



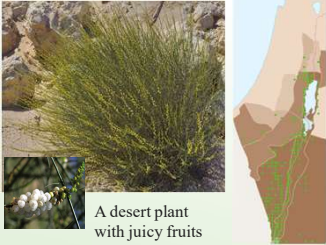
# Gut bacteria disarm the *Ochradenus baccatus* fruits “mustard-oil-bomb”

Beny Trabelsy, Yoram Gerchman and Ido Izhaki  
Department of Evolutionary and Environmental Biology, University of Haifa



## Introductions:

*Ochradenus baccatus*  
Order: Brassicales  
Family: Resedaceae



A desert plant with juicy fruits

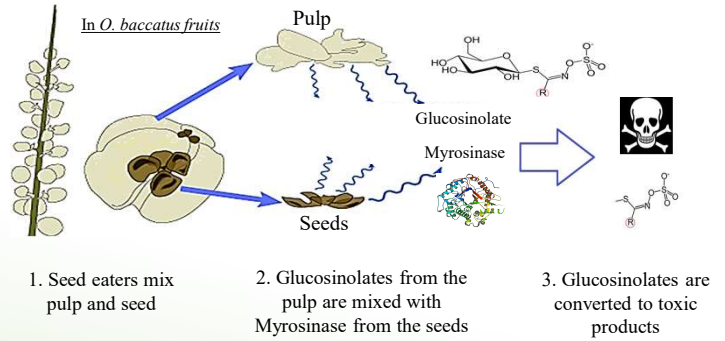
The major distributors of the fruit's seeds are birds



*Onychognathus tristramii*  
(טריסטראמיית ים המלח)

*Pycnonotus xanthopygus*  
(בולבול צהוב-שח)

## The “mustard-oil-bomb” reaction



1. Seed eaters mix pulp and seed
2. Glucosinolates from the pulp are mixed with Myrosinase from the seeds
3. Glucosinolates are converted to toxic products

## Research questions:

- 1) Dose the “mustard-oil-bomb” reaction occurs in seed eaters digestive system?
- 2) Do toxic products interfere with food digestion ?
- 3) Can gut bacteria protect birds from the toxic products?

## Method:

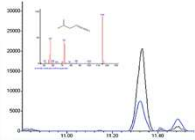
Ten *Pycnonotus xanthopygus* (bulbul) were captured:  
● 4 from a northern region (assumed naive to *O. baccatus*)  
● 6 from a southern region (assumed acquainted with *O. baccatus*)  
● *O. baccatus* distribution area.  
The birds were fed in different combinations of banana and *O. baccatus* fruits and digestibility was tested.



## Results:

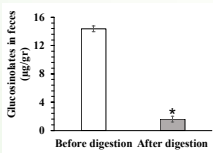
### 1) GLSs breakdown in the digestive system:

#### Production of toxic products:



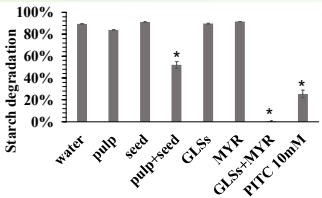
Soaking ground or intact seeds with commercial GLSs leads to production of toxic products

#### Glucosinolates in feces:



Quantification of glucosinolates in the feces of bulbuls fed on *O. baccatus* fruit indicates rapid degrade most of them.

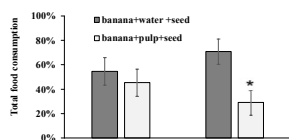
#### :Amylase activity



Combined pulp and seeds, commercial GLSs + myrosinase and PITC all inhibit amylase activity *ex vivo*.

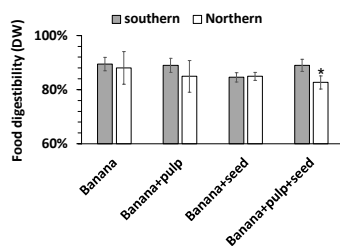
### 2) GLSs affect food: consumption, choice and digestion

#### Food consumption:

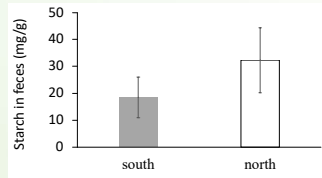


Northern birds consumed less food when banana was mixed with pulp and seeds

#### Food digested:



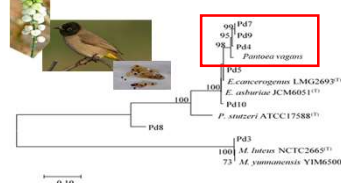
Northern birds digest less food when banana was mixed with pulp and seeds.



The amount of starch in feces of the northern birds is higher than in the southern feces'

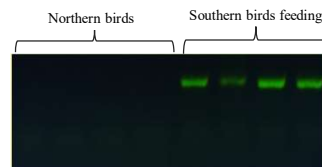
### 3) Bacteria help birds cope the toxic breakdown products:

#### Bacterial phylogenetic tree:



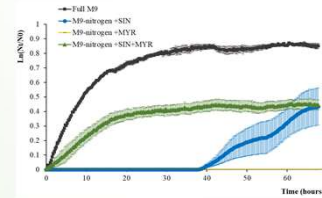
*Pantoea vagans* isolate from feces of birds fed *O. baccatus* fruit

#### Difference in presence of *Pantoea* in the feces:



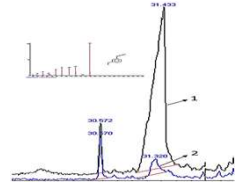
*P. vagans* is present in southern birds gut but absent from northern birds

#### GLSs breakdown products can support *Pantoea* growth:



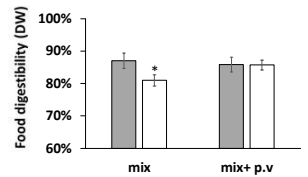
GLSs toxic products can replace nitrogen

#### *Pantoea* remove benzyl isothiocyanate



Grinding whole fruits result in the production of benzyl isothiocyanates, a glucosinolates toxic products (1), *Pantoea* degrade these toxic products (2)

#### *Pantoea* “probiotics” enhance digestion of the northern birds



After feeding northern birds banana enriched with *P. vagans* the difference in digestibility of seed-pulp mixture disappears

## Conclusions:

1. Bird naive to the *O. baccatus* fruit digests less of the pulp and seeds mixture compared to *O. baccatus* acquainted birds.
2. The difference in digestion can be explained by glucosinolate breakdown products inhibition of the amylase activity.
3. The bacterium *Pantoea vagans* resides in the gut of birds accustomed to *O. baccatus*. This bacterium can degrade and utilize the glucosinolates toxic products'.
4. Introduction of *P. vagans* to the gut micro biota of *O. baccatus* naive birds remedies their inability to digest *O. baccatus*.