Halyomorpha halys

(Hemiptera: Pentatomidae)

in Chile



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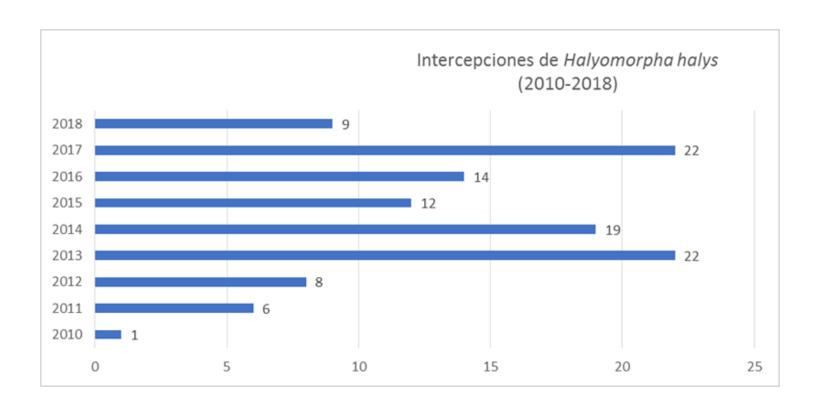
Sub Department of Surveillance and Control for Agricultural Pests

Department of Plant Health

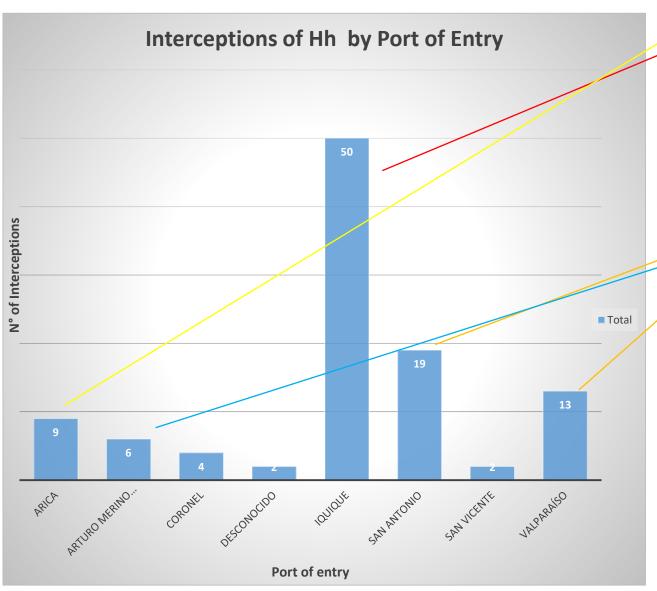
Agriculture and Forestry Protection Division

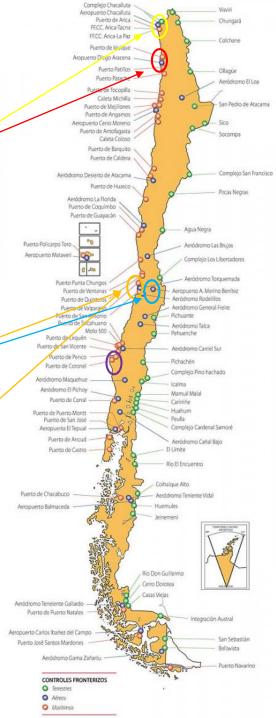
Beginnings of the Halyomorpha halys story in Chile

• Since 2010, **interceptions of Hh** have become more and more important in several ports of Chile, especially in **the north**, in containers with used products imported from the U.S.A.



Ports of entry





Actions taken at that time

The following measures were implemented:

- PRA was carried out (2011) and quarantine pest was declared
- Res. N° 6319/2011 was issued to regulate products (fumigation) mainly coming from the U.S.A. Even though the interceptions decreased, they were not over and new countries join the play.



Were do they come from?

- Mainly USA, some from China and Europe.
- This year all the interceptions are from USA and Italy.

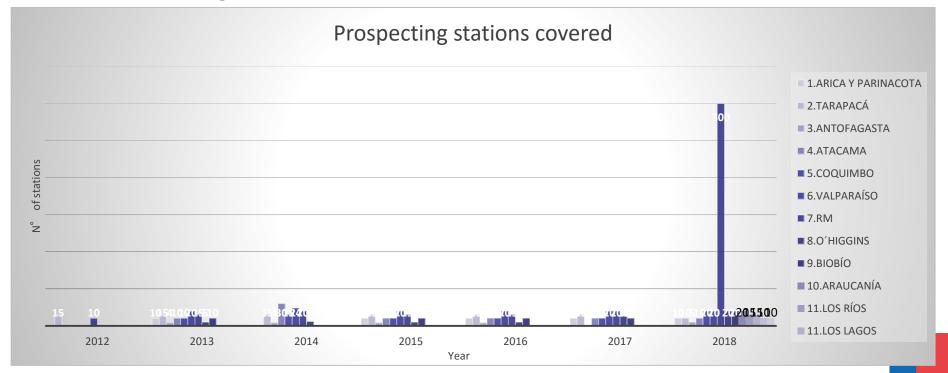
Hh interceptions per country (2010-2018) PERU From USA in NO DETERMINADO used cloth JAPON ITALIA HOLANDA 1 FRANCIA 2 ESPAÑA 2 CHINA 4 ALEMANIA 1 100 10 20

From Italy in furnitures



Halyomorpha in land

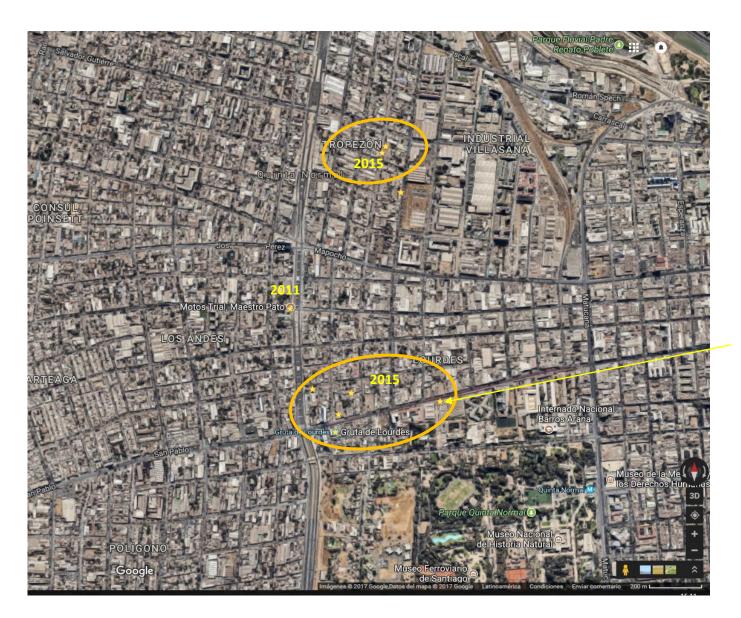
- The first specimen detected in land was back in 2011 (a single insect) in the Quinta Normal Commune (urban prospection of *Lobesia botrana*).
 - 89 prospection stations were placed
 - Light traps were set (no pheromones available by then)
 - No further specimens were detected so we assumed it was a interception
- A national Surveillance program was implemented
 - First in two regions, and then national.



In 2015 several detections of adults were found in Santiago

- A live insect was detected in March 2015 in an evangelical church thanks to a notification, near the "Gruta de Lourdes" subway station, in the Quinta Normal Commune.
 - Due to the prospections carried out as a result of this notification, a second live specimen was found in the area.
 - Winter prospections were carried out in homes.
 - Several meetings were held with neighborhood councils and the Municipalities of Quinta Normal, Estación Central, and Santiago.
 - During 2015, the presence of Hh adults was identified in 6 points in Quinta Normal.

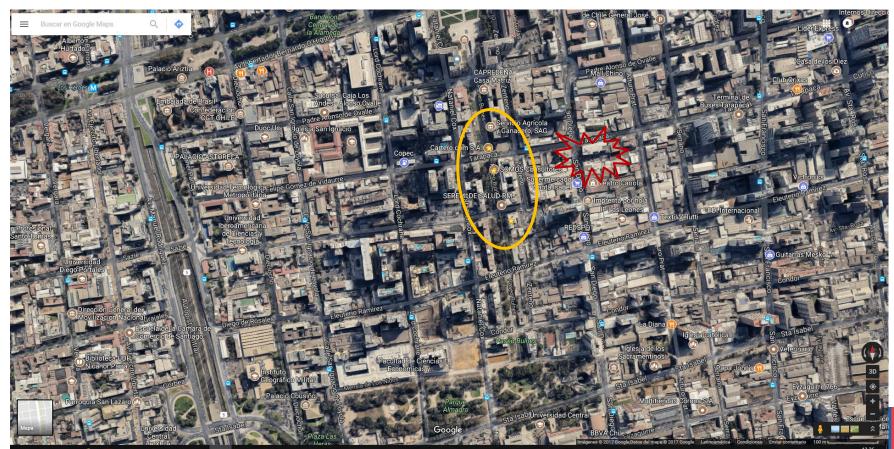
2015, *Halyomorpha halys* story in Chile: turning into a not so nice one



Notification of Hh made by the company Ursus Trotter found in furnaces imported from China.

An other Detection area is broadened to Downtown Santiago

- At the same time, in March 2015 the SAG's Maine Offices, through its OIRS (Office for Information, Complaints, and Suggestions) received a notification about a specimen found inside an office in the Paseo Bulnes neighborhood.
- An adult specimen was found inside SAG's Central Offices (near the area of risk)



Suspicious...





From China?



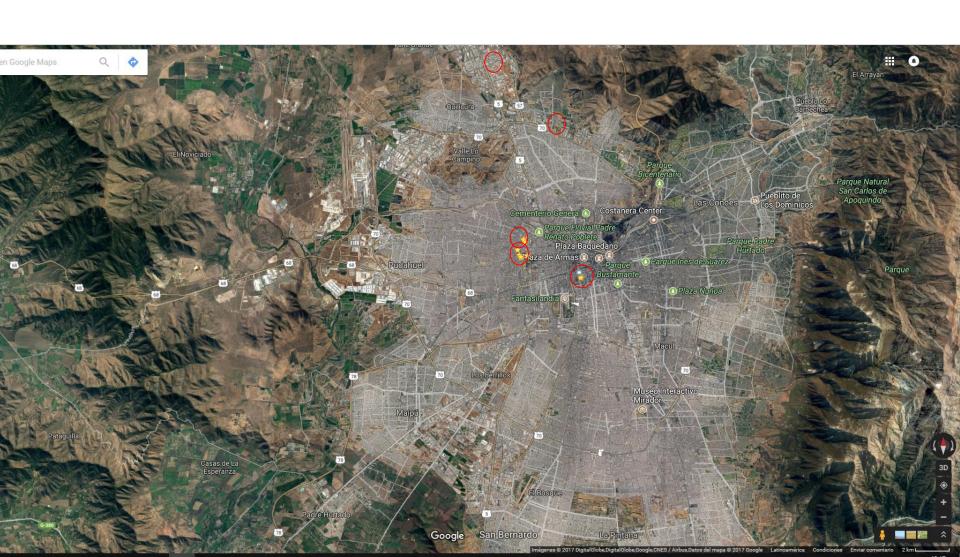
2016: The detection of several stages of *Halyomorpha* halys was confirmed

In December the **presence** (active population) of the pest was verified in urban trees (*Ailanthus altissima, Acer negundo*) of the Q. Normal Commune.



Halyomorpha halys found in Greater Santiago

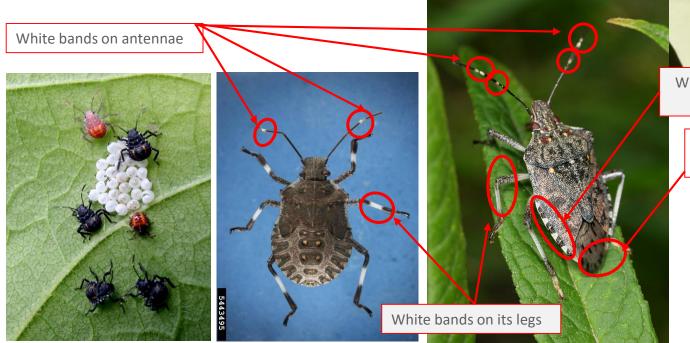
Overview of greater Santiago and the nearest agricultural areas.



Halyomorpha halys - What is it?

- This insect belongs to the Family Pentatomidae of the Hemiptera group. It is known as the Brown Marmorated Stink Bug.
- It comes from Asia.
- Its distinctive features include white bands on the antennae, legs, and abdomen.
- Black spots on the back of the wings.

The size of an adult is 17 mm (0.6 inches)



White bands and black bands on the edge of abdomen

Black spots on the back of the wings



9381

Seasonal development

- The adult overwinters with no sign of activity (within buildings, trunks, and leaf litter). Nuisance pest.
- In spring, when temperatures rise, it **migrates** towards plants to start feeding (month of October in the Quinta Normal Commune).
- It would require to "awaken" ("clean" itself by defecating) before reacting to **pheromone-based traps.**
- Two weeks later the **mating** begins and eggs are laid on several species of plants.

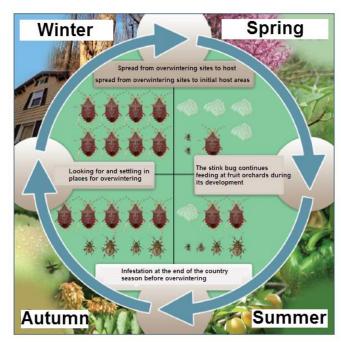


Fig. 1. Seasonal life cycle of BMSB

- Throughout its life it needs different nutrients, therefore it moves from host to host.
- In general, it flies up to 5 km (3 miles) but it may reach distances of over 100 km (62 miles) in one day. Its crawling is very efficient.
- It does not travel with agricultural products around the world. The anthropic transport is highly efficient.

Nuisance pest

It may be unpleasant to citizens as it reaches a high population and discharges a strong odor when disturbed in any form. In USA was recorded up to 25,000 specimens in one house.



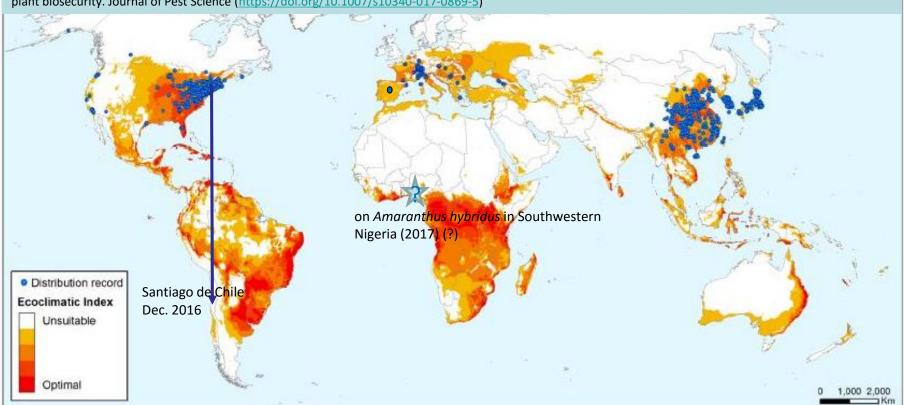
Already spread... but... does it settle?

- It entered the U.S.A. (stowaway) at the end of the 90's. In 2001 it settled in Pennsylvania and in 2014 it spread to 43 states, including Canada.
 - In 2010 the damage level to agricultural crops is critical, especially stone fruit trees and pome fruit trees.
- In 2007 (2004) the first detection in Europe occurred (Switzerland).
 - The first damage reported was on pepper plant in 2012. Severe damage occurred in 2017
- It was detected in Italy in 2012
 - Considerable damage was found in 2015, with over 50% of the fruit (pears) deformed.
 - To day, Italy is a main exporter of Halyomorpha.
- In 2015 the detection occurred in Georgia
 - In 2016 Georgia recorded damage losses on hazelnut trees equivalent to US\$ 24 million. In 2017 after applications the loss decreased by 20 - 30 %.

Current and potential distribution (Maxent bioclimatic model)



Kriticos, Kean, Phillips, Senay, Acosta, Haye (2017) The potential global distribution of the brown marmorated stink bug, Halyomorpha halys: A critical threat to plant biosecurity. Journal of Pest Science (https://doi.org/10.1007/s10340-017-0869-5)



- Asia: China, Korea, Japan, Taiwan,
- America: U.S.A., Canada.
- Europe: Germany, Austria, Bulgaria, Slovakia, Spain, France, Georgia, Greece, Hungary, Italy,
 Liechtenstein, Romania, Russia, and Serbia. The outbreak in Chile signals the first pest report in the southern hemisphere.
- A report from Nigeria is to be confirmed
 - Dioli, Paride & Leo, Piero & Maistrello, Lara, (2016), First quote for Spain and Sardinia about the invasive species Halyomorpha halvs (Stål. 1855), with notes on its spread in Europe (Hemiotera, Pentatomidae), Revista Gaditana de Entomología, 7, 539-548

Areas under risk

Potential distribution (Maxent bioclimatic modeling)

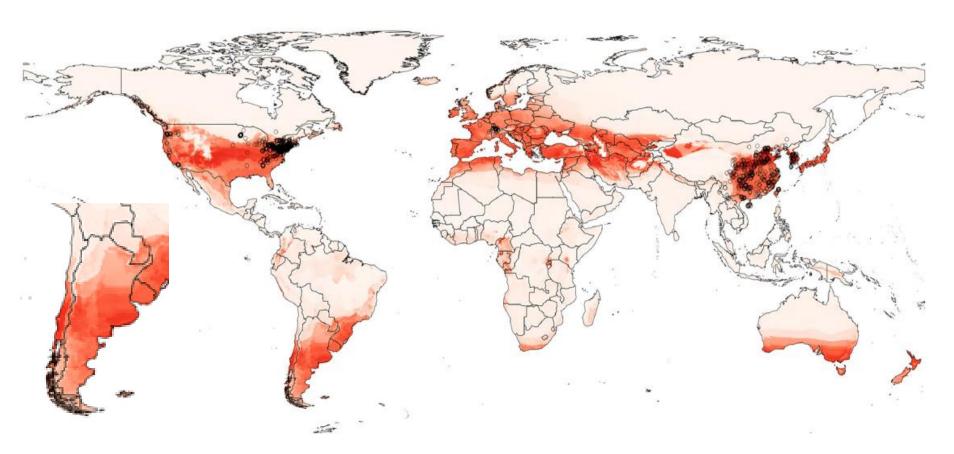


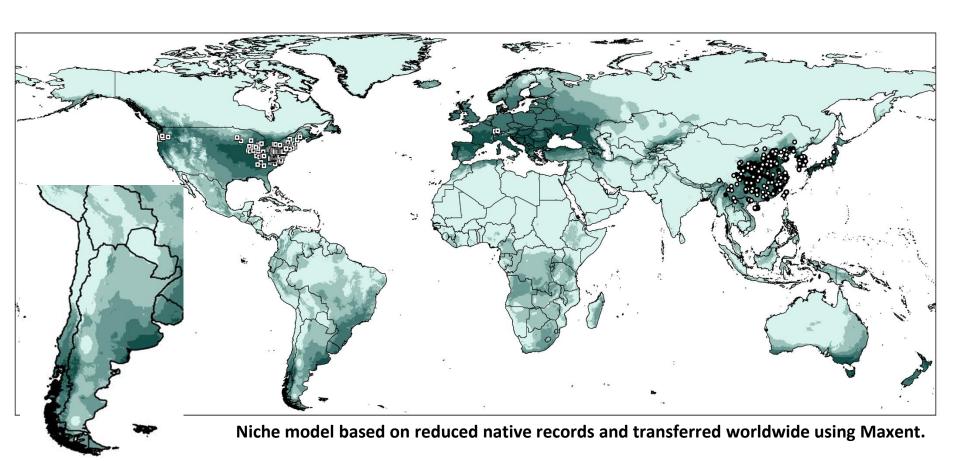
Fig. 1 Current world distribution of *Halyomorpha halys* (circles) and bioclimatic model (Maxent software, http://www.cs.princeton.edu/~schapire/maxent/) based on distribution data in Asia. *Dark colour*

represents high habitat suitability; *light colour* indicates low suitability (Rossi and Streito, unpublished). Background map from http://www.naturalearthdata.com

Haye, T., T. Gariepy, K. Hoelmer, J. P. Rossi, J. C. Streito, X. Tassus, and N. Desneux. **2015**. Range expansion of the invasive brown marmorated stink-bug, Halyomorpha halys: An increasing threat to field, fruit and vegetable crops worldwide. J. Pest Sci. 88: 665–673

Areas under risk

Potential distribution (Maxent bioclimatic modeling)



Zhu G, Bu W, Gao Y, Liu G (**2012**) Potential Geographic Distribution of Brown Marmorated Stink Bug Invasion (Halyomorpha halys). PLOS ONE 7(2): e31246. https://doi.org/10.1371/journal.pone.0031246

TENTH ANNIVERSARY

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0031246

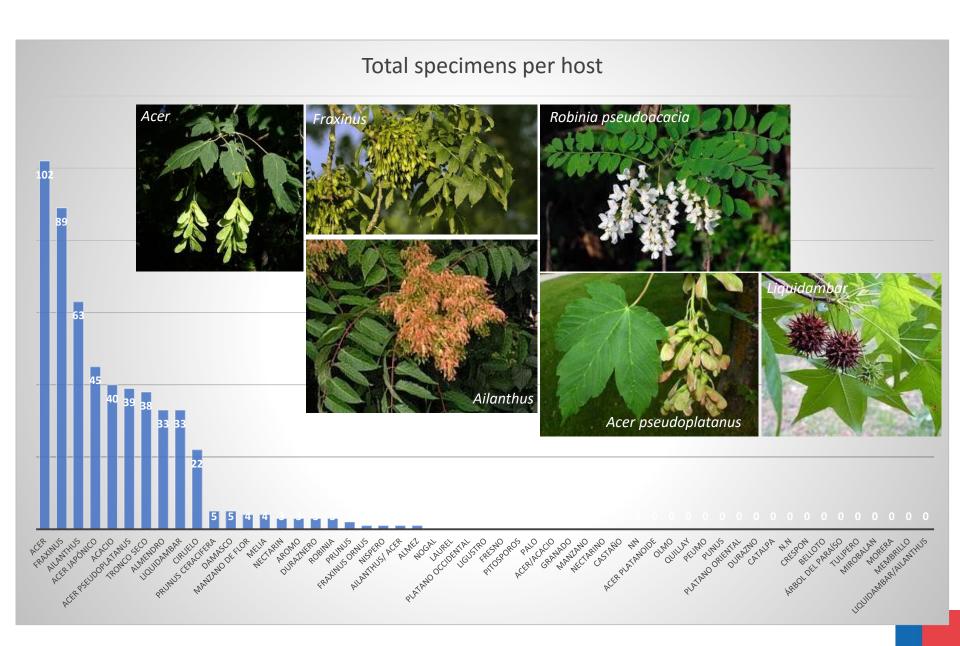
Another relevant characteristic of the pest is the large amount of hosts!

- This is a **highly polyphagous** pest found in over 170 species where it settles in forests, fruit orchards, and crops including urban areas.
- It **feeds** on buds, leaves, flowers, fruits, and trunks.
- **Peach trees** are considered its preferred host. It can complete its full cycle on these, without moving to other species.
- It is considered a "border" moving pest as it constantly moves from species to species.

http://www.stopbmsb.org/where-is-bmsb/host-plants/



Our detections in Santiago



Strategies to face the pest in Chile

- The pest was declared under official control through resolution 1.761/03.2017
- Sourveillance: trap setting in Santiago with the first strategy design by a trinational team (New Zealand, Chile, with the help of Tracy Leskey, Aphis, USDA)
 - Prospecting: Monthly programming from the Arica and Parinacota Region to the Magallanes Region.
 - Trapping: monthly programming of trap revision.
- **Chemical control:** Still in process. Application of pesticides authorized by SAG depending on the specific dosage provided by the manufacturer in areas with actual detection.
- **Private Associations of Agricultural producers involved**, as well as public institutions, and the USDA **were informed and asked for support**
- **Handout material** is prepared to distribute in the urban area and inform the population of possible invasion of homes.

Trap setting in Chile 2018



Activity Management Official Monitoring of Halyomorpha halys 2018

			OFFICIAL	MON	TORIN	IG HAL	YOM	ORPH	IA HA	LYS 2	018						
			N° ACTIVITY (N° OF REVISIONS/MONTH)													REVISIONS	
REGION	OFFICE	T	TRAPS	E	F	M	A ▼	M	J	J	A	S ▼	0	N	D ▼	PER TRAP <u>▼</u>	%ADVAN
ARICA & PARINACOTA	REGIONAL	Scheduled	5	10	10	10							10	10	10	60	
		Performed		10	10	10							0	0	0	30	50%
TARAPACA	REGIONAL	Scheduled	6	12	12	12	10	10	10	10	10	10	12	12	12	132	
		Performed		11	11	13	0	0	0	0	0	0	0	0	0	35	27%
ANTOFAGASTA	REGIONAL	Scheduled	5	10	10	10							10	10	10	60	
		Performed		10	10	10							0	0	0	30	50%
ATACAMA	REGIONAL	Scheduled	5	10	10	10							10	10	10	60	
		Performed		10	10	10							0	0	0	30	50%
COQUIMBO	REGIONAL	Scheduled	10	20	20	20							20	20	20	120	
		Performed		20	20	20							0	0	0	60	50%
VALPARAISO	REGIONAL	Scheduled	30	60	60	60							60	60	60	360	
		Performed		47	57	58							0	0	0	162	45%
METROPOLITAN	REGIONAL	Scheduled	268	979	878	1,026							1,000	1,000	1,000	5,883	
REGION		Performed		988	893	1,004								-		2,885	49%
O'HIGGINS	REGIONAL	Scheduled	40	80	80	80							80	80	80	480	
		Performed		80	80	80							0	0	0	240	50%
MAULE	REGIONAL	Scheduled	40	80	80	80							80	80	80	480	
		Performed		80	80	80							0	0	0	240	50%
BIO BIO ARAUCANIA	REGIONAL	Scheduled	30	60	60	60							60	60	60	360	3070
	TEGIOTE TE	Performed	30	60	60	49							0	0	0	169	47%
	REGIONAL	Scheduled	30	60	60	60							60	60	60	360	4770
	REGIOTAL	Performed	30	54	50	50							0	0	0	154	43%
LOS RIOS	REGIONAL	Scheduled	10	20	20	20							20	20	20	120	4370
	REGIONAL	Performed	10	20	20	20							0	0	0	60	50%
LOS LAGOS	REGIONAL	Scheduled	10	20	20	20							20	20	20	120	3070
	REGIONAL	Performed	10	18	20	22							0	0	0	60	50%
AYSEN	REGIONAL	Scheduled	5	10	10	10							10	10	10	60	50%
	REGIONAL	Performed	3	10	10	10							0	0	0	30	50%
	DECIONAL	Scheduled	F												_		50%
MAGALLANES	REGIONAL	Performed	5	10	10 10	10 10	0	0	0	0	0	0	10 0	10 0	10 0	60 30	50%
		renomieu		10	10	10	U	U	U	U	U	U	U	U	U	30	50%
	NATIONAL	Scheduled	499	1,441	1,340	1,488	10	10	10	10	10	10	1,462	1,462	1,462	8,715	
		Performed		1,428	1,341	1,446	_	_		_	_	_	_	_	_	4,215	47%

Installation of traps

• First Installation of traps





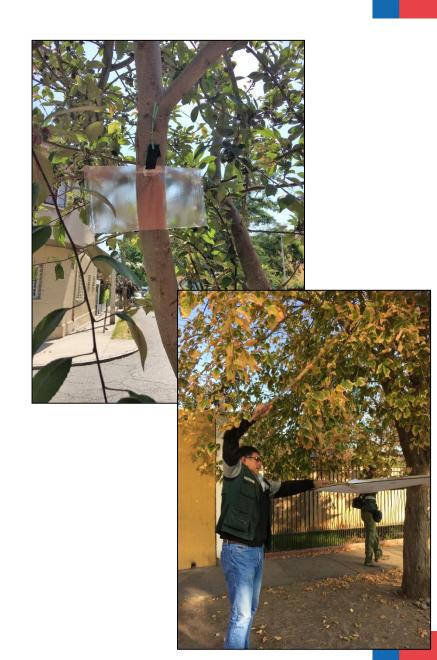






Installation instructions

- Install in places where the entomological screen can be fixed (adjacent foliage).
- Plants which yield fruit/seed are preferable.
- Vertical branch installation is preferable.
- Install the pheromone separated from the board so that when you change the SB, the pheromone is not manipulated.
- Remove leaves and branches in contact or possible contact with the SB (active growth).
- Mark the trap with the internal code from each office with permanent marker.



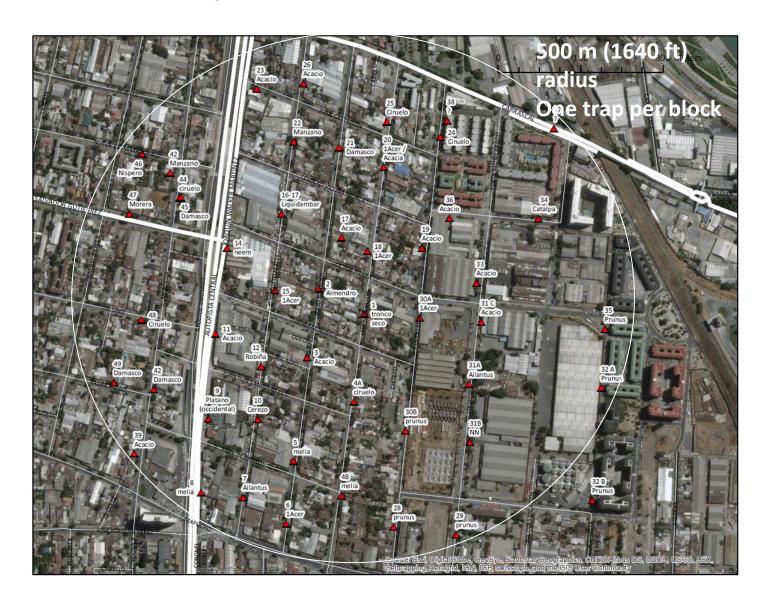
Trapping and revision service

- The traps use **aggregation alluring** which, unlike the pheromone-baited traps we commonly use for Agricultural Surveillance, the bugs may be stuck to the trap or in **its surroundings**. The specimens caught in Santiago have been detected in the same plant or surrounding plants.
- 7% of the Halyomorpha caught were directly stuck to the trap. The 93% left was caught during the inspection and "mitigating" of the plant or surrounding trees. In view of this the visual prospection is essential at the site of the installation of every trap.

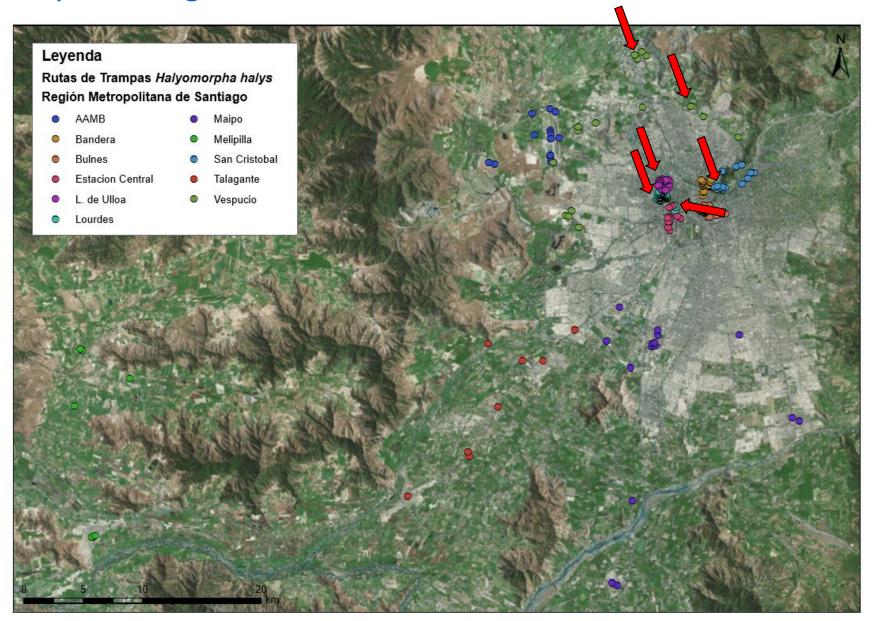
Actions:

- Revision of the SB
- Carry out a visual inspection of the entire plant during 3 minutes
- Using the entomological screen, use the traps at least 5 times in different areas of the plant.
- Repeat this action in surrounding plants.

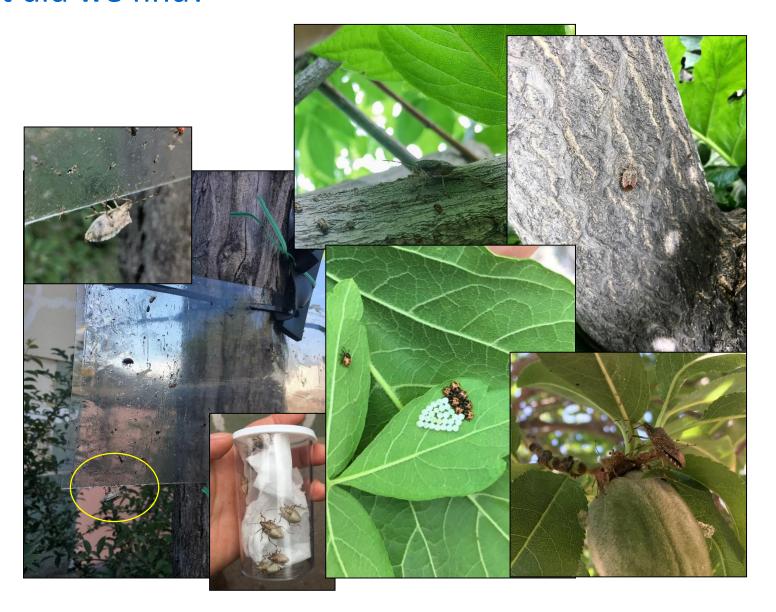
Outbreak boundary



Traps setting in RM

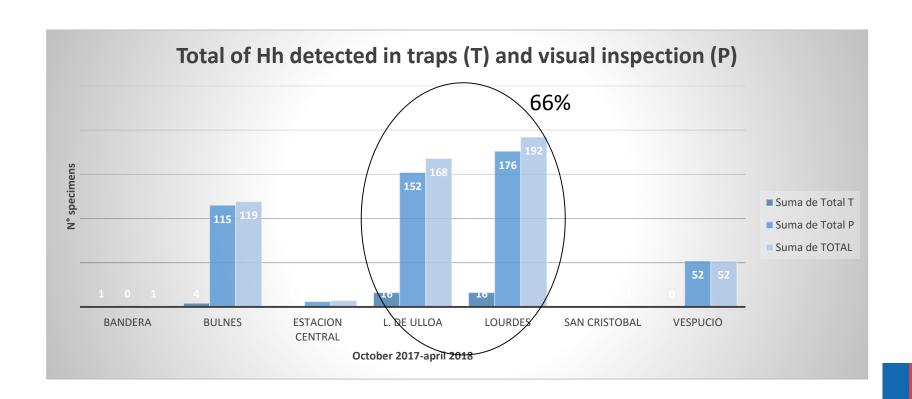


What did we find?

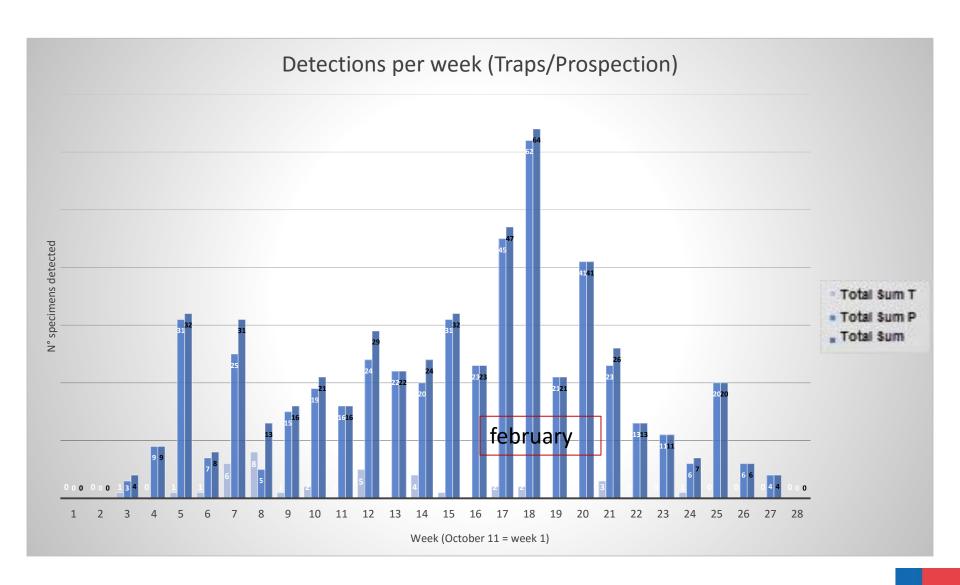


Results

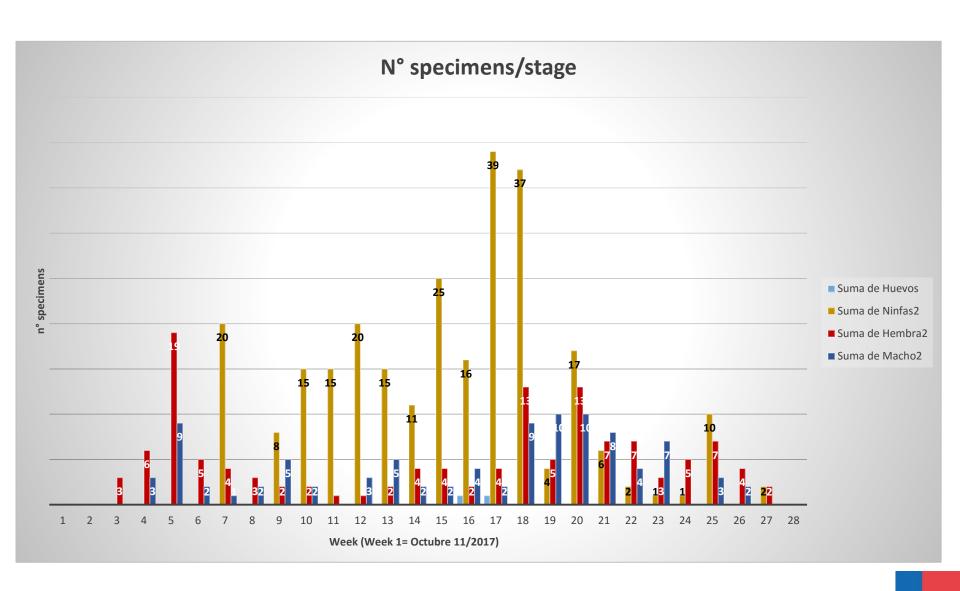
- The surveillance is carried out with traps and its related prospection (the pheromone is of the aggregation type, thus the stink bugs may remain between 3 to 5 meters [9.8 to 16.4 ft] from the trap).
- 93% of the detections are carried out by prospecting the plant where the pheromone is installed, and only 7% of the specimens is trapped.



Progression of detection per week



Progression of detections per stage



Next activities: Prospecting during cold season

- Where? They are carried out in areas of higher risk, such as deconsolidation centers of merchandise imported from China, Asia in general, U.S.A., and Europe (Italy). Sales centers and warehouses with second-hand clothing, toys, ports, etc.
- When? This activity mainly aims at overwintering adults or those who come from the northern hemisphere. Therefore, the most adequate time is winter or spring. As the overwintering adults do not react to the pheromone, prospection is the only tool used to detect the pest (and the notifications, of course).
- Supervision of the technical program: This activity exists at the regional and central level, to evaluate the development and performance of the program in relation to the current procedures.
- It is fundamental that this activity is accompanied by a promotion program. Place posters, distribute brochures, etc. In this way, the people will be attentive to the bugs at home, or in warehouses and will report it to SAG. In this way, the bugs which turned out to be active outbreaks were detected in the Quinta Normal Commune and Santiago.

Promotion

- SAG's website
- Talks
- Posters
- Brochures







WE TAKE YOUR
CALLS AT
600 81 81 724
To call from a
cellphone dial
(+56 2) 2345 1100

Make your complaint at: http://www.sag.cl/contacto

oficina.informaciones@sag.gob.cl

There is high worldwide expectation regarding the biological monitoring of this pest



- Even though no authorization has been issued by any NPPO, the research studies are at the final stage to request release permission of the most promising monitor: *Trissolcus japonicus* (50-90%)
- We are keen for approval in the U.S.A., New Zealand, Switzerland, and other EU countries to release the most promising biological monitor: Trissolcus japonicus.
- Future steps:
 - Establish breeding of "Chilean" pentatomidae
 - 6 natives
 - 10 from South America
 - Import of the monitor
 - Testing stage
 - Authorization (or rejection)
 - Overcrowding
 - Release



