Defensa inducida en el manejo de enfermedades de las plantas

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Politécnico Colombiano JIC

5-8-2021

http://www.lavozdemichoacan.com.mx/morelia/michoacan-el-septimo-en-intoxicaciones-por-plaguicidas/

Ortgea-Miller et al. 2017

Mutation Research/Genetic Toxicology and Environmental Mutagenesis
Volume 824, December 2017, Pages 25-31

Cytogenetic damage in peripheral blood lymphocytes of children exposed to pesticides in agricultural areas of the department of Cordoba, Colombia

Javier Alonso Ruiz-Guzmán, Pamela Gómez-Corrales,

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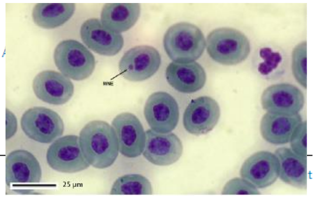
https://doi.org/10.1016/j.mrgentox.2017.10.002

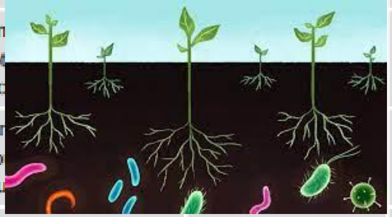


Highlights

- Pesticides and/or its metabolites were recorded in the children's urine samples.
- Frequency of cytogenetic damage was higher in the exposed children that in control group.
- Results suggest a permanent health risk for pesticide exposure.

TABLE 4.1 Effect of agrochemicals on the function and physiology of soil microorganism.

Agrochemicals	Microbial species	Impact	References
Atrazine, isoproturon, metribuzin, and sulfosulfuron	*Bradyrhizobium japonicum*	Reduced nodulation, nitrogenase activity, and total N content	Mallik and Tesfai (1985)
Glyphosate, paraquat, diquat, and chlorsulfuron	*Rhizobium trifolii*	Reduced the viability	Eberbach and Douglas (1989)
Pendin isoprot fluchlo		Reduced the survival	Aamil (2002)
Atrazin metrib sulfosu		Affected bradyrhizobium	Khare and Arora (2015)
DDT and 2,4-dichlorophenoxyacetic acid	*Rhizobium* sp.	Inhibited the growth of *Rhizobium* sp.; inhibited nod expression by 32%–90% by disrupting plant–rhizobial signaling	Fabra et al. (1997), Mclachlan (2001)
Hexaconazole	*Anabaena doliolum*	Reduction in nitrogenase activity	Hammouda (1999)



Singh et al., 2020

Environmental Science and Pollution Research
https://doi.org/10.1007/s11356-019-06213-8

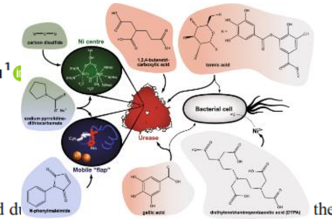
RESEARCH ARTICLE

Check for updates

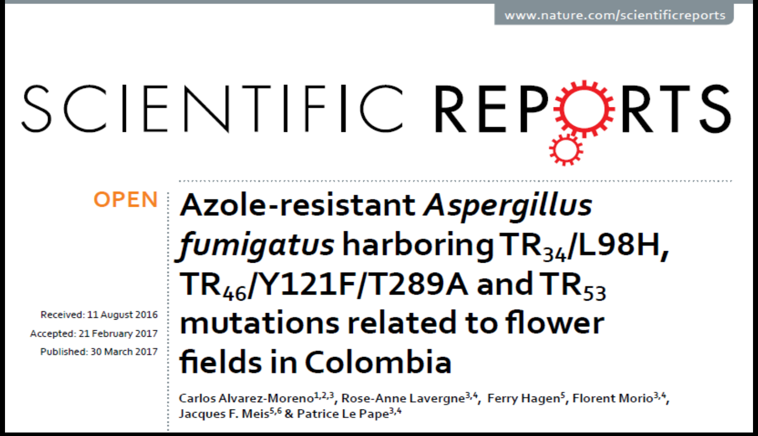
Influence of chlorothalonil and carbendazim fungicides on the transformation processes of urea nitrogen and related microbial populations in soil

Hong Ding[1] · Xiangzhou Zheng[1] · Jin Zhang[1] · Yushu Zhang[1] · Juhua Yu[1]

Received: 20 March 2019 / Accepted: 14 August 2019



Abstract
To improve crop yielding, a large amount of fungicides is continuously applied d... the effects of fungicides residues on microbial processing of N in soil need further study. In the present study, two broad spectrum fungicides, chlorothalonil and carbendazim, were applied at the rates of 5, 10, and 50 mg of active ingredient (A.I.) per kg of dry soil combined with urea with 200 mg of N per kg of dry soil under laboratory conditions. The results showed that chlorothalonil obviously retarded the hydrolysis of urea, whereas carbendazim accelerated it in 4 days after the treatments ($P < 0.05$). Chlorothalonil reduced denitrification, nitrification, and N_2O production ($P < 0.05$), but not for carbendazim. Further analysis on N-associated microbial communities showed chlorothalonil reduced *nitrosomonas* populations at the rates of 10 and 50 mg of


www.nature.com/scientificreports

SCIENTIFIC REPORTS

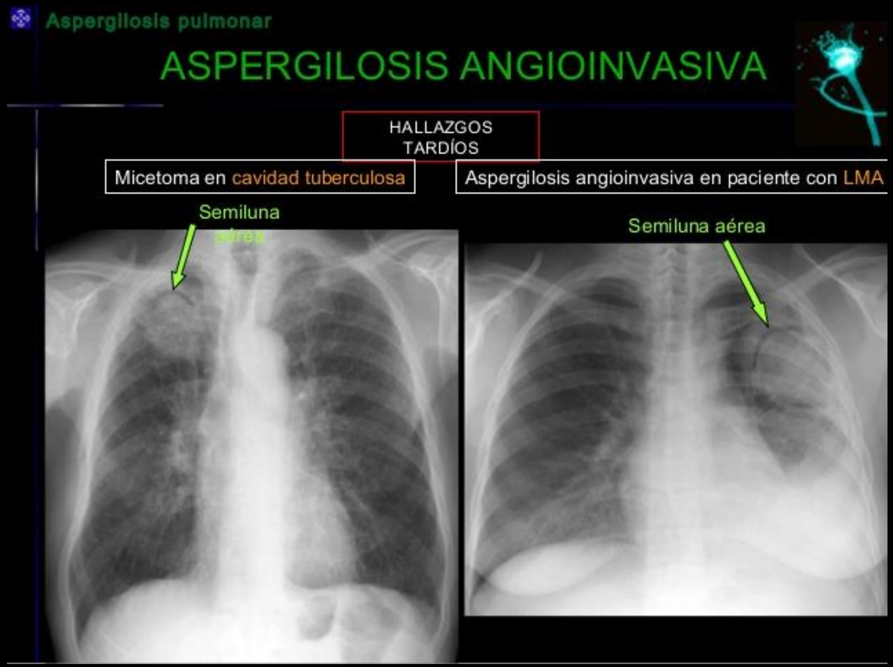
OPEN

Azole-resistant *Aspergillus fumigatus* harboring TR_{34}/L98H, TR_{46}/Y121F/T289A and TR_{53} mutations related to flower fields in Colombia

Received: 11 August 2016
Accepted: 21 February 2017
Published: 30 March 2017

Carlos Alvarez-Moreno[1,2,3], Rose-Anne Lavergne[3,4], Ferry Hagen[5], Florent Morio[3,4], Jacques F. Meis[5,6] & Patrice Le Pape[3,4]

40 de 86 muestras Resistentes a Azoles



Global Ecology and Conservation
Volume 28, August 2021, e01668

Natural habitat partially mitigates negative pesticide effects on tropical pollinator communities

Diana Obregon [a], Olger R. Guerrero [b], Elena Stashenko [c], Katja Poveda [a]

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https://doi.org/10.1016/j.gecco.2021.e01668

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Highlights

- We explored how landscape composition and pesticide residues impact bee communities and pollination services in *Solanum quitoense* Lam. crops.
- As natural habitat increased, bee richness increased but as pesticide hazard increased, bee richness and abundance decreased.
- Natural habitat mitigates negative pesticide effects on bees when hazard quotients are low/medium, but not when they are high.
- *S. quitoense* crops are highly dependent on bees for optimum yield.

Cuadro 3. Número de plaguicidas encontrados en los vegetales analizados.
Table 3. Number of organophosphate pesticides in analyzed fruit and vegetables.

Vegetal	Número de muestras con residuos				
	2 Plaguicida	3 Plaguicidas	4 Plaguicidas	5 Plaguicidas	6 Plaguicidas
Tomate	0	0	3	12	2
Cebolla	0	0	1	2	0
Papa	1	2	0	1	2
Uva	0	2	0	1	0
Fresa	0	1	2	0	0
Manzana	1	1	1	0	0





Murcia, A. M., & Stashenko, E. (2008). Determinación de plaguicidas organofosforados en vegetales producidos en Colombia. Agro sur, 36(2), 71-81.

Otro problema……

Pérdida de sensiblidad a fungicidas

Benzimidazoles
Retirados en el 1999

Triazoles pérdida en el 2004.
uso restringido- FRAC

Estrobilurinas
Retirados en el 2004

REVISTA DE **Biología Tropical**

Evaluación genotóxica del agua del Río Grande (Antioquia, Colombia) mediante frecuencia de eritrocitos micronucleados de *Brycon henni* (Characiformes: Characidae)

Lina M. Zapata-Restrepo, Luz Y. Orozco-Jiménez, Maribel Rueda-Cardona, Sandra L. Echavarría, Nehir Mena-Moreno & Jaime A. Palacio-Baena
Grupo de Investigación en Gestión y Modelación Ambiental (GAIA)- Universidad de Antioquia - Sede de

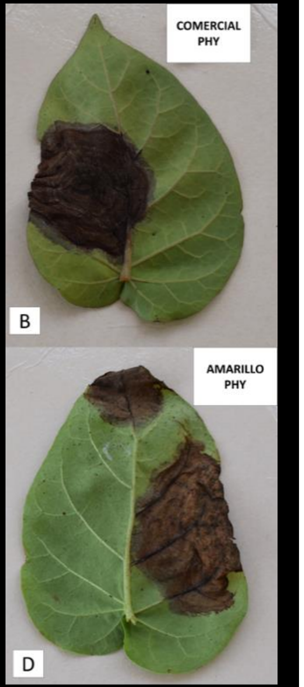
CUADRO 2
Datos biométricos y frecuencia de EMN en sangre periférica de peces *Brycon henni* procedentes de dos estaciones de muestreo del Río Grande

TABLE 2
Biometric data and MNE frequency in peripheral blood of fish *Brycon henni* from two sampling stations in Río Grande

Sitio de muestreo	Época climática	N	Longitud	Peso	Factor de condición	Frecuencia de EMN	Frecuencia de EMN por estación
Estación 1	Lluvia 2010	18	14.56±2.40	44.06±29.03	1.13±0.23	0.05±0.06	0.06±0.08*[c]
	Seca 2011	18	16.65±2.05	61.50±27.25	1.24±0.13	0.07±0.09*[a]	(N = 36)
Estación 2	Lluvia 2010	18	13.52±2.45	31.94±29.23	1.08±0.44	0.04±0.07*[b]	0.15±0.18*[c]
	Seca 2011	18	14.83±1.62	40.82±13.96	1.20±0.13	0.21±0.19*[ab]	(N = 36)

Table 1
Phytophthora infestans strains used in this study.

Host of origin	Isolate no.[a]	Collected site	Clonal lineage[b]	Mating type[b]	Mitochondrial haplotype[b]	Mefenoxam sensitivity[c]	Race
Solanum tuberosum	1810	Boyacá[e]	EC-1	A1	IIa	R	1.3.4.5.6.7.10
S. tuberosum	2400	Granada[e]	EC-1	A1	IIa	R	1
S. tuberosum	2401	Cogua[e]	EC-1	A1	IIa	I	2.3.4.5.6.7.8.1.11
S. tuberosum	2414	Cogua[e]	EC-1	A1	IIa	S	10
S. tuberosum	2421	Cogua[e]	EC-1	A1	IIa	S	2.3.4.8
S. tuberosum	2435	Granada[e]	EC-1	A1	IIa	S	1.7
S. tuberosum	2404[d]	Cogua[e]	Nd	A1	IIa	Nd	Nd
S. tuberosum	US940480	Reference strain	US-8	A2	Ia	S	Nd
S. phureja	2473	Cogua[e]	EC-1	A1	IIa	S	2.4.7.8.10
S. phureja	2475	Cogua[e]	EC-1	A1	IIa	I	2.3.5.7.8
S. phureja	2506	Granada[e]	EC-1	A1	IIa	S	Nd
S. phureja	2518	Granada[e]	EC-1	A1	IIa	S	2.3
S. phureja	2526	Granada[e]	EC-1	A1	IIa	S	2.3.5.6.8.10.11
S. phureja	2524[d]	Granada[e]	Nd	A1	Nd	Nd	Nd
S. phureja	Z3-2	Zipacón[e]	Nd	A1	Nd	S	Nd
S. phureja	6	Guasca[e]	Nd	A1	Nd	I	1.5.7.11.
S. phureja	10	Guasca[e]	Nd	A1	Nd	S	1.3.5.6.7.10.11.
S. phureja	21	Guasca[e]	Nd	A1	Nd	I	7.8.10.
S. phureja	100	Guasca[e]	Nd	A1	Nd	R	5.7.10.11.
S. lycopersicum	2527[d]	Tabio[e]	Nd	A1	Nd	Nd	Nd
S. lycopersicum	US940494 [d]	Reference strain	US-12	A1	IIb	Nd	Nd
Physalis peruviana	2557	San Francisco[e]	CO-1	A1	IIa	S	5.7.10.11.
P. peruviana	2562	San Francisco[e]	EC-1	A1	IIa	R	1.5.6.7.8.10.
P. peruviana	2768 (4084)[f]	San Francisco[e]	US-8	A2	Ia	S	2.3.5.6.
Solanum lycopersicum	2530	Tibacuy[e]	EC-1	A1	IIa	R	Nd
S. tuberosum	SR1[d]	Santa Rosa, Mérida, Venezuela	Nd	A1	Ia	Nd	Nd
S. tuberosum	TCH2[d]	Las Porqueras, Táchira, Venezuela	Nd	A1	Ia	Nd	Nd



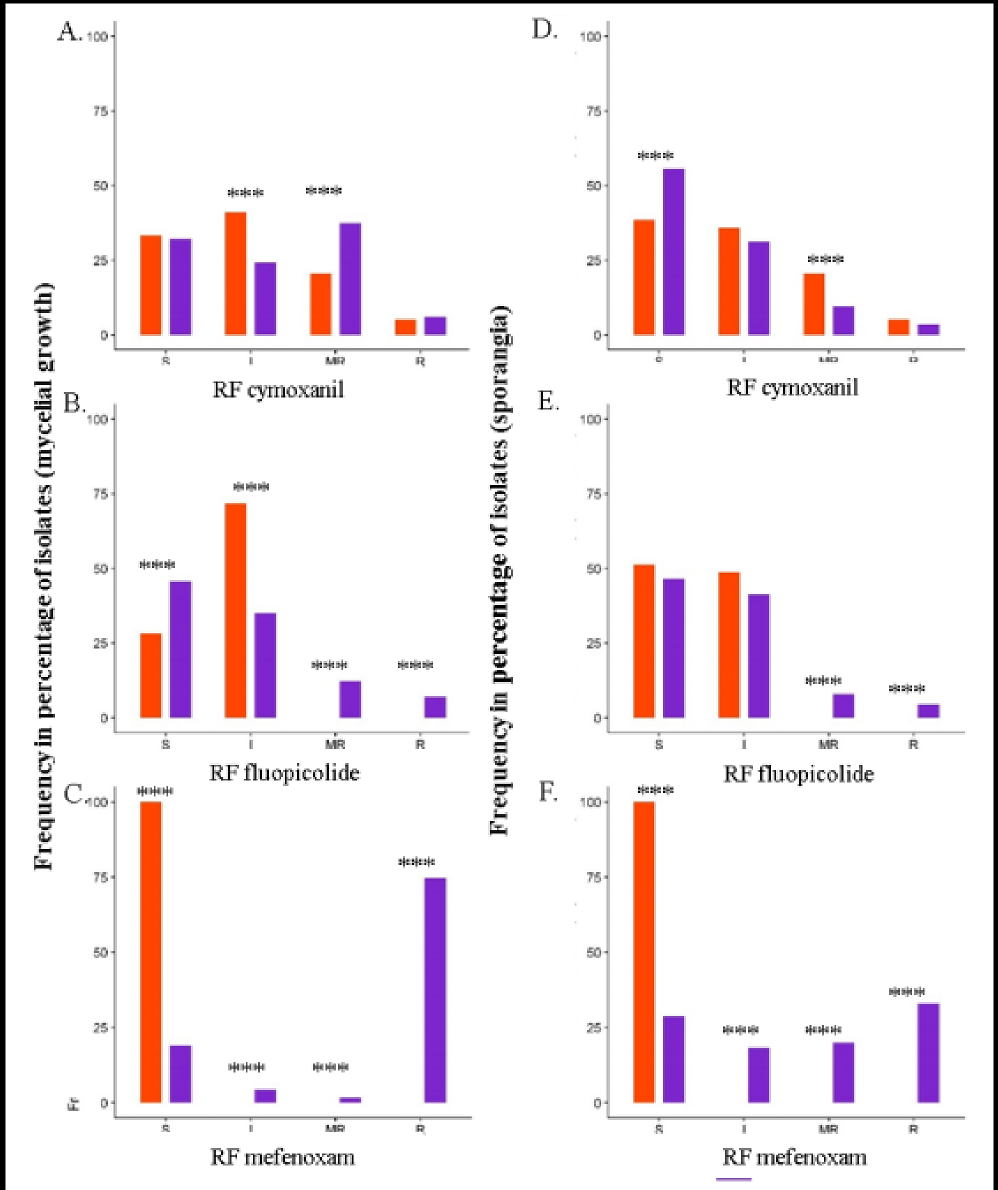
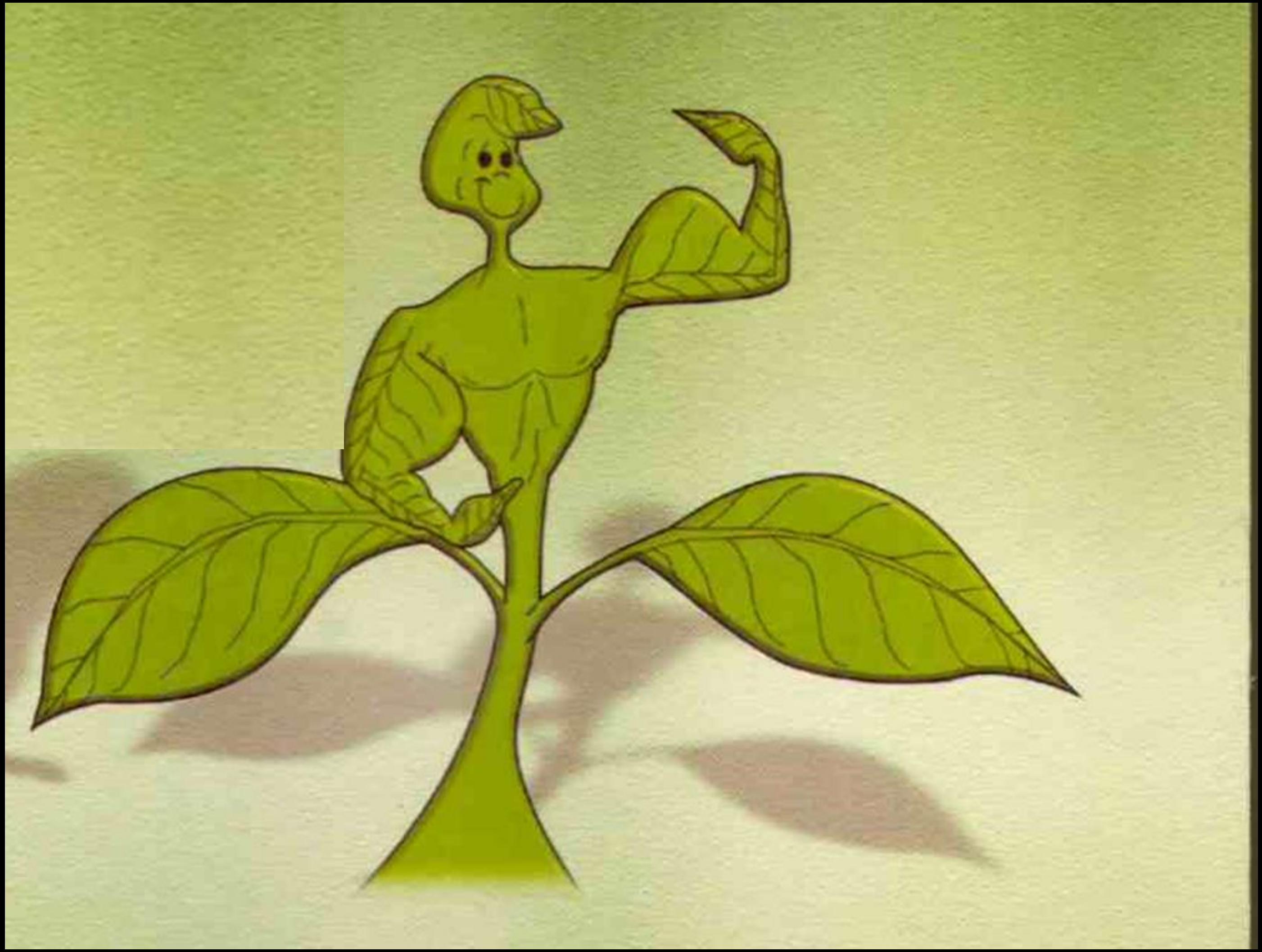


Figure 3: **Frequency of fungicide sensitivity of *P. infestans* and *P. betacei* isolates** of **three systemic fungicides (n=153).** Results for mycelial growth and sporulation for each

Parra Bastidas, M. L. (2020). *Genetic population structure and fungicide sensitivity of Phytophthora betacei and P. infestans to systemic fungicides in isolates from tree tomato and potato in Colombia* (Master's thesis, Uniandes).

Explorar nuevas alternativas ………

Defensa Inducida



Reconocimiento, es la palabra clave….

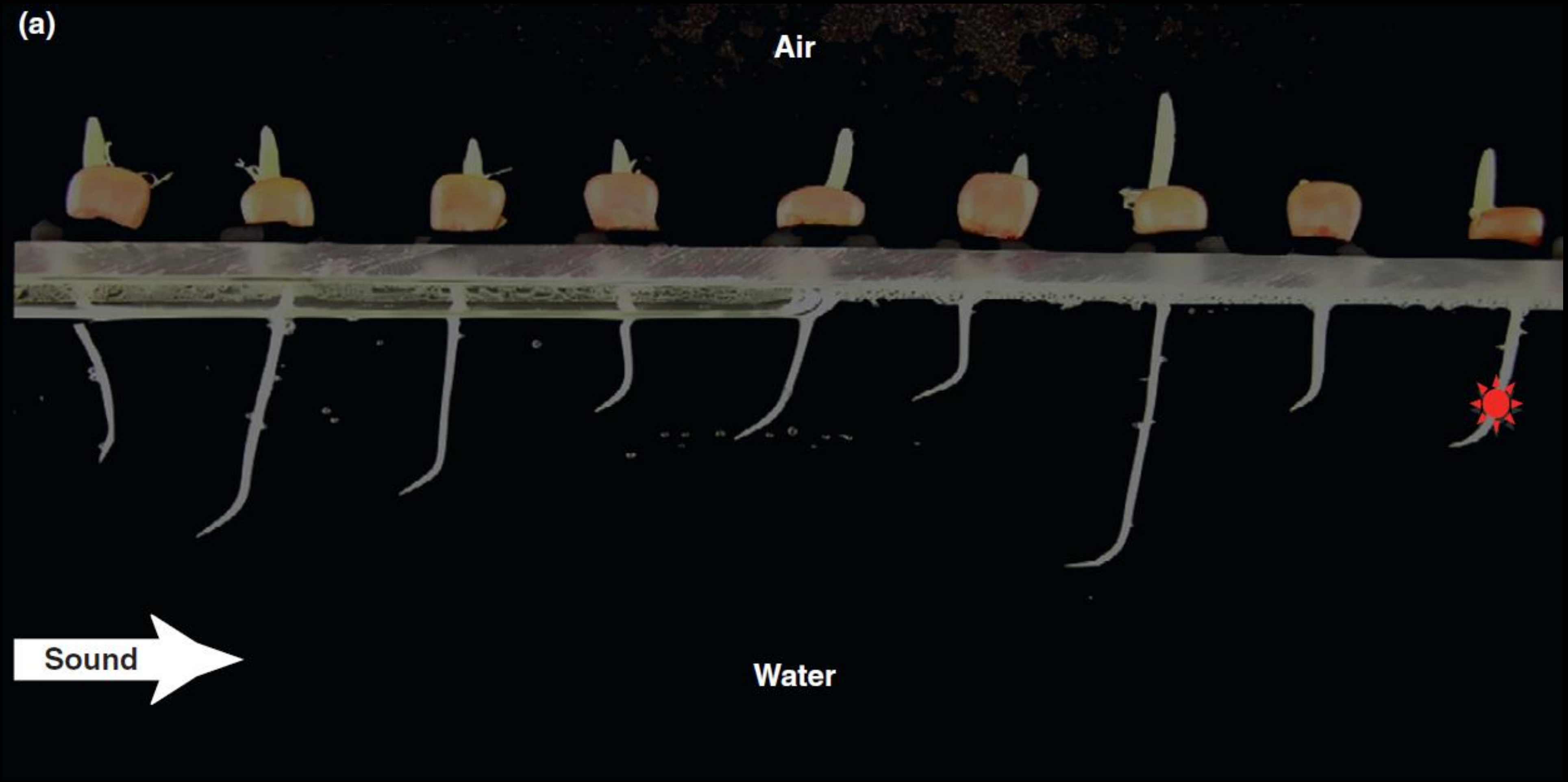
‘soft mechanical stress’ to leaves. – more resistance to *Botrytis cienerea -*

Benikhlef, L., L’Haridon, F., Abou-Mansour, E., Serrano, M., Binda, M., Costa, A., Lehmann, S., and Métraux, J-P. (2013) Perception of soft mechanical stress in Arabidopsis leaves activates disease resistance. BMC Plant Biology 13: 133.

"se comunican e intercambian información (entre ellas y con los animales),
duermen,
memorizan,
cuidan de sus hijos,
personalidad,
toman decisiones,
Manipulan a otras especies

¿Cómo negar pues que también son inteligentes?"

Stefano Mancuso



Spotlight

Towards understanding plant bioacoustics

Monica Gagliano[1,2], Stefano Mancuso[3] and Daniel Robert[4]

[1] Centre for Evolutionary Biology, School of Animal Biology, University of Western Australia, Crawley, WA 6009, Australia
[2] Centre for Microscopy, Characterisation and Analysis, University of Western Australia, Crawley, WA 6009, Australia
[3] LINV, Department of Plant, Soil and Environmental Science, University of Firenze, Sesto F.no (FI), Italy
[4] School of Biological Science, University of Bristol, Bristol, UK

Trends in Plant Science June 2012, Vol. 17, No. 6

elCOLOMBIANO

TEMAS DEL DÍA | CAMBIO DE GOBIERNO EN ECUADOR | COPA LIBERTADORES | PRESTASALUD

ANTIOQUIA | COLOMBIA | INTERNACIONAL | NEGOCIOS | DEPORTES | OPINIÓN | CULTURA

Las plantas oyen cuando hay agua cerca

Planta de arverja con la que se hizo el estudio. Foto Pixabay

CIENCIA

POR RAMIRO VELÁSQUEZ GÓMEZ | PUBLICADO EL 11 DE MAYO DE 2017

A+ A-

EL TIEMPO

SUSCRIBIRSE | INICIAR SESIÓN

Descubren inteligencia ‘verde’ de las plantas

Conversan unas con otras, luchan y se defienden de sus enemigos, eligen donde vivir. Reaccionan a las infecciones y se quejan cuando las hieren. Además tienen visión de futuro e instinto de supervivencia. Pero no se trata de seres humanos, como cabe suponer, sino de una serie especies vegetales, que demuestran asombrosas formas de "inteligencia verde".

Por: ÓMAR SEGURA REPORTAJES EFE | 24 de febrero de 2007, 05:00 am

Las plantas tienen más sentidos

Un neurobiólogo de la Universidad de Florencia (Italia) reveló que las plantas tienen 15 sentidos más que los humanos. Poseen una capacidad hipersensorial que les permite percibir "cambios eléctricos, el campo magnético, entre otros". Y se estimulan con los sonidos bajos.

Oecologia (2018) 186:29–31
https://doi.org/10.1007/s00442-017-4029-7

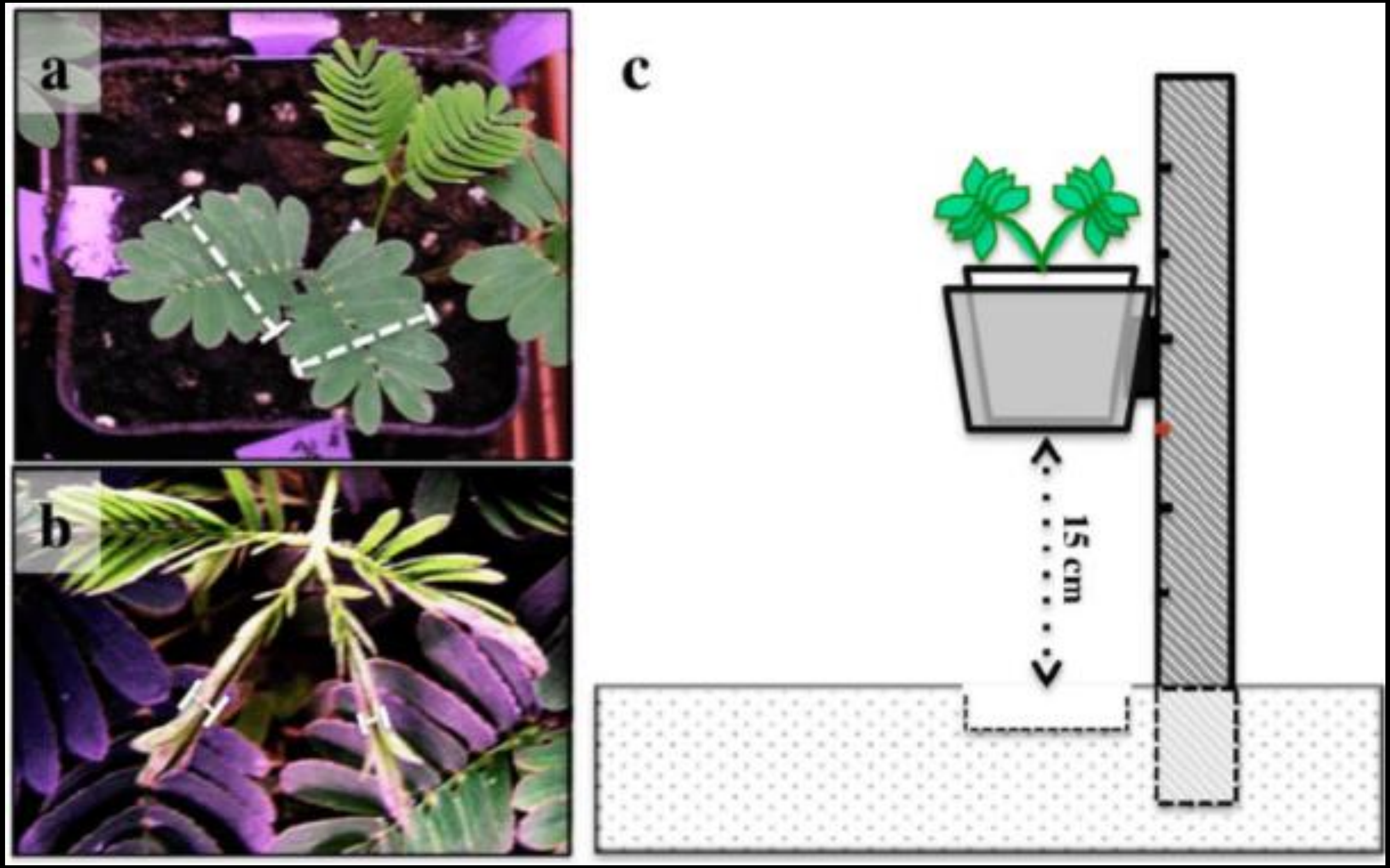
VIEWS AND COMMENTS

CrossMark

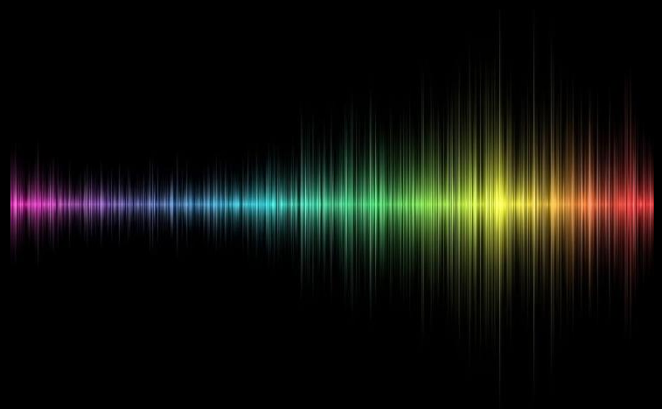
Plants learn and remember: lets get used to it

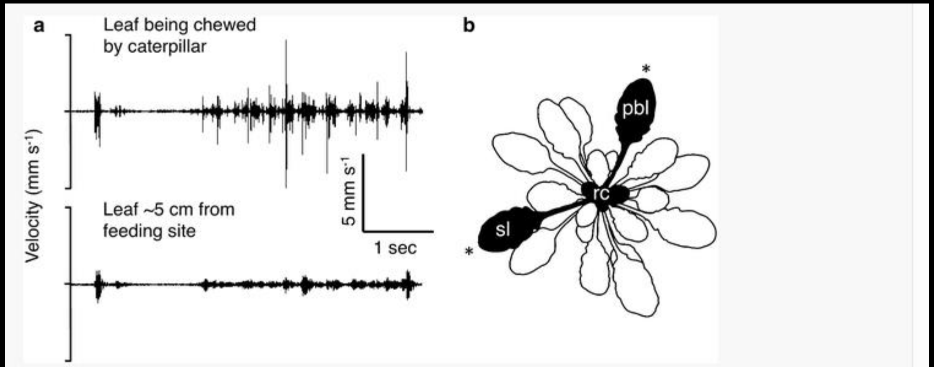
Monica Gagliano[1,2] · Charles I. Abramson[3] · Martial Depczynski[4]

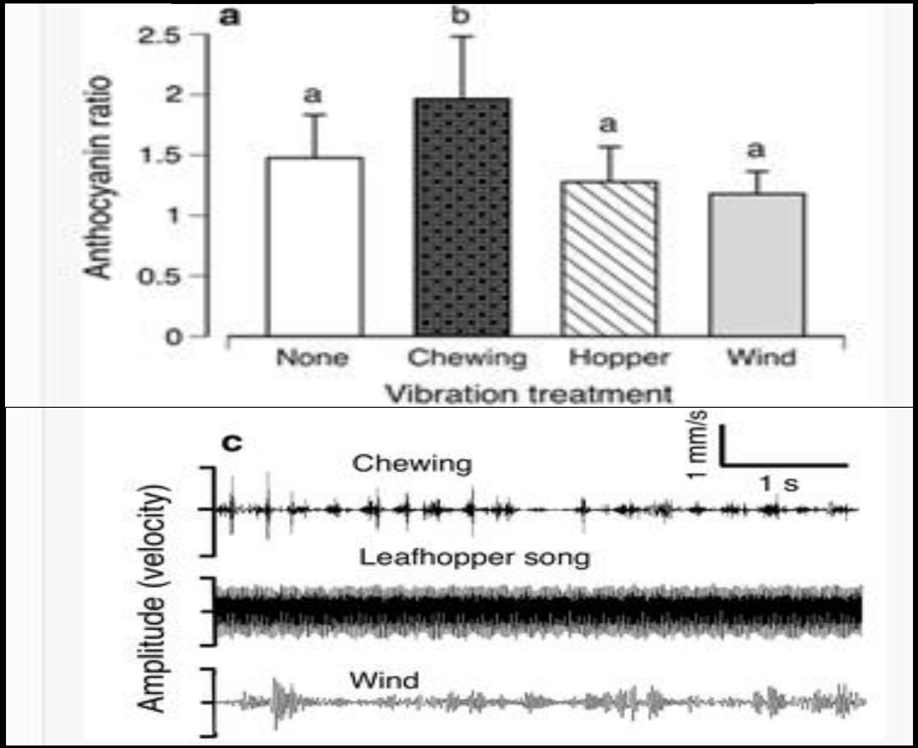
Received: 22 November 2017 / Accepted: 27 November 2017 / Published online: 7 December 2017



Gagliano, M., Renton, M., Depczynski, M., & Mancuso, S. (2014). *Oecologia*, *175*(1), 63-72





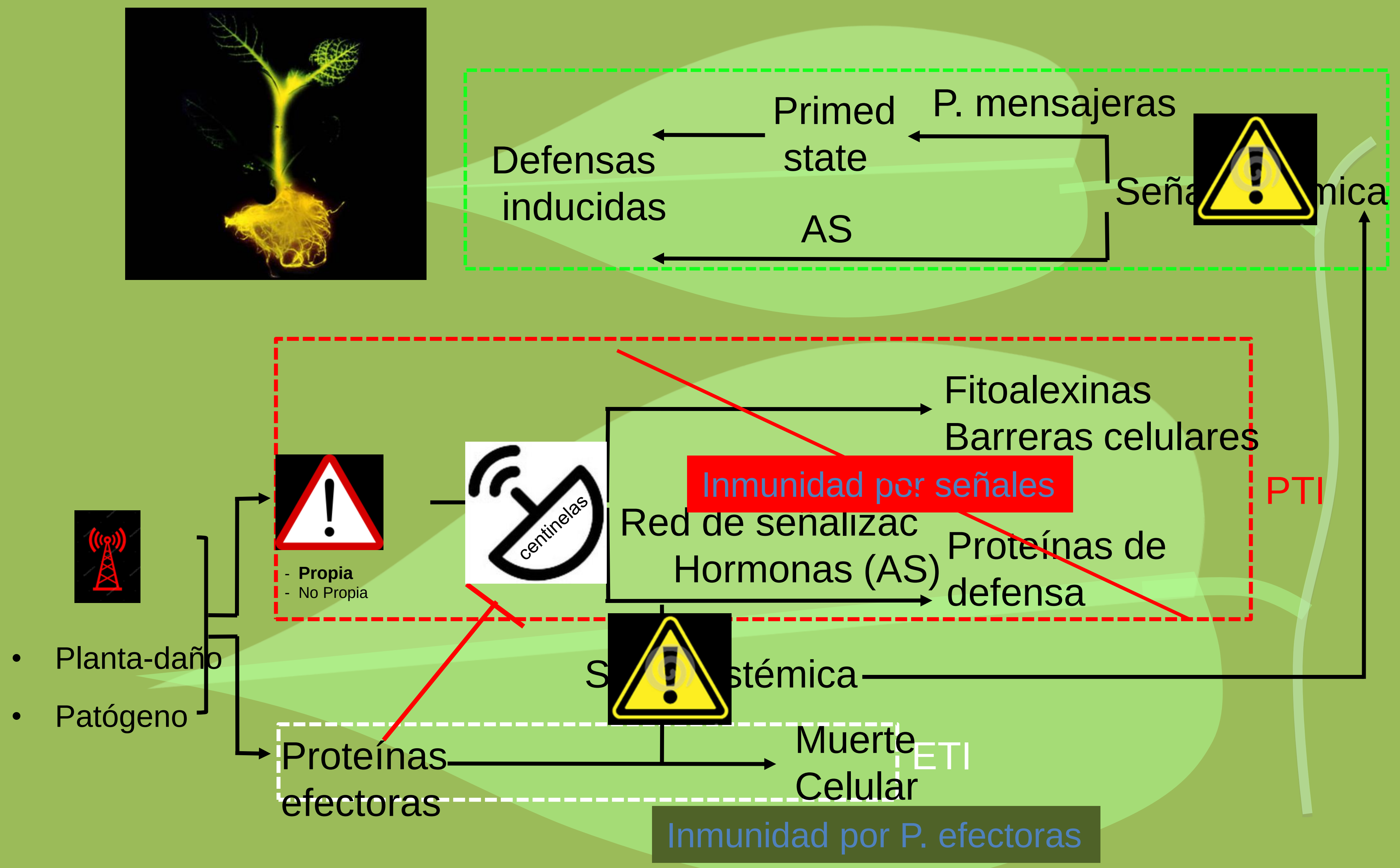


Plants respond to leaf vibrations caused by insect herbivore chewing. Oecologia
August 2014, Volume 175, Issue 4, pp 1257–1266

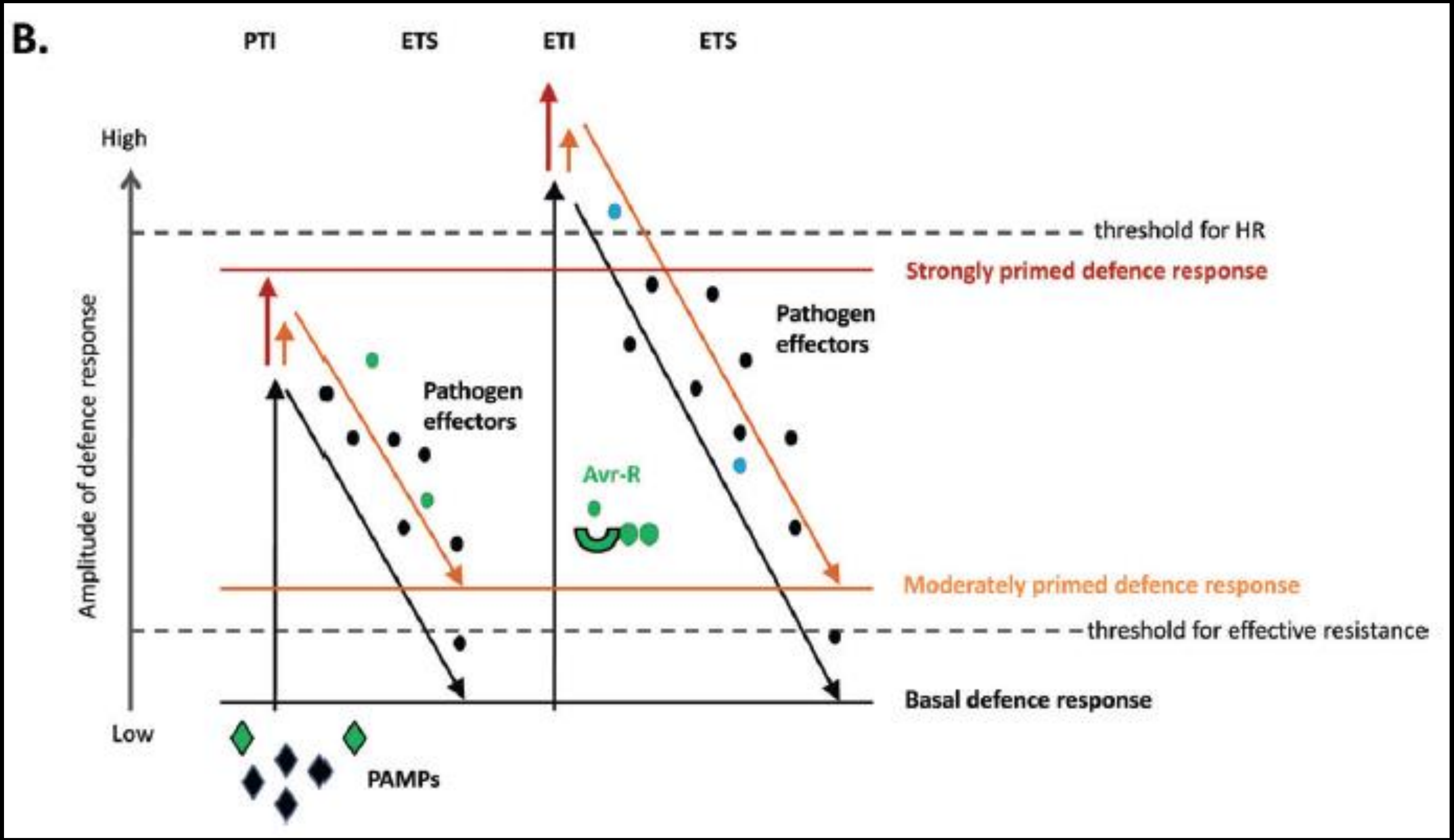
http://agriculturers.com/las-plantas-se-comunican-mediante-una-internet-de-hongos/

http://www.dailymotion.com/video/xbth6g_inteligencia-vegetal-las-acacias_school

Como funciona esto dentro de la planta?



Jean-Pierre Métraux – Sep 2010. Department of Biology University of Fribourg, Switzerland



Natural variation in priming of basal resistance: from evolutionary origin to agricultural exploitation

SHAKOOR AHMAD[1,2], RUTH GORDON-WEEKS[1], JOHN PICKETT[1] AND JURRIAAN TON[1]

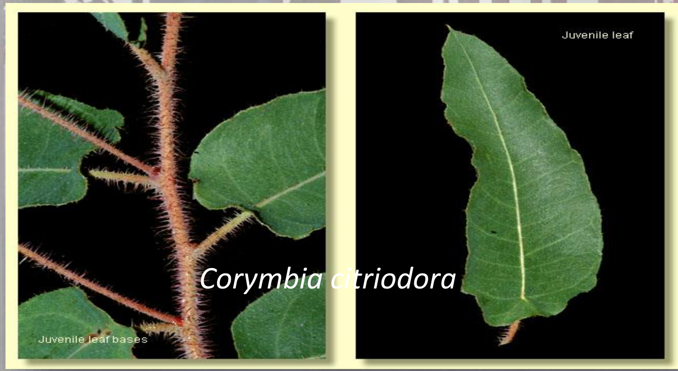
MOLECULAR PLANT PATHOLOGY (2010) **11**(6), 817–827

Uso de extractos vegetales de plantas medicinales en la inducción de defensas en plantas

Artemisia camphorata

Achillea millefolium

Cymbopogon citratus



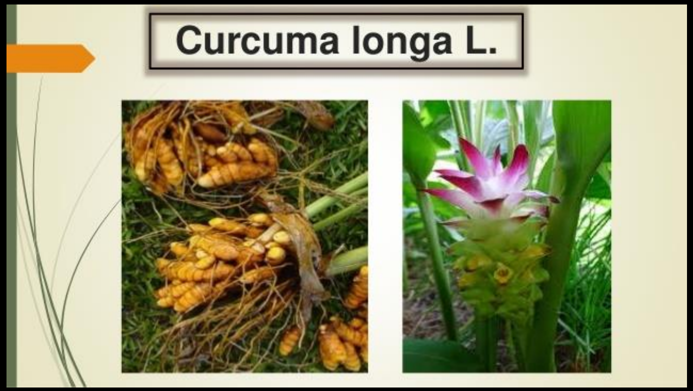
Corymbia citriodora

Curcuma longa

Kátia Regina F. Schwan-Estrada Sep 2010

Universidade Estadual de Maringá

Tomato plant treated with *Curcuma longa* and inoculated with *Alternaria solani*



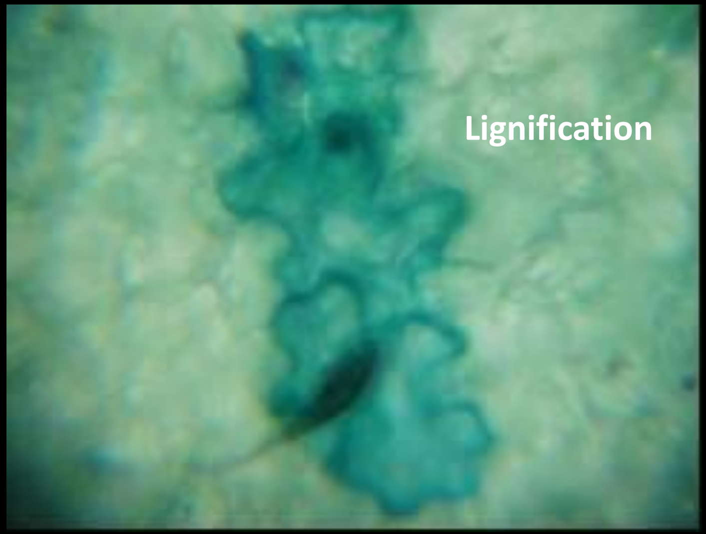


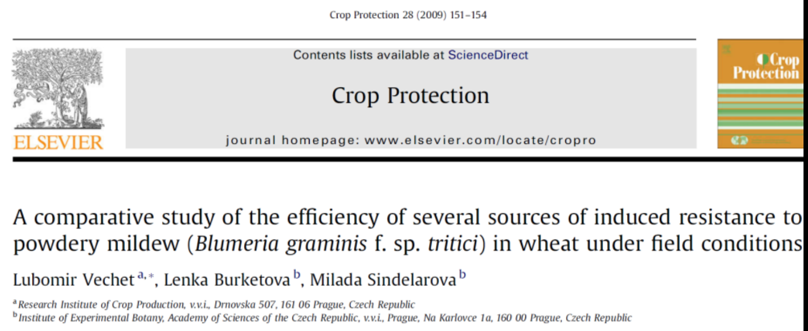
Table 1

Efficiency of inducers on powdery mildew infection of the susceptible Kanzler cultivar in comparison with resistant cultivars (Vlasta, Alka – race-specific resistance; Ramiro – partial resistance) in three years of experiments.

	2004		2005		2006		Average		
	CPLAD	%	CPLAD	%	CPLAD	%	CPLAD	%	
Inducer									
CO	144.4	100.0	15.5	100.0	24.1	100.0	61.3	100.0	a
SA	71.8	49.7	7.3	47.1	7.4	30.7	28.8	47.0	b
OB	55.7	38.6	2.7	17.4	10.1	41.9	22.8	37.2	c
GB	42.0	29.1	3.9	25.2	12.7	52.7	19.5	31.8	cd
RS	41.8	28.9	1.7	11.0	9.0	37.3	17.5	28.5	d
CU	36.6	25.3	1.9	12.3	11.4	47.3	16.6	27.1	d
GI	32.0	22.2	0.7	4.5	12.4	51.5	15.0	24.5	de
BTH	16.5	11.4	0.3	1.9	9.9	41.1	8.9	14.5	f
Resistant cultivars									
Alka	16.4	11.4	0.0	0.0	17.1	71.0	11.2	18.2	ef
Ramiro	13.2	9.1	0.1	0.7	8.9	36.9	7.4	12.1	f
Vlasta	3.6	2.5	0.0	0.0	4.2	17.4	2.6	4.2	g

Inducers used: salicylic acid (SA), oak bark (OB), glycine betaine (GB), giant knotweed (RS), curcuma (CU), ginger (GI), benzothiadiazole (BTH); untreated control cv. Kanzler (CO). CPLAD = cumulative proportion of leaf area disease. Different letters in

Reynoutria sachalinensis
Polygonacea


Crop Protection 28 (2009) 151–154
Contents lists available at ScienceDirect
Crop Protection
journal homepage: www.elsevier.com/locate/cropro

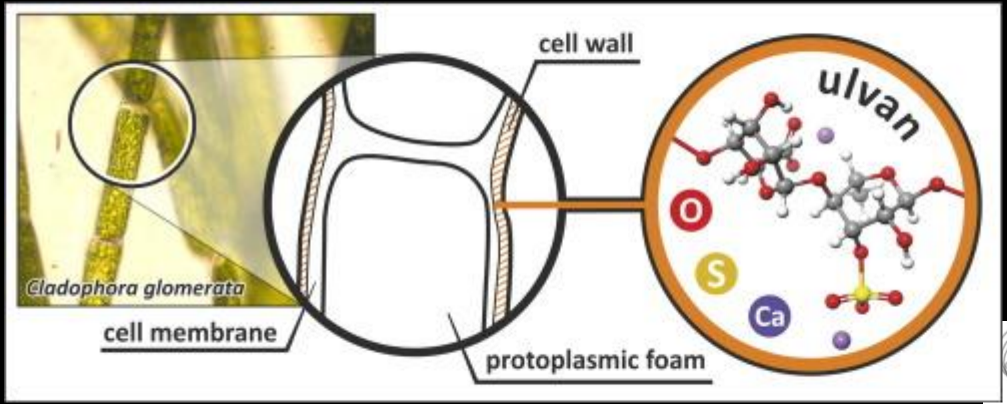
A comparative study of the efficiency of several sources of induced resistance to powdery mildew (*Blumeria graminis* f. sp. *tritici*) in wheat under field conditions

Lubomir Vechet[a,*], Lenka Burketova[b], Milada Sindelarova[b]

[a] Research Institute of Crop Production, v.v.i., Drnovska 507, 161 06 Prague, Czech Republic
[b] Institute of Experimental Botany, Academy of Sciences of the Czech Republic, v.v.i., Prague, Na Karlovce 1a, 160 00 Prague, Czech Republic

TABLE 1 - Effects of foliar application of ulvan or extracts from *Ulva* spp. on disease severities in different host-pathogen interactions.

Host plant	Pathogen	Disease intensities	Reference
Alfafa	*Colletotrichm trifolii*	reduced	Cluzet et al. (2004)
Apple	*Colletotrichum gloeosporioides*	reduced	Araújo et al. (2008)
Bean	*Colletotrichum lindemuthianum*	reduced	Paulert et al. (2009)
	Erysiphe polygoni	reduced	Jaulneau et al. (2011)
	Uromyces appendiculatus	reduced	Borsato et al. (2010)
Cereals	*Blumeria graminis*	reduced	Paulert et al. (2010)
Cucumber	*Sphaerotheca fuliginea* (Schlechtendal) Pollacci	reduced	Jaulneau et al. (2011)
Grapevine	*Erysiphe necator* Schweinitz	reduced	Jaulneau et al. (2011)
	Plasmopara viticola	reduced unaffected	Galvão et al. (2006) Peruch et al. (2007)
	Sphaceloma ampelinum de Bary	reduced	Galvão et al. (2006)
Green onions	*Alternaria porri* (Ellis) Ciferri	reduced	Araújo et al. (2012)
Onion	*Burkholderia cepacia* (Palleroni and Holmes) Yabuuchi	unaffected	Wordell et al. (2007)
	Peronospora destructor Caspary	unaffected	Wordell et al. (2007)



http://www.sciencedirect.com/science/article/pii/S2211926416300649

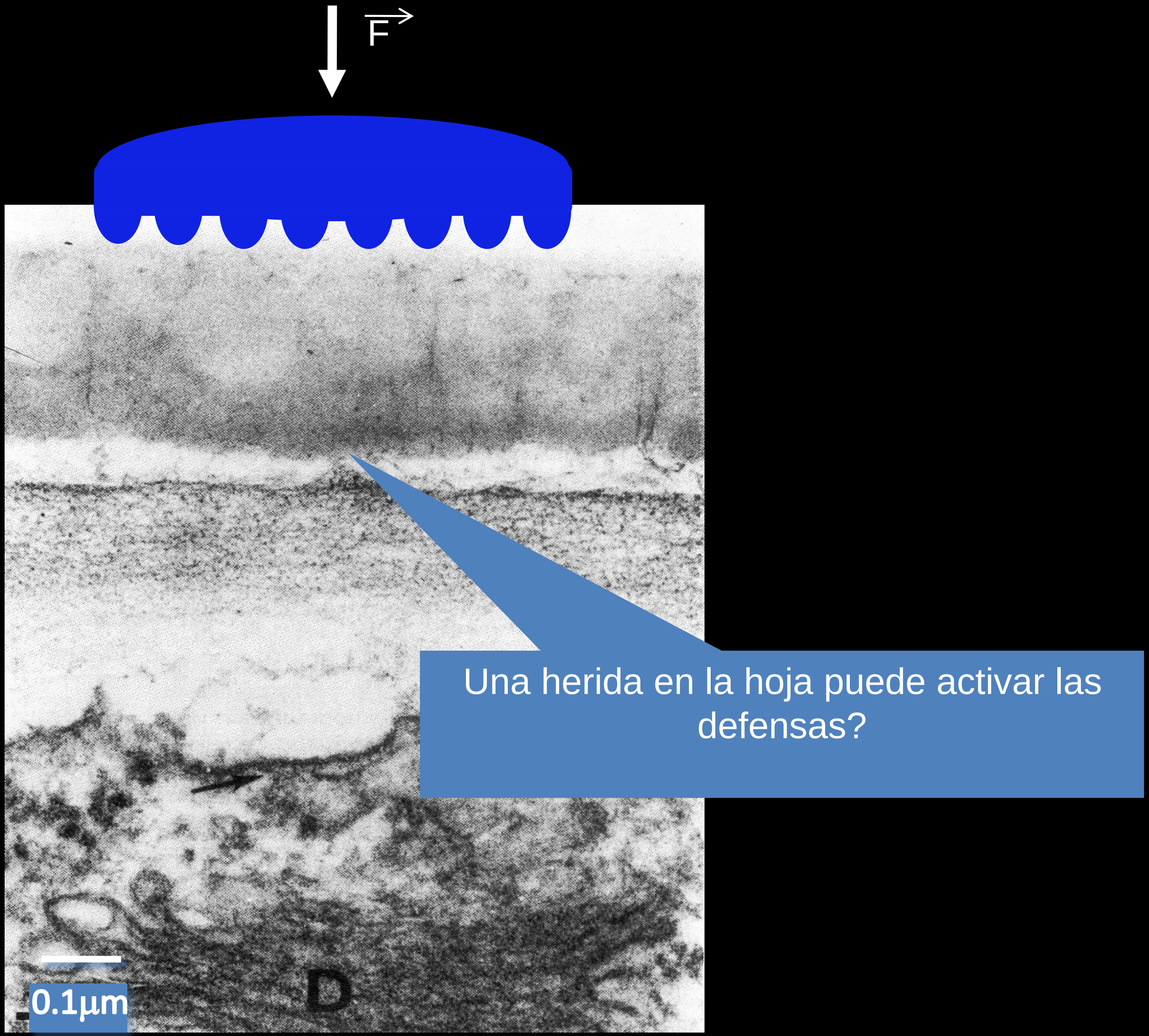
Tropical Plant Pathology, vol. 39(2):111-118, 2014

REVIEW ARTICLE

Algal polysaccharides as source of plant resistance inducers

Marciel J. Stadnik & Mateus B. de Freitas

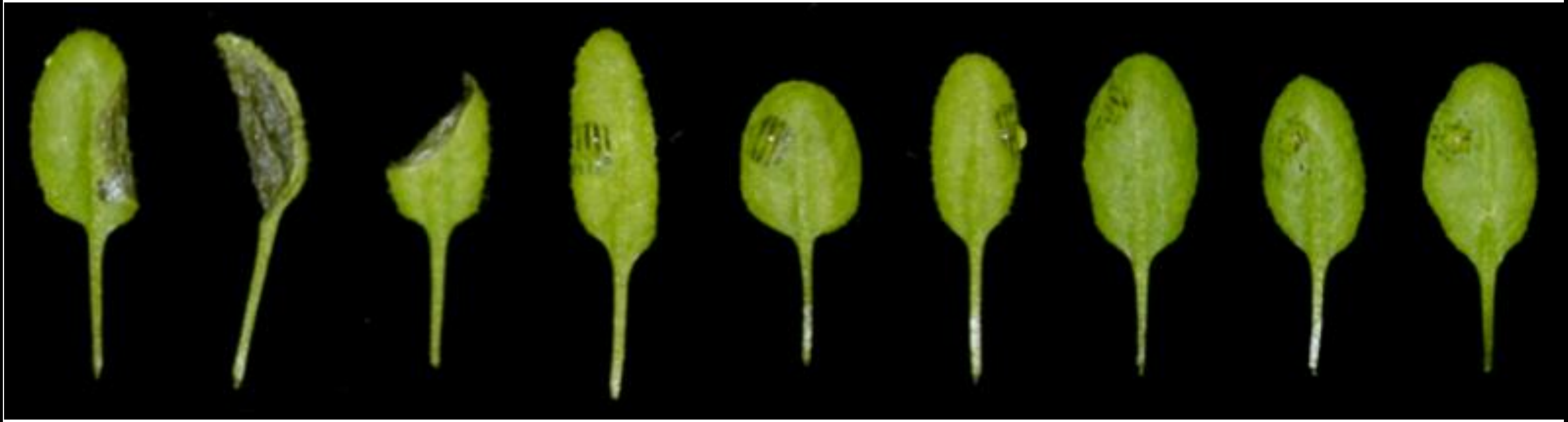
Laboratório de Fitopatologia, CCA, Universidade Federal de Santa Catarina, 88034-001, Florianópolis, SC, Brazil


F
Una herida en la hoja puede activar las defensas?
0.1µm
D

No herida

Herida con pinzas

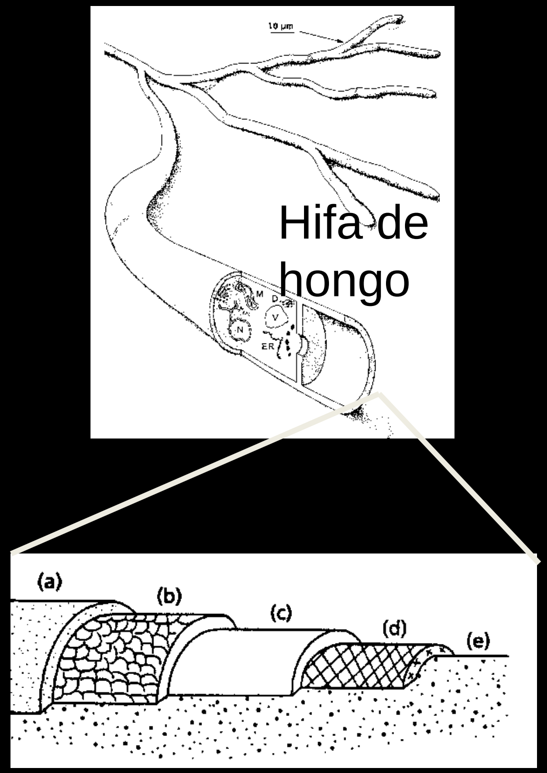
Herida con aguja



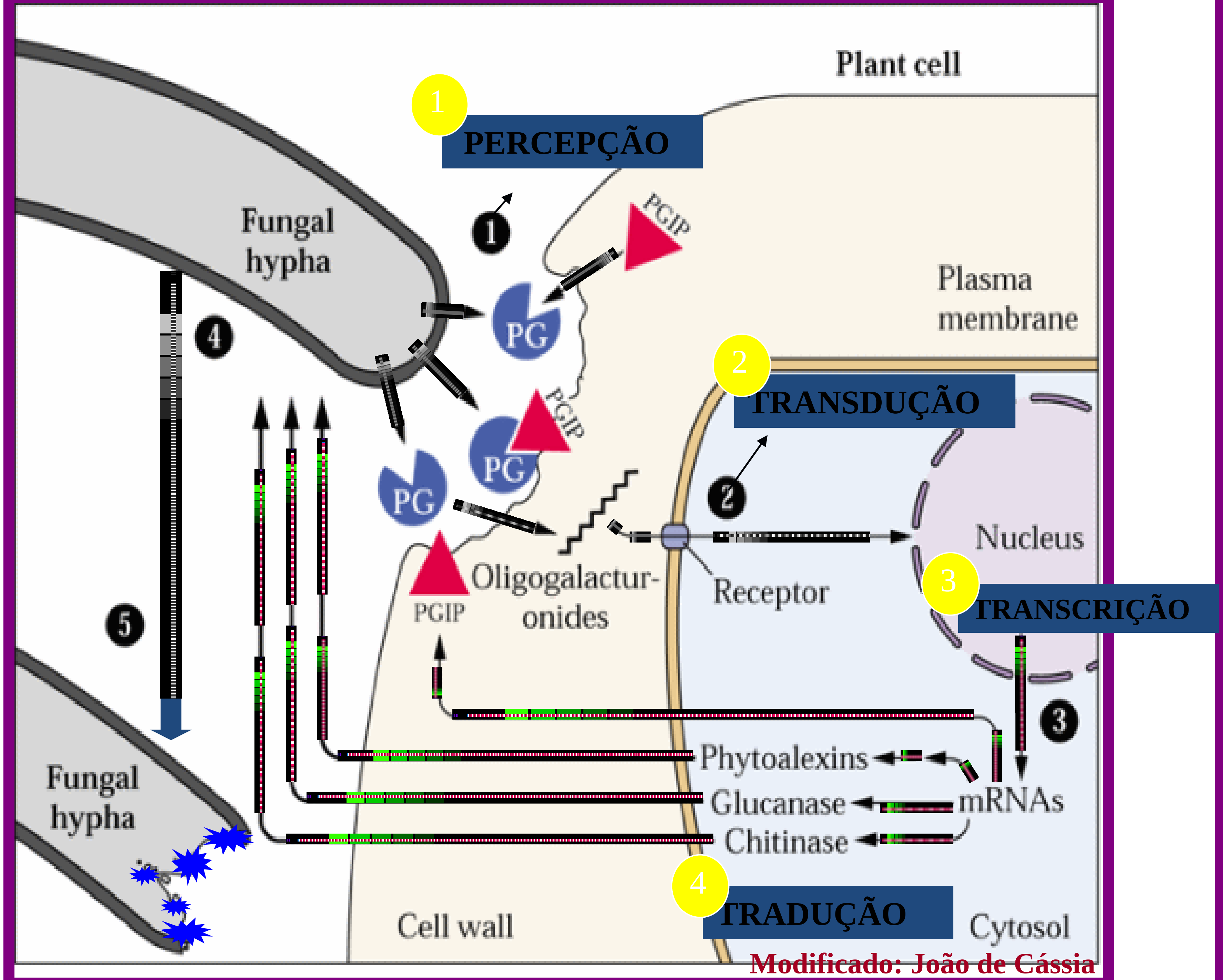
Chassot et al., Plant J, 2008

Defensas químicas

⇒ β-1,3-glucanasas y quitinasas



(a) - **β-1,3 e β-1,6-glucanas**
(b) - Retículo glicoproteico
(c) - Proteína
(d) - **Microfibrilas de quitina**
(e) - Plasmalema



Plant cell
1
PERCEPÇÃO
PGIP
Fungal hypha
Plasma membrane
PG
PG
PGIP
PG
2
TRANSDUÇÃO
Nucleus
PGIP
Oligogalacturonides
Receptor
3
TRANSCRIÇÃO
Fungal hypha
Phytoalexins
Glucanase
mRNAs
Chitinase
4
TRADUÇÃO
Cell wall
Cytosol
Modificado: João de Cássia

Respuestas de defensa en la planta - PTI

Entrada de Ca^{2+} y H^{+}

Producción de agua oxigenada y hormonas

Activación de enzimas mensajeras

Reforzamiento de la pared celular

Moléculas antimicroniales

Fitoalexins

Reconocimiento: proteína del patógeno x Proteína de la planta = ETI

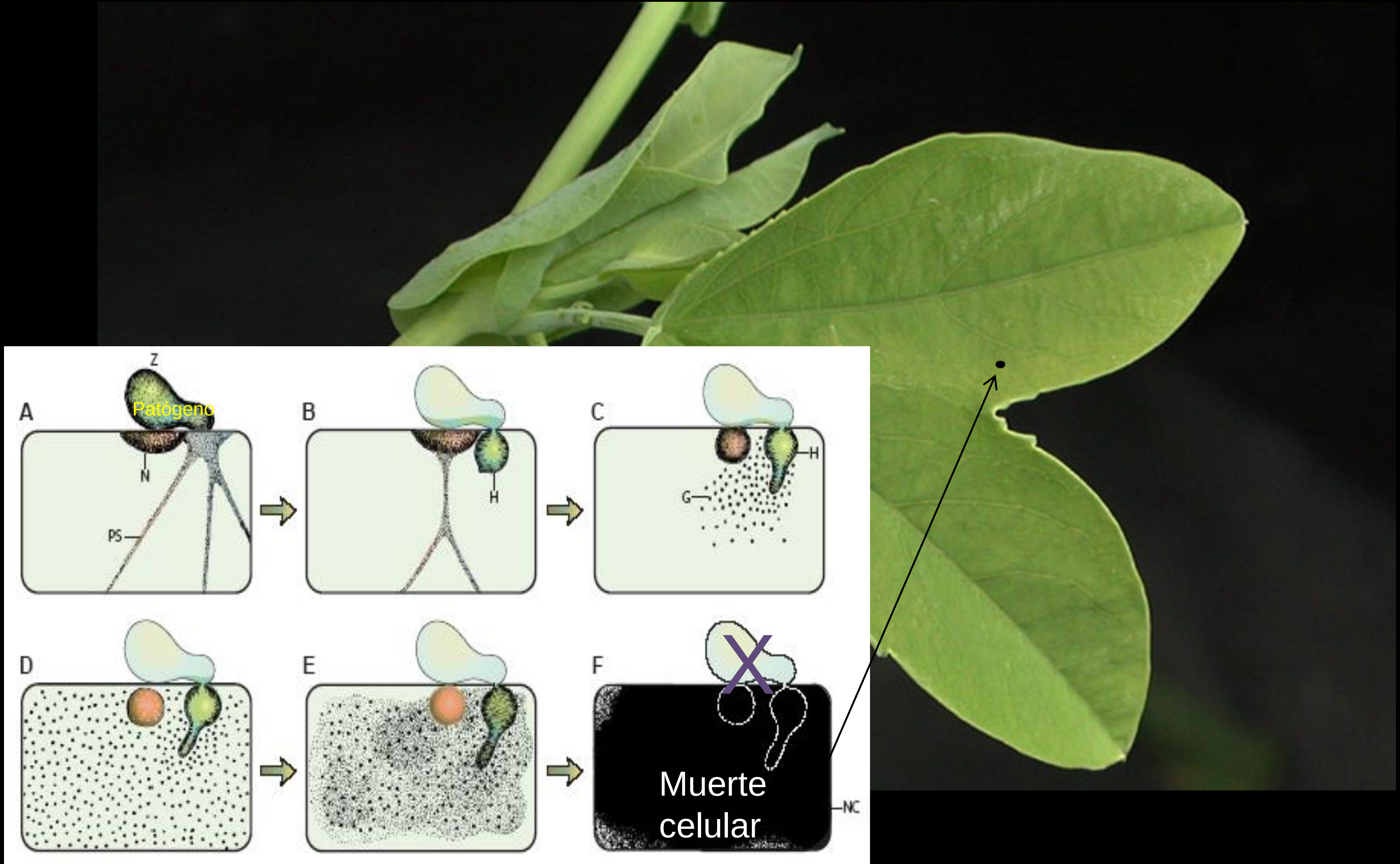
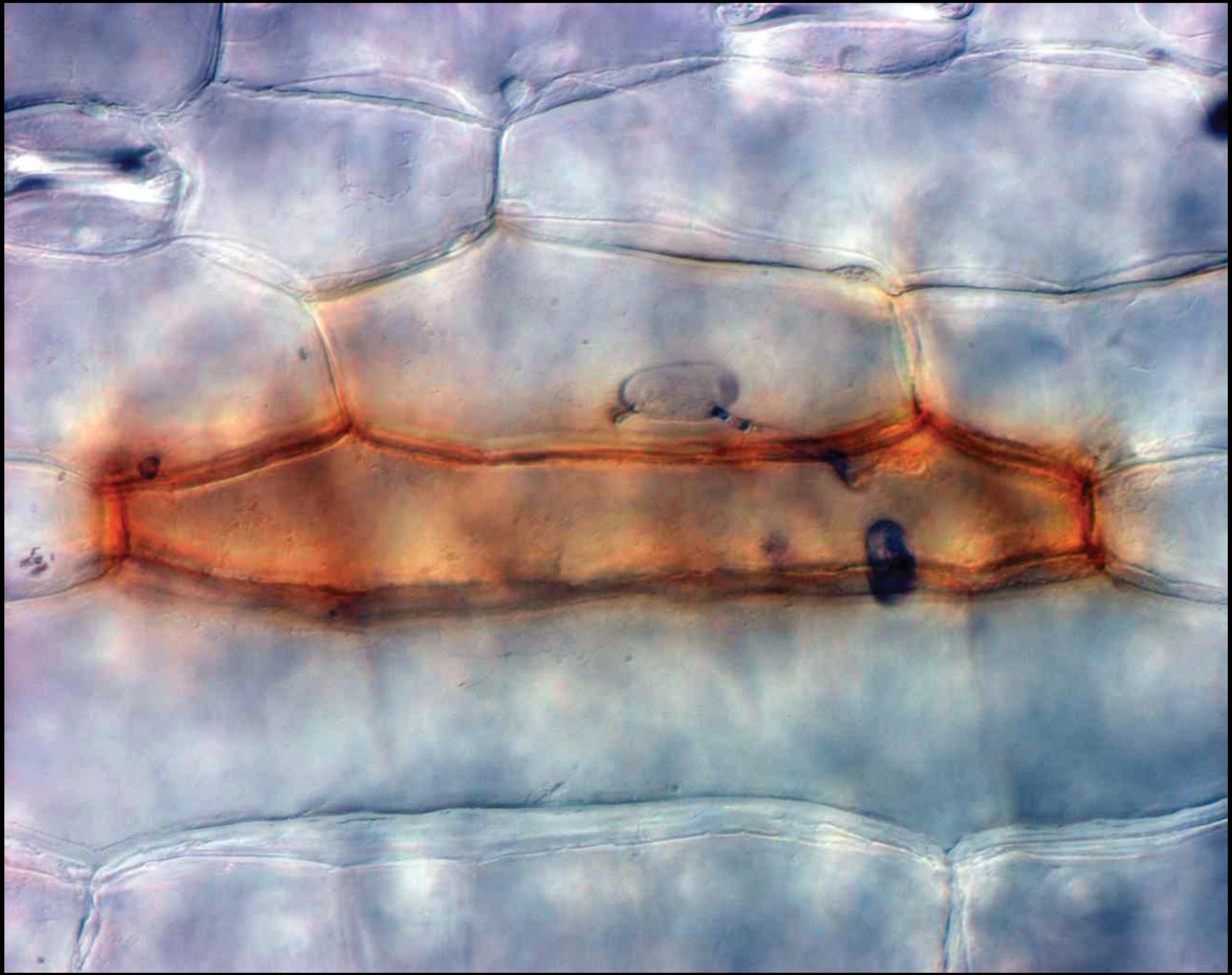


FIGURE 6-9 Stages in the development of the necrotic defense reaction in a cell of a very resistant potato variety infected by *Phytophthora infestans*. N, nucleus; PS, protoplasmic strands; Z, zoospore; H, hypha; G, granular material; NC, necrotic cell. [After Tomiyama (1956). *Ann. Phytopathol. Soc. Jpn.* 21, 54–62.]



Hypersensitive response of a barley leaf cell to attack by the powdery.
mildew fungus, Blumeria graminis f.sp. hordei. . Walters, D. 2017


New Phytologist
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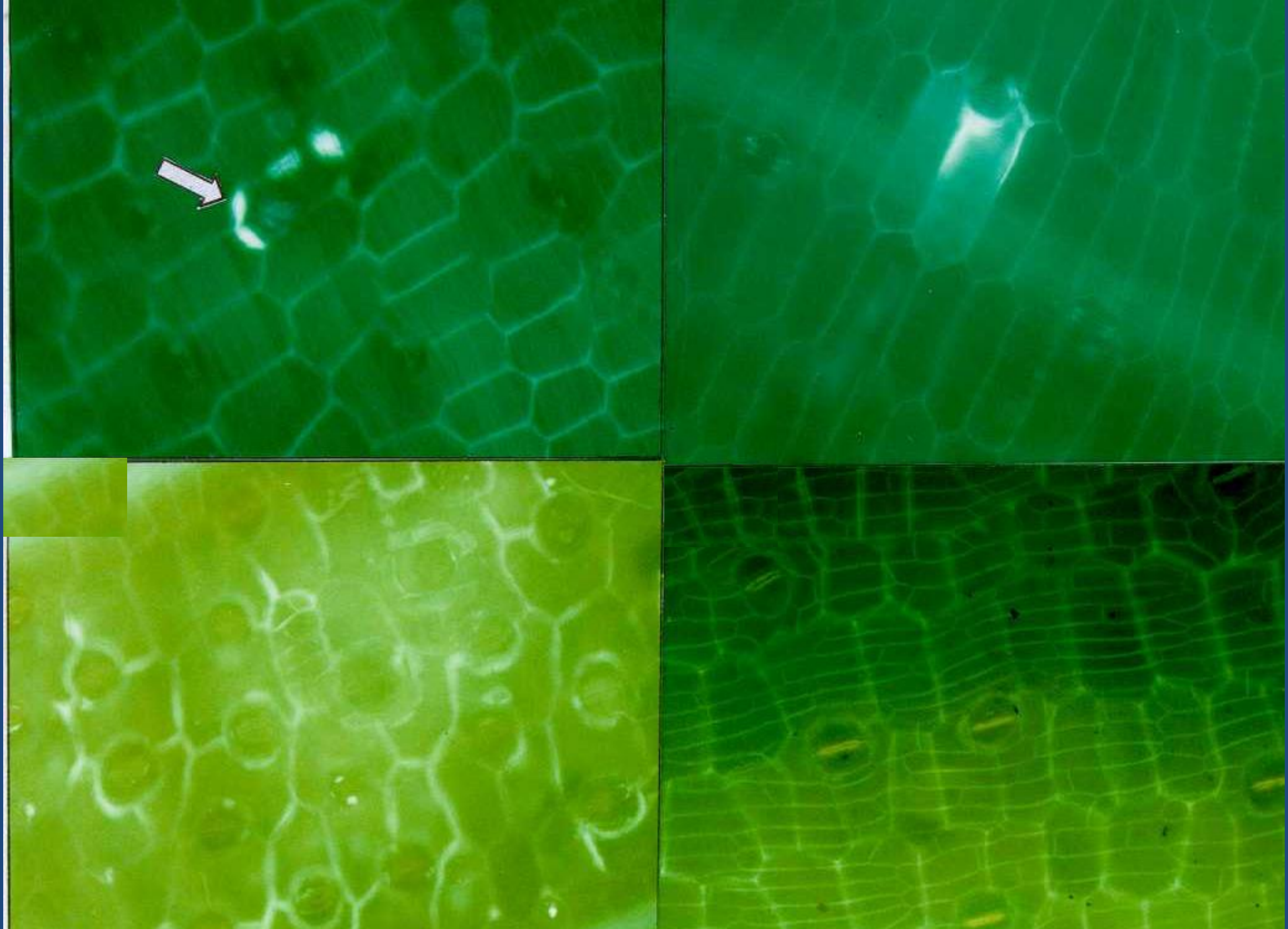
Full paper

Differential accumulation of callose, arabinoxylan and cellulose in nonpenetrated versus penetrated papillae on leaves of barley infected with *Blumeria graminis* f. sp. *hordei*

Jamil Chowdhury, Marilyn Henderson, Patrick Schweizer, Rachel A. Burton, Geoffrey B. Fincher, Alan Little

First published: 20 August 2014 Full publication history

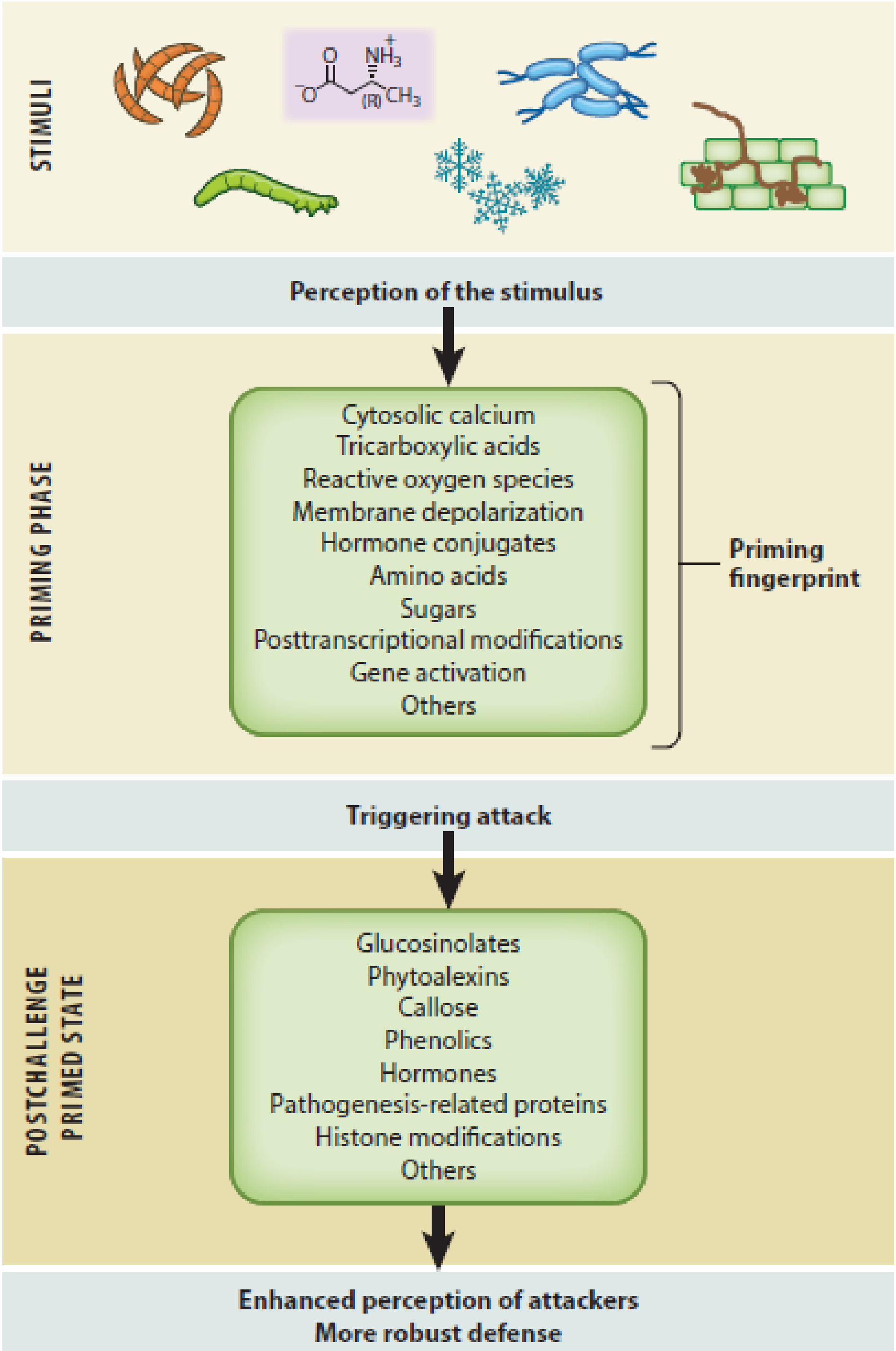
View issue TOC
Volume 204, Issue 3
November 2014
Pages 650–660
or
Browse Virtual Issue



Defensa inducida (*Priming*)

Activación de mecanismos de defensa latentes en respuesta a un estímulo

SE MODIFICA LA INTERACCIÓN PLANTA-PATÒGENO



Defense Priming: An Adaptive Part of Induced Resistance

Brigitte Mauch-Mani,[1] Ivan Baccelli,[1] Estrella Luna,[2] and Victor Flors[3]

Annu. Rev. Plant Biol. 2017. 68:485–512

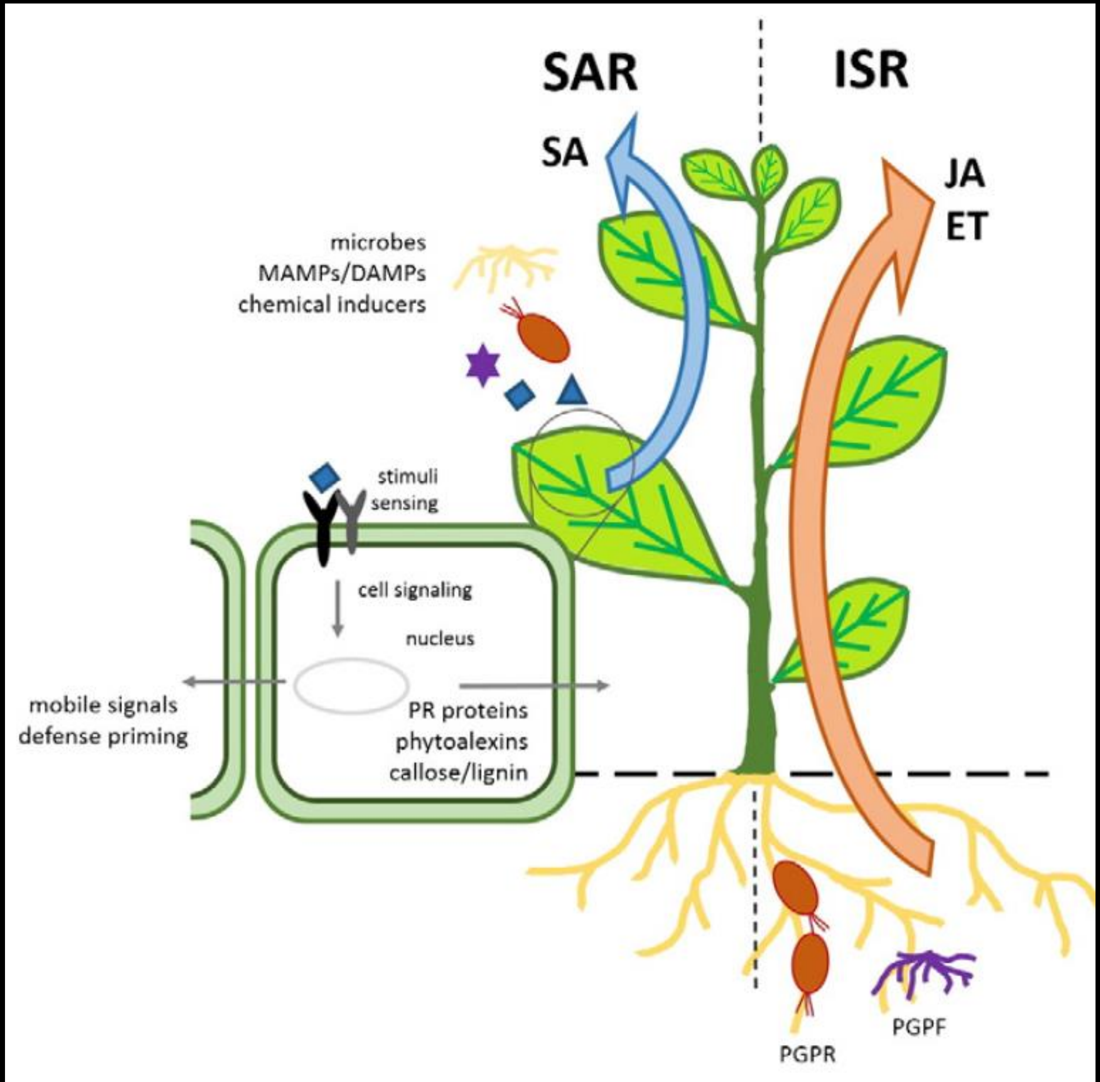


Fig. 1. Scheme of different types of systemic resistance. The systemic acquired resi

Biotechnology Advances 33 (2015) 994–1004

Contents lists available at ScienceDirect

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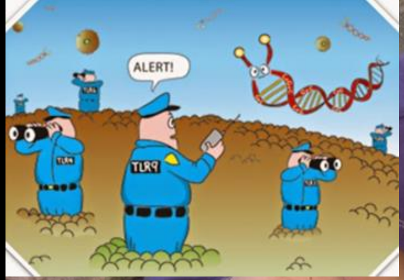
journal homepage: www.elsevier.com/locate/biotechadv

Research review paper

Bio-based resistance inducers for sustainable plant protection against pathogens

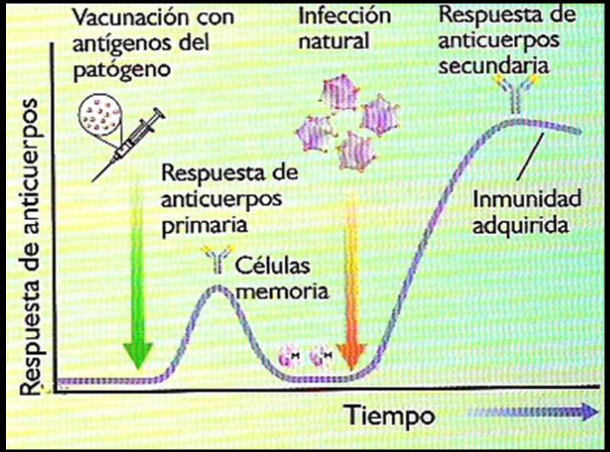
Lenka Burketova [a,*], Lucie Trda [a], Peter G. Ott [c], Olga Valentova [b]

[a] Institute of Experimental Botany, The Czech Academy of Sciences, Rozvojová 313, 165 02 Prague 6–Lysolaje, Czech Republic
[b] Department of Biochemistry and Microbiology, Institute of Chemical Technology Prague, Technická 5, 166 28 Prague 6, Czech Republic
[c] Plant Protection Institute, Centre for Agricultural Research, Hungarian Academy of Sciences, Herman Otto Str. 15, H-1022 Budapest, Hungary


ALERT!
TLR9

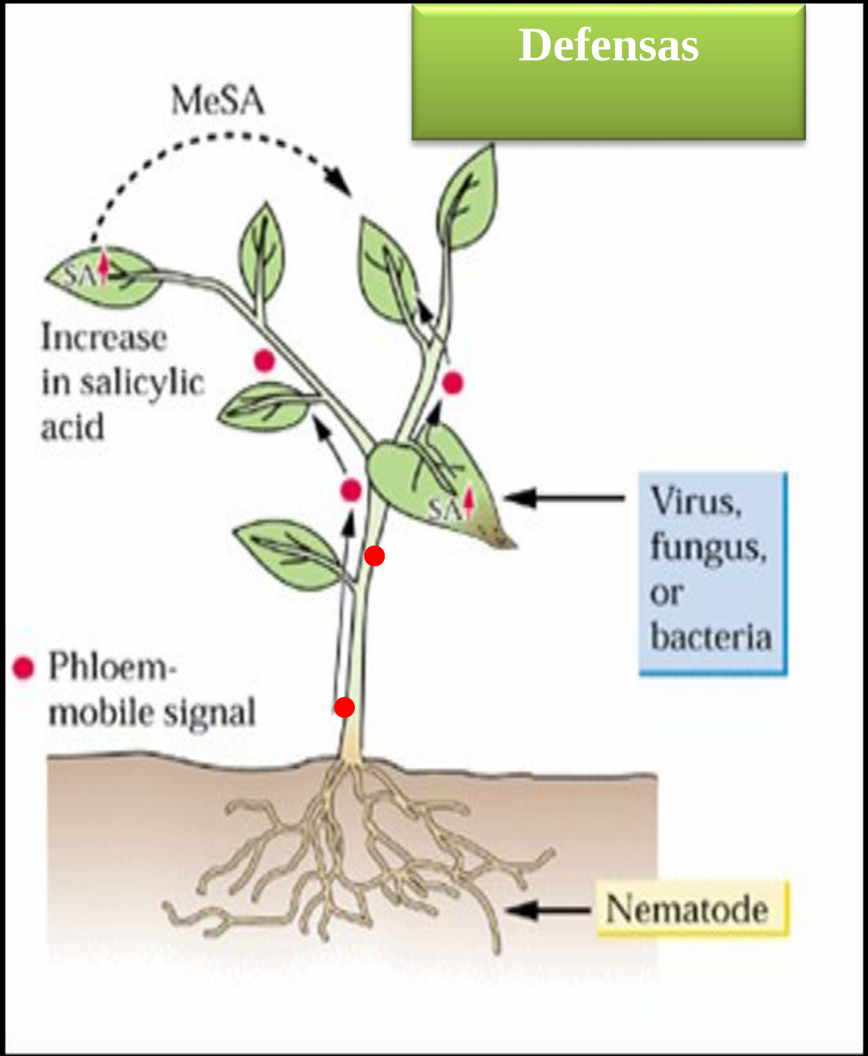

Tierra en las manos


¿Cómo funciona una vacuna?
1. Se inyecta la vacuna, que contiene los microorganismos que producen la enfermedad previamente debilitados.
2. Esta administración hace que el sistema inmunológico desarrolle una respuesta y produzca anticuerpos para luchar contra esa clase de microorganismo.
3. Los anticuerpos eliminan los microorganismos que supuestamente producirían la enfermedad.
4. Los anticuerpos utilizarán la misma respuesta cuando nuestro cuerpo se enfrente al microorganismo con el que nos vacunamos.
Microorganismos debilitados
Anticuerpos
Microorganismo destruido por los anticuerpos

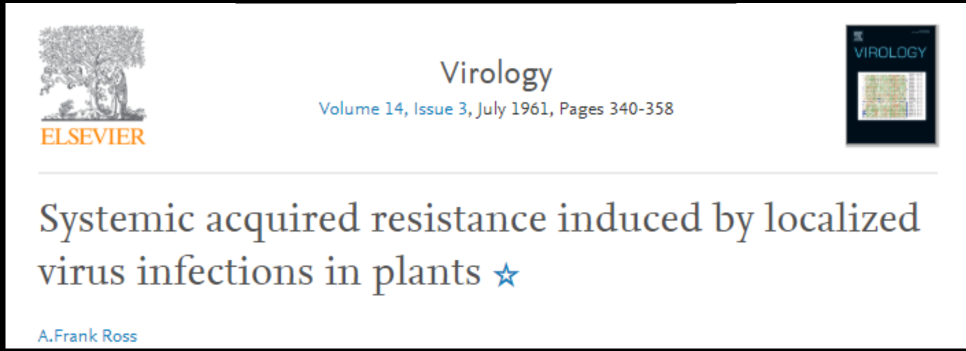

Vacunación con antígenos del patógeno
Infección natural
Respuesta de anticuerpos secundaria
Respuesta de anticuerpos primaria
Células memoria
Inmunidad adquirida
Respuesta de anticuerpos
Tiempo

Resistencia sistémica

Estímulo Biótico/Abiótico



Alivio del dolor y la defensa de la planta
2,000 años BC - Sumerios


Virology
Volume 14, Issue 3, July 1961, Pages 340-358

Systemic acquired resistance induced by localized virus infections in plants ☆

A.Frank Ross

Jean Beauverie & Julien Ray, 1901

Respuesta a la herida:

STRUCTURE AND SYNTHESIS OF A PLANT WOUND HORMONE

In an earlier publication the isolation of a crystalline substance possessing wound hormone activity has been described.[1] This substance, which was isolated from the water extract of green string-beans, possesses

[1] J. English, J. Bonner and A. J. Haagen-Smit, *Proc. Nat. Acad. Sci.*, 25: 323, 1939.

Traumatin (1939)

Science Contents News Careers Journals

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REPORTS

Wound-Induced Proteinase Inhibitor in Plant Leaves: A Possible Defense Mechanism against Insects

T. R. Green[1], C. A. Ryan[1]
+ See all authors and affiliations

Science 18 Feb 1972:
Vol. 175, Issue 4023, pp. 776-777
DOI: 10.1126/science.175.4023.776

Sistemin (1972)

Proc. Natl. Acad. Sci. USA
Vol. 87, pp. 7713–7716, October 1990
Botany

Interplant communication: Airborne methyl jasmonate induces synthesis of proteinase inhibitors in plant leaves

(jasmonic acid/pathogen/wound-inducible genes/localized/systemic defense responses)

Edward E. Farmer and Clarence A. Ryan
Institute of Biological Chemistry, Washington State University, Pullman, WA 99164-6340

Contributed by Clarence A. Ryan, July 13, 1990

ABSTRACT Inducible defensive responses in plants are known to be activated locally and systemically by signaling molecules that are produced at sites of pathogen or insect attacks, but only one chemical signal, ethylene, is known to travel through the atmosphere to activate plant defensive genes. Methyl jasmonate, a common plant secondary compound, when applied to surfaces of tomato plants, induces the synthesis of defensive proteinase inhibitor proteins in the treated plants and in nearby plants as well. The presence of methyl jasmonate in the atmosphere of chambers containing

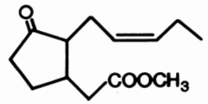
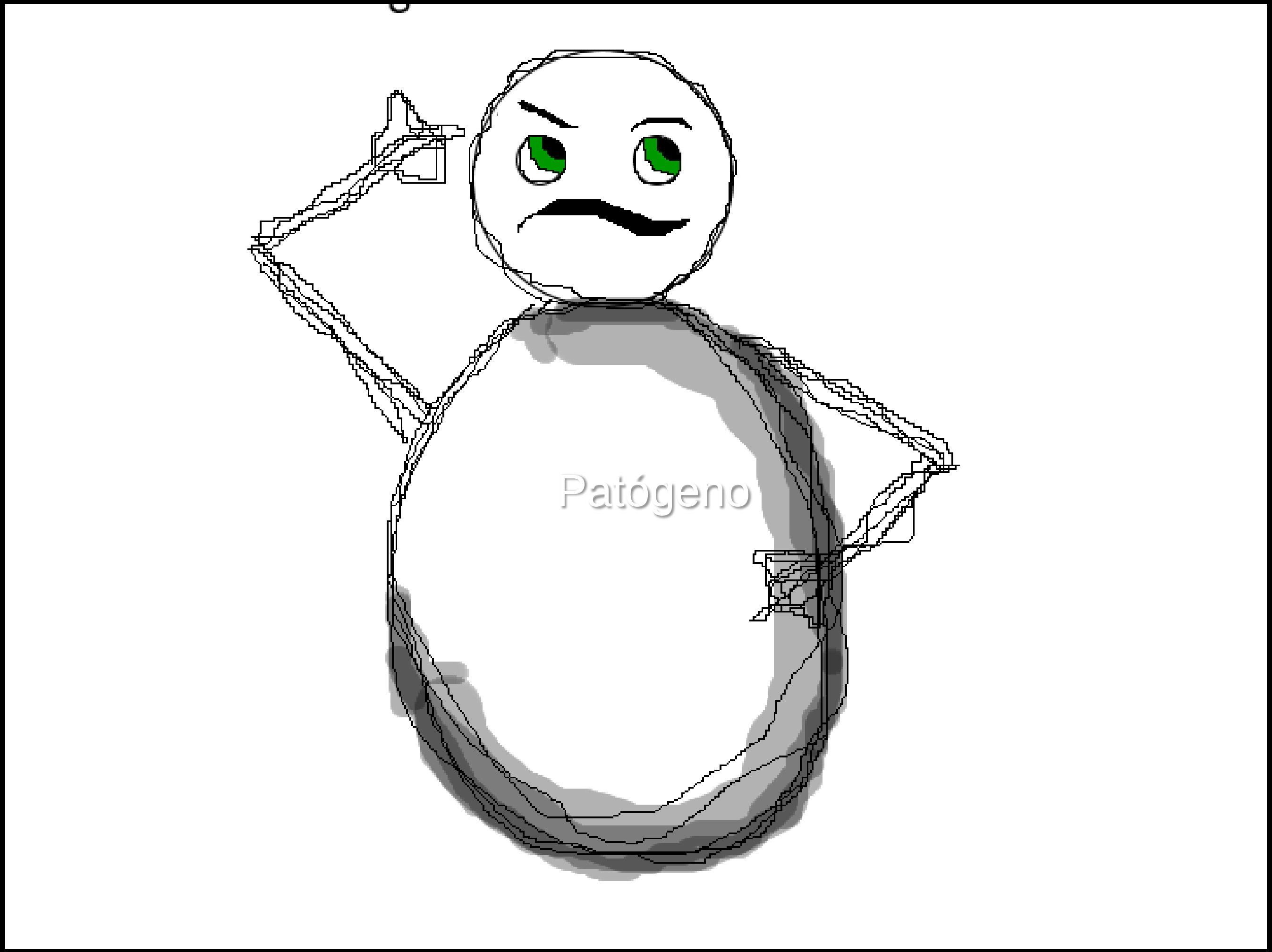


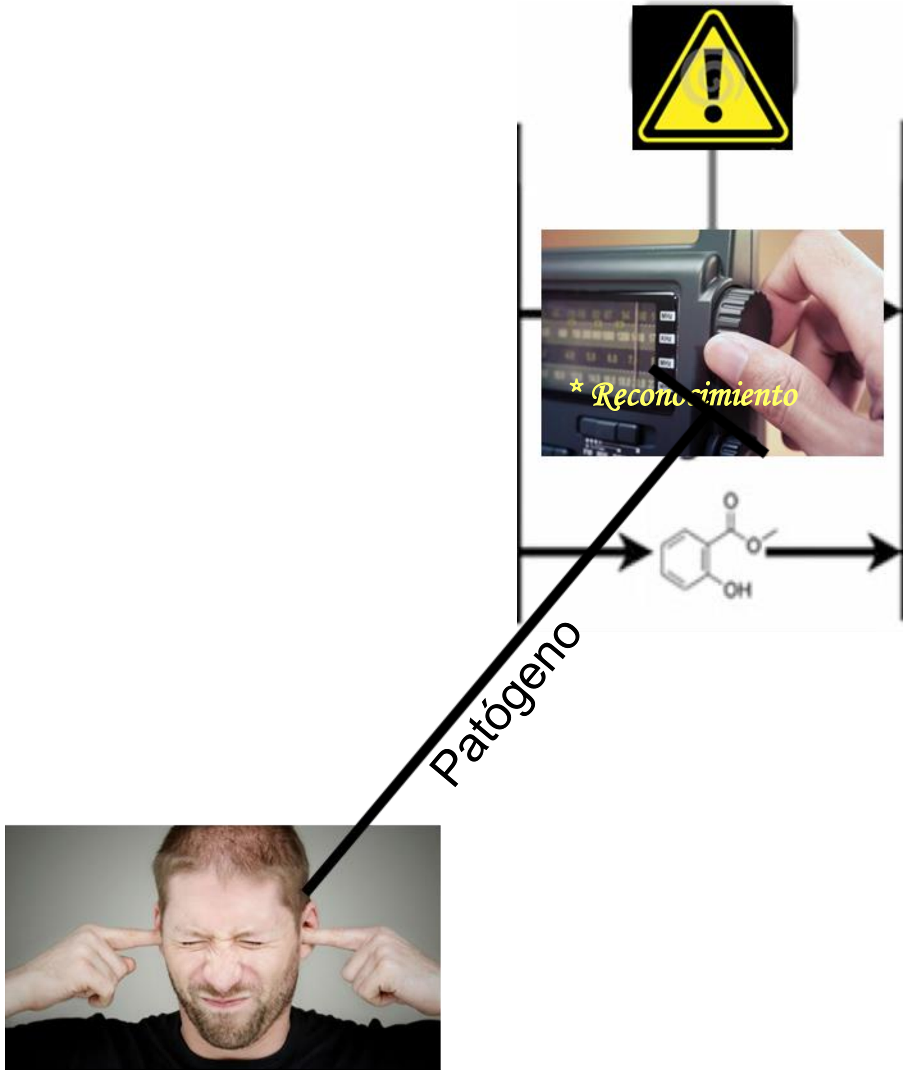
Fig. 1. Structure of methyl jasmonate.

Methyl Jasmonato (1990)


UW-Madison Campus Connection
Un estudio mostró **cómo**
las plantas sienten dolor
FUENTE: Revista Science, 14/09/18 : 1112-1115
-0:43
HD

Como hago para no dejarme detectar?



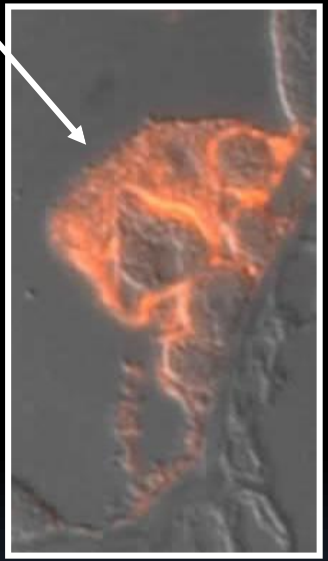


Plant Hormones and Metabolites as Universal Vocabulary in Plant Defense Signaling

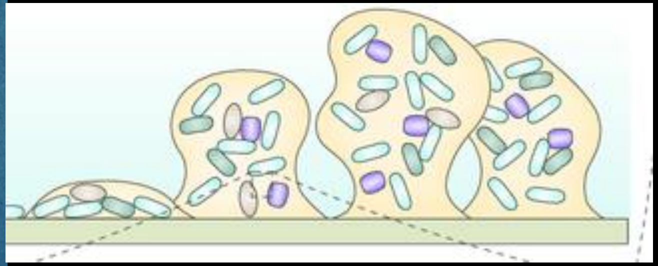
D. Balmer and B. Mauch-Mani

G. Witzany and F. Baluška (eds.), *Biocommunication of Plants*,
Signaling and Communication in Plants 14,
DOI 10.1007/978-3-642-23524-5_3, © Springer-Verlag Berlin Heidelberg 2012

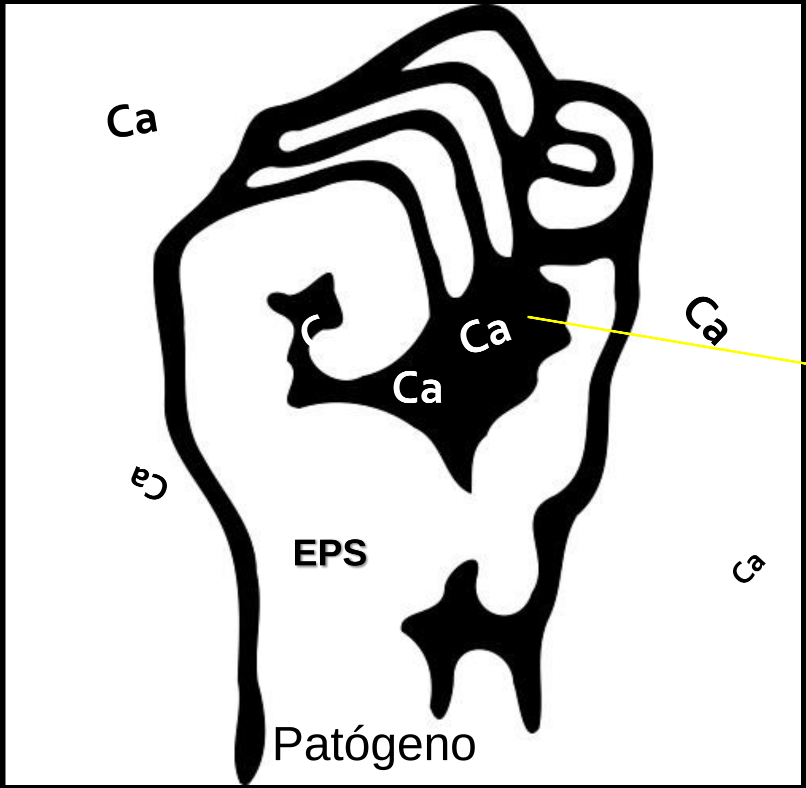
Pathogenic fungi, bacteria and oomycetes have evolved arsenals of *secreted protein* ***effectors*** to counteract MAMP-induced innate immunity

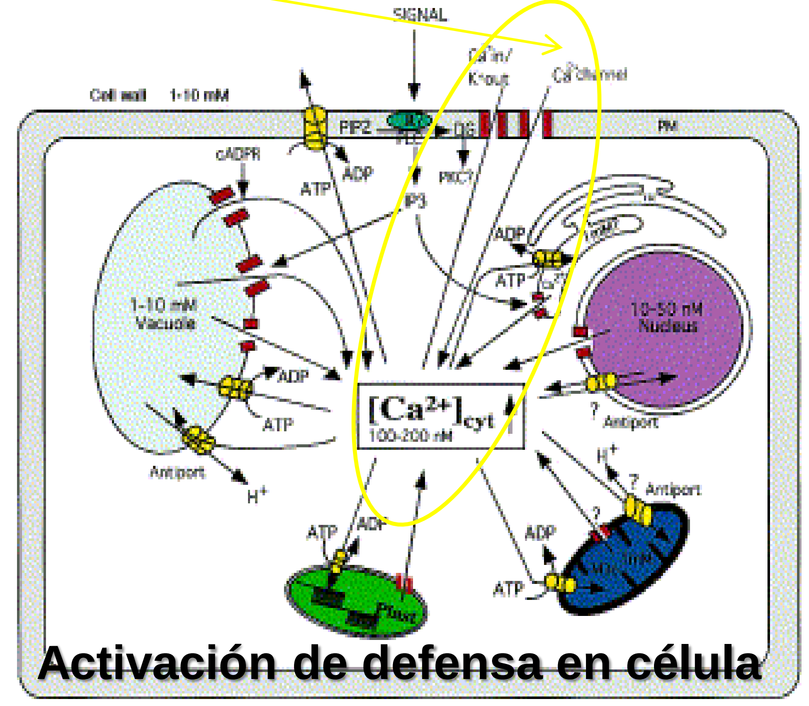


Richard M. COOPER. Sep 2010. Dept Biology & Biochemistry
University of Bath, BATH, UK

Richard M. COOPER. Sep 2010. Dept Biology & Biochemistry
University of Bath, **BATH, UK**

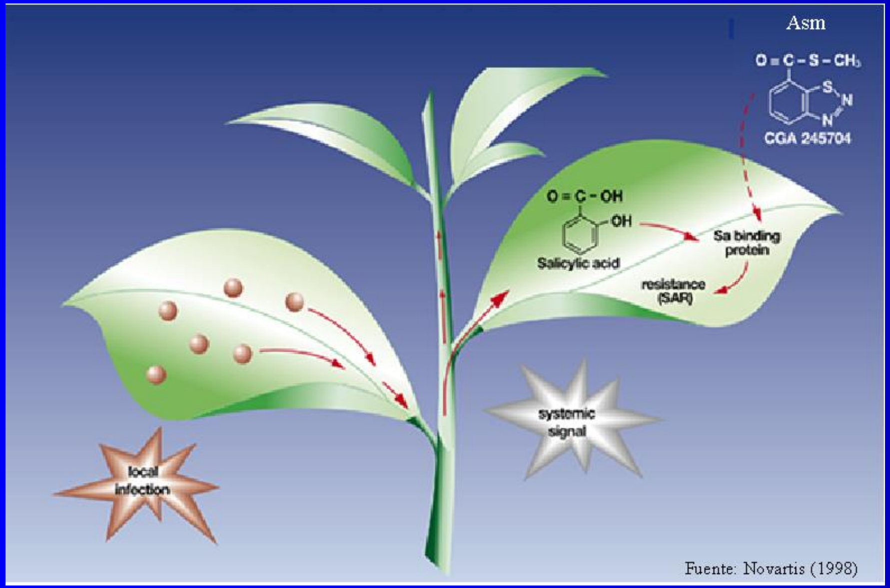




Richard M. COOPER. Sep 2010. Dept Biology & Biochemistry University of Bath, **BATH, UK**

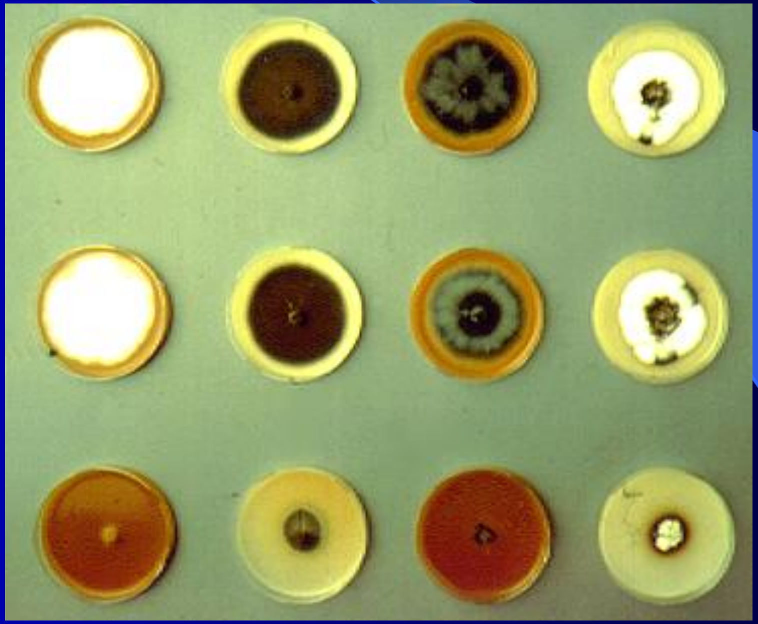
RESISTENCIA INDUCIDA EN EL CONTROL DE ENFERMEDADES

INDUCCIÓN DE RESISTENCIA



Evaluación *in vitro* de Asm

	Phytophthora infestans	*Pyricularia oryzae*	*Colletotrichum lagenarium*	*Cercospora nicotianae*
Control				
Asm				
Fungicida				



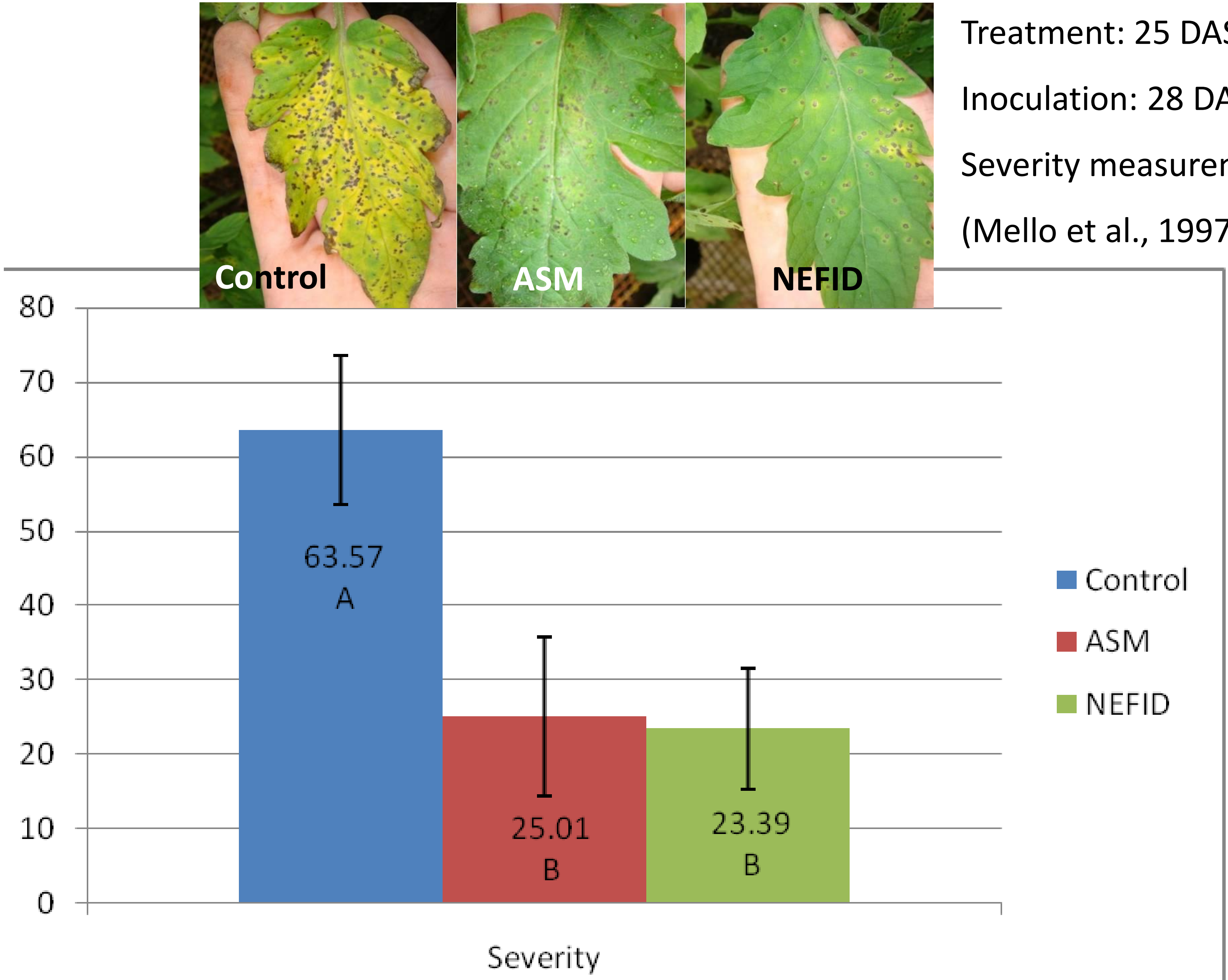
Fuente: Novartis (1998)

Treatment: 25 DAS

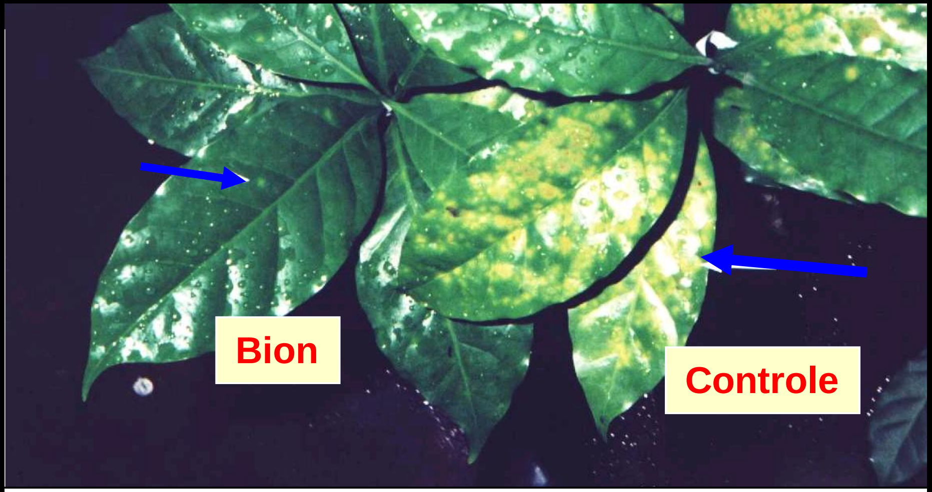
Inoculation: 28 DAS

Severity measurement: 38DAS

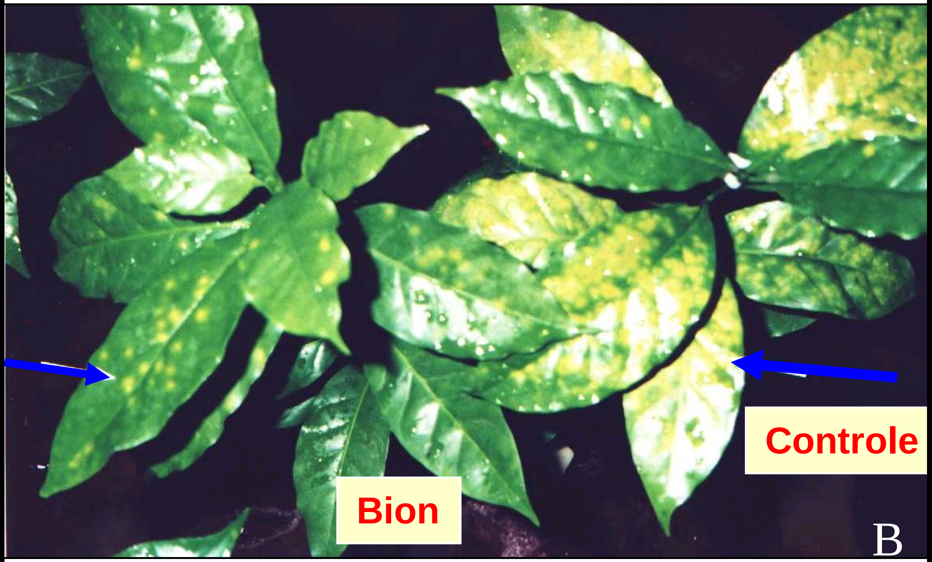
(Mello et al., 1997)



Both NEFID (Fitoforce) and ASM (Bion/Actiguard) reduced bacterial spot severity at 10 days after inoculation. Control (water), Acibenzolar-S-methyl (ASM) (0.2g/L) and NEFID 10%.



5 semanas
Bion → *H. vastatrix*



8 semanas
Bion → *H. vastatrix*

SAR

Indução de resistência em plantas de café contra *Hemileia vastatrix* (Ferrugem)

Tempo de duração entre a indução e a inoculação

Indutor : Acibenzolar-S-metil (Bion)

frontiers in Plant Science | Plant Pathogen Interactions

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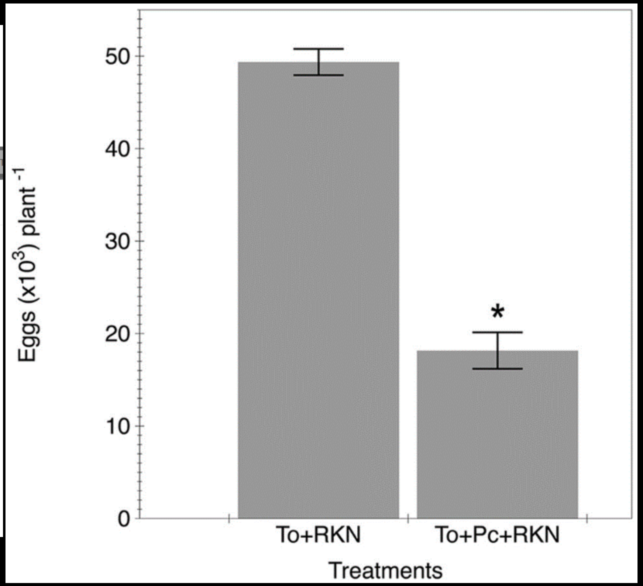
Nematodes in Phytobiomes View all 21 Articles ›

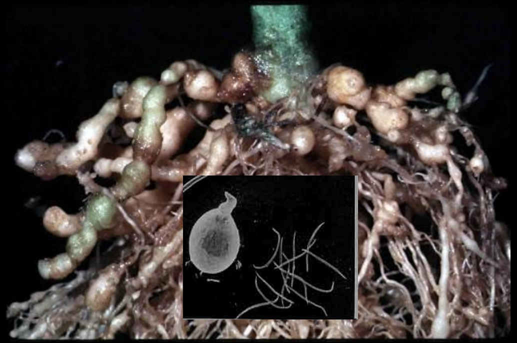
ORIGINAL RESEARCH article
Front. Plant Sci., 13 August 2019 | https://doi.org/10.3389/fpls.2019.00945

Pochonia chlamydosporia Induces Plant-Dependent Systemic Resistance to *Meloidogyne incognita*

Zahra Ghahremani[1], Nuria Escudero[1], Ester Saus[2,3], Toni Gabaldón[2,3,4] and F. Javier Sorribas[1*]

[1]Departament d'Enginyeria Agroalimentària i Biotecnologia, Universitat Politècnica de Catalunya, Barcelona, Spain
[2]Bioinformatics and Genomics Programs, Centre for Genomic Regulation (CRG), Barcelona Institute of Science and Technology, Barcelona, Spain
[3]Department of Experimental and Health Sciences, Universitat Pompeu Fabra (UPF), Barcelona, Spain
[4]ICREA, Barcelona, Spain





MPMI Vol. 28, No. 5, 2015, pp. 519–533. http://dx.doi.org/10.1094/MPMI-09-14-0260-R

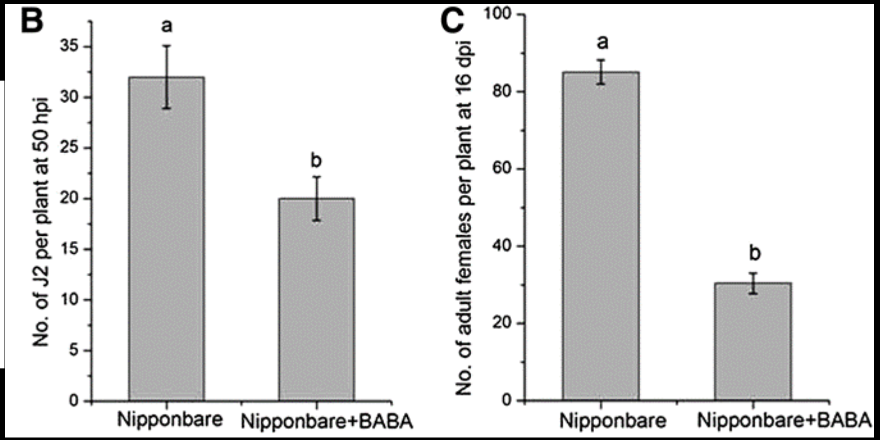
e-Xtra*

β-Aminobutyric Acid–Induced Resistance Against Root-Knot Nematodes in Rice Is Based on Increased Basal Defense

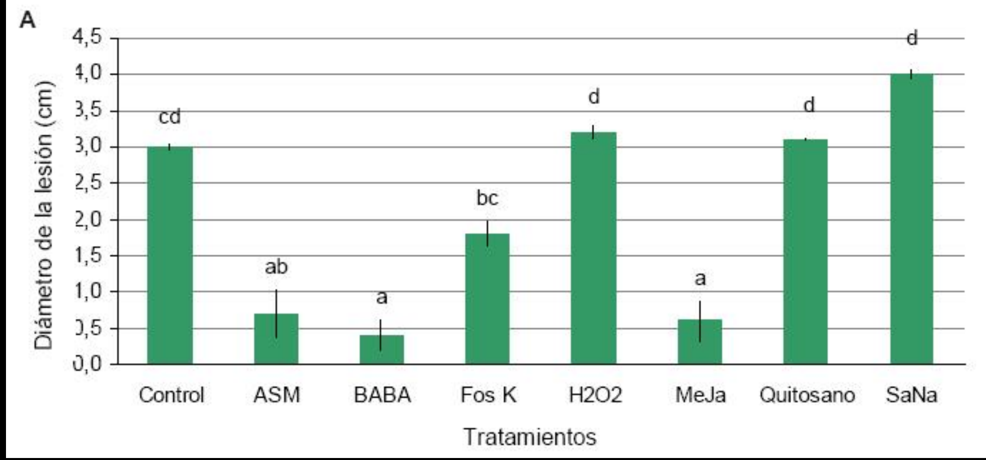
Hongli Ji,[1,2] Tina Kyndt,[1] Wen He,[1] Bartel Vanholme,[3] and Godelieve Gheysen[1]

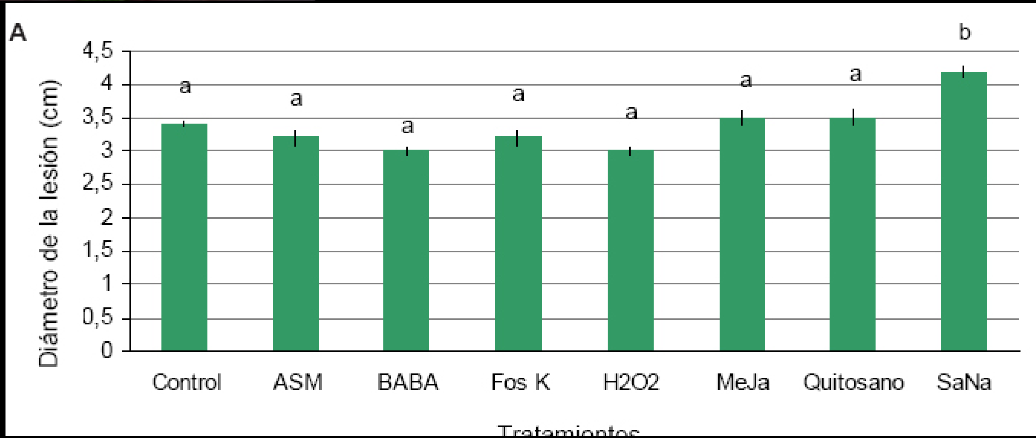
[1]Department of Molecular Biotechnology, Ghent University, Coupure links 653, B-9000, Ghent, Belgium; [2]Institute of Plant Protection, Sichuan Academy of Agricultural Sciences, Jingjusi road 20, 610066, Chengdu, China; [3]Department of Plant Systems Biology, Flanders Institute for Biotechnology (VIB) and Department of Plant Biotechnology and Bioinformatics, Ghent University, Technologiepark 927, B-9052 Ghent, Belgium

Submitted 9 August 2014. Accepted 22 December 2014.




Asm 2
Testigo
Sust. Fol





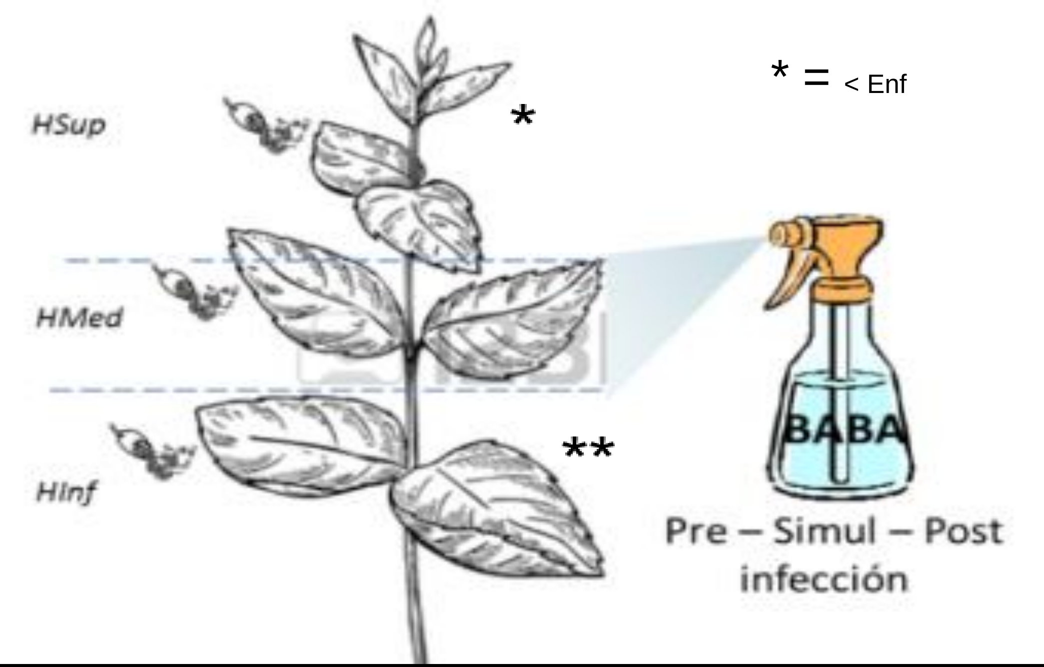
Rev. Protección Veg. Vol. 30 No. 3 (sep.-dic. 2015): 204-212
ISSN: 2224-4697

ARTÍCULO ORIGINAL

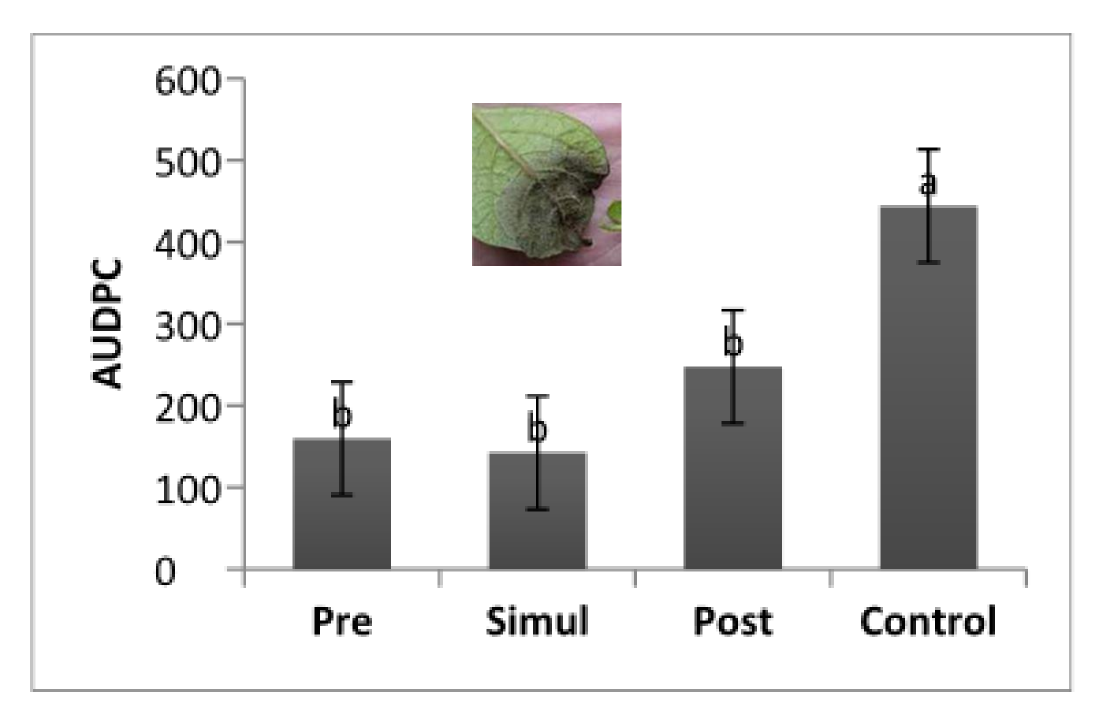
Alternativa para el manejo de *Phytophthora infestans* (Mont.) de Bary en *Solanum betaceum* Cav. mediante inductores de resistencia

Julián Castaño Monsalve[I], Joaquín Guillermo Ramírez Gil[I], Luis Fernando Patiño Hoyos[II], Juan Gonzalo Morales Osorio[I]*

http://hpc.ilri.cgiar.org/beca/training/IMBB_2016/Phytophtora_CD_update/key/A%20Lucid%20Key%20to%20the%20Common%20Species%20of%20Phytophthora/Media/Html/Phytophthora_andina.htm



Resultados no publicados



Coctel de inductores= ?

![frontiers in Plant Science]

Front Plant Sci. 2014; 5: 241. PMCID: PMC4036063
Published online 2014 May 28. Prepublished online 2014 Apr 14.
doi: 10.3389/fpls.2014.00241

Control of foliar pathogens of spring barley using a combination of resistance elicitors

Dale R. Walters,[1,*] Neil D. Havis,[1] Linda Paterson,[1] Jeanette Taylor,[1] David J. Walsh,[2] and Cecile Sablou[1]

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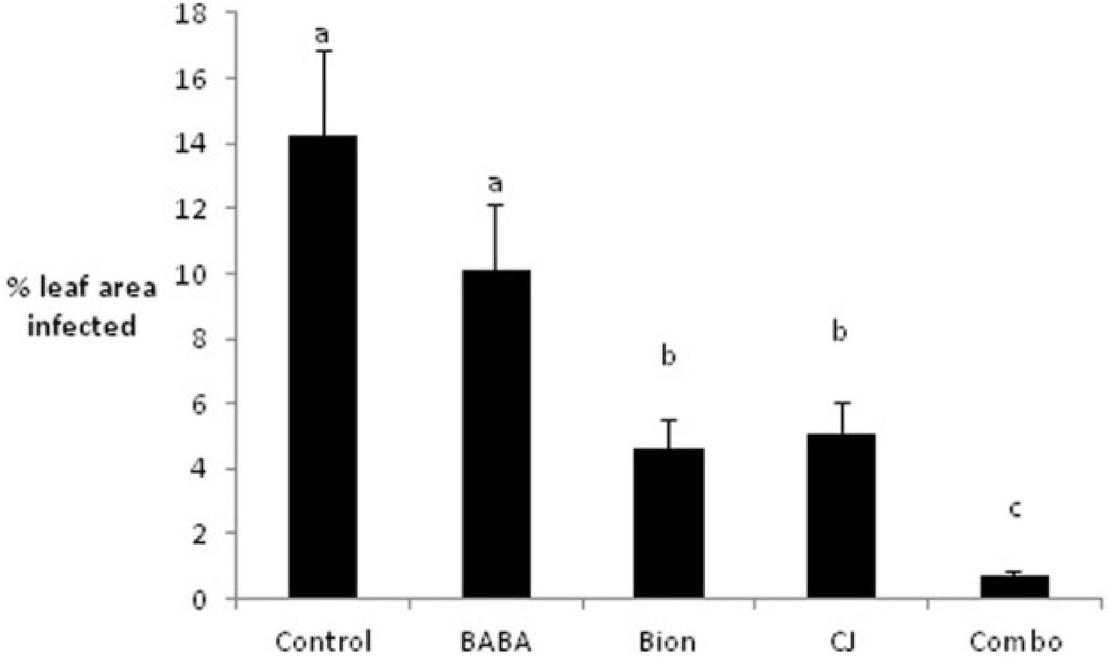


Effects of elicitors, singly and in combination, on infection of barley with *R. commune*. Leaves 1–4 were sprayed with elicitor and inoculated with *R. commune* 2 days later. Infection intensity was assessed 21 days later on leaves 5–7. Bars with a different letter are significantly different at $P < 0.05$ (Fisher's LSD).

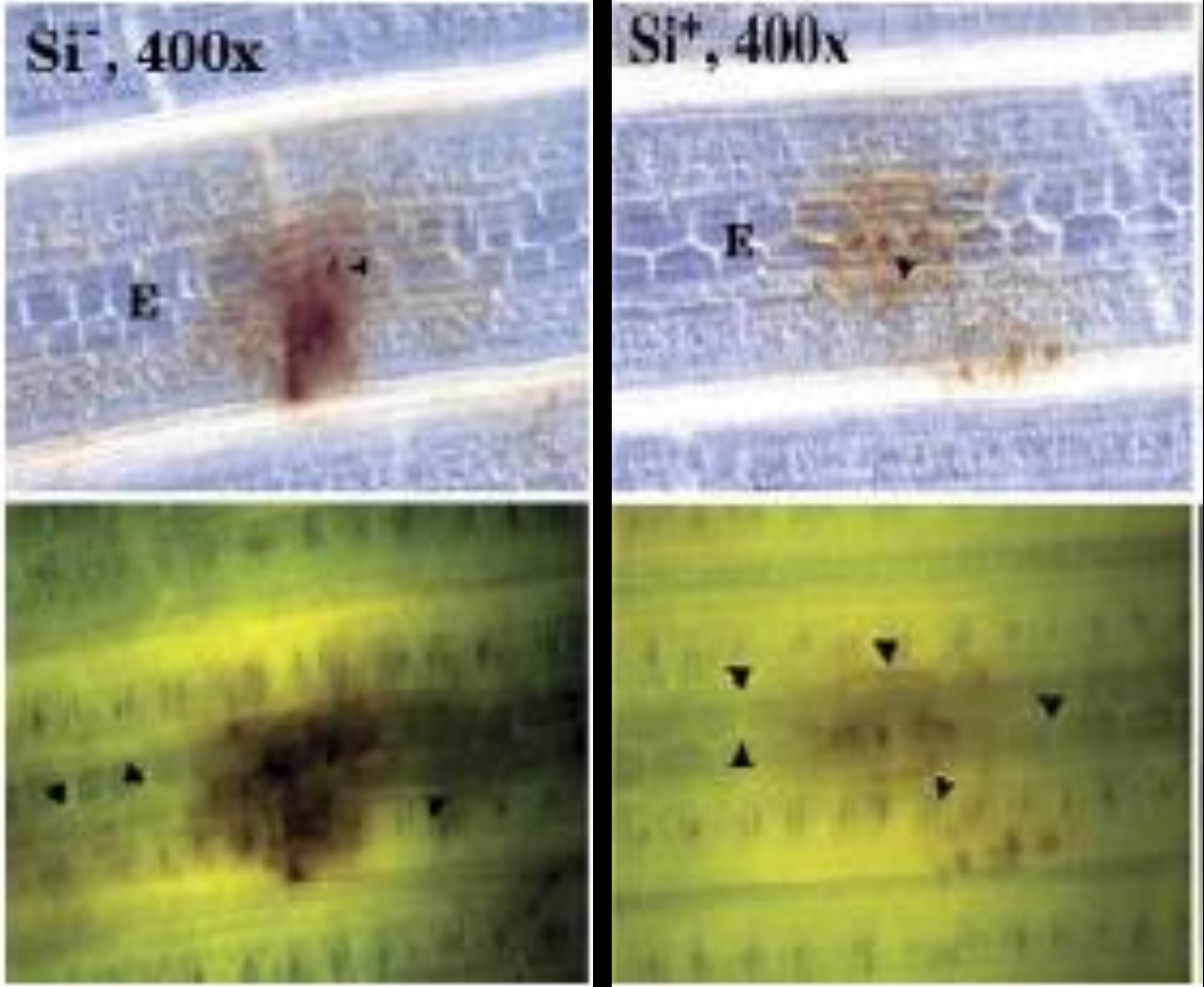
Inductor de Resistencia + Fungicida = ?

K.D. Sharma et al. / Crop Protection 30 (2011) 1519–1522

Table 1
Effect of BTH (5 … applications on blight severity (%) and dry grain yield (t ha^{-1}) in chickpea

Treatment	Severity[c] 2007–08	Severity[c] 2008–09	Severity[c] Average
BTH: seed soaking for 24 h	25.0 (5.1)[c]	20.0 (4.5)[c]	22.5
BTH: One spray	20.0 (4.5)[c]	15.0 (3.9)[bc]	17.5
BTH: Two sprays	8.3 (3.0)[ab]	6.7 (2.7)[ab]	7.5
BTH: Three sprays	5.0 (2.5)[a]	3.3 (2.0)[a]	4.2
BTH: One spray + Mencozeb: one spray	10.0 (3.3)[b]	6.7 (2.7)[ab]	8.3
Mencozeb: Three sprays	8.3 (3.0)[ab]	6.7 (2.7)[ab]	7.5
Control (No chemical spray)	50.0 (7.1)[d]	41.7 (6.5)[d]	45.8
LSD ($p \leq 0.05\%$)	0.82	1.38	
CV (%)	11.71	22.38	

[a] Commercial product Bion (50% ai, Sandoz) was used at a concentration of 100 ppm.
[b] Spray interval 15 days. The figures with same superscript letter are not statistically significant at $p \leq 0.05$.
[c] Transformed values (square root of log of value plus one) are within parenthesis.



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Physiological and Molecular Plant Pathology 66 (2005) 144–159

PMPP

www.elsevier.com/locate/pmpp

Silicon influences cytological and molecular events in compatible and incompatible rice-*Magnaporthe grisea* interactions

Fabrício Á. Rodrigues[1], Wayne M. Jurick II, Lawrence E. Datnoff, Jeffrey B. Jones, Jeffrey A. Rollins*

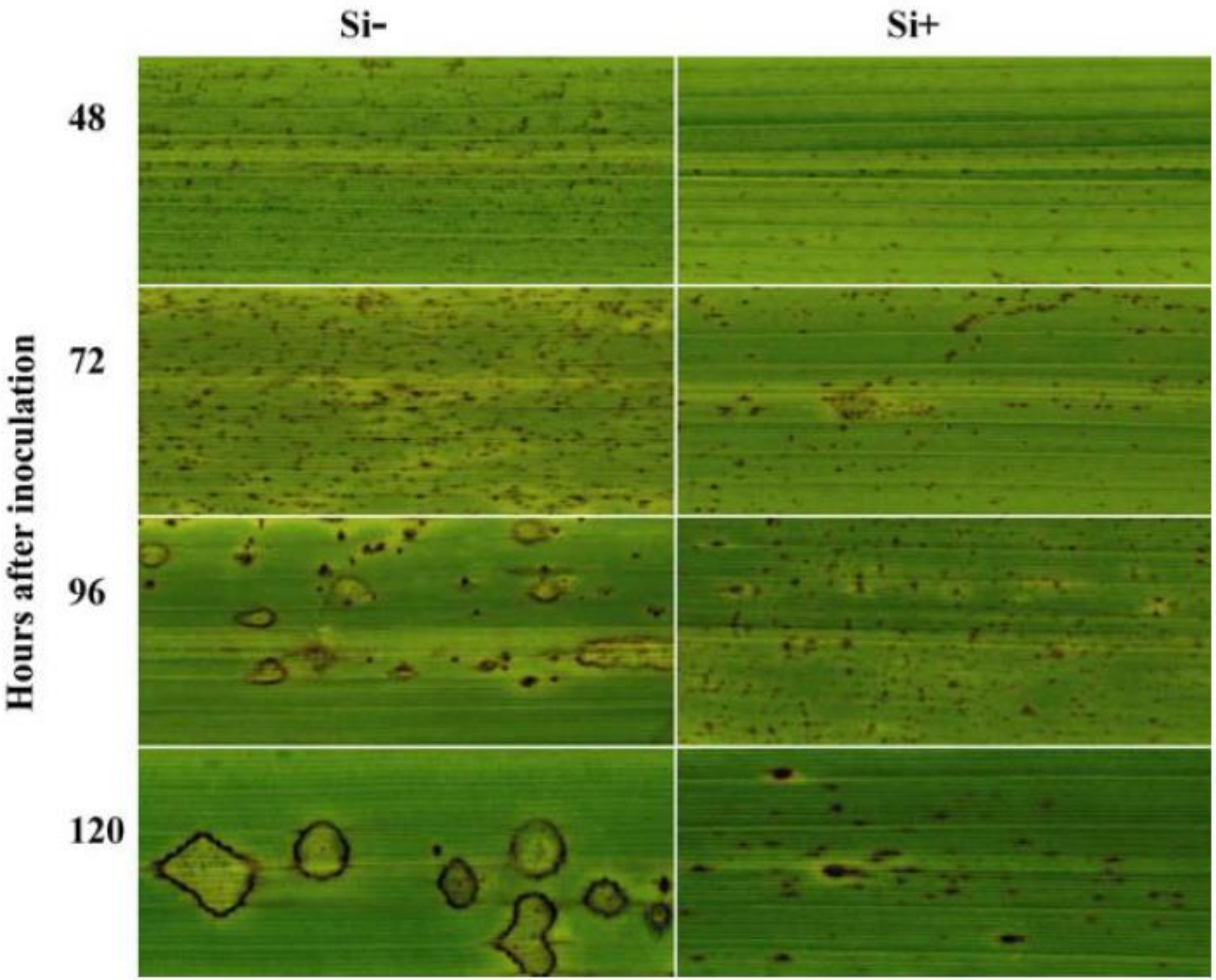
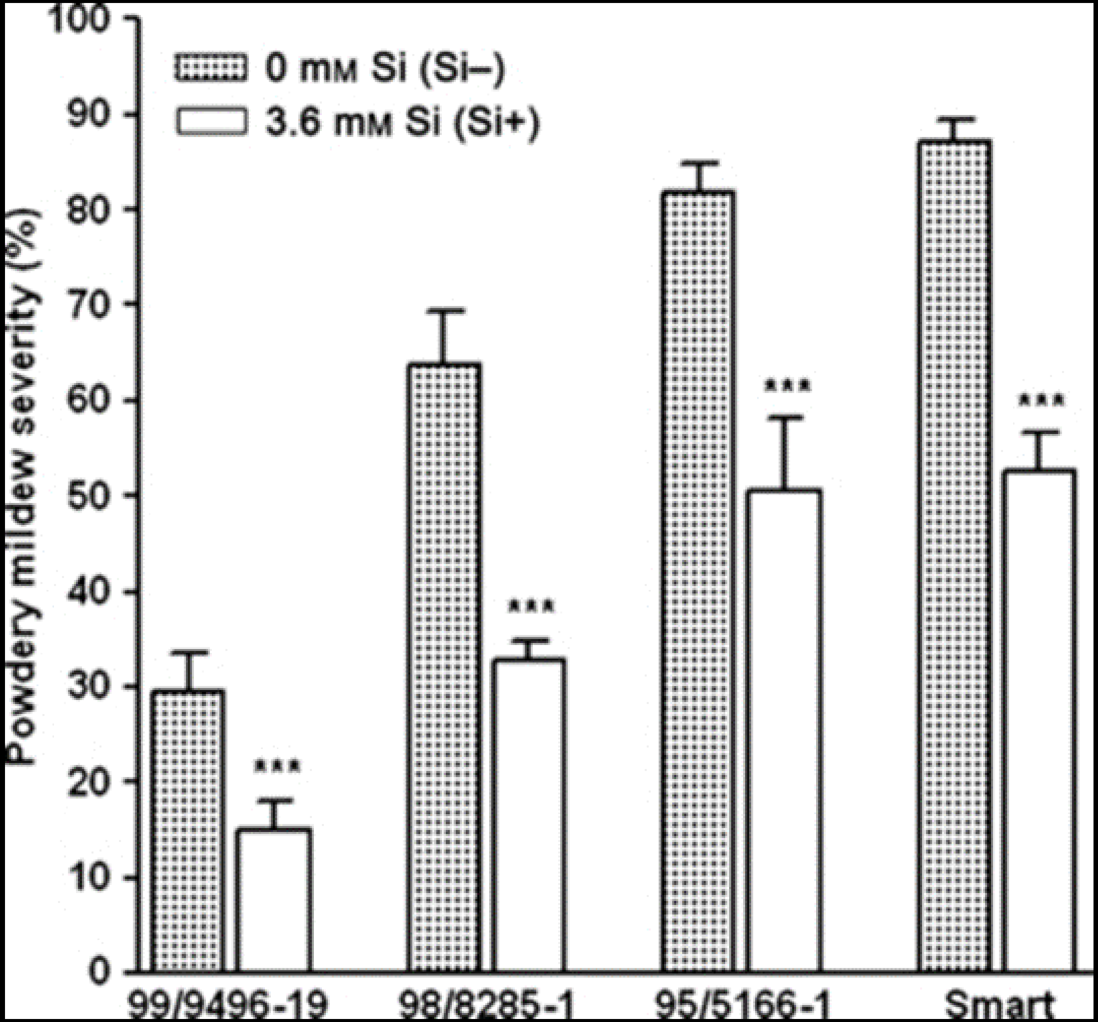
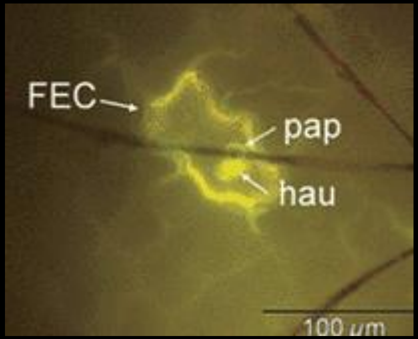


Fig. 1. Development of blast lesions on the adaxial leaf blades of rice plants nonamended (Si–) or amended with silicon (Si+) at 48, 72, 96, and 12
inoculation with *Magnaporthe grisea*.

Rodrigues, F. Á., Benhamou, N., Datnoff, L. E., Jones, J. B., and Bélanger, R. R. 2003. Ultrastructural and cytochemical aspects of silicon-mediated rice blast resistance. Phytopathology 93:535-546.





Plant Pathology
An International Journal edited by the British Society for Plant Pathology
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Silicon induced resistance against powdery mildew of roses caused by *Podosphaera pannosa*

R. Shetty, B. Jensen, N. P. Shetty, M. Hansen, C. W. Hansen, K. R. Starkey, H. J. L. Jørgensen

First published: 3 July 2011 Full publication history
DOI: 10.1111/j.1365-3059.2011.02493.x View/save citation

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Volume 61, Issue 1
February 2012
Pages 120–131

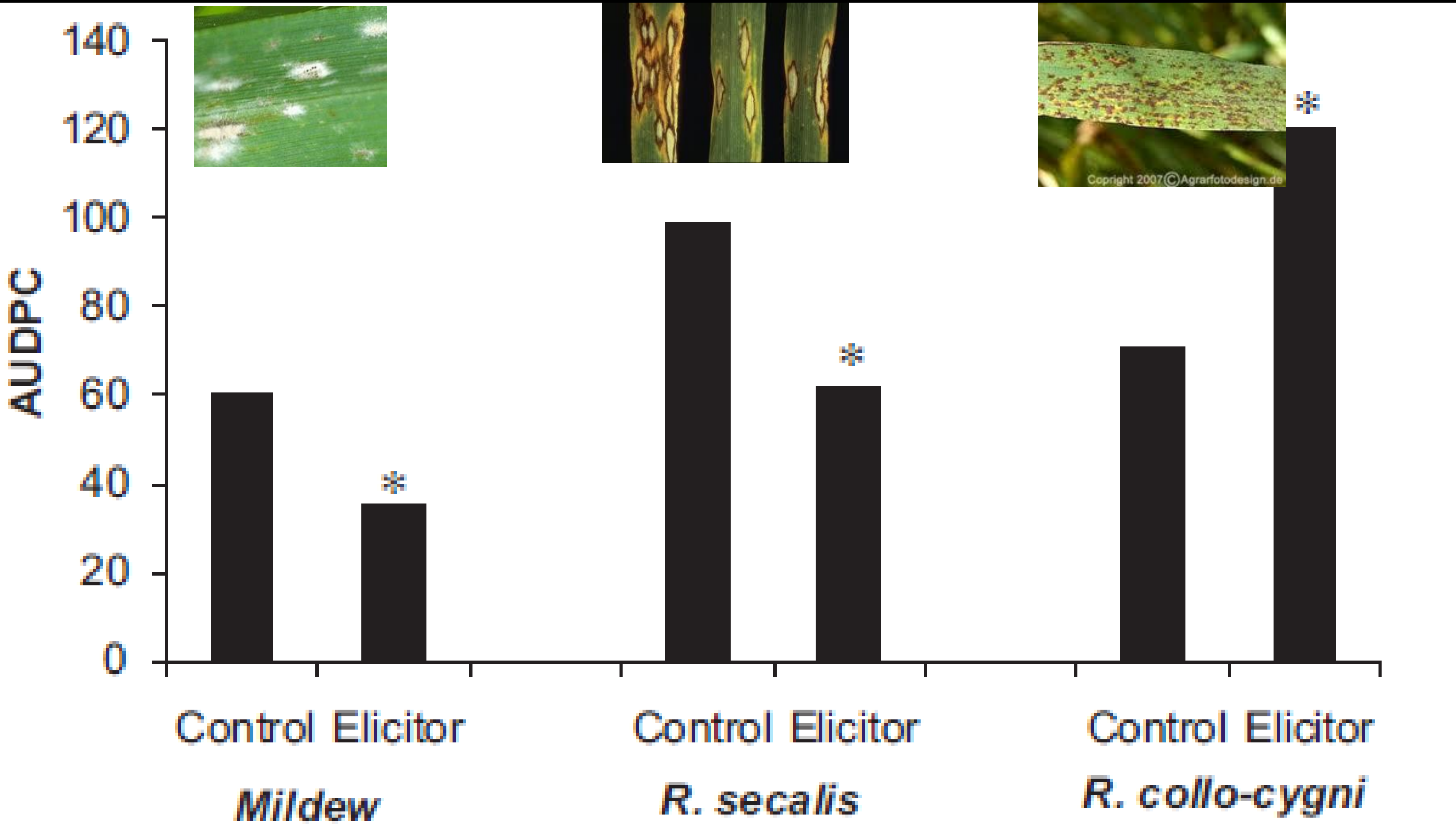

Fig. 2. AUDPC values for powdery mildew, *R. secalis*, and *R. collo-cygni* on the barley varieties Optic (a) and Cellar (b) in a field experiment in 2007. * = significantly different from the respective control at $P < 0.05$ (Fisher's LSD).

D.R. Walters et al. / Physiological and Molecular Plant Pathology 75 (2011) 188–192

C F.o ASM 0,14,28

Ramos Peña, I. M. (2013). *Inducción de genes de defensa por Acibenzolar S Metil y su efecto en el control del marchitamiento vascular causado por Fusarium Oxysporum en Uchuva (Physalis Peruviana)* (Master's thesis, Facultad de Ciencias).

Y LA RESISTENCIA INDUCIDA EN EL CAMPO?

Table 1. Elicitors and plant activators approved in the European Union *.

Active Substance (ID) ^	Date of Approval
Elicitors	
Chitosan hydrochloride (1096)	01/07/2014
Fructose (2375)	01/10/2015
Heptamaloxylglucan (1449)	01/06/2010
Laminarin (1510)	01/04/2005
Pepino Mosaic Virus strain CH2 isolate 1906 (2315)	07/08/2015
Sucrose (2340)	01/01/2015
Zucchini Yellow Mosaic Virus weak strain (2020)	01/06/2013
Plant activators	
Acibenzolar-*S*-methyl (benzothiadiazole) (914)	01/04/2016
Cerevisane (2301)	23/04/2015

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Editorial

Moving to the Field: Plant Innate Immunity in Crop Protection

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Tabla 2. Efecto de inductores de resistencia y edad de la hoja sobre el grado de evolución de los síntomas e índice de severidad de las sigatokas amarilla y negra en plántulas de Dominico-Hartón 112 días después de la siembra

Tratamiento	Dosis	Grado de evolución de los síntomas	Índice de severidad (%)
Fosfito de potasio	27 mL L-1	1,4 d*	6,23 d*
Propiconazol	0,4 L ha-1	1,7 d	10,25 cd
BABA	8 mM	2,4 c	13,65 bcd
ASM	0,01 mL L-1	2,5 bc	18,56 bc
Clorotalonil	2 L ha-1	3,1 ab	20,63 b
AS	5 mM	3,3 a	31,88 a
Testigo absoluto		3,4 a	33,02 a
Hoja		**Grado de evolución de los síntomas**	**Índice de severidad**
2		0,40 d*	0,77 d*
3		1,94 c	7,43 c
4		3,51 b	25,41 b
5		4,48 a	43,08 a

* Promedios en cada columna seguidos de letras distintas denotan diferencias altamente significativas según la prueba de Tukey al 5%.

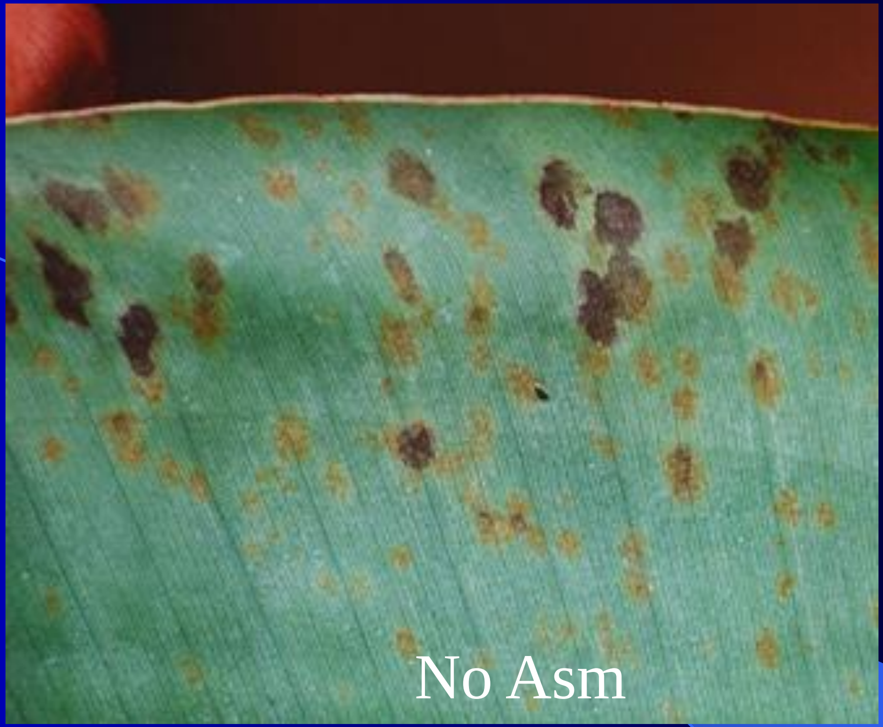
Rev. acad. colomb. cienc. exact. fis. nat. vol.35 no.137 Bogotá Oct./Dec. 2011

FITOPATOLOGÍA

EFECTO DE INDUCTORES DE RESISTENCIA EN PLÁNTULAS DE PLÁTANO DOMINICO-HARTÓN (*MUSA BALBISIANA* AAB) CONTRA *MYCOSPHAERELLA* SPP.

Ángela Mogollón Ortiz[1], Jairo Castaño Zapata[2]


Asm


No Asm

SALICILATO DE SODIOY ACIBENZOLAR-S-METIL COMO INDUCTORES DE RESISTENCIA A LA SIGATOKA NEGRA EN PRODUCCIÓN COMERCIAL DE BANANO

Juan Sebastián Venegas-Ramirez[1], Luis Fernando Patiño-Hoyos[1], Elkin Bustamante-Rojas[2].
Juan Gonzalo Morales-Osorio[3] y John Jairo Mira-Castillo[4]

[1]Politecnico Colombiano Jaime Isaza Cadavid, Facultad de Ciencias Agrarias; [2]Consultor Internacional en MIP; [3]Universidad Nacional de Colombia, Facultad de Ciencias Agropecuarias; [4]Augura-Cenibanano.

2012 Fitopatologia Colombiana /Volumen 36 No 1

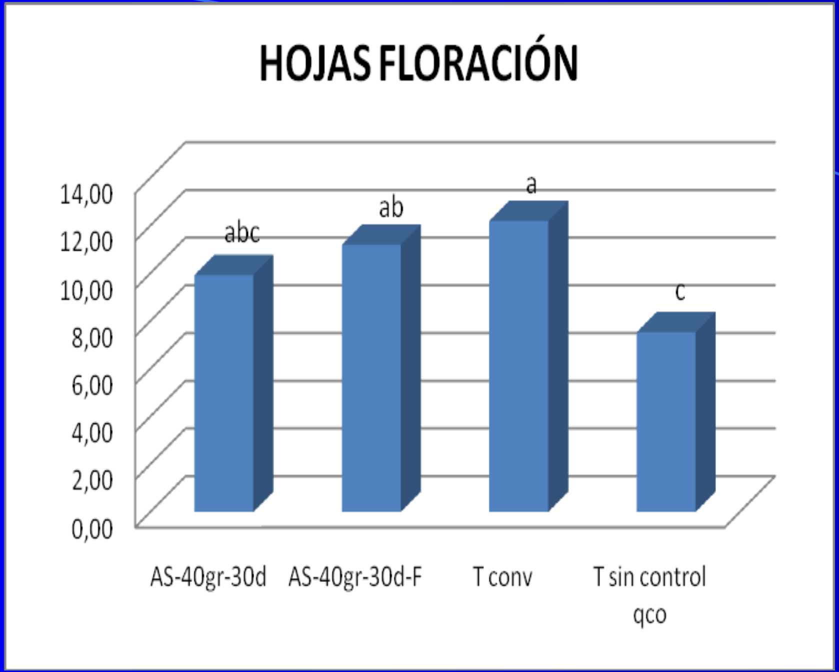


Figura . Hojas Funcionales a Floración en campo experimental (Finca AUGURA), con AS 40 gr. i.a.Ha[-1]-30 días **(solos y en rotación con fungicidas) Tratamientos con letra diferente indican significancia de acuerdo Tukey (p<0.05)**

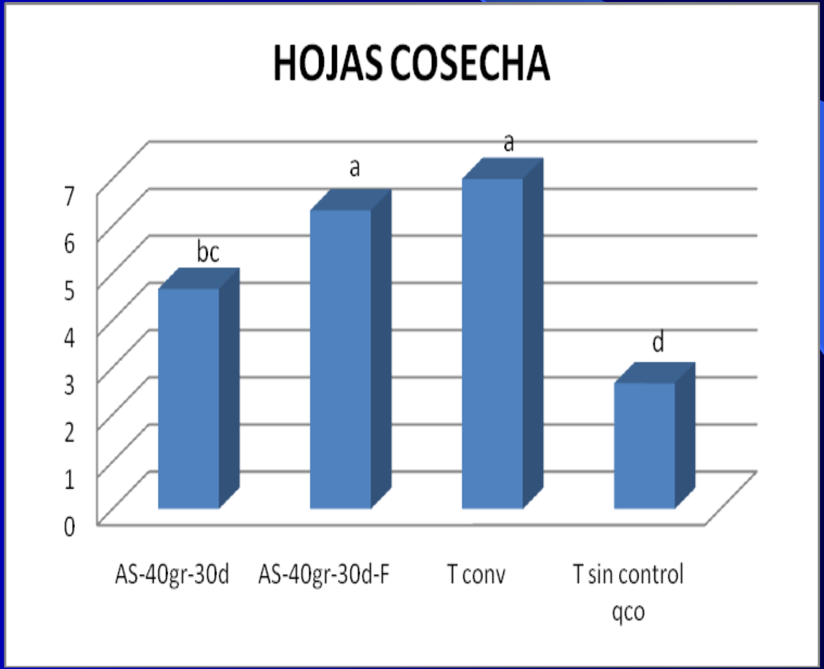


Figura . Hojas Funcionales a Cosecha en campo experimental (Finca AUGURA), con AS 40 gr. i.a.Ha[-1]-30 días **(solos y en rotación con fungicidas) Tratamientos con letra diferente indican significancia de acuerdo Tukey (p<0.05)**

ANALÍSIS ECONÓMICO

Alternativa (Rotación)	Costo US$. ha^{-1}	Tratamiento convencional	Costo US$. ha^{-1}
AS 40	9,5	Bravo	18
Calixin	37	Calixin	37
		Bravo	18
AS 40	9,5		
Bravo	18	Bravo	18
AS 40	9,5		
		Bravo	18
		Bravo	18
Bravo	18		
AS 40	9,5		
		Bravo	18
Bravo	18	Bravo	18
AS 40	9,5		
Bravo	18	Calixin	37
Calixin	37		
AS 40	9,5	Baycor	37
Baycor	37	Bravo	18
AS 40	9,5		
Sico		Sico	37
		Bravo	18
Bravo	18		
		Bravo	18
		Opus	37
Opus	37		
AS 40	9,5	Bravo	18
Bravo	18		
		Bravo	18
		Bravo	18
AS 40	9,5		
Bravo	18	Bravo	18
No. ciclos convencionales	**12**		**19**
% Reducción ciclos conv	**36,8**		
Costo total (US$. ha^{-1})	**359,5**		**437**
% Reducción costos	**17,8**		

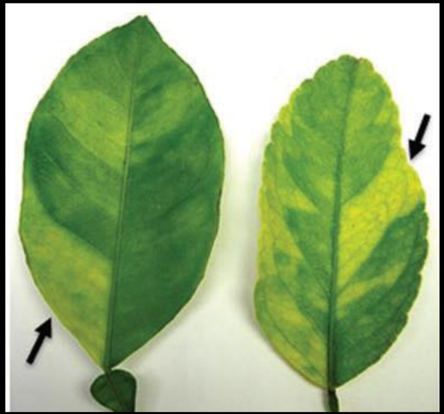
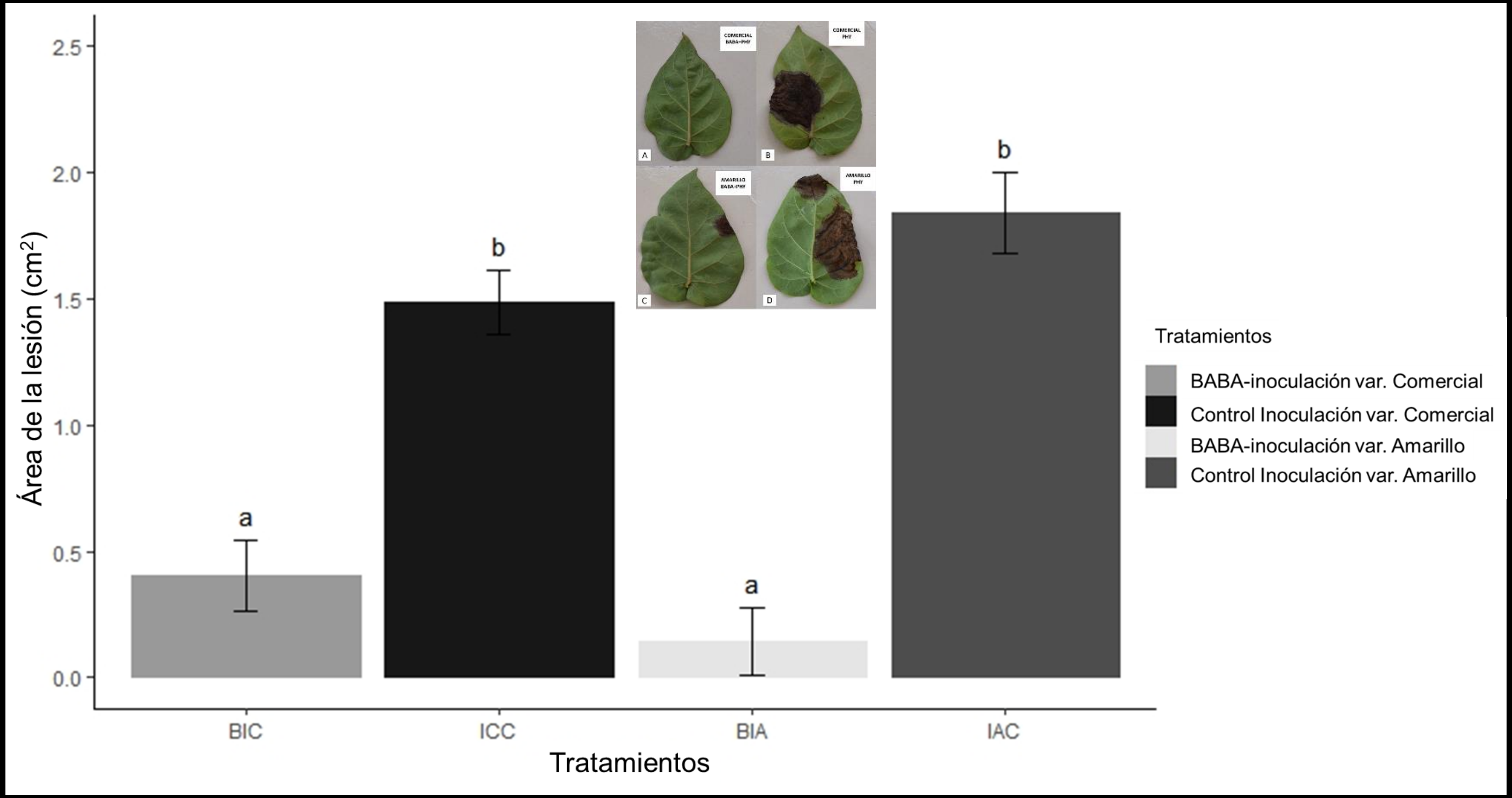


TABLE 6. Summary of the best performing treatments in each experiment

Experiment	Citrus variety (tree age[x])	Treatment[y]	Reduction of Las titer (log unit per gram of plant tissue)[z]
I	Midsweet orange (7 years)	BABA (15–150 μM)	0.63
II	Midsweet orange (8 years)	BABA (0.2 mM)	0.66
		BTH (1.0 mM)	0.79
		INA (0.1 mM)	0.81
III	Murcott mandarin (10 years)	BABA (1.0 mM)	0.66
		BTH (1.0 mM)	0.63
		INA (0.5 mM)	0.61
		2-DDG (100 μM)	0.66
IV	Valencia sweet orange (4 years)	BABA (0.2–1.0 mM)	0.68
		BTH (1.0 mM)	0.78
		INA (0.1–0.5 mM)	0.69
		2-DDG (100 μM)	0.70

[x] The age at the beginning of the experiment.
[y] BABA: β-aminobutyric acid; BTH: 2,1,3-benzothiadiazole; INA: 2,6-dichloroisonicotinic acid; and 2-DDG: 2-deoxy-D-glucose.
[z] The reduction in populations of '*Candidatus* Liberibacter asiaticus' (Las) compared with control at the end of the experiment.

Li, J., Trivedi, P., and Wang, N. 2016. Field evaluation of plant defense inducers for the control of citrus huanglongbing. Phytopathology 106:37-46.



Efecto de BABA en plantas de tomate de árbol inoculadas con P. infestans en condiciones de campo.

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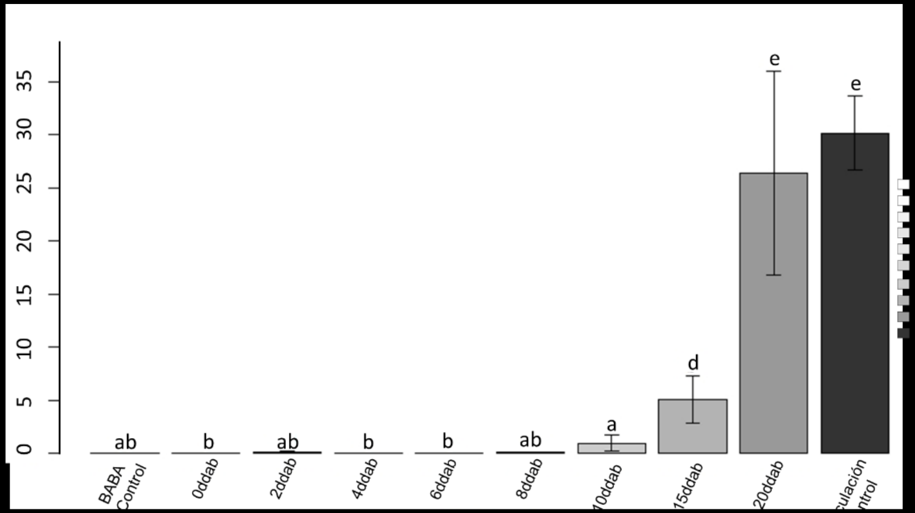
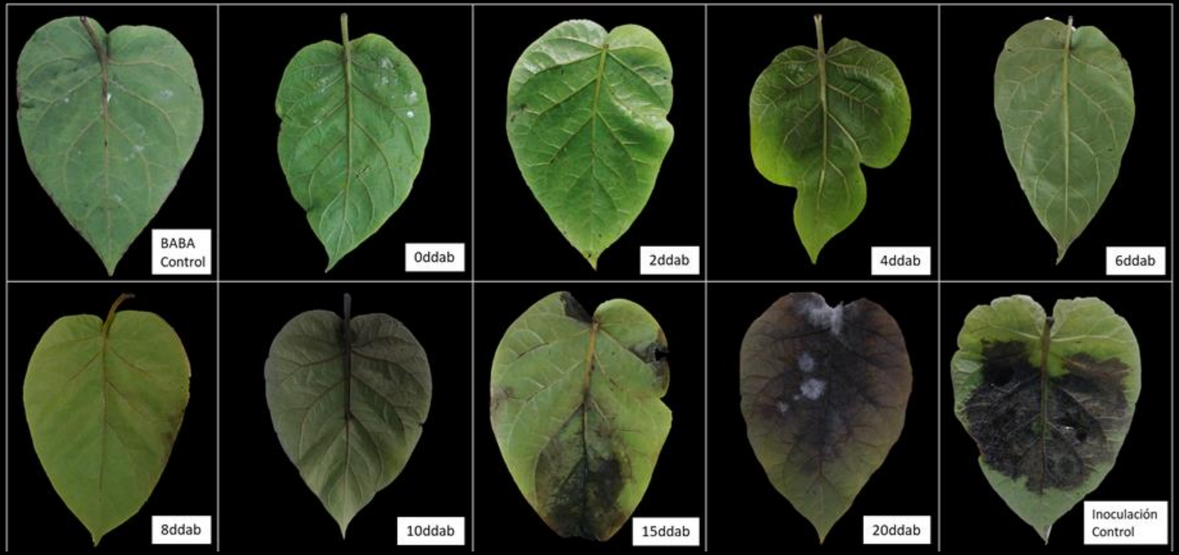
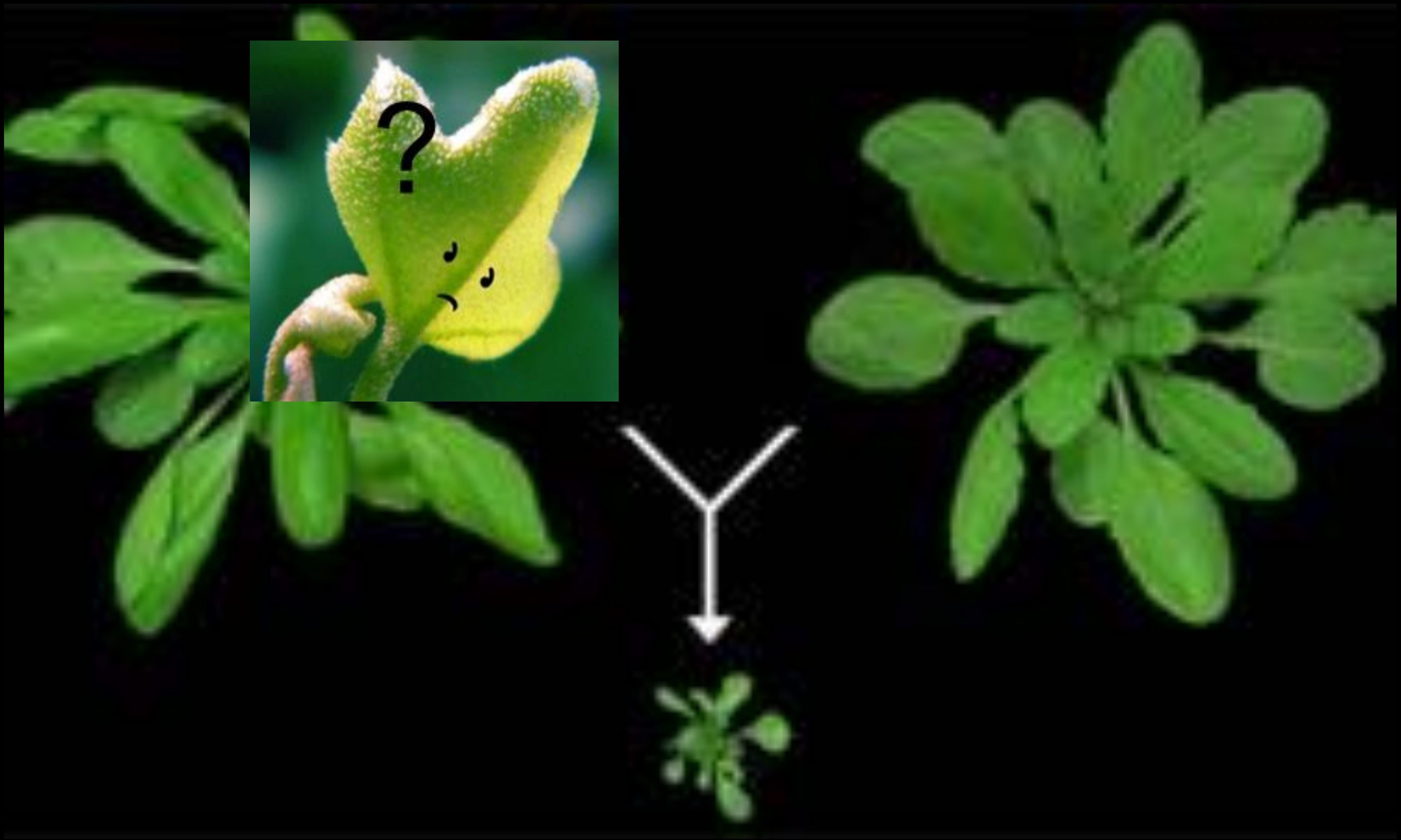
Figura 40. Duración del efecto BABA frente al ataque de *P. infestans* en plantas de tomate de árbol.



Las barras de error representan la desviación estándar con un n= 11 mediciones por tratamiento. Se identificaron diferencias significativas entre tratamientos mediante la prueba no paramétricas de Kruskal-wallis (p-value= 6.252e-07).





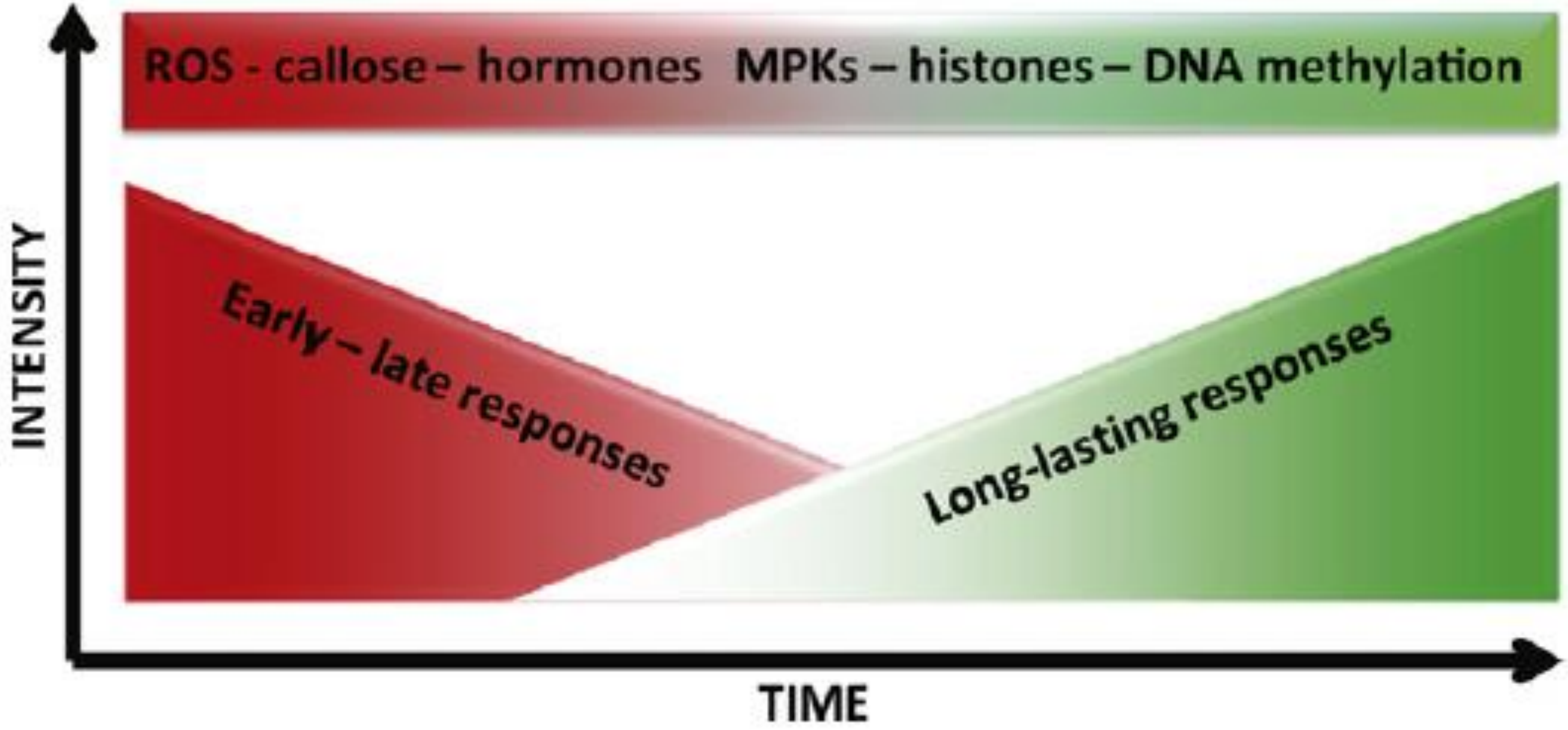


Fig. 2. Temporal events during priming.

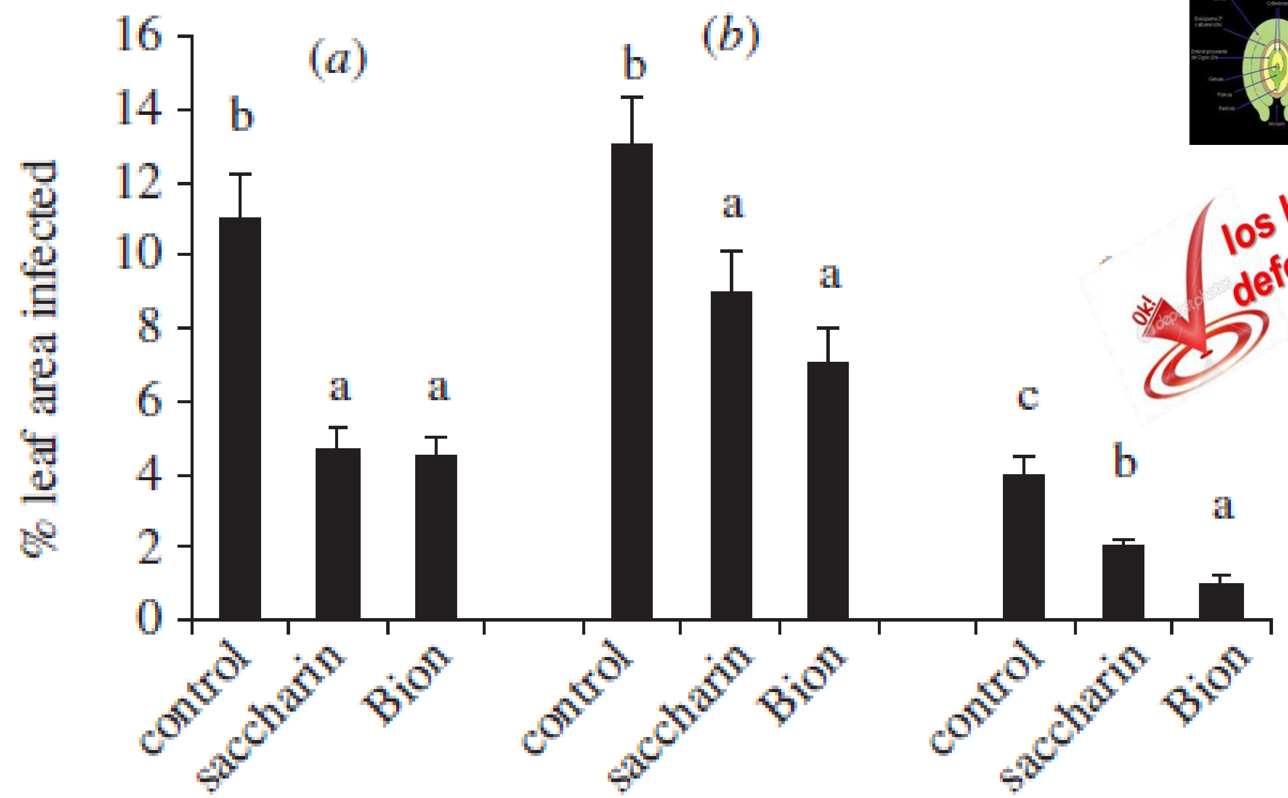


Figure 2. Effects of treating barley with saccharin or ASM on resistance of the progeny to infection by *R. secalis*. Progeny received no treatment with elicitors, but were inoculated with *R. secalis*. Per cent leaf area infected was then determined on leaves (*a*) one, (*b*) two and (*c*) three. Bars with different letters are significantly different at $p < 0.05$ (Fisher's LSD).

los hijos pueden recordar la defensa inducida en la madre

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Physiology

Parents lend a helping hand to their offspring in plant defence

Dale R. Walters* and Linda Paterson

frontiers in Plant Science

ORIGINAL RESEARCH
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BABA-primed defense responses to *Phytophthora infestans* in the next vegetative progeny of potato

Jolanta Floryszak-Wieczorek[1], *Magdalena Arasimowicz-Jelonek*[2]* *and Dariusz Abramowski*[1]

[1] *Department of Plant Physiology, Poznan University of Life Sciences, Poznan, Poland,* [2] *Department of Plant Ecophysiology, Faculty of Biology, Adam Mickiewicz University, Poznan, Poland*

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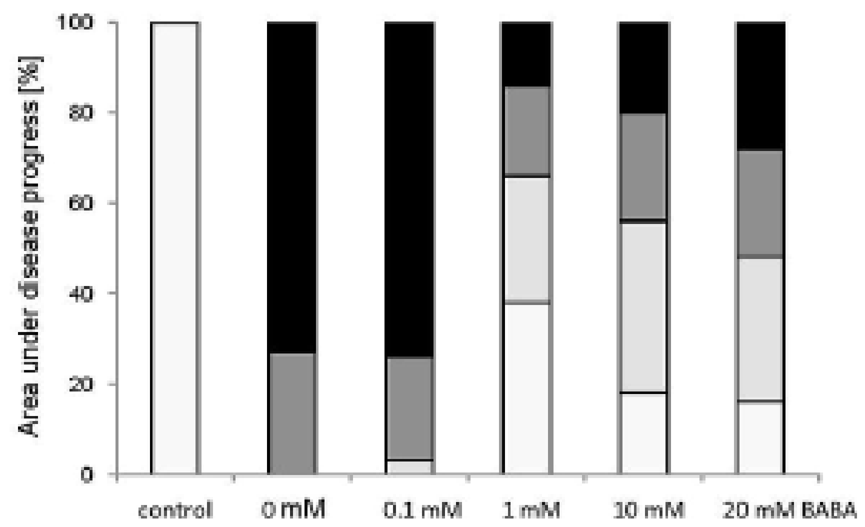

FIGURE 4 | *PR-1* gene transcript accumulation in progeny lines of immunized potato plants (B_B stage) -offspring received from the BABA-treated parental line with use of tubers. (A) After induction of

COLCIENCIAS


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