QUIESENCE OF POSTHARVEST PATHOGENS:

A FUNGAL INHIBITION PROCESS OR

AN IMMUNE RESPONSE OF THE UNRIPE HOST FRUIT?

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Postharvest fungal infections

Are initiated before, during, or after harvest, but often remain dormant in a quiescent stage until fruit ripening and senescence

Different from pathogens that show a full cycle in the developing plant

Ustilago tritici

Ustilago maydis

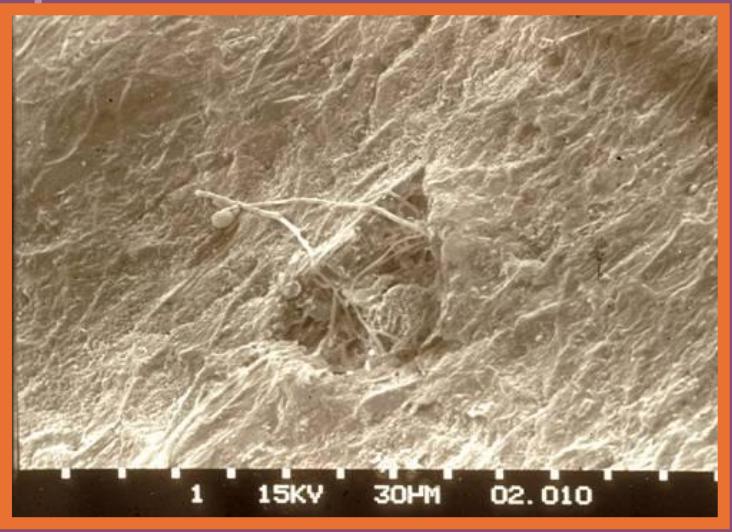
Postharvest pathogens infect fruits and vegetables through two main mechanisms:

Direct penetration Colletotrichum

Postharvest pathogens infect fruits and vegetables through two main mechanisms:

Wound penetration in Alternaria

a. Lenticel penetration



b. Initial symptoms

Postharvest pathogens infect fruits and vegetables through two main mechanisms:

Wound penetration in Monilinia

During fruit development until harvest conditions, the infections remain quiescent

Symptoms usually are not visible until prolonged cold storage or during shelf life, just before consumption

Symptoms usually become visible only after fruit maturation, with prolonged cold storage or during shelf life, just before consumption

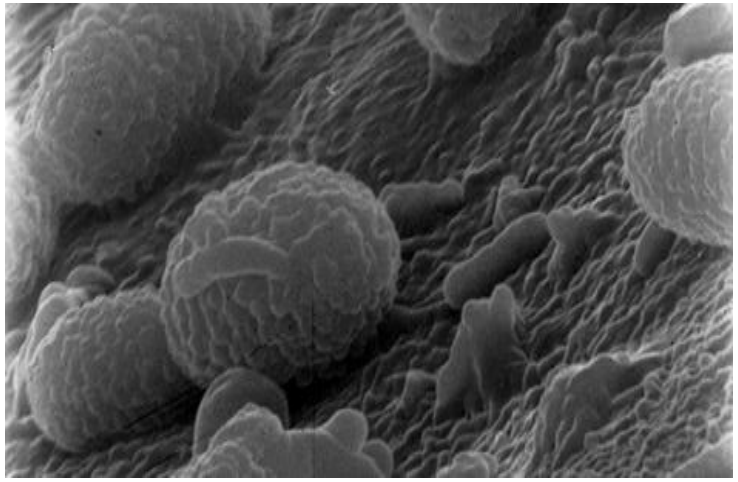
Colletotrichum

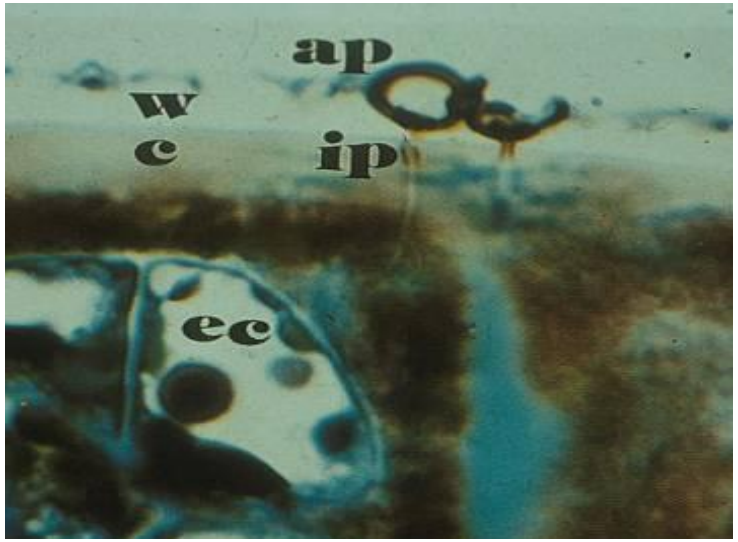
Botrytis

Monilinia

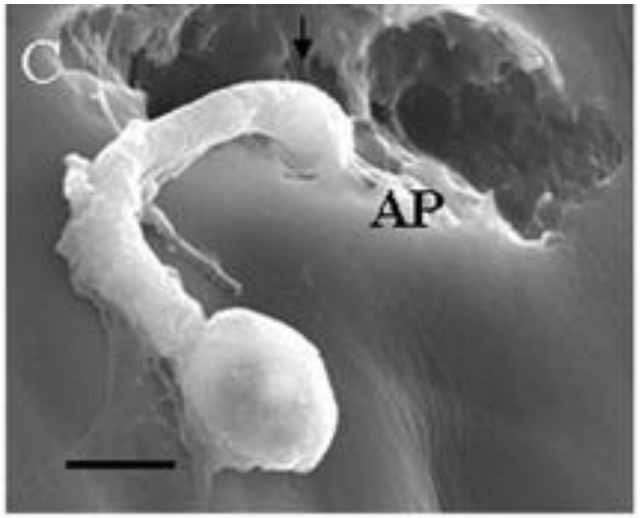
Infection mechanisms of postharvest pathogens that become quiescent

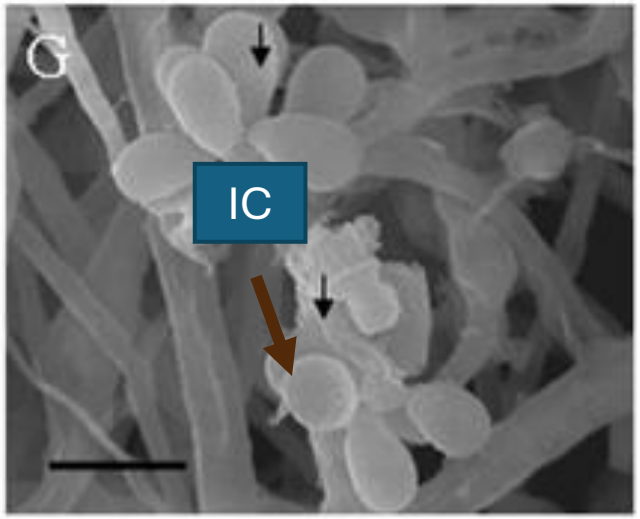
Colletotrichum



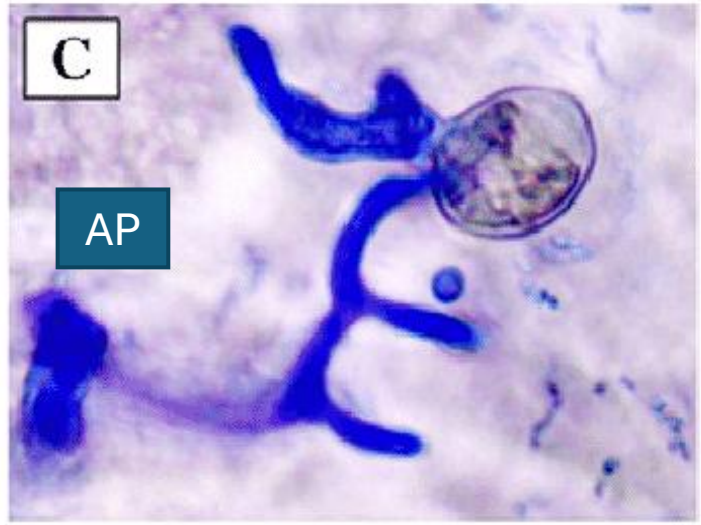


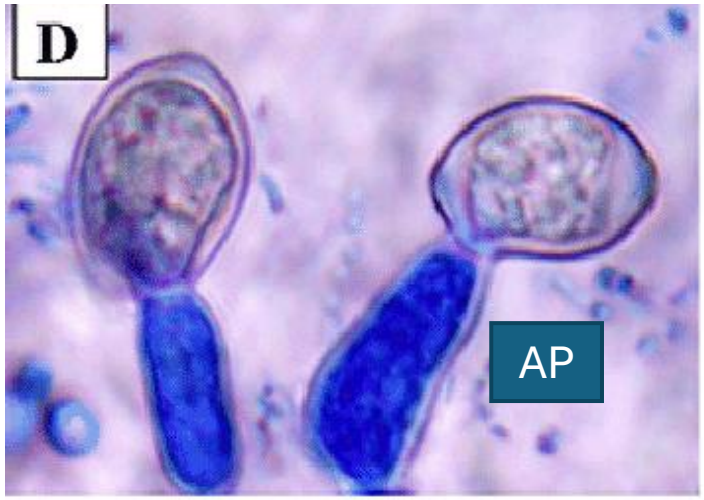
Botrytis





Monilinia



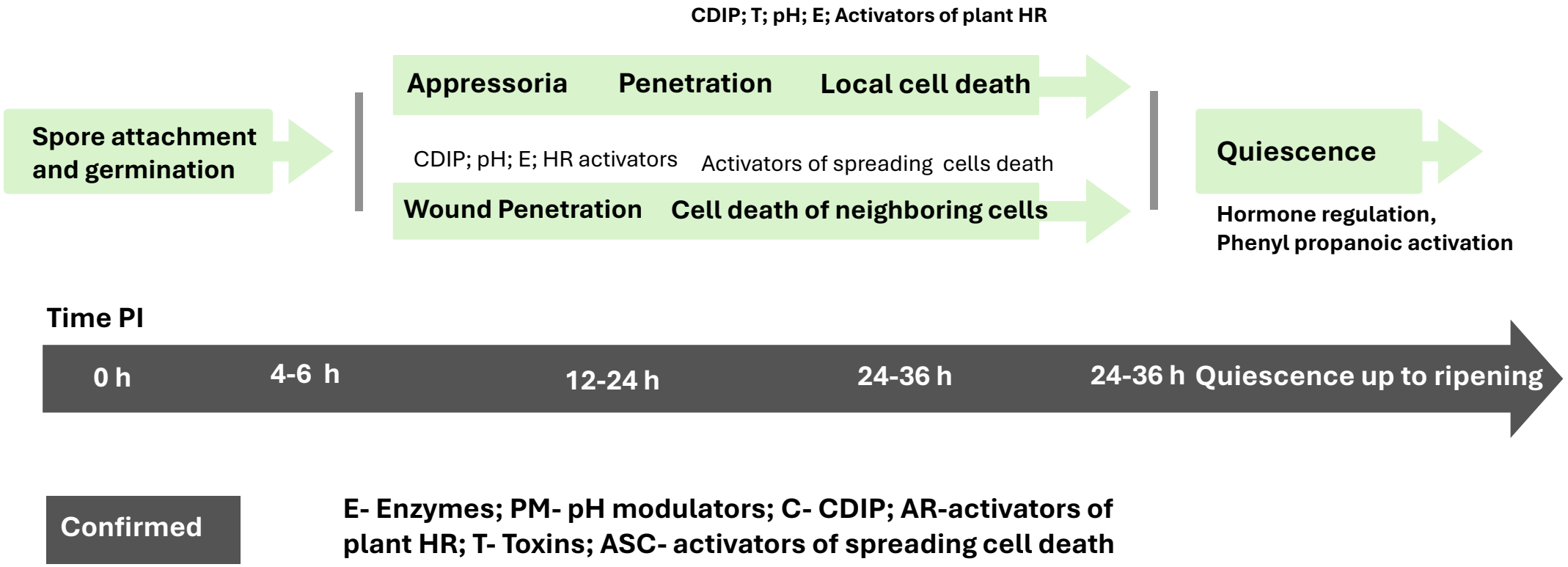


The road map of the infection of Botrytis in leaves until the first line of defense in plants, (**P**attern-**T**riggered **I**mmunity, PTI), which imparts a baseline level of disease resistance during the first 48 h after infection, includes:

Confirmed processes:

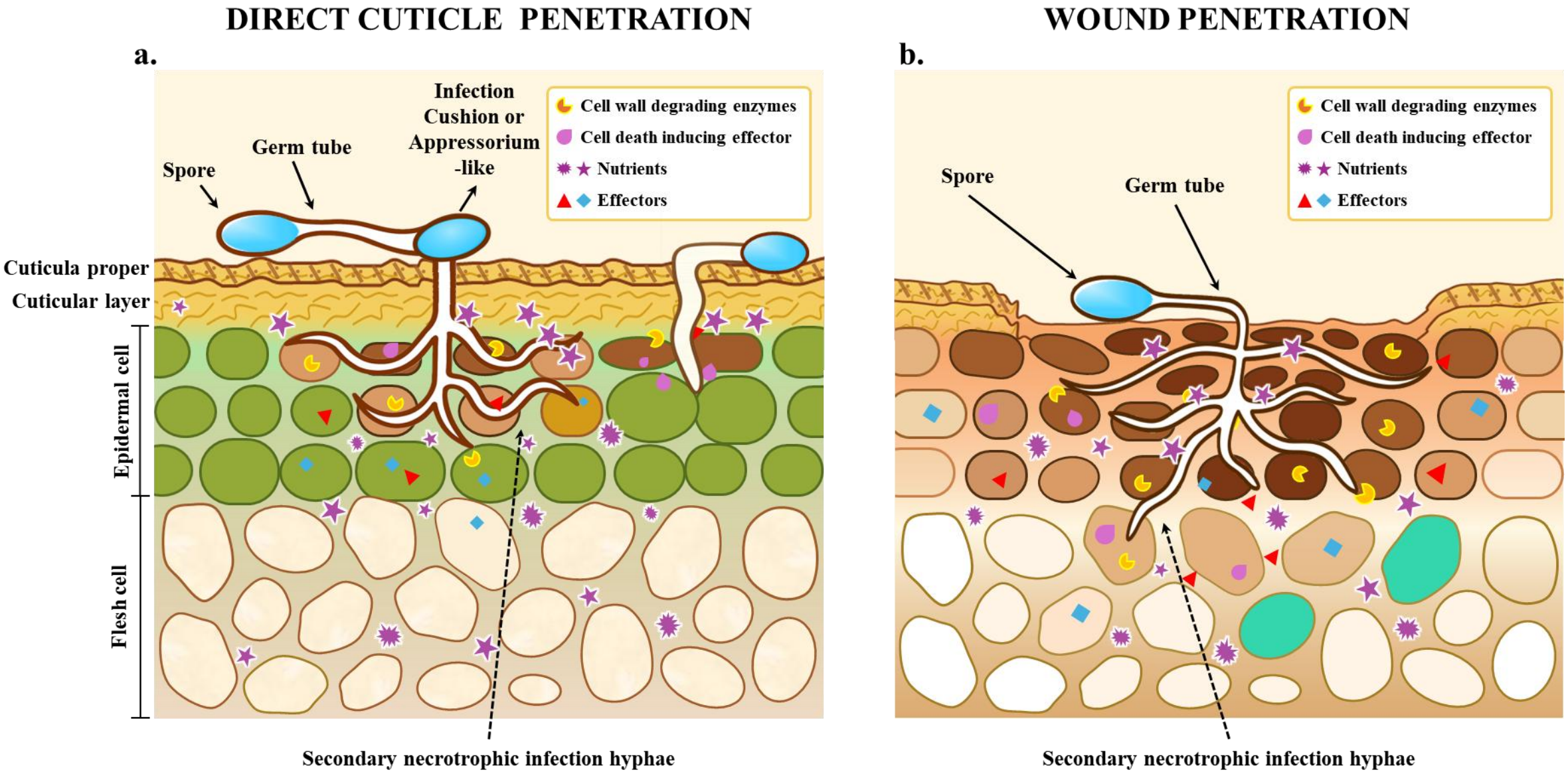
C-Cell death-inducing proteins (CDIPs)
E-Enzymes
T- toxins,
PM- pH modulators,
AR- activators of plant HR
ASC-activators of spreading cell death
SAR-Suppressors of autophagy

A series of processes during the early quiescence of Botrytis in strawberries and grapes



Petrarch et al., 2019;. Govrin et al., 2006; Curvers et al., 2010; Haile et al., 2017; Keller et al., 2003

Quiescence of Botrytis cinerea with a very short biotrophic stage



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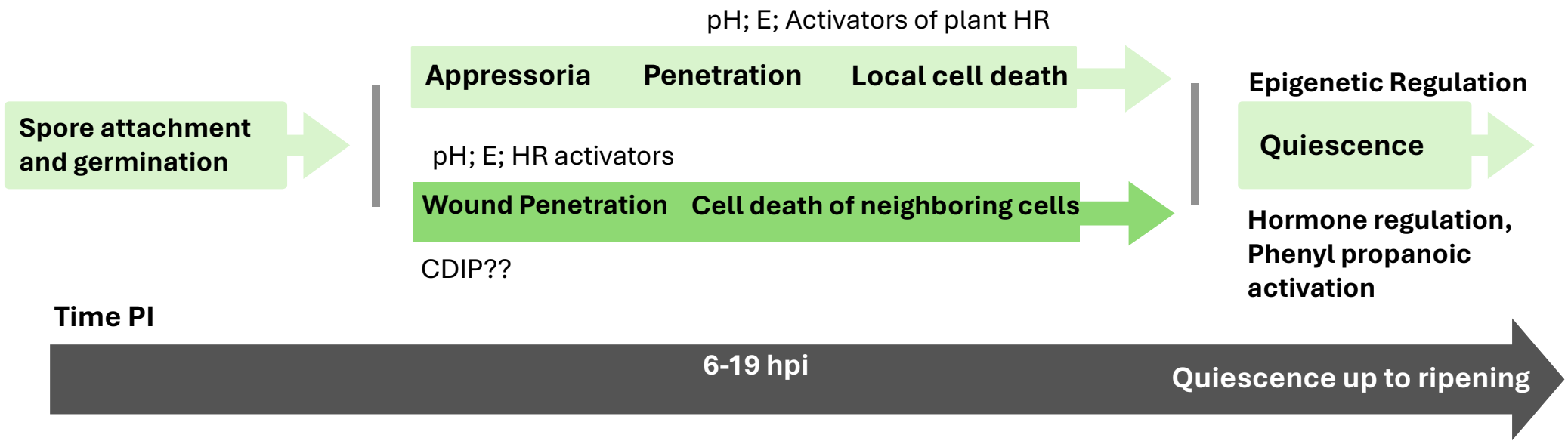
A series of processes during early quiescence in Colletotrichum



Confirmed

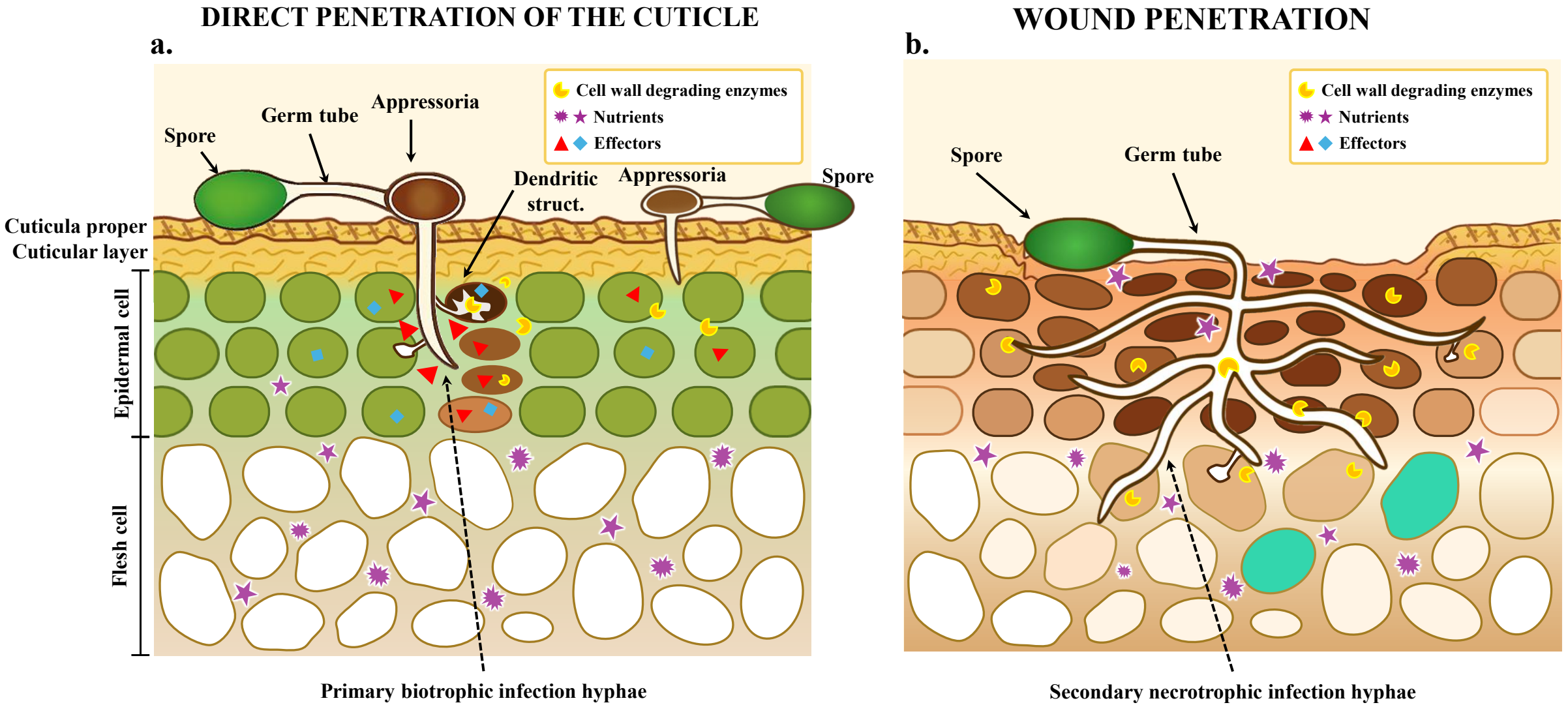
Most likely

E- Enzymes; PM- pH modulators; AR- activators of plant HR;

C-Cell Death-Inducing Proteins

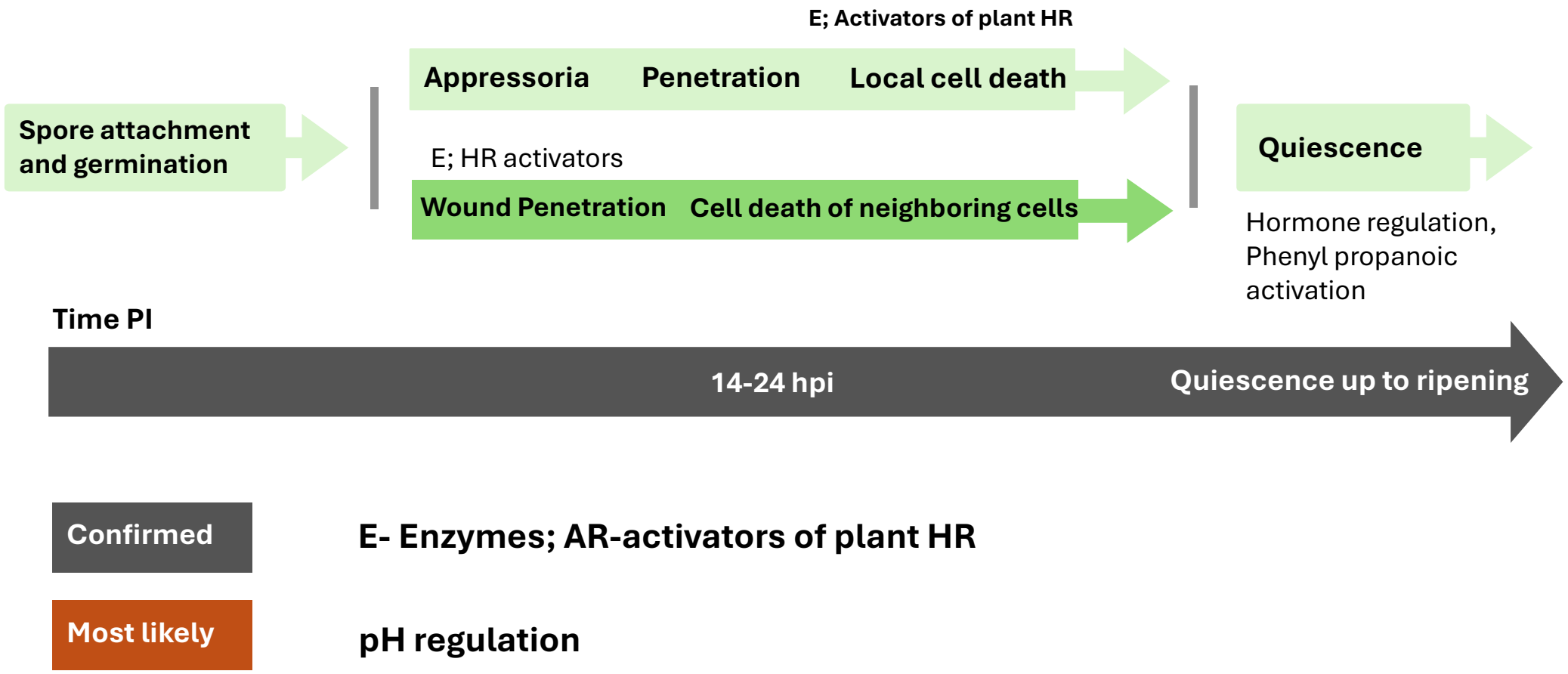
Alkan et al,. 2014

Quiescence of Colletotrichum a pathogen with long biotrophic stage



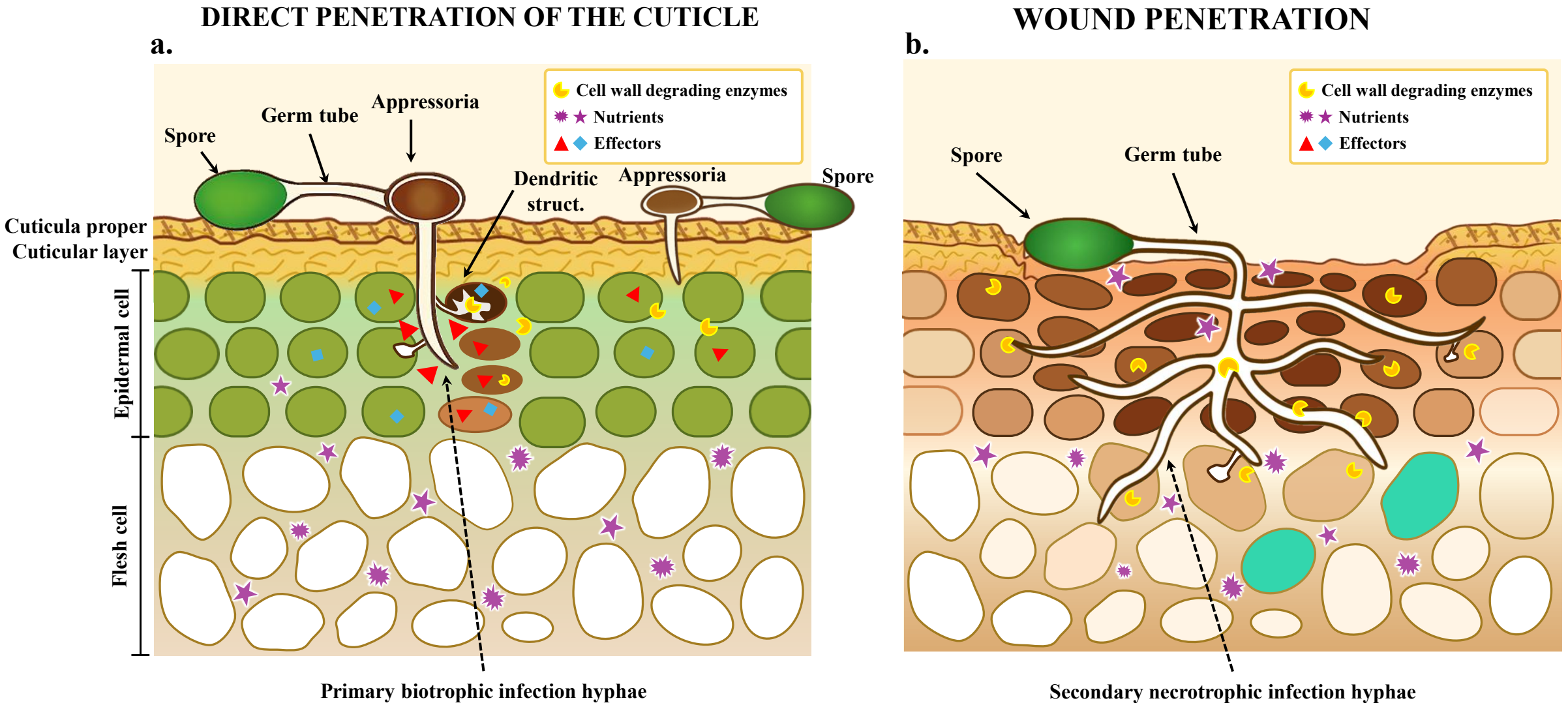
Alkan et al,. 2014

A series of processes during early quiescence in Monilinia



Balsells-Llauradó et al., 2020; 2022a, b

Quiescence of Monilinia a pathogen with a short biotrophic stage



(Balsells-Llauradó et al., 2020; 2022a, b).

In summary:

Postharvest pathogens first detect the host and then regulate diverse metabolic processes to:

(i) Develop penetration structures
(ii) Identify optimal entry sites
(iii) Equip these structures with cutinase and lipases to breach the host cuticle, ensuring successful quiescence
(iv) Inhibition of fungal colonization and host immunity until fruit ripening.

In conclusion

- These findings suggest that fruit immunity during quiescence is characterized by a rapid and synergistic interacting-processes, not all of which are described.

- They are differentially regulated across host species and developmental stages, including fruit maturity and ripening.

- This coordinated regulation enhances disease resistance and initiates a cascade of downstream defense responses, leading to fruit decay

Therefore, understanding this host-pathogen mechanism during quiescence

and its activation proves critical for the prevention of fruit decay throughout postharvest storage life

Quiescence of Postharvest Pathogens: A Fungal Inhibition Process or an Immune Response of the Unripe Host Fruit?

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