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ICTA

SCREENING BEAN LINES FOR RESISTANCE TO THE COMMON AND MEXICAN BEAN WEEVIL IN GUATEMALA

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Feed the Future Innovation Lab for Collaborative Research on Grain Legumes

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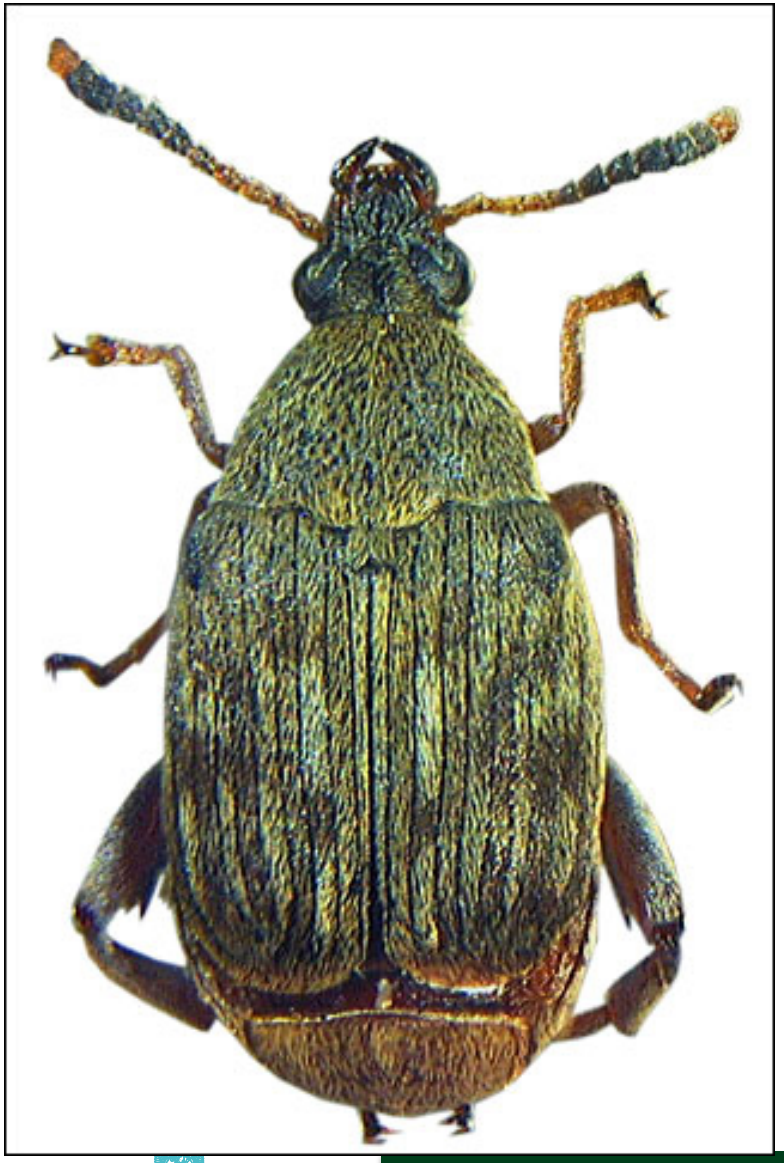
INTRODUCTION

- In Guatemala, the common bean weevil [*Acanthoscelides obtectus* (Say)] and the Mexican bean weevil [*Zabrotes subfasciatus* (Boheman)] are responsible for significant losses in stored bean seed.
- Losses average 15%, which is alarming if we take into account that all those metric tons of grain could be used to satisfy the hunger of thousands of people.

Common Bean Weevil

- *Acanthoscelides obtectus* Say, is the most important pest of beans stored in highlands, this species can cause damage to bean seed both in storage sites and in the field, because the females oviposit in the cracks of the bean pods, or in spaces between stored grains.

Source: www.padil.gov.au/viewPestDiagnosticImages.asp



Common Bean Weevil

Acanthoscelides obtectus Say

Mexican Bean Weevil

- *Zabrotes subfasciathus* (Boheman 1833), is responsible for the losses of stored grain in the lowlands. Eggs are laid only on seeds that have fallen from a pod or that are still attached inside a partly dehisced pod. This trait is the reason why this species has become a pest of stored grain legumes.

Source: www.infonet.biovision.org

Mexican Bean Weevil

Zabrotes subfasciathus

Bruchid Resistance

- Varietal resistance or genetic resistance is a preferred method to control pests affecting crops. This form of management of agricultural pest populations is ecologically clean and natural.
- 212 RIL´s were evaluated and selected 15 (7.1%).

OBJETIVE

- The objective of this study was to identify sources of genetic resistance to the damage caused by common and Mexican bean weevils.

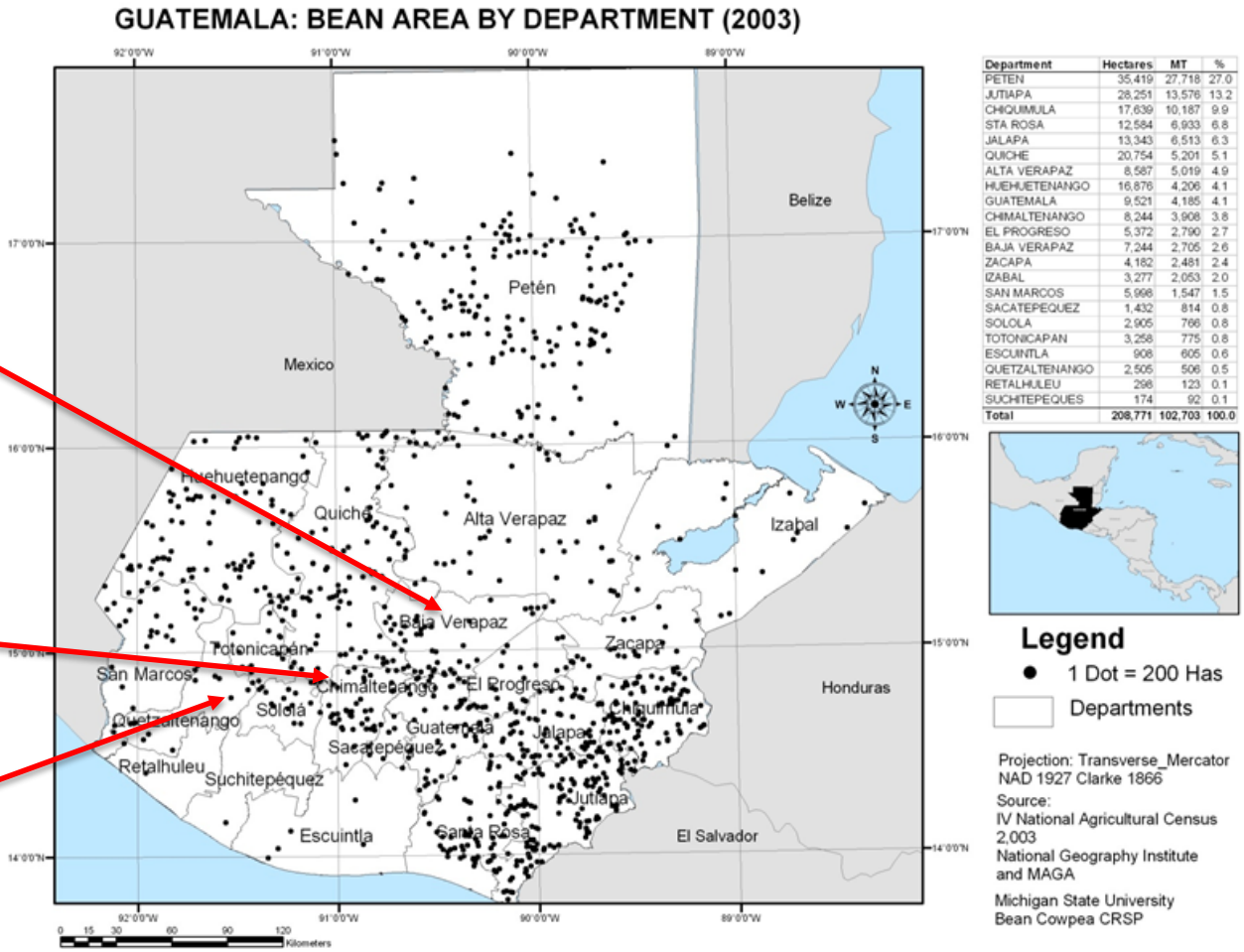
METHODOLOGY

LOCALITIES:

San Jerónimo
(990 masl)

Chimaltenango
(1,670 masl)

Quetzaltenango
(2,380 masl)



Department	Hectares	MT	%
PETEN	35,419	27,718	27.0
JUTIAPA	28,251	13,576	13.2
CHIQUIMULA	17,639	10,187	9.9
STA ROSA	12,584	6,933	6.8
JALAPA	13,343	6,513	6.3
QUICHE	20,754	5,201	5.1
ALTA VERAPAZ	8,587	5,019	4.9
HUEHUETENANGO	16,876	4,206	4.1
GUATEMALA	9,521	4,185	4.1
CHIMALTENANGO	8,244	3,908	3.8
EL PROGRESO	5,372	2,790	2.7
BAJA VERAPAZ	7,244	2,705	2.6
ZACAPA	4,182	2,481	2.4
IZABAL	3,277	2,053	2.0
SAN MARCOS	5,998	1,547	1.5
SACATEPEQUEZ	1,432	814	0.8
SOLOLA	2,905	766	0.8
TOTONICAPAN	3,258	775	0.8
ESCUINTLA	908	605	0.6
QUETZALTENANGO	2,505	506	0.5
RETALHULEU	298	123	0.1
SUCHITEPEQUES	174	92	0.1
Total	208,771	102,703	100.0

METHODOLOGY

- Completely randomized design
- 15 genotypes
- 3 repetitions
- 20 seeds/20 bruchids
- Highlands: 2 sites (*Acanthoscelides obtectus* Say)
- Lowlands: 1 site (*Zabrotes subfasciathus*)
- Mean test = “DGC” (Alpha = 0.05)

TREATMENTS

#	Line	Characteristics	Color
1	PR 1165-5	bgm, I, bc3	Black
2	PR 1165-3	bgm,I,bc3	Black
3	PR 1165-2	bgm,I,bc3	Black
4	PR 806-82-C	bgm,I,bc3,Ur4,Ur5,Ur11	White
5	PR 806-81-C	bgm,I,bc3,Ur4,Ur5,Ur11	White
6	PR 806-80-C	bgm,I,bc3,Ur4,Ur5,Ur11	White
7	**PR 1303-42**	bgm,SW12,I,bc3, Res. bruchids in PR	Black
8	**PR 1303-121-129**	bgm,SW12,I,bc3, Res. bruchids in PR	Black
9	PR 1424-3-1012-29	bgm,SW12,I,bc3, Res. bruchids in PR	Black
10	**PR 1429-4-1012-29**	bgm,SW12,I,bc3, Res. bruchids in PR	Black
11	PR 1350-12	bgm,SW12,I,bc3, Res. bruchids in PR	Black
12	PR 1352-12	bgm,SW12,I,bc3, Res. bruchids in PR	Black
13	PR 1464-4	bgm,SW12,I,bc3, Res. bruchids in PR	Black
14	**PR 1464-6**	bgm,SW12,I,bc3, Res. bruchids in PR	Black
15	ICTA HUNAPU	Res. rust, anthracnose, ALS	Black

RESULTS

Acanthoscelides obtectus Say

- In the investigation carried out in Quetzaltenango and Chimaltenango with common beans evaluated for damage caused by *Acanthoscelides obtectus,* there was no significant difference between locations

- The results identified four bean genotypes to have significantly less damage:
  - PR 1429-4-1012-29
  - PR 1464-6
  - PR 1303-121-129
  - PR 1303-42

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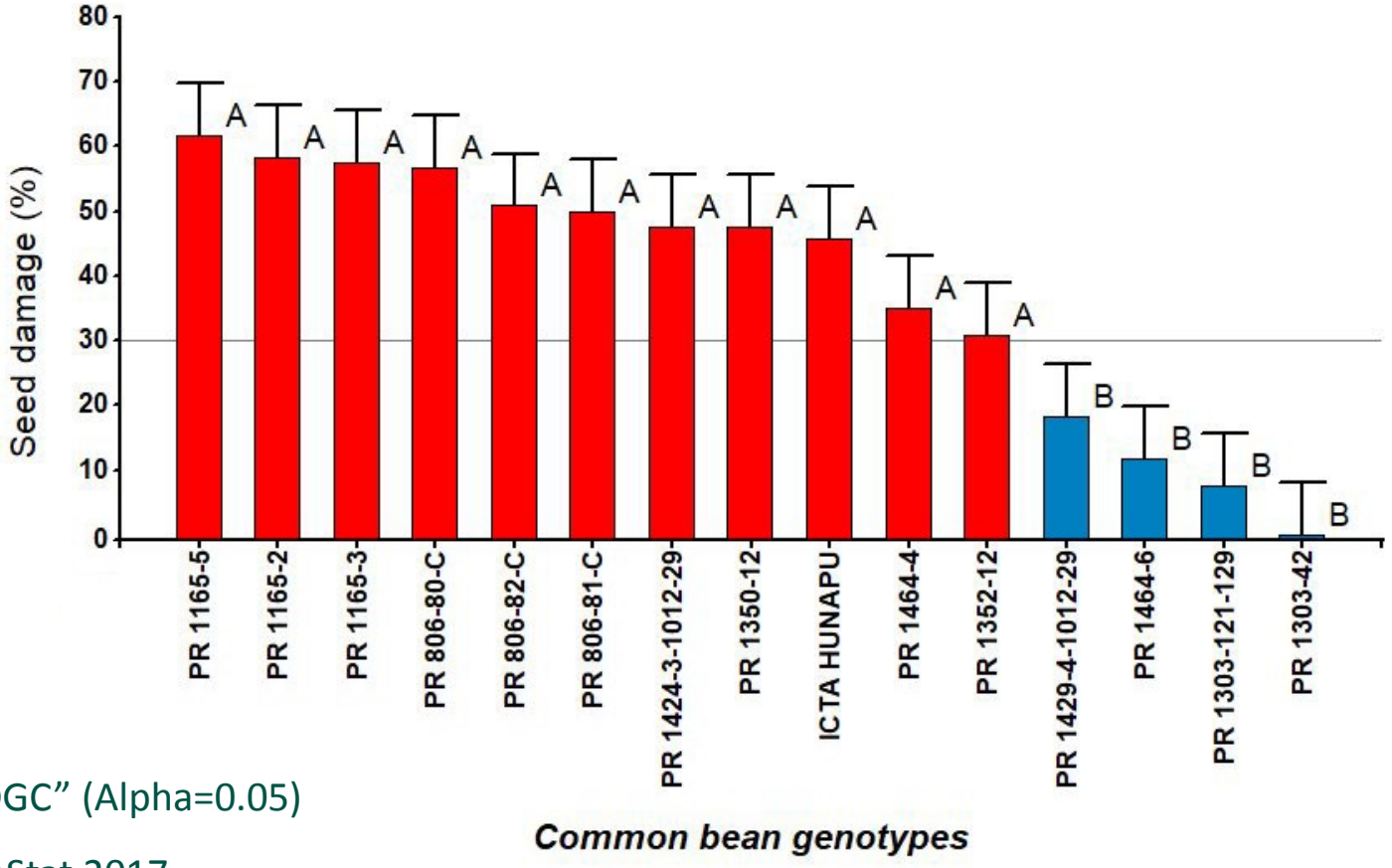
Grain damaged (%) caused by common bean weevil. Chimaltenango and Quetzaltenango 2016.



Mean test = “DGC” (Alpha=0.05)

Software = InfoStat 2017

Analysis method = GLM (General Lineal Model)

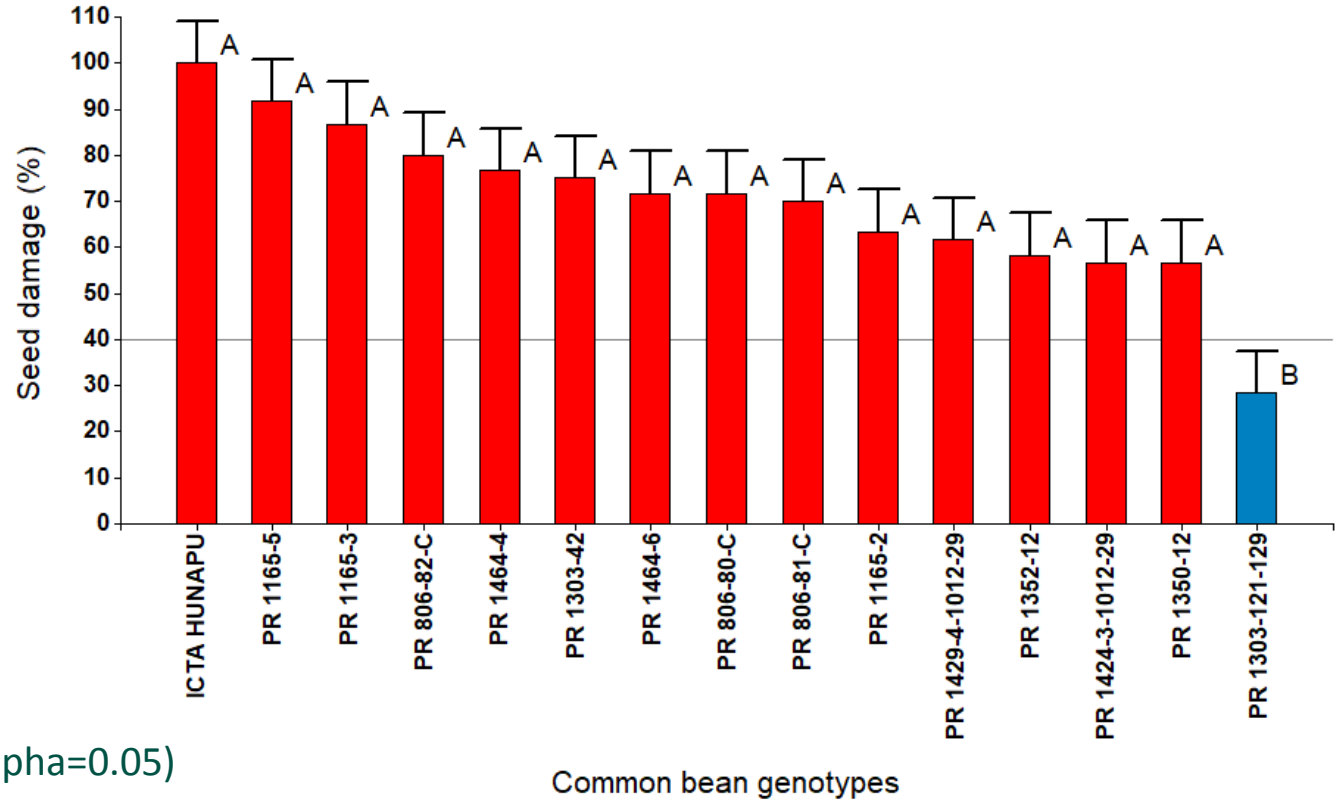
Common bean genotypes	Weight lost from seeds (g)	Holes per seed
PR 1303-42 *	0.53	0.00
PR 1303-121-129 *	0.50	0.56
PR 1429-4-1012-29 *	0.57	1.45
ICTA HUNAPU	0.67	2.25
PR 1464-6 *	0.48	2.40
PR 1165-3	0.92	2.58
PR 1352-12	0.70	2.62
PR 1350-12	0.75	2.74
PR 1165-2	0.80	2.97
PR 1464-4	0.68	3.15
PR 1165-5	0.95	3.17
PR 1424-3-1012-29	0.73	3.26
PR 806-80-C	0.62	3.67
PR 806-81-C	0.60	3.79
PR 806-82-C	0.72	4.10

* Genotypes of common bean that have significantly less damage.

Zabrotes subfasciathus

- In the investigation carried out in San Jerónimo to evaluate the resistance of common bean lines to *Zabrotes subfasciatus,* significant differences were found among the fourteen genotypes evaluated.
- The results showed that only the line “PR 1303-121-129” had significantly less damage than the other lines.

Grain damaged (%) caused by the Mexican bean weevil. San Jerónimo, 2016.



Mean test = “DGC” (Alpha=0.05)

Software = InfoStat 2017

Analysis method = GLM (General Lineal Model)

Common bean genotypes	Weight lost from seeds (g)	Holes per seed
PR 1303-121-129 *	1.67	2.20
PR 1165-3	2.00	2.56
PR 806-82-C	1.73	2.80
PR 1165-2	1.67	2.87
PR 1165-5	2.27	3.00
PR 1303-42	2.03	3.24
PR 806-81-C	1.80	3.70
PR 806-80-C	2.17	3.81
PR 1424-3-1012-29	2.10	3.86
PR 1464-6	0.87	10.87
PR 1464-4	1.30	12.18
ICTA HUNAPU	1.80	12.40
PR 1352-12	1.67	14.37
PR 1429-4-1012-29	1.67	15.23
PR 1350-12	1.93	17.95

* Genotypes of common bean that have significantly less damage.

SUSCEPTIBLE

RESISTANT

CONCLUSIONS

- The black bean breeding lines:
  - PR 1429-4-1012-29
  - PR 1464-6
  - PR 1303-121-129
  - PR 1303-42

From Puerto Rico were identify to be resistant to the common bean weevil (*Acanthoscelides obtectus*) at Quetzaltenango and Chimaltenango

CONCLUSIONS

- The black bean breeding line PR 1303-121-129 is also moderately resistant to the Mexican bean weevil (*Zabrotes subfasciatus*) at San Jerónimo.

FOLLOW-UP ACTIVITIES

- The ICTA bean research program used the bruchid resistant black bean lines PR1303-42, PR1303-(121-129) and PR1464-6 as parents in the ICTA breeding program. F_3 lines derived from these crosses look promising in trials planted in San Jerónimo in December, 2016.

FOLLOW-UP ACTIVITIES

- ICTA bean researchers selected the bruchid and multiple virus resistant black bean line PR1303-(121-129) for evaluation in multi-location yield trials in Guatemala.

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