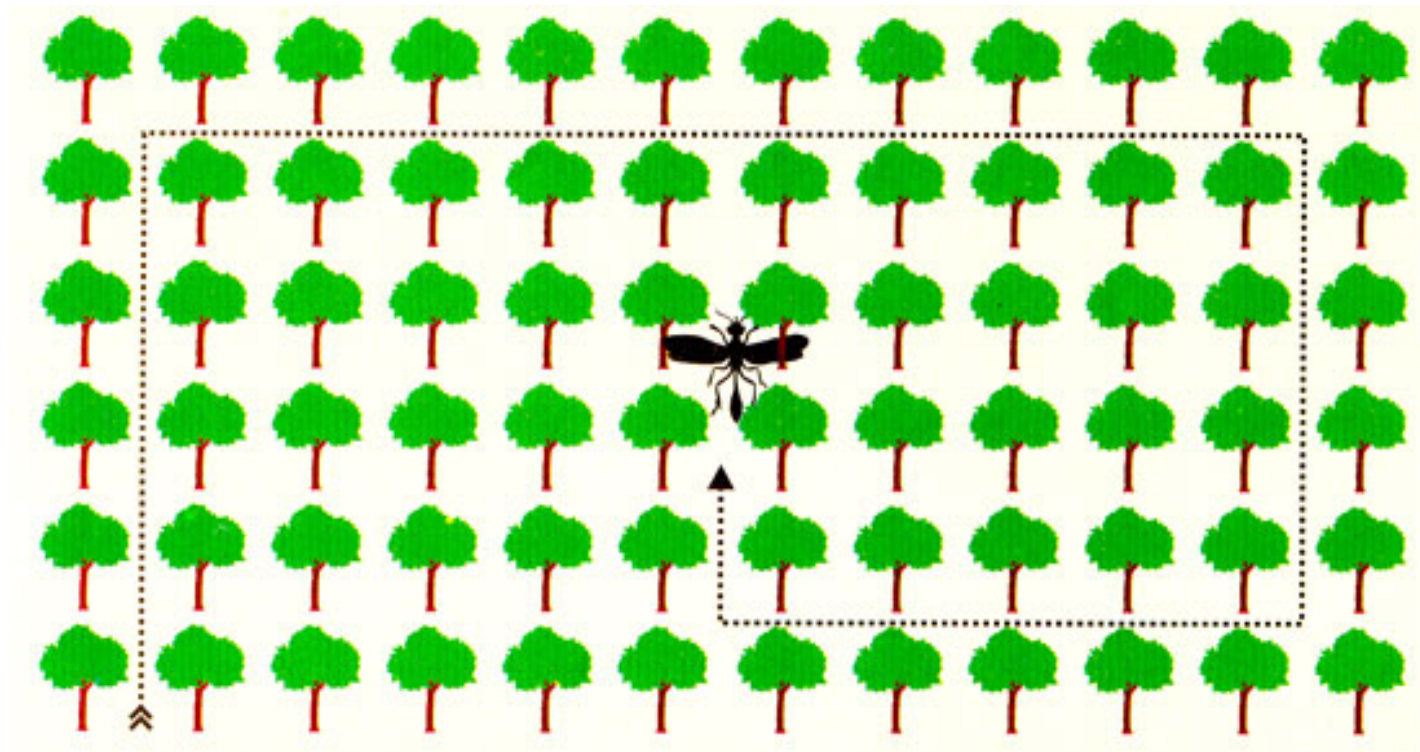
>1000 adults in releasing package



# *Leptomastix dactylopii*



# *L. dactylopii* releasing diagram









# Efficacy of Parasitism

- Parasitism can recognize after 2 - 3 weeks by mealybug mummies and emerging holes

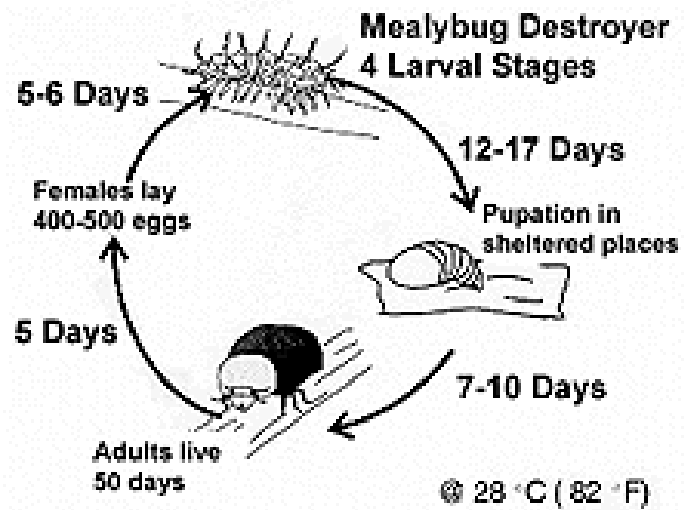


# ***BiyoAvcı S (Cryptoleamous montrouzieri)***

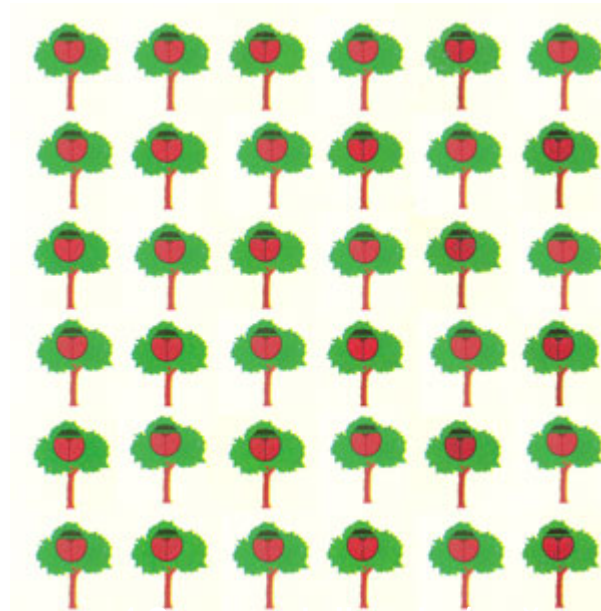
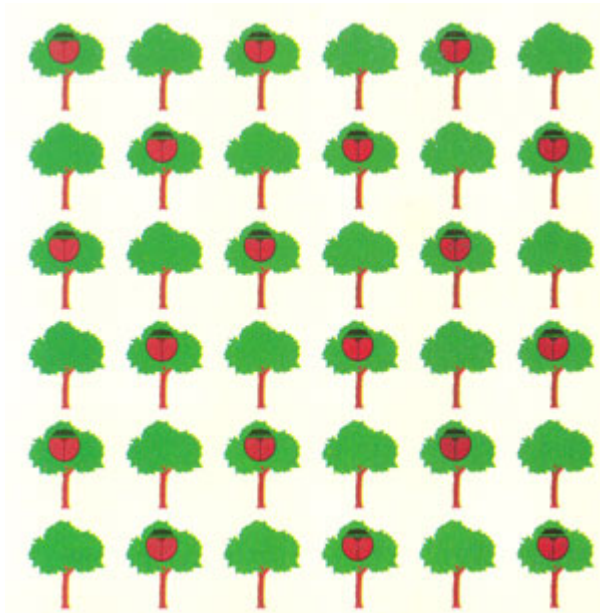
10±2 adults in releasing package



## *C. montrouzieri* biology



## *C. montrouzieri* releasing diagram





# Releasing Beneficials

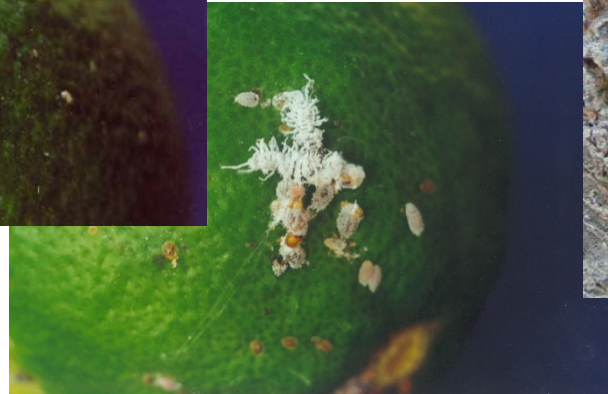


# Releaing packages



# Efficacy of Predator

- They directly feed on eggs and small larval stages of mealybug





## For Best Results

- Release in early morning or late evening
- Do not store under any conditions
- The releasing packages should not expose to direct sun light
- *C. montrouzieri* and *L. dactylopii* should be use together to complete result
- Broad spectrum pesticides should not used 4 weeks before and after release



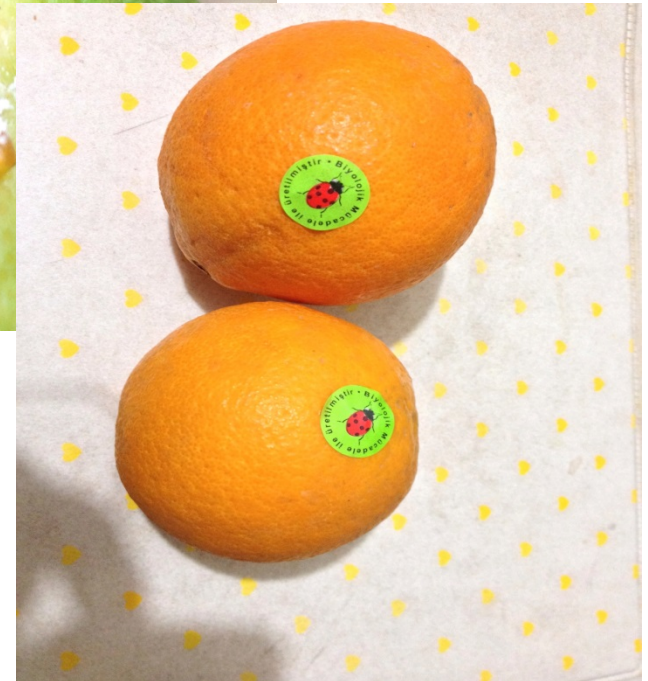
# Biocontrol agents releasing time

- The earliest in May
- Before the first egg mass only *L. dactylopii* release may be possible
- June and afterwards two beneficials, *C. montrouzieri* and *L. dactylopii* recommended together,
- The release could be continue upto mid October

# ***L. dactylopii* and *C. montrouzieri*** **releasing rates**

- Preventive – no recommended
- Curative light – 10 adults per tree  
(10 *L. dactylopii* and 10 *C. montrouzieri*)
- Curative heavy – 20 adults per tree  
(20 *L. dactylopii* and 20 *C. montrouzieri*)
- First infection detected without egg masses only  
*L. dactylopii* release may be possible
- The orchards should be scout every week to understand population development of mealybug.

# Citrus



# Pomegranate



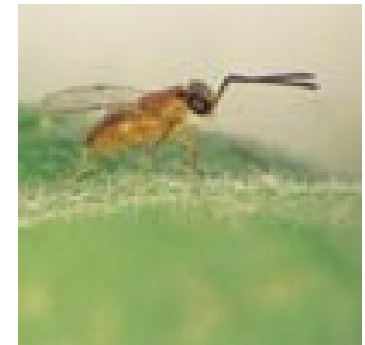


# Grapes





# Cover Crop Banana



# Ornamentals





**Thanks**

