FITOSANIDAD DE LA RAÍZ

Bertha Tlapal Bolaños
btlapalb@chapingo.mx

Shoot

Functions

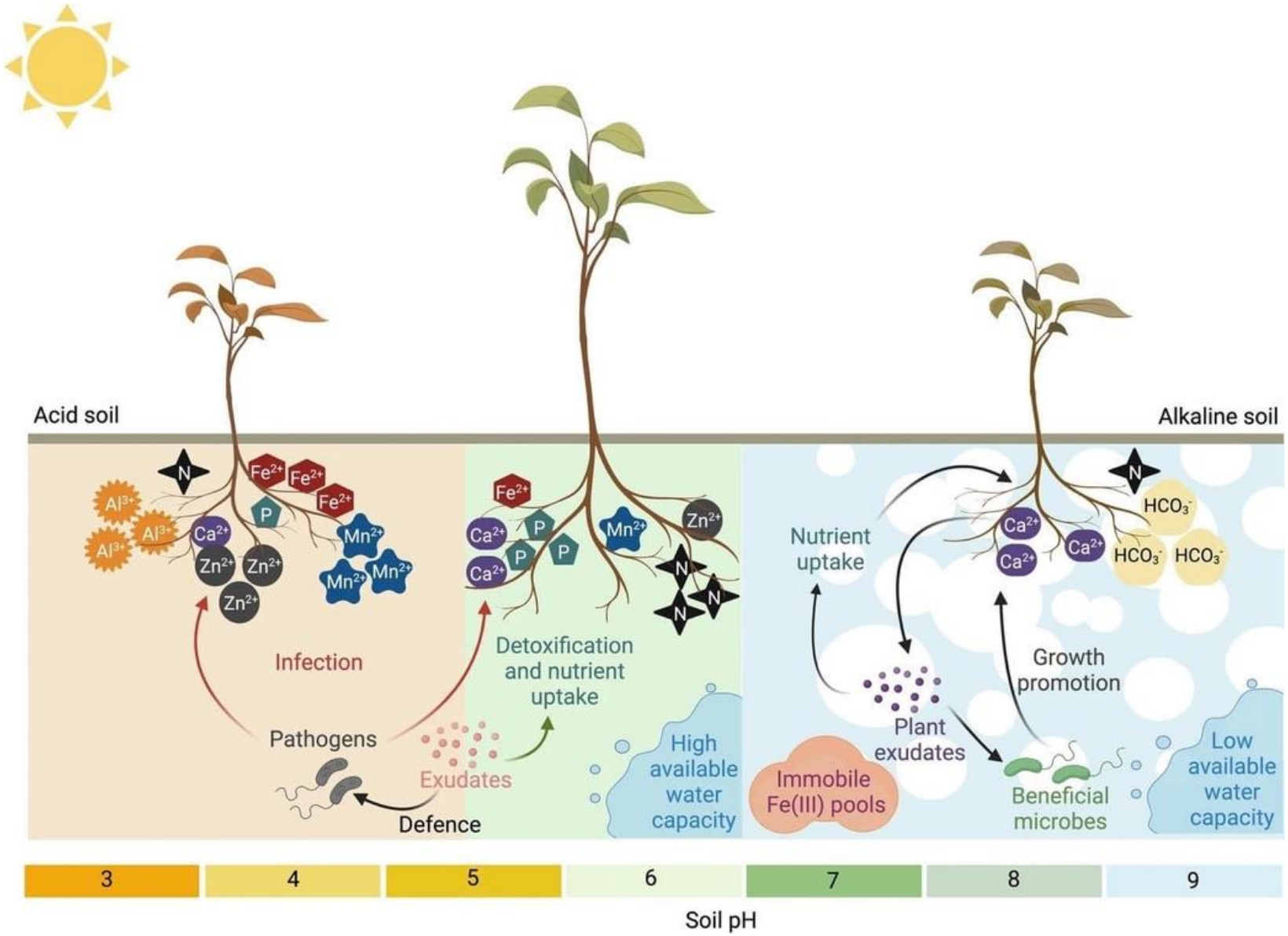
- Photosynthesis
- Transport of food and water
- Reproduction
- Storage

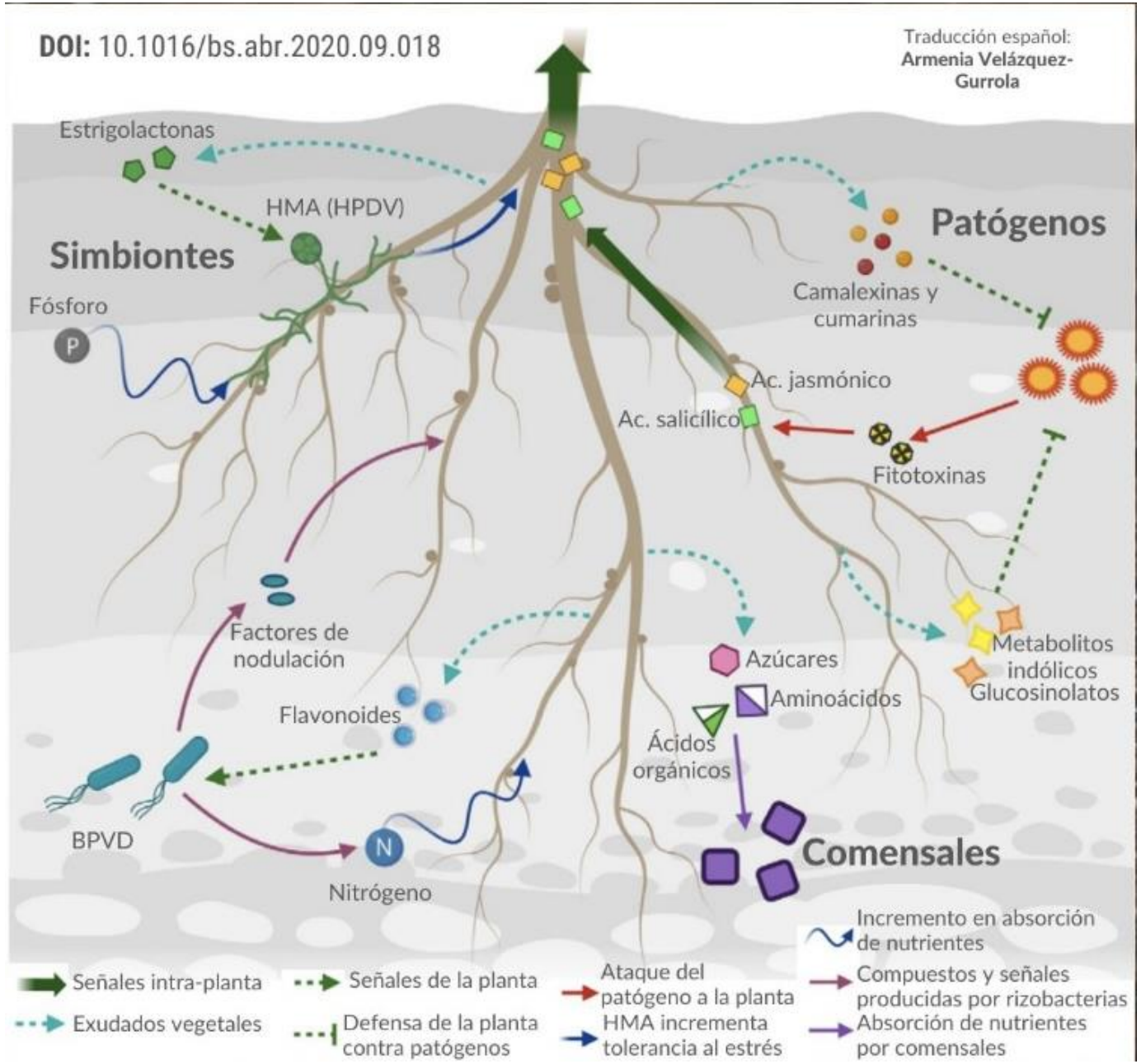
Root System

Functions

- Anchorage
- Absorption of water and minerals
- Transport of food and water
- Reproduction

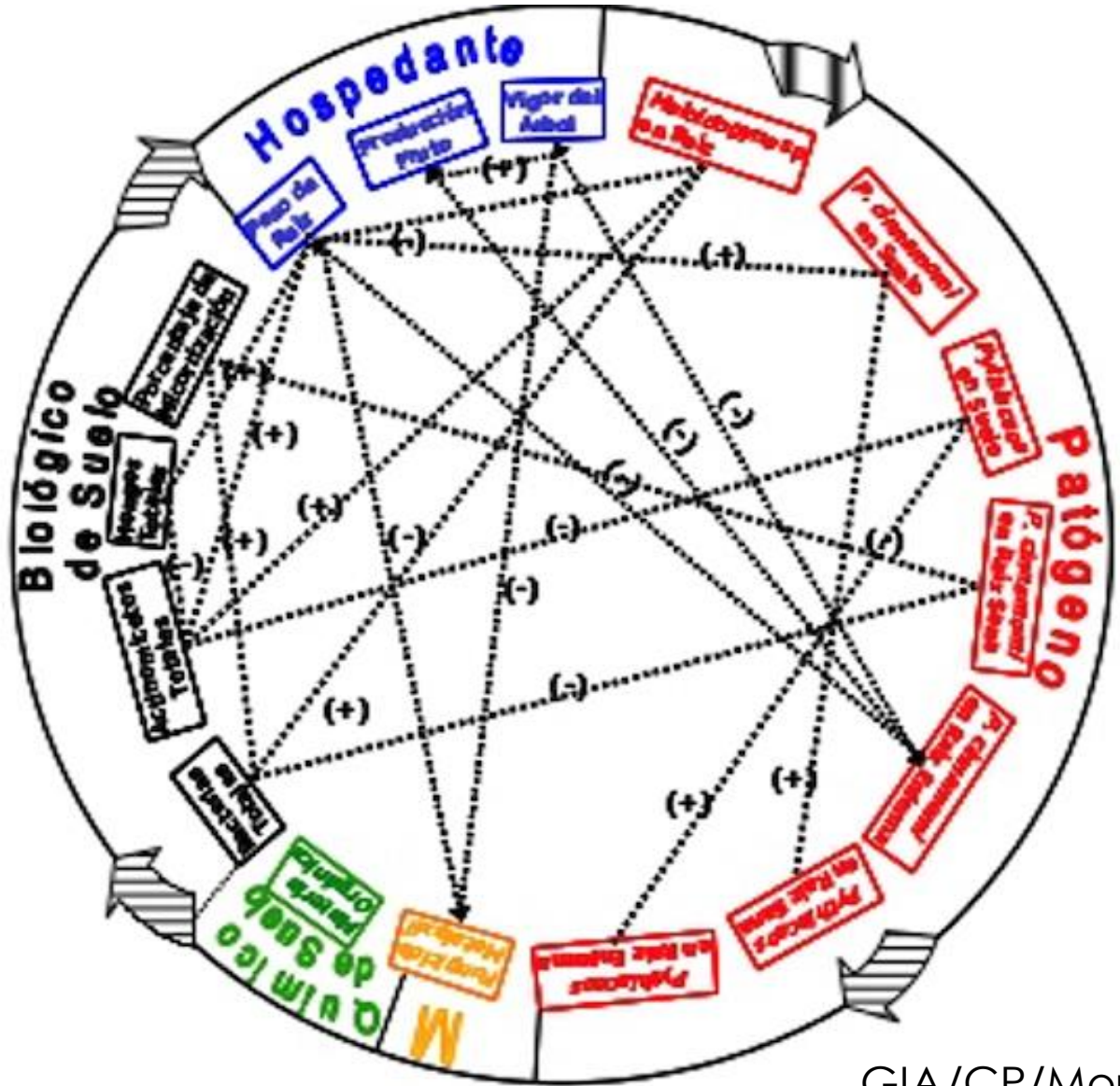
SUELOS REGIONES/ pH/Planta:Patógeno





LOS DIFERENTES FACTORES DETERMINARAN LAS RELACIONES QUE SE LLEVEN A CABO EN EL MICROBIOMA DE LA RAÍZ

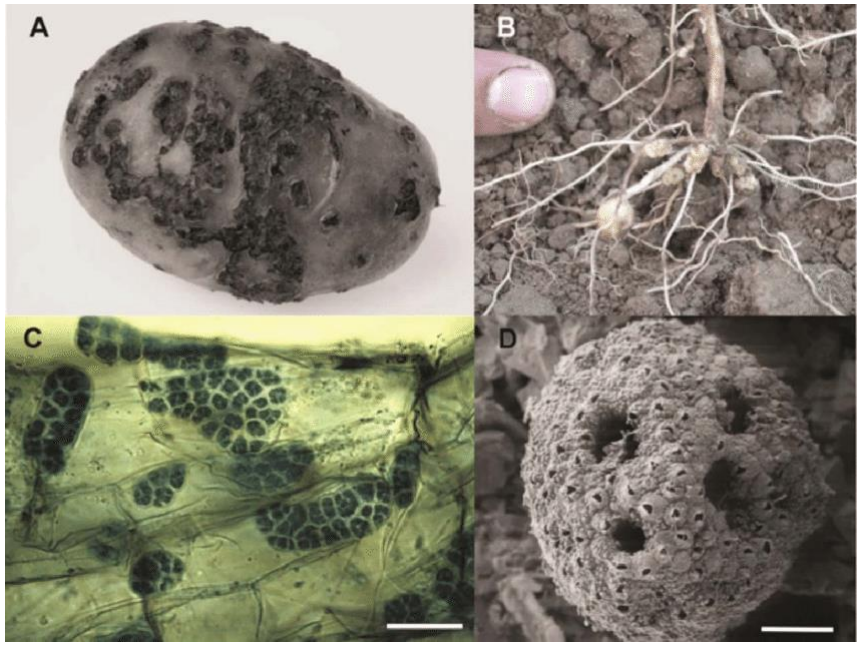
RAÍZ AGUACATE/ *Phytophthora cinnamomi*



GIA/CP/Mora *et al.*, 2013

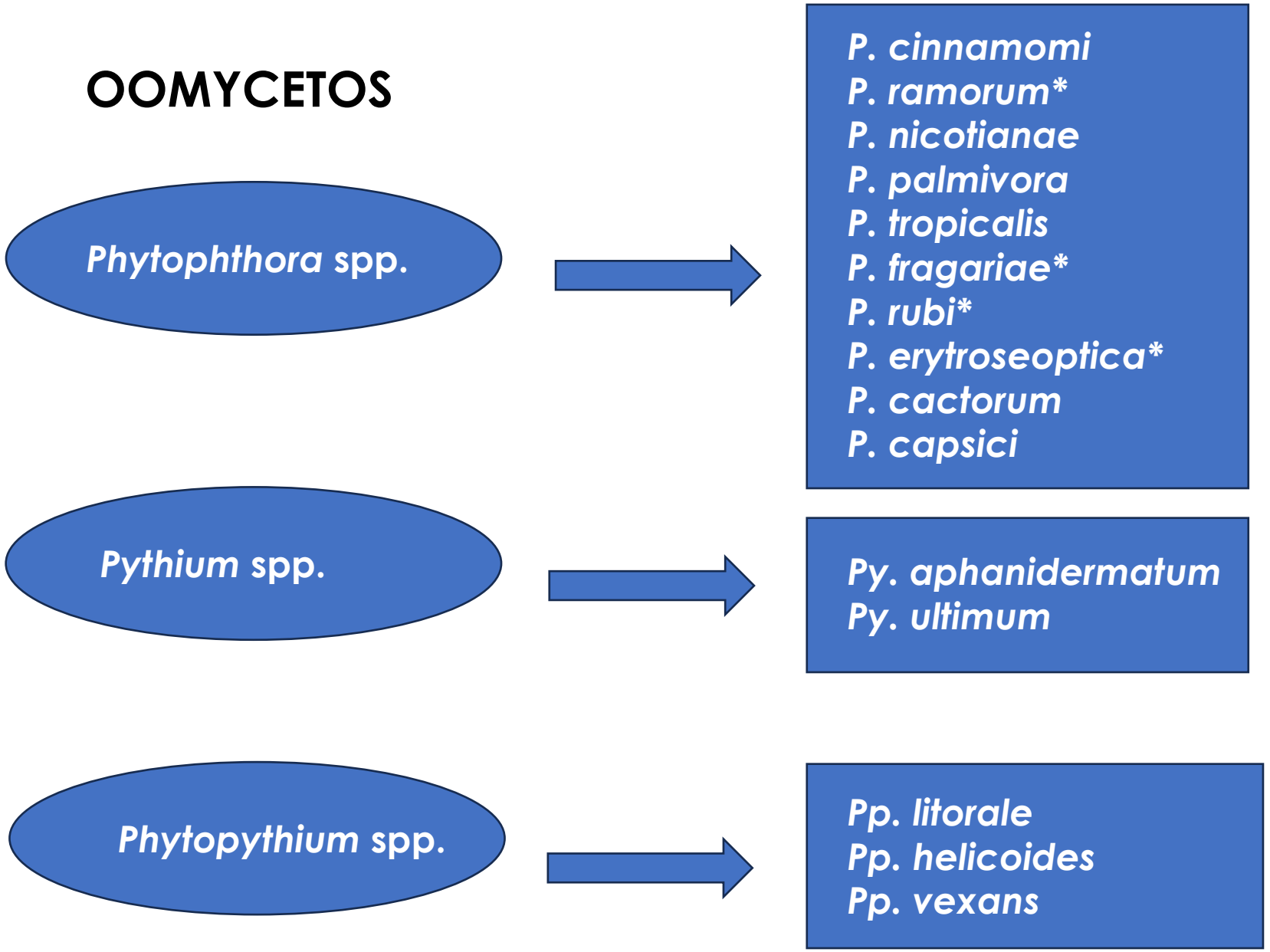
PLASMODIOPHOROMYCOTA

Plasmodiophora brassicace



Spongospora subterranea

OOMYCETOS


Phytophthora spp.
P. cinnamomi
P. ramorum*
P. nicotianae
P. palmivora
P. tropicalis
P. fragariae*
P. rubi*
P. erytroseoptica*
P. cactorum
P. capsici
Pythium spp.
Py. aphanidermatum
Py. ultimum
Phytopythium spp.
Pp. litorale
Pp. helicoides
Pp. vexans

Phytophthora cinnamomi
Aguacate

Phytophthora nicotianae var. parasitica
Limón Persa

Phytophthora capsici

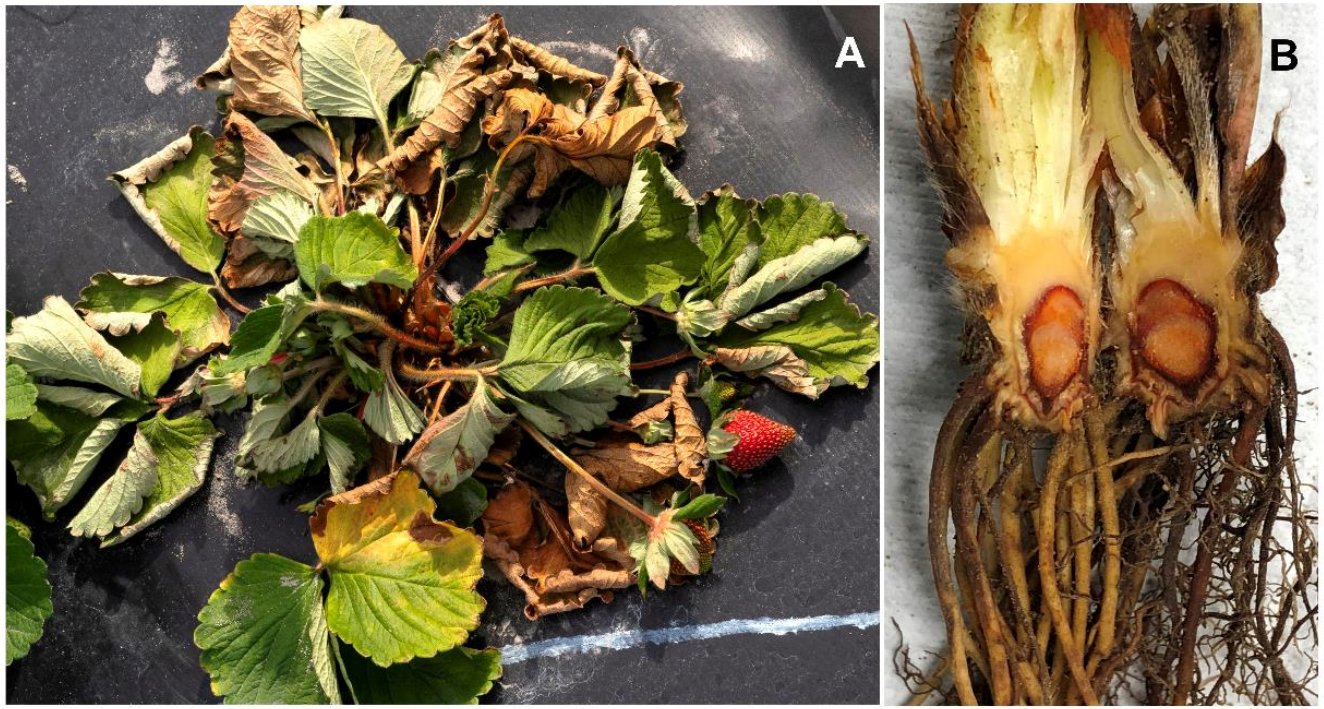


FIGURE 1
Symptoms of Phytophthora crown rot disease in strawberry. **(A)** Strawberry plant wilting, and **(B)** crown rot symptoms caused by *Phytophthora cactorum*.

DOI 10.3389/fagro.2022.941111

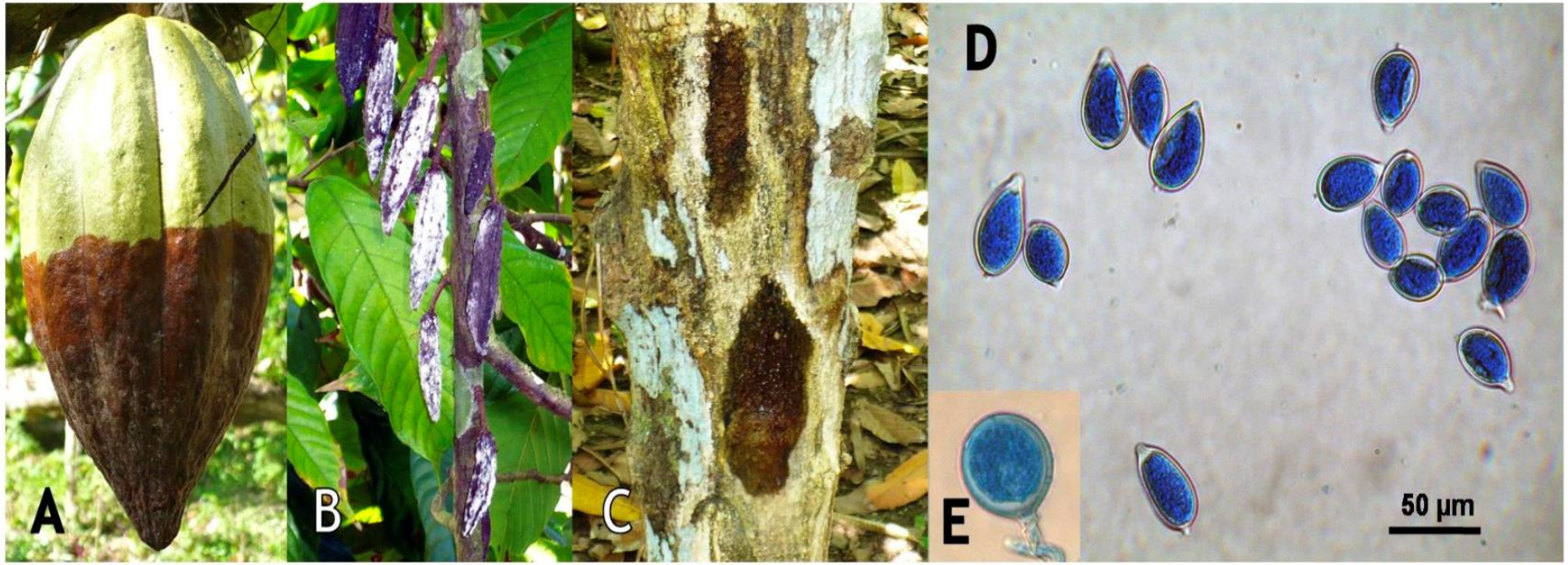
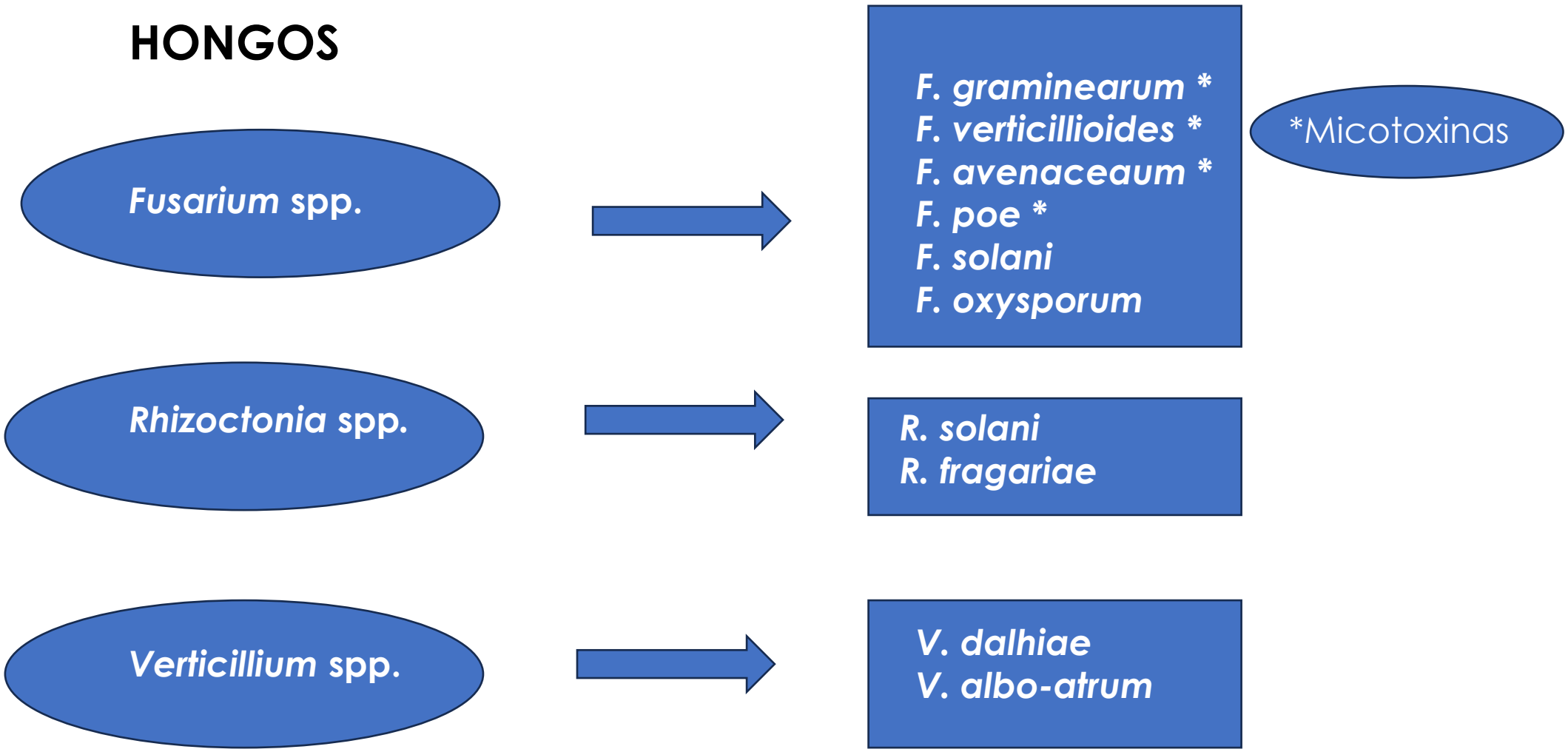


FIGURA 2. *Phytophthora palmivora:* A) Pudrición negra de la mazorca; B) frutos momificados con micelio: C) Cancro del tallo; D) esporangios E) clamidospora./ *Phytophthora palmivora: A) Cacao black pod; B) momified fruit with mycelia: C) stem canker; D) sporangia E) chlamydospores.*

HONGOS


Fusarium spp.
F. graminearum *
F. verticillioides *
F. avenaceaum *
F. poe *
F. solani
F. oxysporum
*Micotoxinas
Rhizoctonia spp.
R. solani
R. fragariae
Verticillium spp.
V. dalhiae
V. albo-atrum

Fusarium cerealis

Fusarium graminearum

Fusarium avenaceum

Fusarium poe

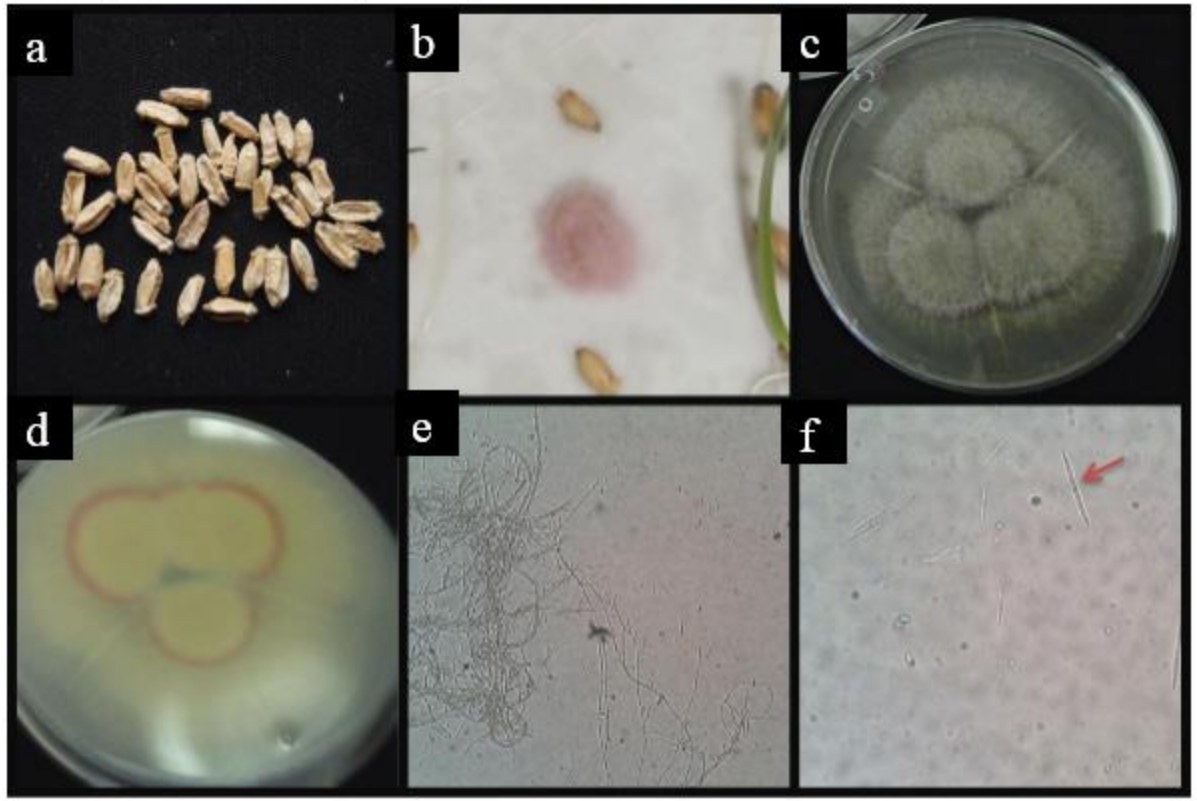


Figura 5. a) Síntoma de granos de trigo. b) Crecimiento de la colonia de *F. aveneceum* en los granos de trigo. c) Crecimiento de la colonia en PDA, micelio algodonoso. d) Superficie de la colonia en PDA. e) Micelio y macroconidios. f) Macroconidios rectos.

Moedano, 2013

El hongo *Gibberella zea* (***Fusarium graminearum*** **)**presenta una amplia gama de hospedantes. Las principales especies de interés económico susceptibles son: trigo, cebada, avena, centeno, maíz, trébol, alfalfa, batata, arroz, entre los más importantes

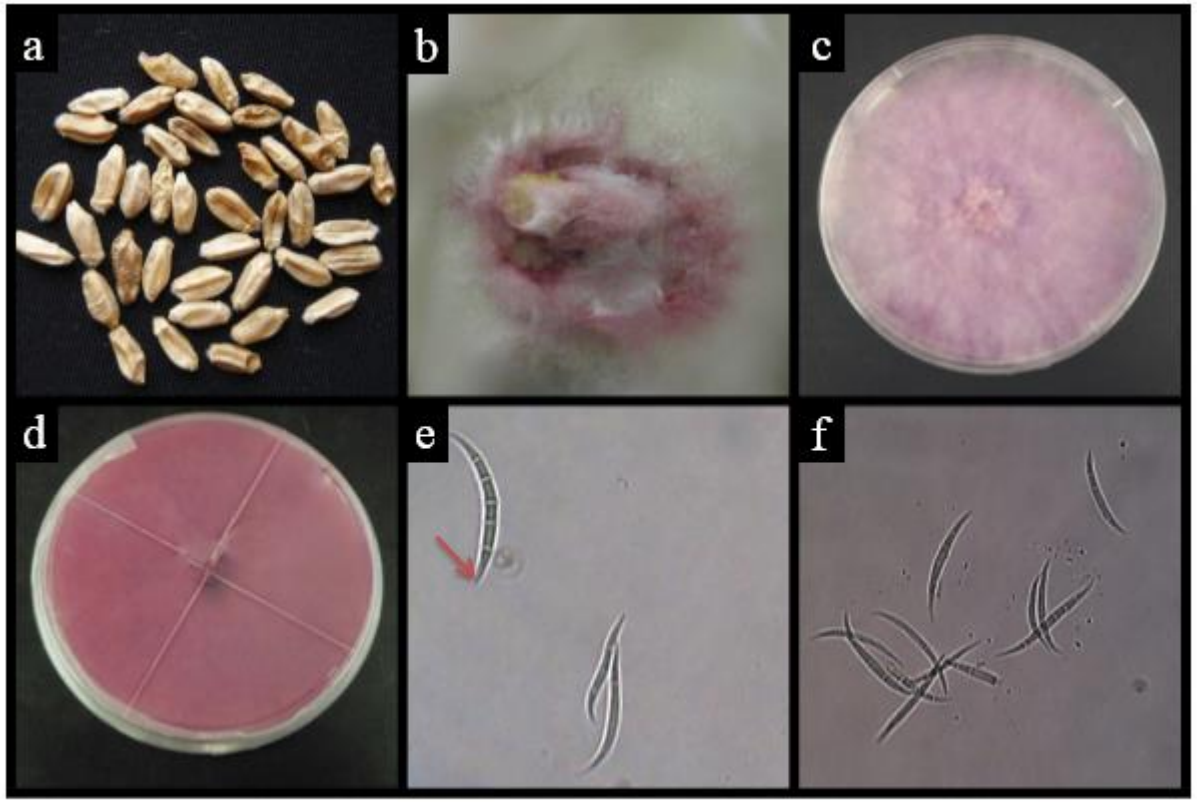
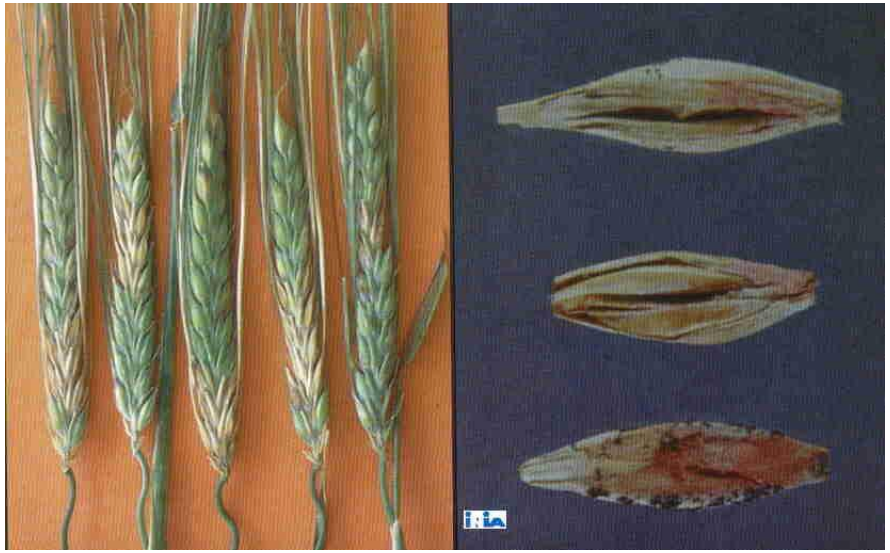


Figura 7. a) Síntomas de granos de trigo. b) desarrollo de la colonia de *F. graminearum* en de granos de trigo. c) crecimiento del micelio aereó de la colonia en PDA, micelio algodonoso rosaceo-violeta. d) superficie de la colonia en PDA. e) macroconidios, célula basal en forma de pie. f) macroconidios de varias formas y de 5-6 septos.

Moedano, 2013



▲ **1: Gibberella ear rot caused by the Fusarium graminearum species complex.** Photo: *https://www.pioneer.com/home/site/ca/agronomy/crop-management/corn-insect-disease/gibberella-ear-rot/*

▲ **2: The characteristic pink discolouration of root tissue infected by the Fusarium graminearum species complex.**

Fusarium oxysporum

Cuadro 2. Porcentaje promedio de hongos y pseudohongos aislados de plantas de fresa con síntomas de secadera en 16 localidades del Valle de Zamora, Michoacán, México. Ciclos 2002/03 y 2003/04.

Table 2. Average percentage of fungi and pseudofungi isolated from strawberry plants with symptoms of dry wilt in 16 localities of the Valley of Zamora, Michoacán, México. Seasons 2002/03 and 2003/04.

Localidades	Fox		Fso		Rhi		Cyl		Ver		Col		Phy		Pyt	
	R†	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C
Tamándaro	60¶	54	5	5	8	8	16	13	0	0	0	0	23	30	5	0
Jacona	43	40	0	0	6	8	25	5	1	0	0	0	7	25	10	8
Los Cerritos	44	70	1	5	12	20	23	5	5	0	0	0	0	0	2	0
Villafuerte	42	69	0	0	0	10	35	0	0	0	0	0	0	10	0	6
Ario de Rayón	70	76	4	0	2	16	8	3	0	0	0	0	23	10	6	10
El Llano	42	85	6	0	3	5	3	0	5	0	0	0	31	26	0	0
La Ladera	50	60	4	0	8	0	21	0	3	0	0	0	7	0	6	13
Ojo de agua	42	73	1	0	13	10	35	0	5	0	0	0	8	10	0	0
Atacheo	49	64	5	5	11	6	17	15	4	6	0	0	8	13	4	0
A. Serdán	55	73	0	5	23	13	13	10	0	0	0	0	0	22	12	5
R. de Torres	57	65	6	0	7	20	19	5	8	0	0	0	18	30	2	0
Zamora	66	100	5	0	11	0	7	0	3	0	5	0	18	0	2	0
Atecucario	59	90	5	0	5	10	13	0	3	0	0	0	0	0	18	23
La Rinconada	52	70	3	0	9	10	26	10	3	0	0	0	17	16	0	0
La Sauceda	54	80	8	0	0	0	20	20	0	0	0	0	3	0	3	0
E. de Amézcua	48	75	5	5	0	5	24	15	0	0	0	0	20	30	3	0
Promedio	52	71	4	2	7	9	21	6	3	0.4	0.3	0	11	14	5	4

†R= Aislamientos de raíz; C= aislamientos de corona.

¶Porcentajes calculados para hongos en PDA y pseudohongos (Phy y Pyt) en PARPH.

Fusarium solani/ jicama/ Santiago Ixcuintla Nayarit

Fusarium oxysporum/ Esparrago

Fusarium oxysporum/ sandía y melón

Fusarium oxysporum/ Zarzamora, Los Reyes Michoacán

SUELOS DE pH superior a 7.0/ (-) m.o

Phymatotricopsis omnivora

Verticillium dahliae

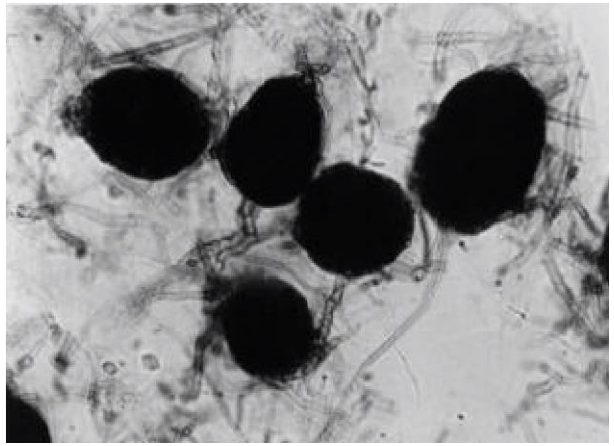
Macrophomina phaseolina

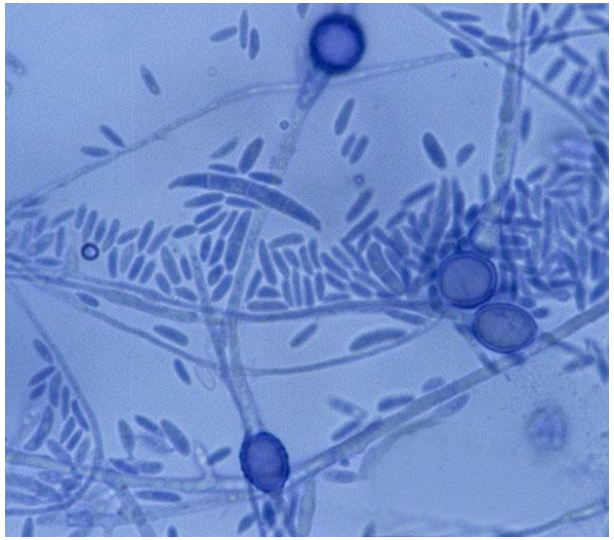
F. oxysporum

F. solani

Esclerocios

Clamidosporas





Phymatotricopsis omnivora

Macrophomina phaseolina/ soya, Tapachula Chiapas

Macrophomina phaseolina/ Fresa, San Quintin, BC

Botrytis cinnerea

Sclerotinia sclerotiorum

Sclerotium cepivorum

Sclerotium rolfsii

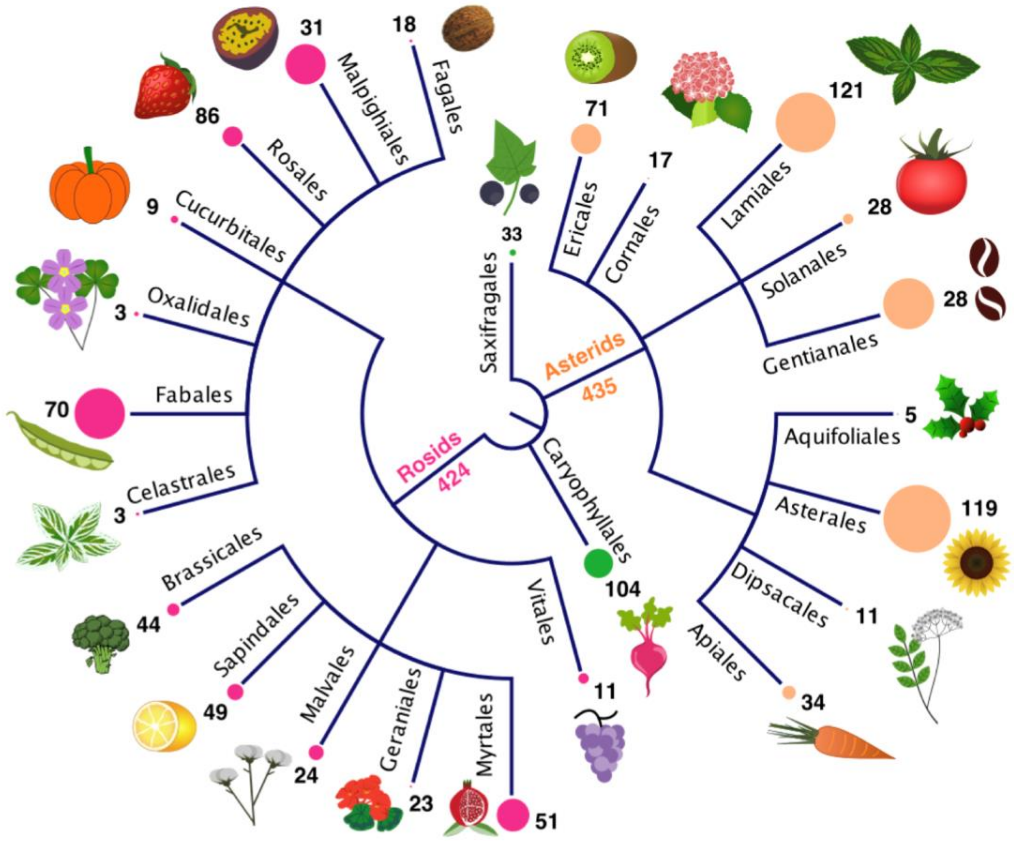


Fig. 1: Disease symptoms caused by *Botrytis cinerea observed on plants from* the core Eudicots. Plant species with disease symptoms were extracted from (Elad et al., 2016). The tree represents major orders from the basal Eudicots (in green), Asterids (in orange) and Rosids (in pink). The size of the circle at the end of the branches is proportional to the species diversity of the order. For each order, the number of species with known disease symptom is indicated.

doi.org/10.1101/507491

1400 especies / 596 género

Quantitative plant disease triangle

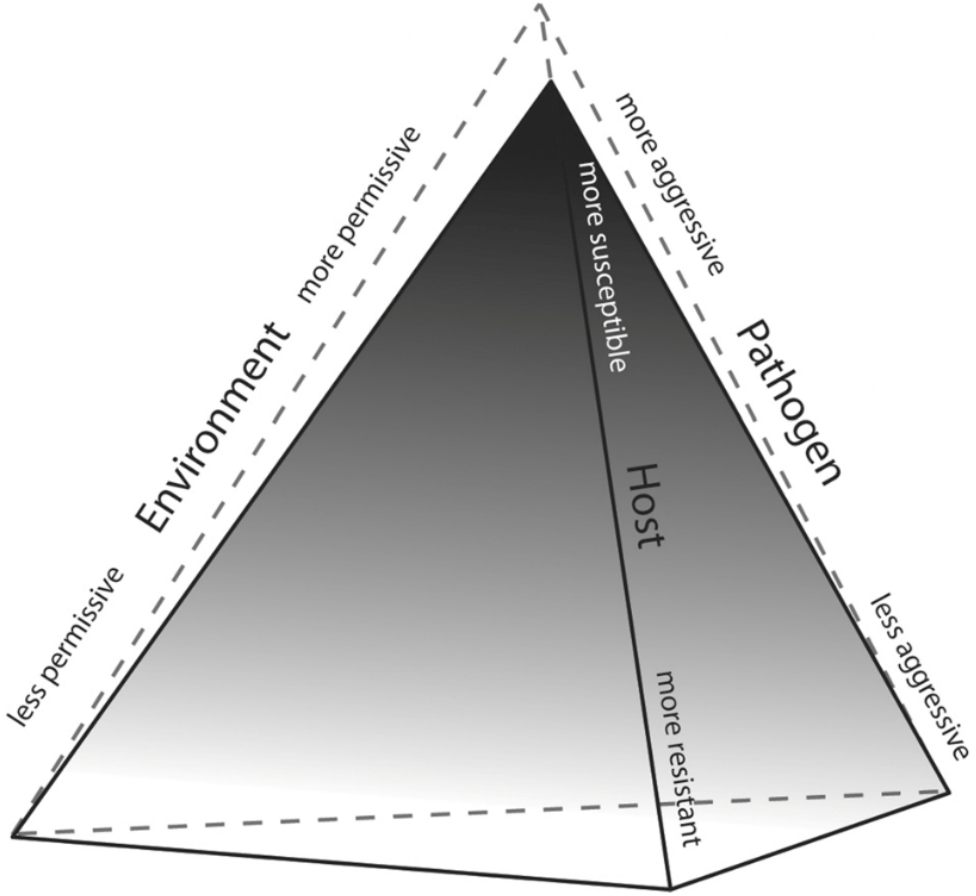


Fig. 2 Hypothetical, quantitative disease triangle in plant–pathogen interactions. The area within the dashed lines reflects potential parameter space in a hypothetical interaction. Solid lines (inner triangle) delineate the realized limits under which disease will develop, with the shading representing relative intensity resulting from interacting host, pathogen and environmental parameters. In this example the intensity of disease (i.e. pathogen growth) is high because of favourable environmental conditions and high pathogen growth and is limited only by the absence of completely susceptible hosts.

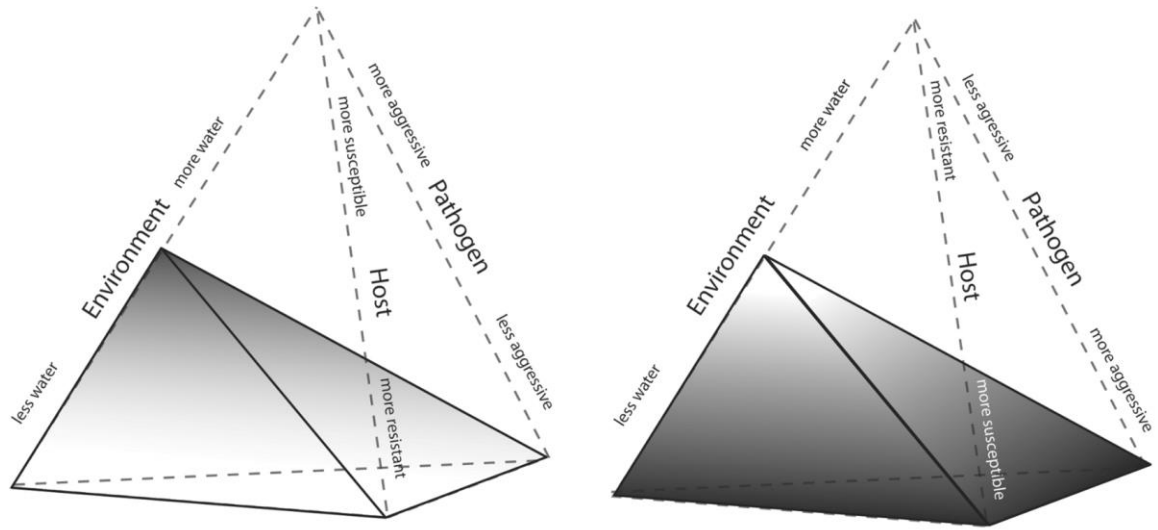
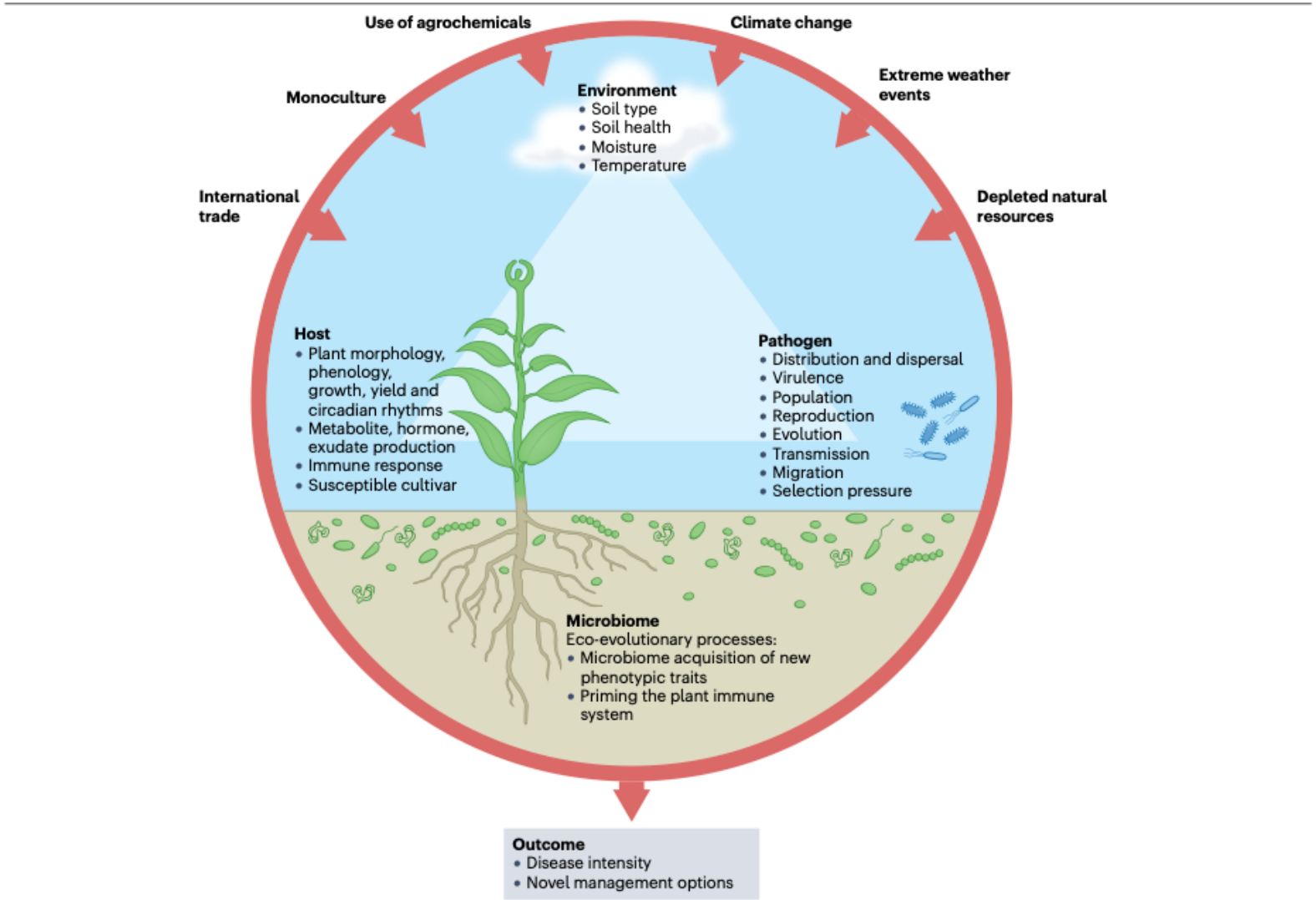
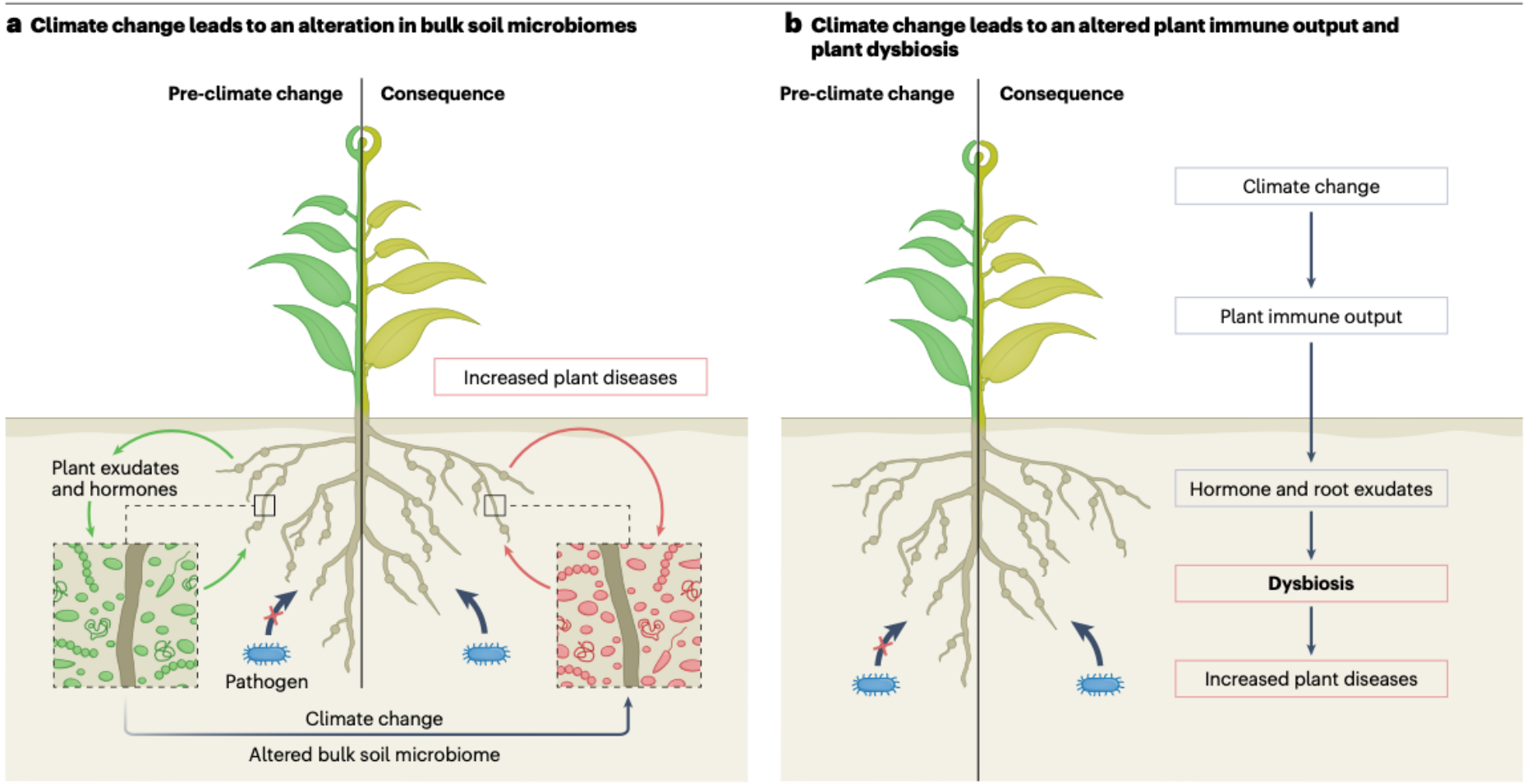


Fig. 3 Corresponding, hypothetical plant disease (a) and fitness (b) triangles in plant–pathogen interactions. In (a), the dashed lines represent the potential parameter space where a pathogen could grow. Solid lines (inner triangle) delineate realized limits under which disease will develop given limited water availability (in this example, 50% of maximum water availability is the limiting parameter). Shading represents the relative intensity of disease resulting from interacting host, pathogen and environmental parameters. In (b), the dashed lines represent the potential parameter space within which a pathogen could reduce plant fitness. Solid lines again reflect realized limits given limited water availability. Shading represents the relative reduction in plant fitness resulting from interacting host, pathogen and environmental parameters. In this example, fitness effects and pathogen growth have become partially uncoupled, so that pathogen growth is reduced in environments with less water, but fitness effects of infection are more severe as a result of the direct effects of water limitations on the plant, interacting with water loss caused by infection.

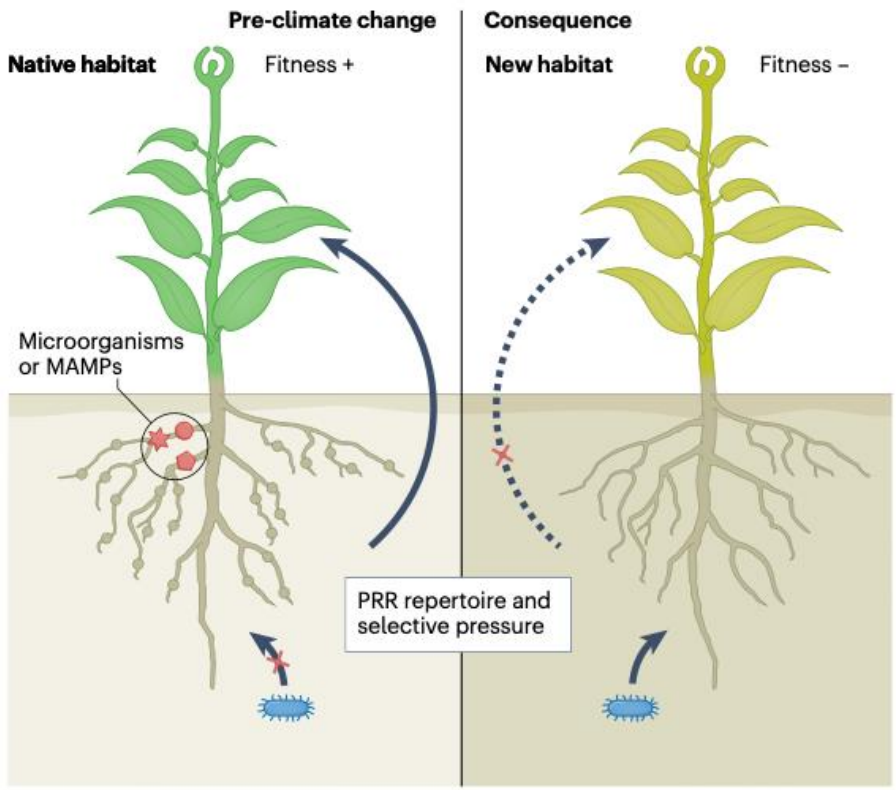
New Phytologist (2009) **183**: 513–529
doi: 10.1111/j.1469-8137.2009.02927.x



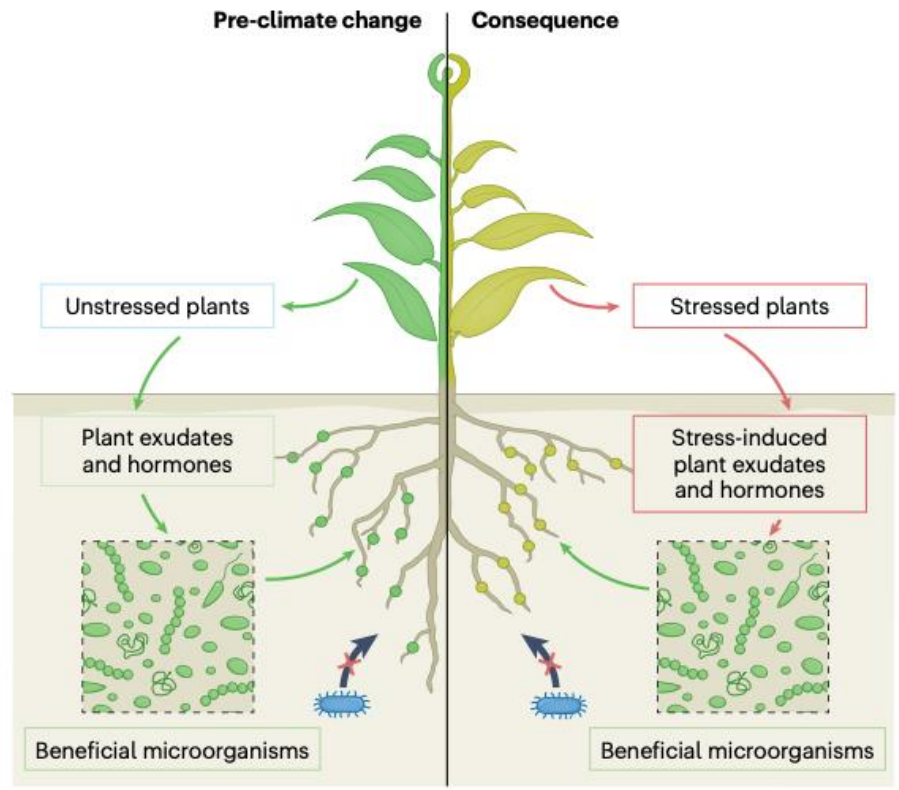
https://doi.org/10.1038/s41579-023-00900-7

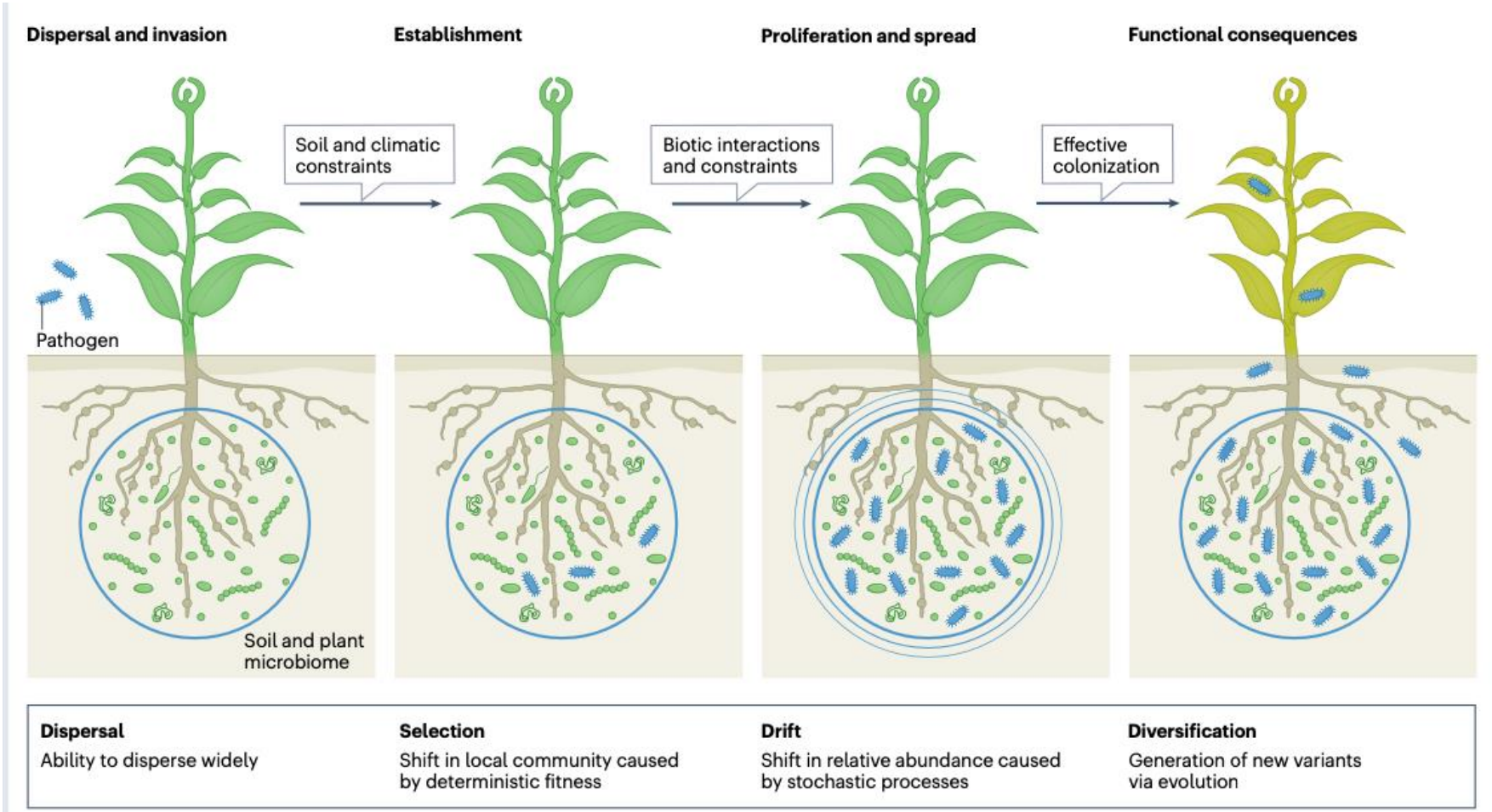

a Climate change leads to an alteration in bulk soil microbiomes
Pre-climate change
Consequence
Increased plant diseases
Plant exudates and hormones
Pathogen
Climate change
Altered bulk soil microbiome
b Climate change leads to an altered plant immune output and plant dysbiosis
Pre-climate change
Consequence
Climate change
Plant immune output
Hormone and root exudates
Dysbiosis
Increased plant diseases

c Climate change leads to plant migration and impacts the associated plant microbiome

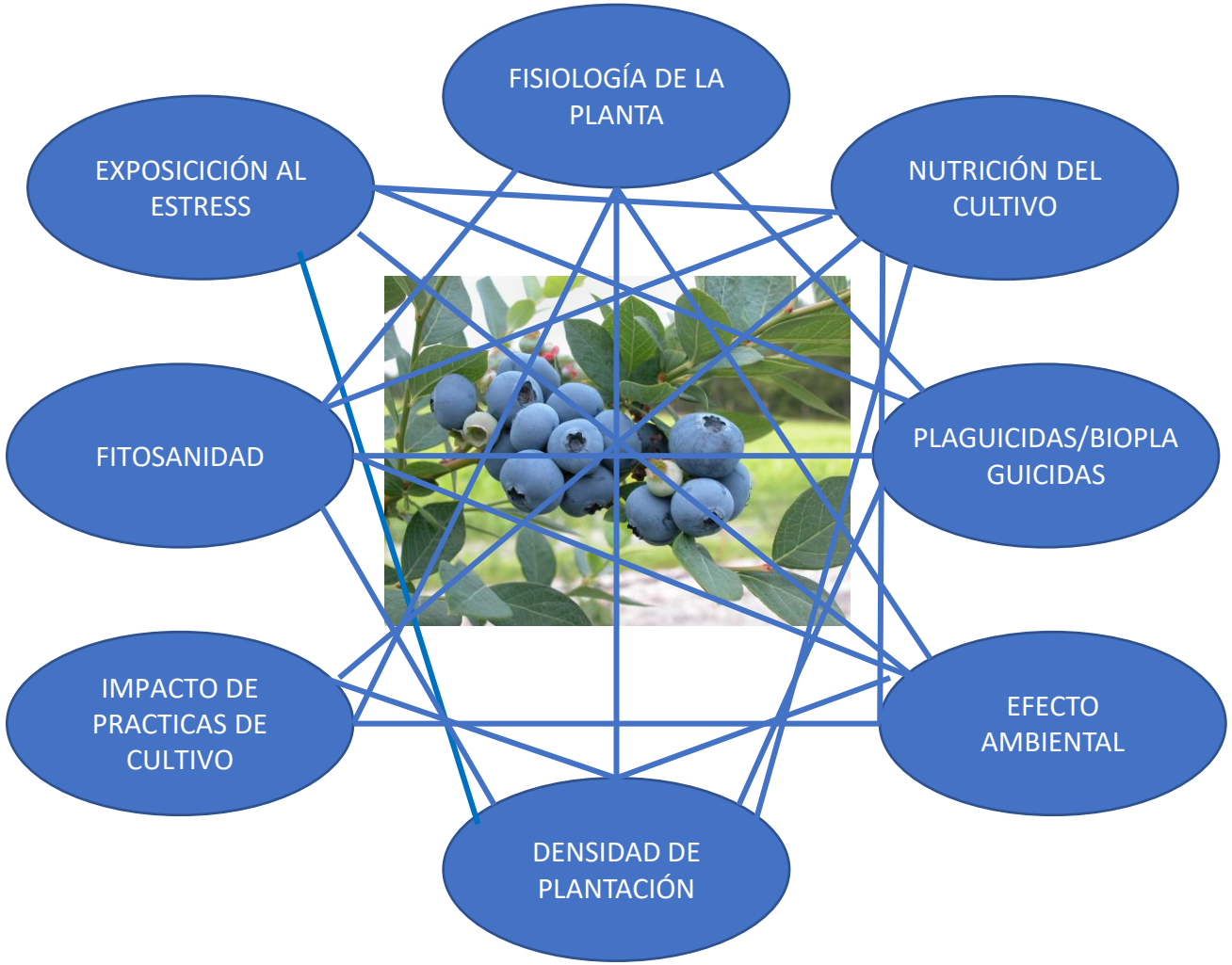


d Climate change impacts the 'cry for help' strategy of plants

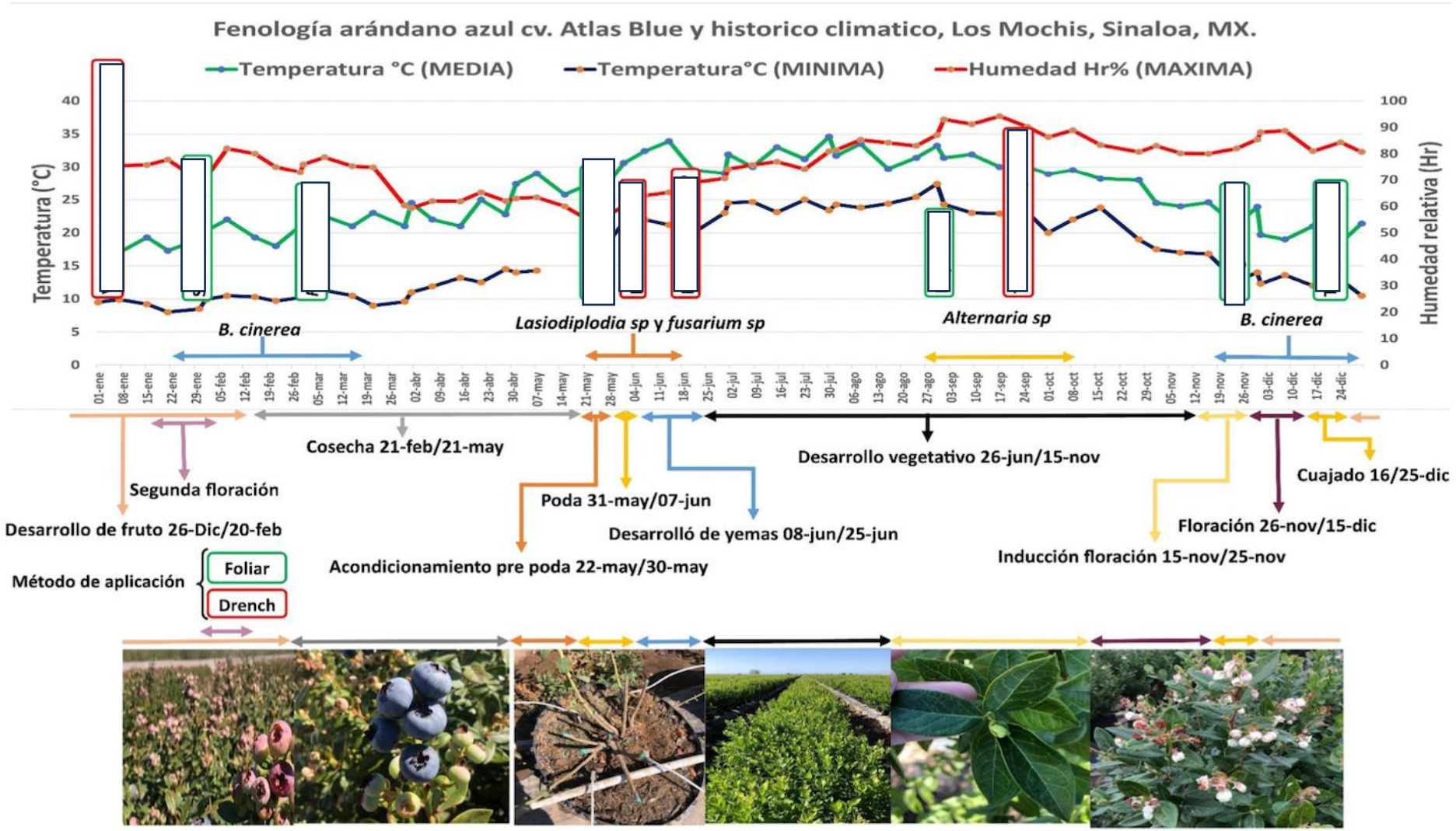



Dispersal and invasion
Establishment
Proliferation and spread
Functional consequences
Soil and climatic constraints
Biotic interactions and constraints
Effective colonization
Pathogen
Soil and plant microbiome
Dispersal
Ability to disperse widely
Selection
Shift in local community caused by deterministic fitness
Drift
Shift in relative abundance caused by stochastic processes
Diversification
Generation of new variants via evolution

AGROECOSISTEMA



Fenología, histórico del clima (2017-2022) y presencia de patógenos a través del tiempo.



Desarrollo fenológico arándano azul cv. Atlas Blue (Hidroponía) , Los Mochis, Sinaloa, MX. Temporada 2021-2022

Días de poda a producción: 190-200

Zavala-García, M. de J., 2023

San Vicente, BC. México
¡GRACIAS POR LA INVITACIÓN!