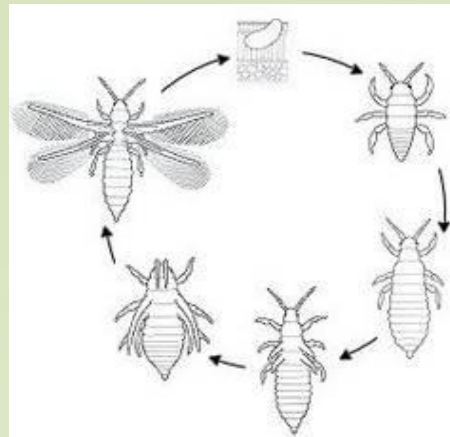


## Towards Biological Control of Red Rust Thrips In Organic and Conventional Banana

Luud Clercx (TASTE, Netherlands), Myiam Arias (INIAP, Ecuador)

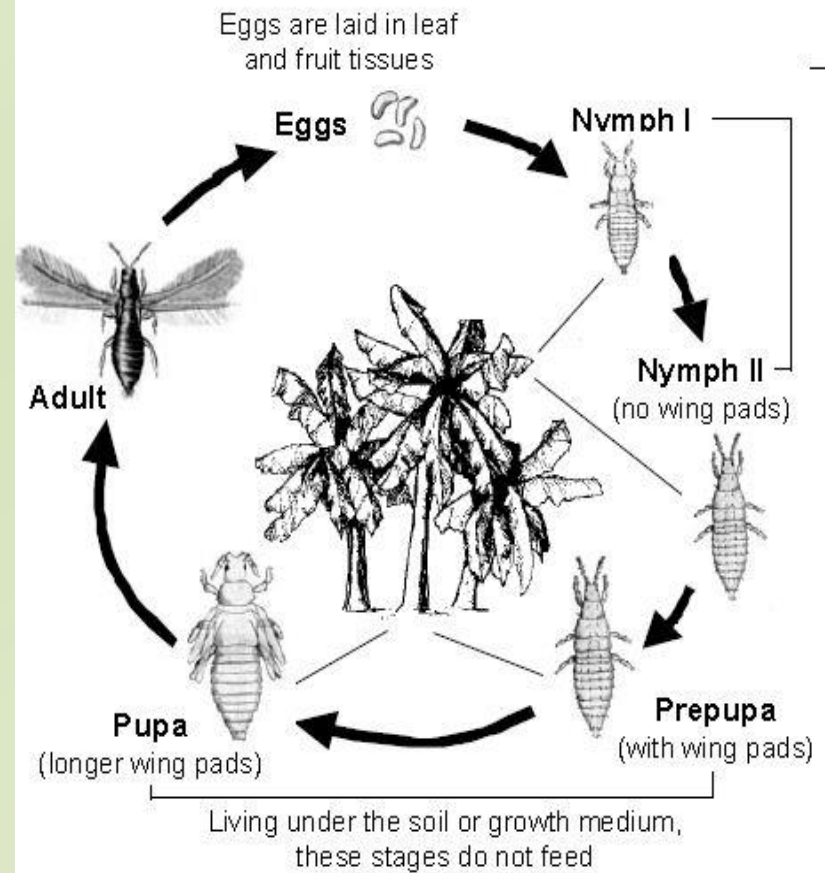
José Dulanto (Master Profesionales, Peru), Benigno Flores (UNT, Peru)



# 1. Red rust banana thrips (1) The insect

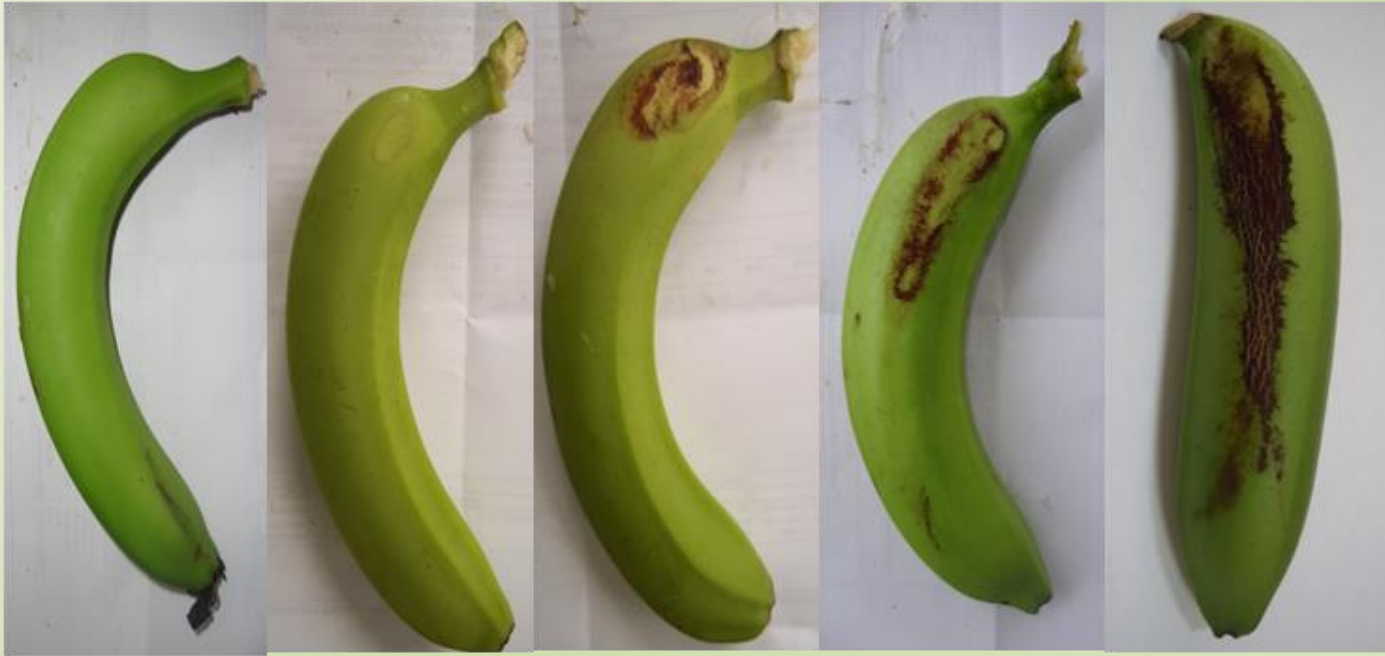
- Small insect (1-2 mm), feeds on flowers and young fruit:  
*Chaetanaphothrips signipennis*.
- Poliphagous, hides, reproduces rapidly: **difficult to control**.
- Cycle of 28 days: eggs, larva, nymph, prepupa, pupa, adult.
- Feeding on young banana: causes **red spots** that expand when the bananas grow.
- Developing **resistance** against insecticides (bunch bags impregnated with Chlorpyrifos)

Figure 4. Life cycle of the banana rust thrips.



Insect drawings from D. Schulz (see *References*).

# 1. Red rust banana thrips (2) The damage



Level	Damage (% peel)	Characteristics
1	0	Without damage
2	10	Initial halo
3	25	Halo with reddish lesion
4	50	Big reddish halo
5	75	Big reddish halo with fissures

## 2. Research project Ecuador – Peru 2011 - 2013

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- Cosmetic issue, but supermarkets manage “ZERO tolerance”.
- Research on red rust banana thrips: **abandoned** after introduction of bunch bags, impregnated with insecticide.
- Agro-ecosystem of monoculture *organic* banana is young – **new challenges arise** (soil management, pests such as thrips).
- Thousands of small organic banana producers in Peru and Ecuador face increasing losses due to red rust caused by thrips: high rejection levels are a **threat to the viability of this sector**.
- Response: **bi-national research project**. Producer association ASOGUABO – government institution INIAP (Ecuador); and TASTE – Universities of Piura, Trujillo and Tumbes (Peru).
- Research agenda: (a) **identification** (taxonomy, habitat); (b) **reproduction of clean stocks** under laboratory conditions; (c) develop **biological control methods**.

## 3A. Project Ecuador (INIAP) (1) Overview

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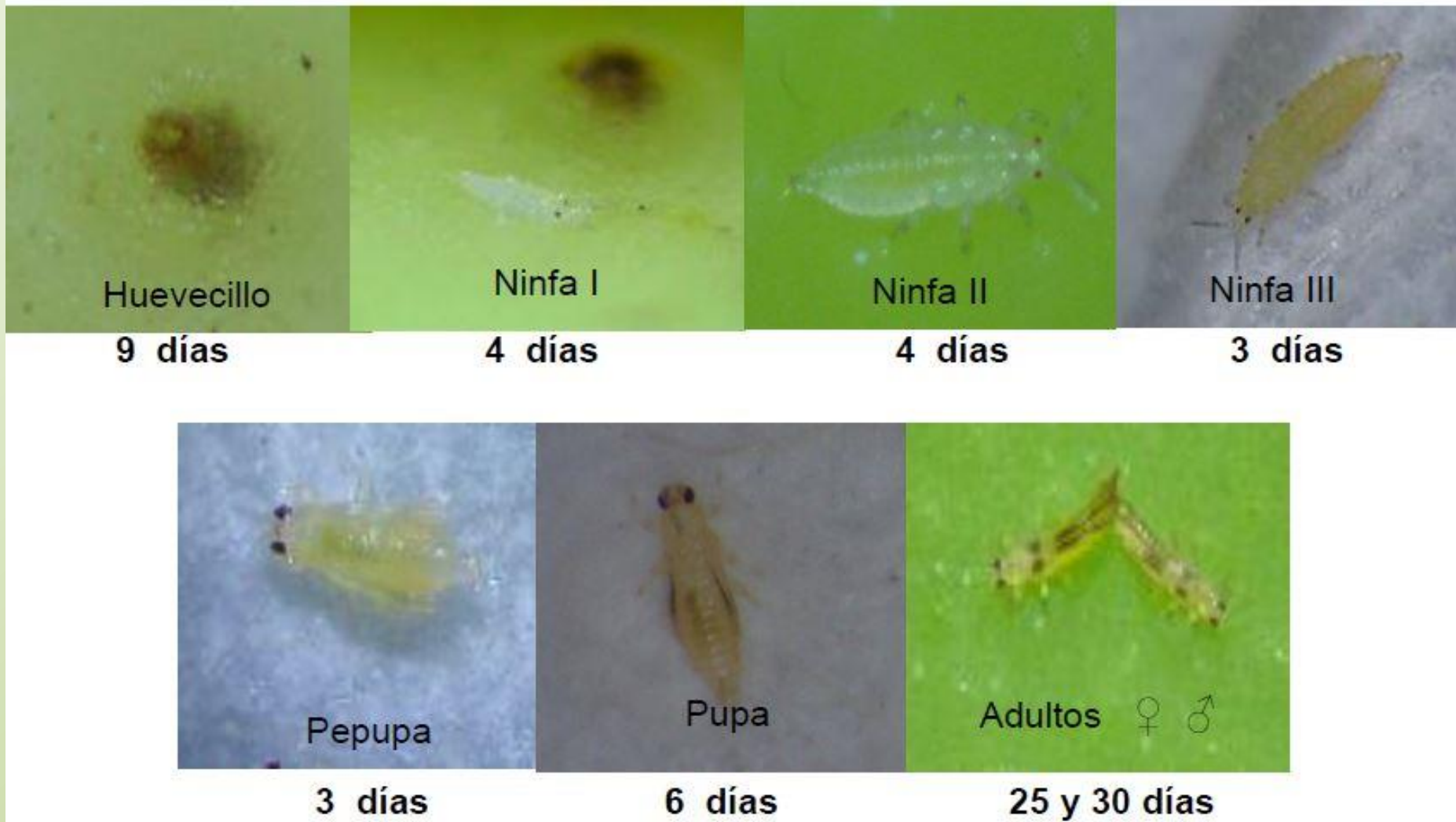
- Objective: determine behaviour, lifecycle and hosts of *Chaetanaphothrips signipennis* (“red rust banana thrips”).
- Better understanding of its lifecycle is fundamental for finding pathways for biological control – interruption of this cycle.
- Literature study on **taxonomy**, **characteristics** and **hosts** of this insect, apart from banana (*Musa AAA*).
- Recollection of thrips in the field → laboratory.
- Daily systematic **observation of the lifecycle** of 20 selected pairs (female, male) in the laboratory.
- Variables: (a) number of eggs/day and during the cycle; (b) incubation time of the eggs (c) number of days of, and size of nymph, prepupa, pupa, adults (d) morphology and behaviour at each stage (nutrition, preferred place to be, oviposition).

# 3A. Project Ecuador (INIAP) (2) Recollection, lab



# 3A. Project Ecuador (INIAP) (3) Lifecycle thrips

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## 3A. Project Ecuador (INIAP) (4) Main results

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- Lifecycle of *Chaetanaphothrips signipennis* unraveled:
  - From egg to adult: 19 – 35 days, average: 28 days.
  - Incubation of egg, average 9.0 days; Nymph I 3.9 days; Nymph II 3.7 days; Nymph III 2.9 days; Prepupa 3.0 days; Pupa 5.6 days; Adult 25 – 30 days.
  - Courtship, average 8 minutes; coupling, 25 minutes
  - First eggs deposited between 1-4 days, average 5,5 eggs / day during adult life; between 144 – 223 eggs, average 171 eggs
- A total of 13 hosts, other than banana (*Musa AAA*) identified on several farms (different species of weed).
- Technique developed for reproduction of thrips under laboratory conditions (complete cycle): important to create clean stocks for trials of biological control methods at the lab.

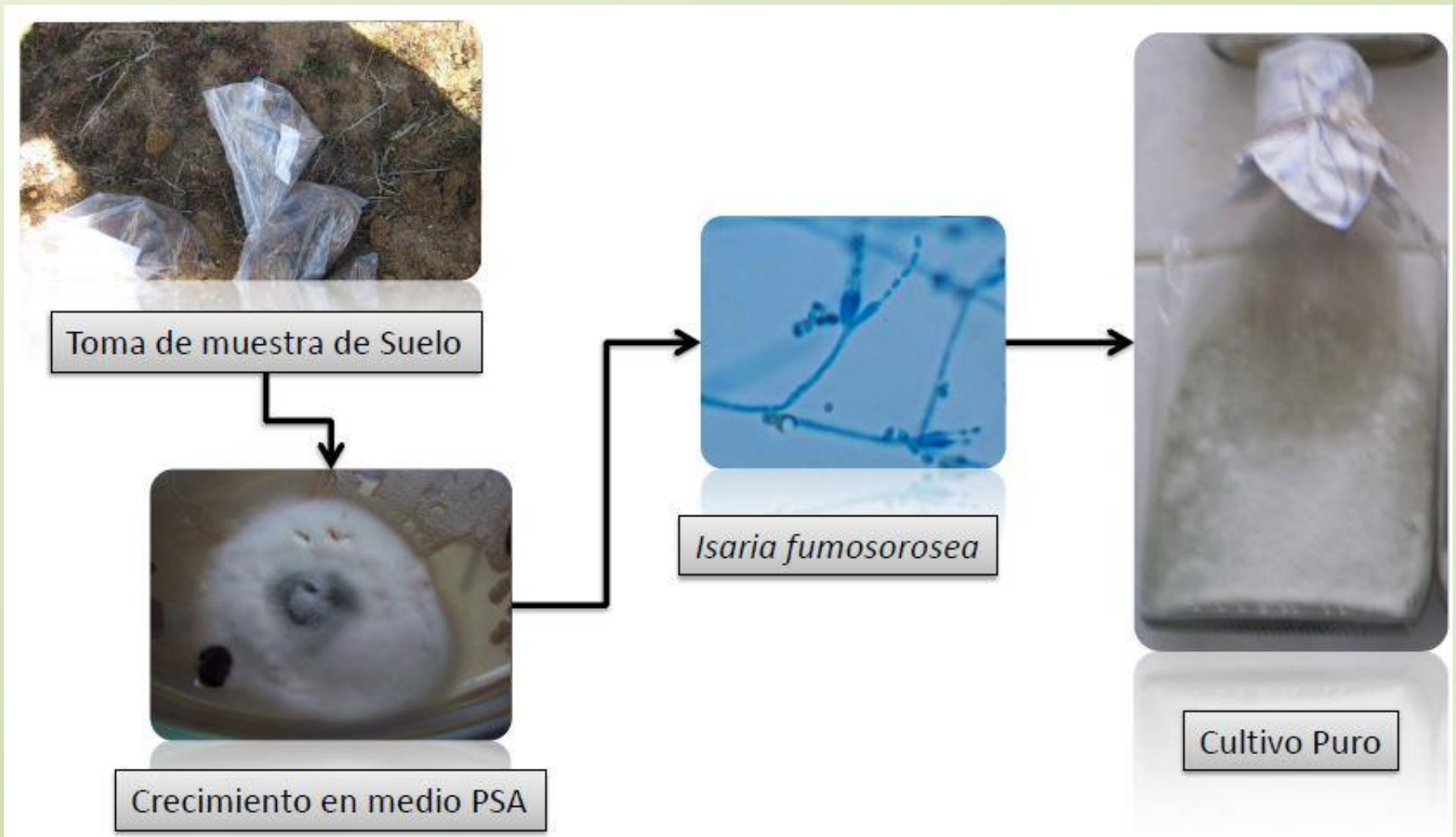


## 3B. Project in Peru (1) Overview

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- Project TASTE – National Universities of Piura, Tumbes and Trujillo. Support for 7 master thesis. Highlight: thesis on effect of entomopathogenic fungi on red rust thrips.
- Inoculation of nymphs of *Chaetanaphothrips signipennis* and *Frankliniella parvula* (mix) with the fungi *Lecanicillium lecanii* (bought in Lima) and *Isaria fumosorosea*, isolated from soil samples in the banana region of the Province of Sullana.
- Laboratory: 3 applications with 4 repetitions (15 specimens each, total 60 per application, total 180 nymphs), with solution of  $8 \times 10^6$  conidia/ml. Observation: 20 days, for signals such as: lack of appetite, death, appearance of mycellium.
- Field: 3 applications of solution with *Isaria fumosorosea* with 4 repetitions, 3 different doses ( $3 \times 10^{12}$ ,  $3 \times 10^{11}$  and  $3 \times 10^{10}$  conidias/l); and a control group.

## 3B. Project in Peru (2) Recollection native fungus



## 3B. Project in Peru (3) Test in laboratory



Insectarios para la crianza de los Thrips



Inoculación de los Biorreactores con *Isaria fumosorosea*



Crecimiento de *Isaria fumosorosea* en sustrato de arroz

## 3B. Project in Peru (4) Test in the field



Búsqueda de Trips a Nivel de Copa de la planta de Banano



Aplicación de *I. fumosorosea* BF 01 a nivel de campo



## 3B. Project in Peru (5) Results

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- Nymphs of *Frankliniella párvula* (flower thrips) and *Chaetanaphothrips signipennis* (red rust banana thrips) have a **soft cuticle, less sclerotized**, in comparison with adults. In addition, they have still an **underdeveloped immune** system; cells have not reached full maturity. These factors probably makes them **more vulnerable** for infections by fungi.
- Laboratory: Application of *Lecanicillium lecanii*, **no effect** at all, **100% survived**; *Isaria fumosorosea*, **only 10%** of nymphs of flower thrips and red rust banana thrips **survived**.
- Field: **100% effect (death)** with *Isaria fumosorosea* in concentrations of  $3 \times 10^{12}$  conidias/l, after **2** applications; and  $3 \times 10^{11}$  and  $3 \times 10^{10}$  conidias/l, after **3** applications.
- The strain of *Isaria fumosorosea* applied is **native of the zone** and adapted to environmental conditions: **a local resource**.

## 4. Concluding remarks: research continues

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- Two **international seminars** on red rust thrips in Peru: June 2012, 30 participants; March, 85 participants. Participation of government institutions and private sector, universities, DOLE. Presentations: <http://www.agropiura.gob.pe/?q=node/263>
- Follow-up: **three year project approved** by **FONTAGRO** (2014 – 2016) on biological control of red rust thrips in Peru, Ecuador and Dominican Republic. Partnership: INIA, INIAP, IDIAF, Wageningen University, TASTE, Bioversity International.
- Consumers and retail should be educated on **difference between quality** and **cosmetic appearance**, to reduce waste. Nothing wrong with a banana *slightly* affected by red spots !
- Proven biological control methods can **migrate to conventional sector**, and contribute to the **health** of **banana workers**, **health** of the **environment** and a **more sustainable banana sector**.

The theme of red rust banana thrips is on de research agenda again, and we will be back with this theme in the near future, hopefully, with interesting and practical results.

In the name of the researchers in Ecuador and Peru:

- **Myriam Arias de López,**
- Rosa Elena Corozo Ayoví,
- Angel Jines Carrasco,
- Tatiana Vera Córdova,
- **José Antonio Dulanto Bejarano,**
- **Benigno Cristofer Flores Espinoza,**
- ... and several more ...

¡ GRACIAS ! / THANK YOU !

