



PHYSIOLOGY OF FRUIT TREES

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BUD, FLOWER AND FRUITLET ABSCISSION

Abcindere (In English: to tear)

Abscission is a process that initiates the removal of a part of plant (Leaf, Bud, Flower, Fruit)

Self Regulatory Mechanism

- Low and often unacceptable fruit market quality
- Inhibition of flower bud induction, causing severe alternate bearing



—————> Fruit Thinning

Current ideas about the abscission of young fruits:

Insufficient supply of assimilate to fruitlet as a result of limited assimilate production and/or allocation to the fruit

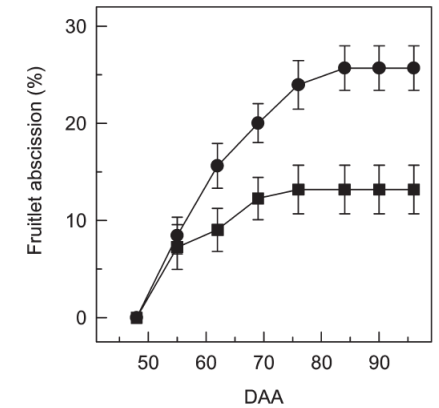
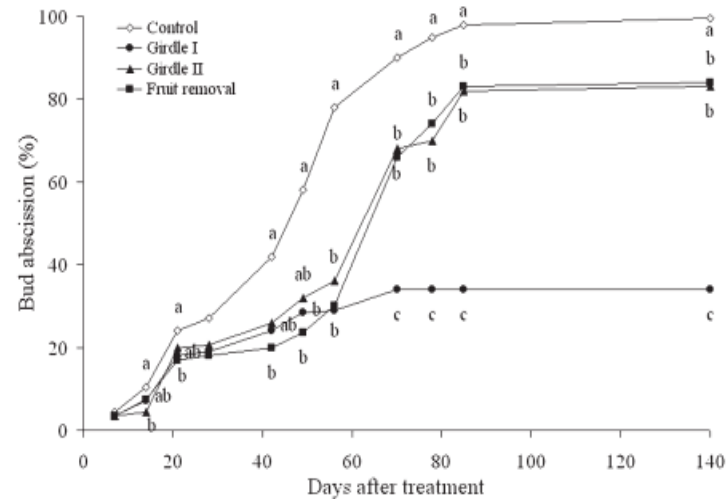
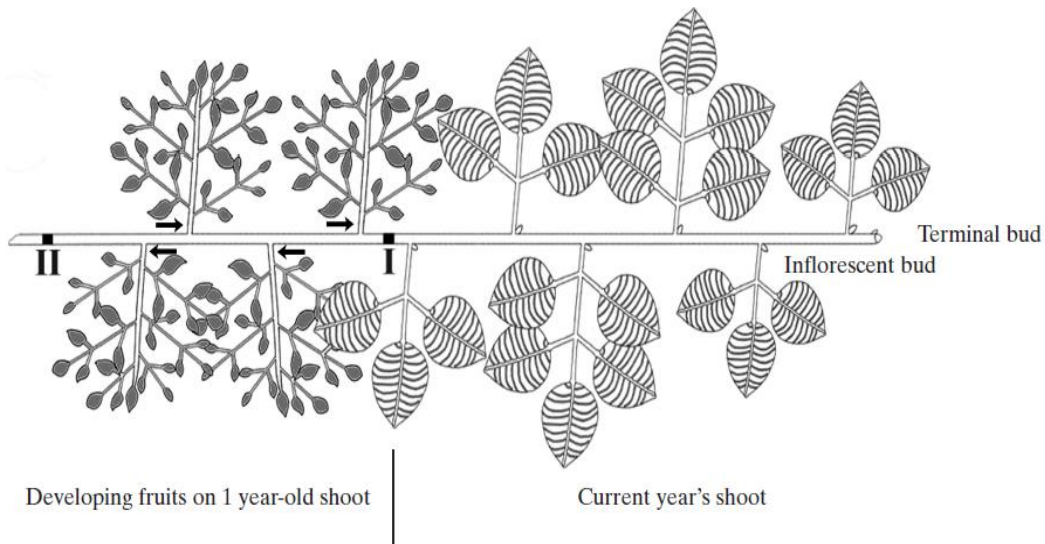


Figure 1. Effect of sucrose on fruitlet abscission in cv. Okitsu trees. The sucrose treatment started at 30 days before anthesis (-30 DAA) and consisted of continuous injections of 292 mM sucrose. After the June drop, each tree had absorbed a minimum of 30 g of sucrose. The experiment was repeated in four consecutive seasons with similar results. Data are means ($n \geq 5$ trees with at least 100 tagged fruitlets per tree) \pm SE. Symbols: \bullet = control; and \blacksquare = sucrose.

A regulatory hormonal mechanism (Auxin, Ethylene)

ABSCISSION ZONE (LAYER)

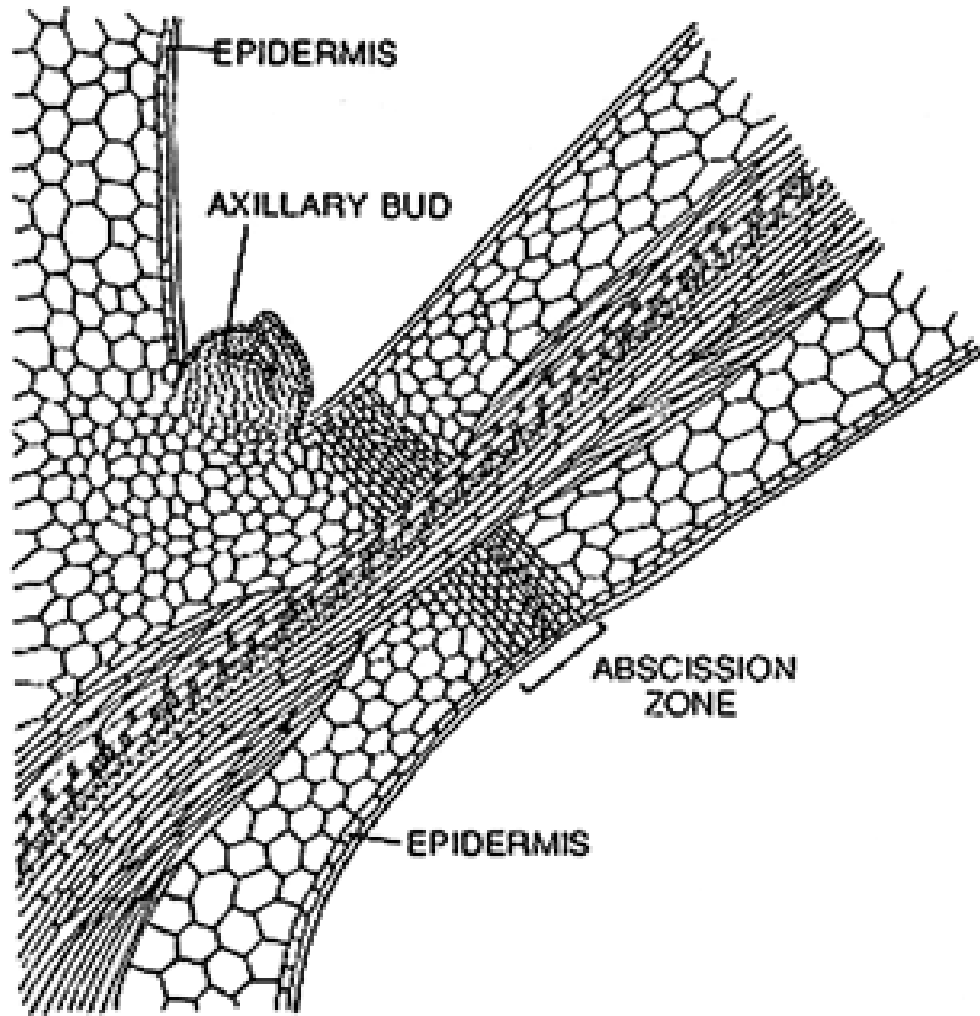
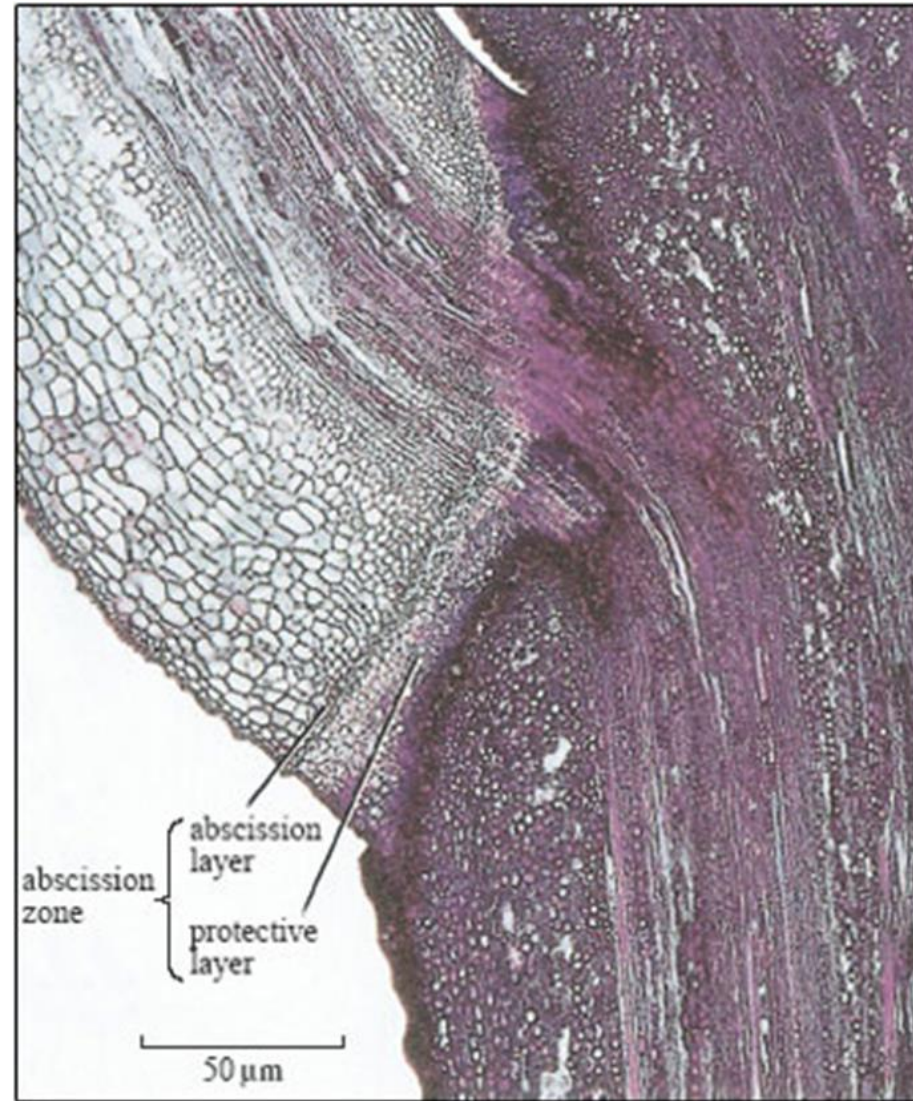
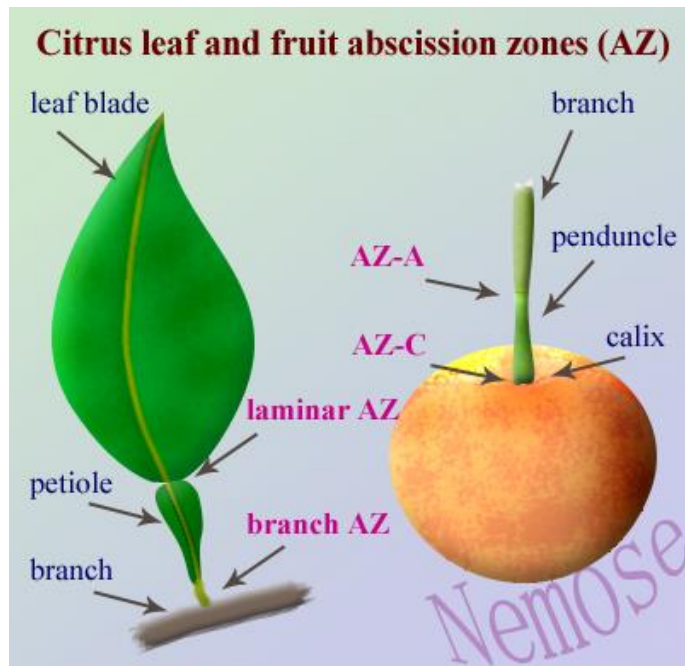
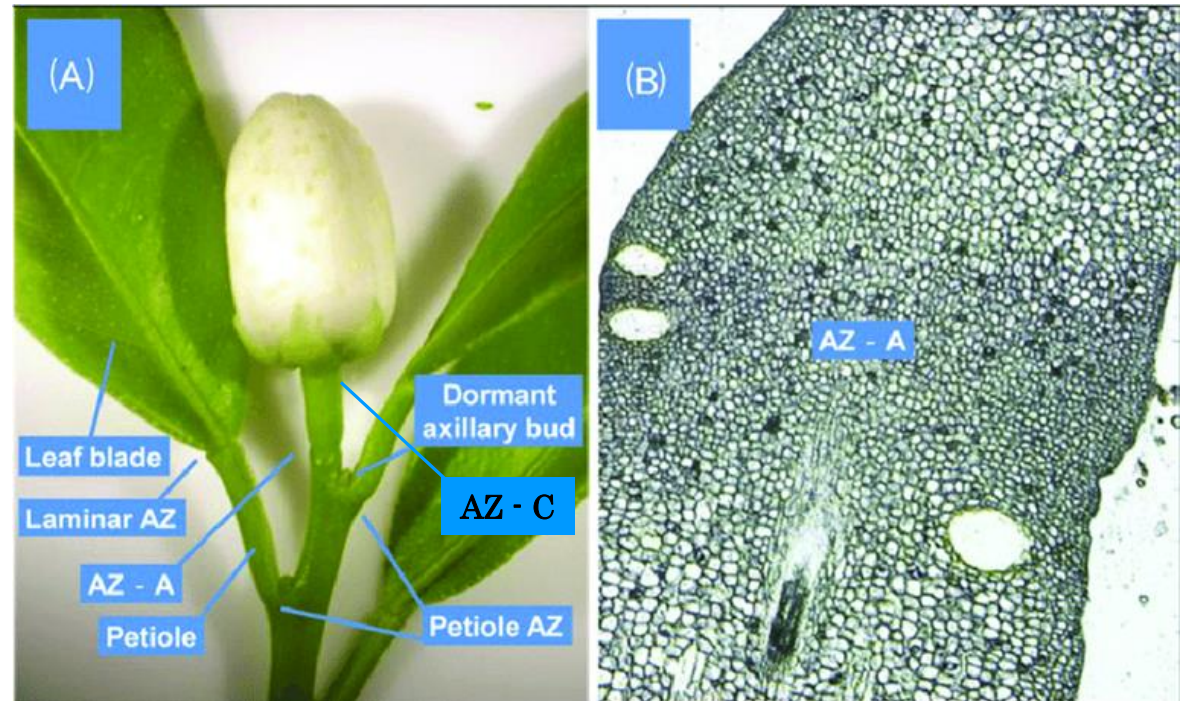


Fig. 6.10. Leaf abscission. Formation of abscission zone.



Abscission Zone in Citrus Fruit



R. Xie et al.

Plant Physiology and Biochemistry 130 (2018) 192–204

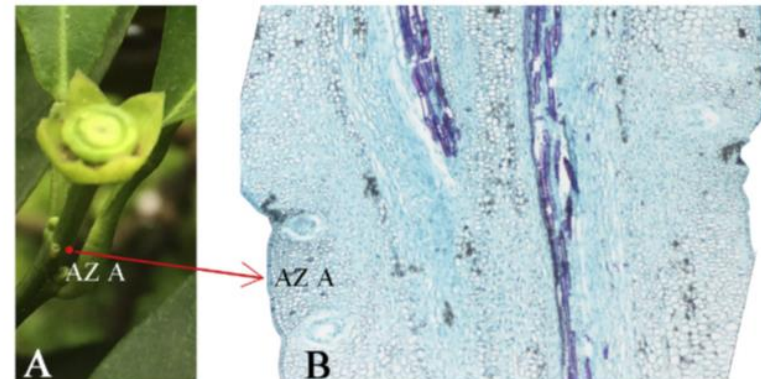


Fig. 1. (A) Citrus calyx after ovary removed and the red solid dot indicates AZ A. (B) Fruit abscission zone A (AZ A) of 'Cara Cara' fruitlet and the arrowhead points at AZ A. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Process of Abscission

1- The stimulus stage

- Natural senescence
- External factors (Heat, Low light, Drought, Mineral deficiency, Mechanical injury, Hormonal treatment)



Decrease auxin level in the AZ
Degeneration of proteins and chlorophyll
Increase ethylene production

PROCESS OF ABSCISSION

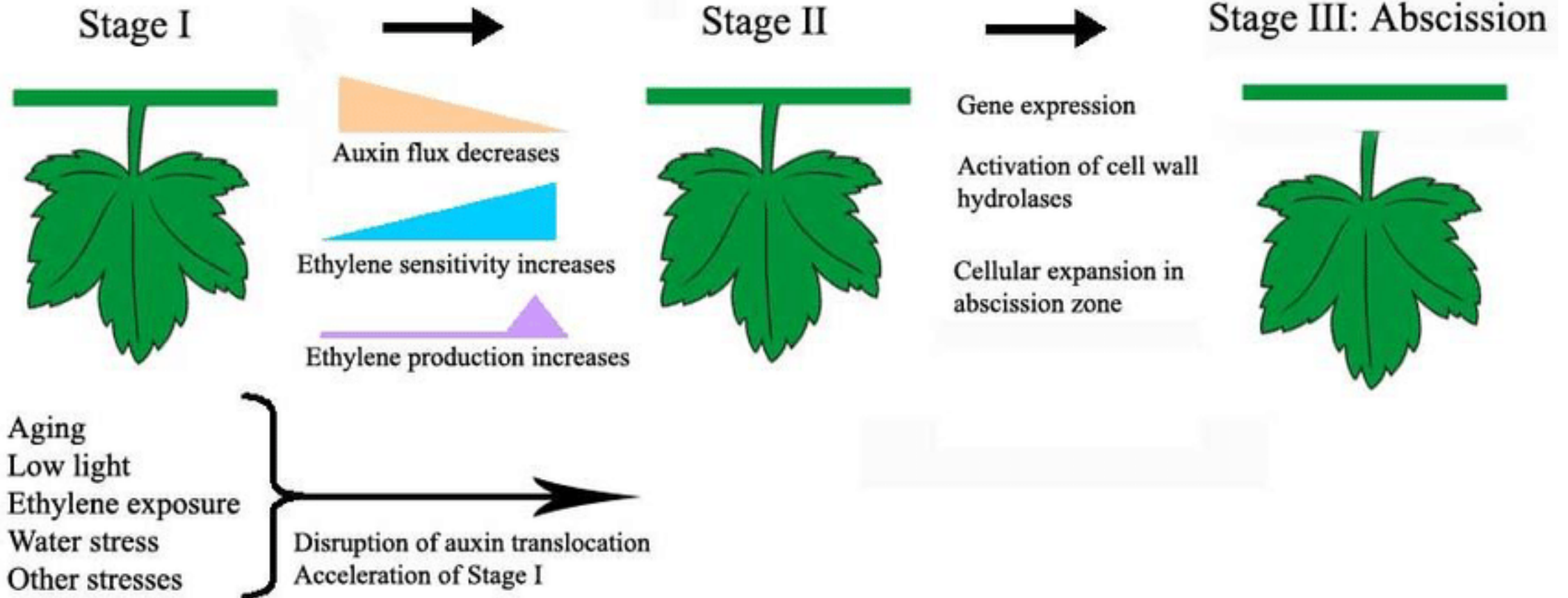
2- The signal stage

- Gene expression and synthesis of specific proteins
- Degeneration of the cell wall and middle lamella by enzyme activity
- Increase ethylene production in AZ
- Decrease in the level of endogenous auxin
- Greater sensitive to ethylene in the cells of the AZ

3- The response stage

- Abscission

Process of Abscission



STRUCTURAL CHANGES IN THE ABSCISSION ZONE

- Cell Division
- Cell Enlargement
- Cell Separation

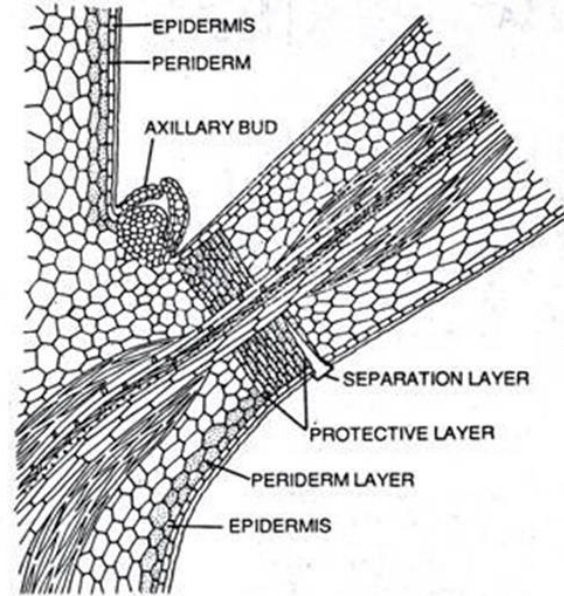
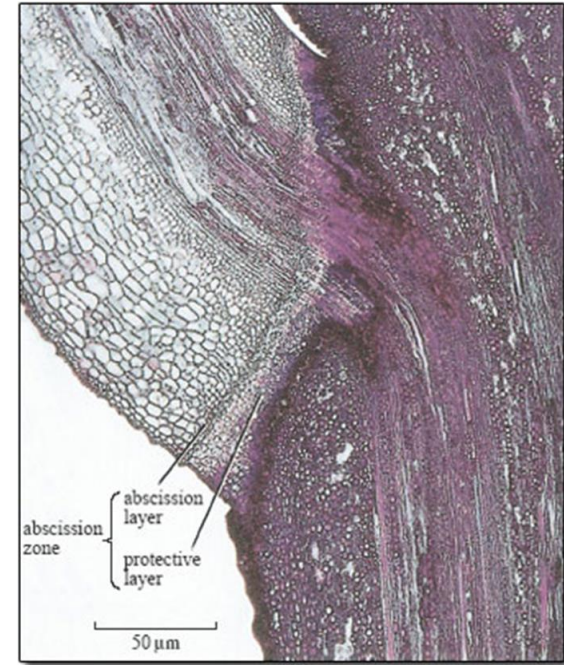
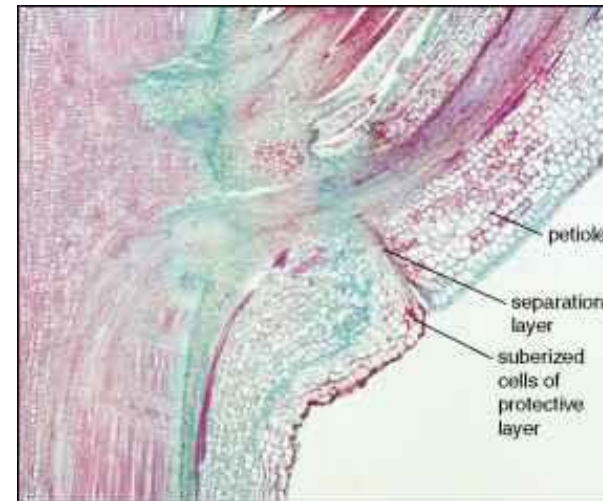


Fig. 41.45. Leaf abscission. Separation within the abscission zone and initiation of periderm.



Initiation of separation (Centrifugal, Centripetal)
Development of the protective zone



THE ROLE OF ENZYMES IN THE ABSCISSION

- Polygalateronase (Pectin Hydrolase) : An enzyme that hydrolyzes the galacturonic acid (Pectin consists of a chain of galacturonic acid units)
- Cellulase: Break down the cellulose molecule into monosaccharides
- Peroxidase: Control of auxin (IAA) level
- Dehydrogenase: Enhance respiration
- Acid Phosphatase: Changes in permeability of cell membrane in AZ
- Uronic Acid Oxidase (UAO): Polygalateronase Activity, Ethylene ↑, Auxin ↓

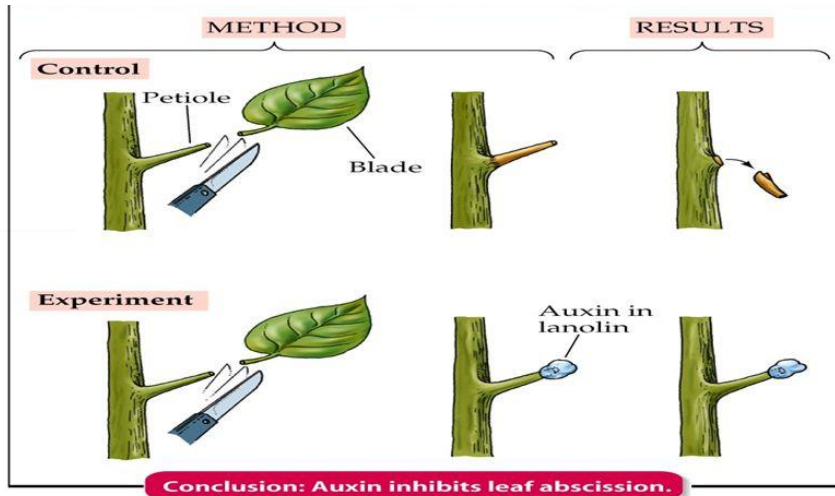
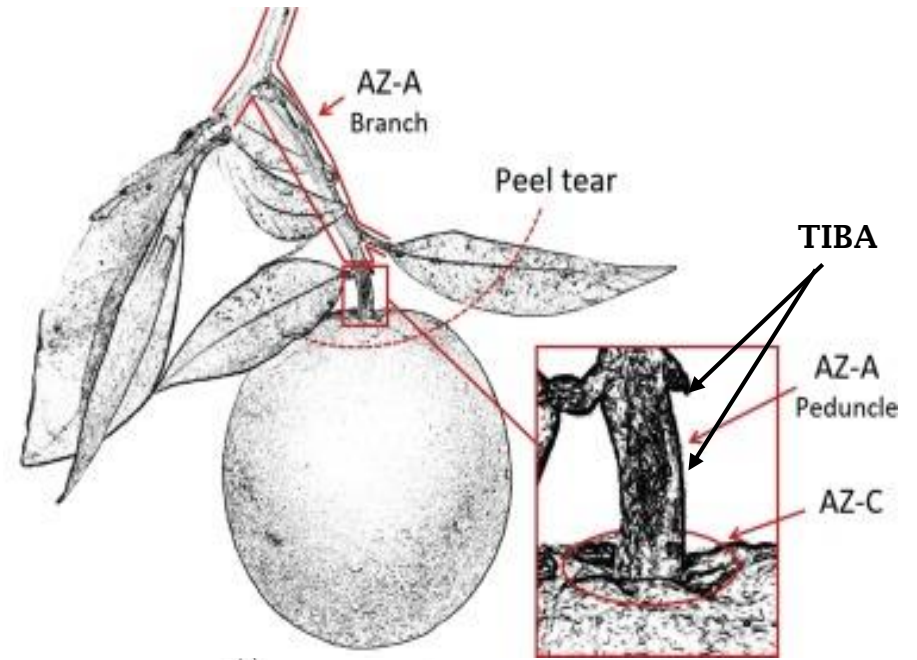


HORMONAL CONTROL IN THE ABSCISSION PROCESS

- Ethylene
 - Increase ethylene level in organ before abscission
 - Exogenously applied ethylene promote abscission
 - Silver ion (as inhibitor of ethylene activity) reduced abscission
- Auxin (Dual effect depending on the concentration and time application)
 - Postpones abscission at the first stage of the process, when ethylene is still unable to promote abscission
 - Enhances abscission at the second stage of the process by promoting ethylene production



Erwinia amylovora (ERWIAM) - <https://gd.eppo.int>



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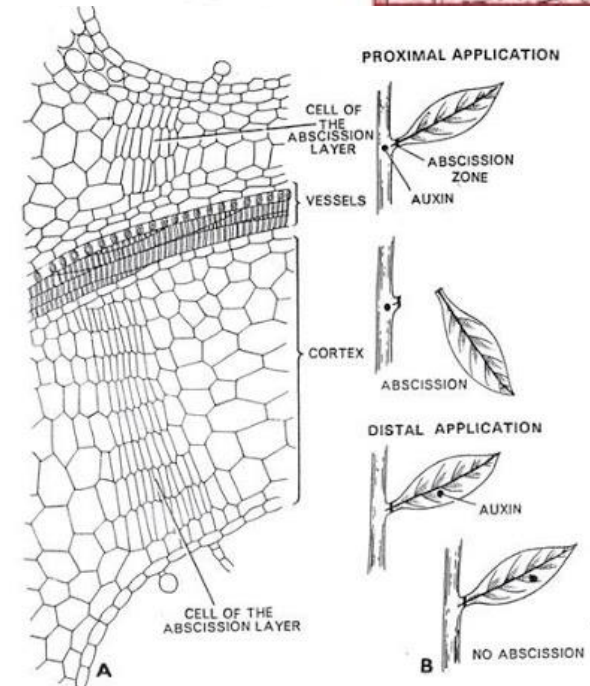


Fig. 17.42. A. L.S. of the petiolar base of a leaf showing abscission layer. B. Effect of proximal and distal application of auxin at the abscission zone on abscission of leaves.

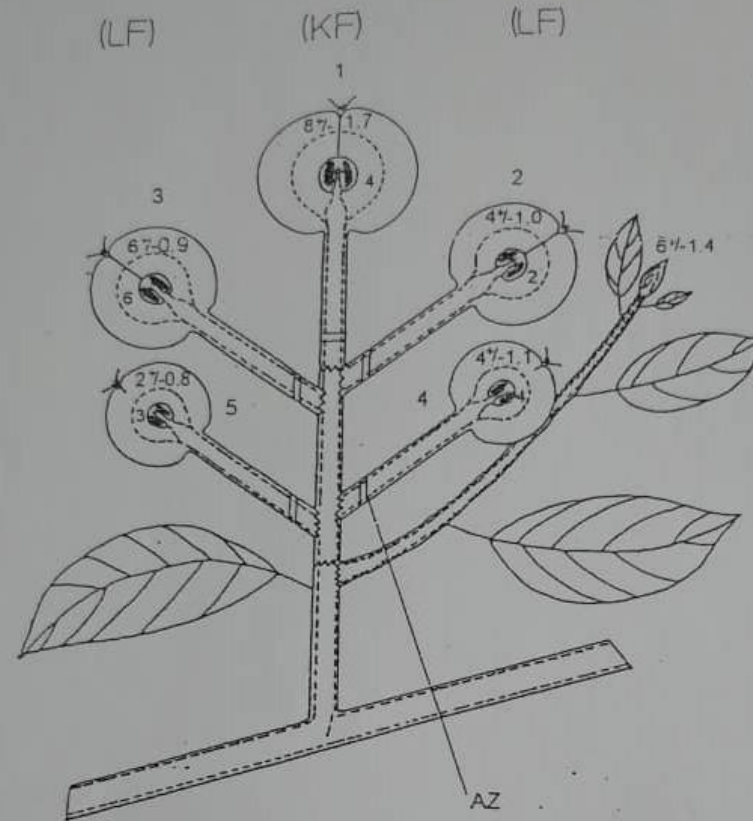
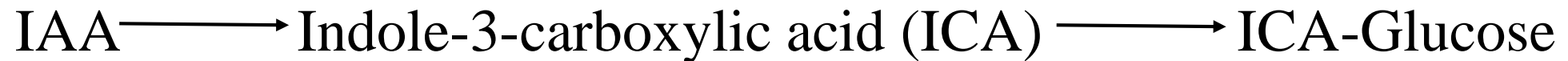


Figure 1. Scheme of an apple fruit cluster. Numbers outside the fruit represent the ranking in PD hierarchy. Numbers inside the fruit give ng IAA export per 20h \pm standard error and, as an example, the number of seeds. Note the influence of PD and the number of seeds on IAA export. All figures of IAA export, including the one of the bourse shoot tip, are from cv. Jonagold and were taken 25 days after full bloom.

- - : polar IAA transport channels
 ^^ : Indicates "junctions where IAA-transport autoinhibition" occurs
 AZ : abscission zone

AUXIN AND ETHYLENE INTERACTION

- Ethylene inhibits or reduces auxin translocation from fruit or leaf to AZ by increase IAA-conjugation (IAA-aspartic acid, IAA-glucose)
- Ethylene reduce endogenous auxin level
- Ethylene promote auxin catabolism in AZ by changes in normal metabolic pathway of IAA



- Abscisic Acid (ABA)
- Gibberellic Acid
- Cytokinin

ENVIRONMENTAL VARIABLES

- Light intensity and light quality

Far Red (700-780nm) light increase abscission (Decrease polar IAA transport)

Red (630-680 nm) light decrease abscission (Increase polar IAA transport)

Temperature (Especially night Temp.)

Dark respiration

Reduce ovule longevity → Decrease seed number → Reduce IAA transport

APPLE FRUIT DROP (ABSCISSION)

- Early Drop

Occurs shortly after petal-fall and may continue for 2 to 3 weeks. The fruit that falls during this period is pea-size and may be the result of poor pollination.

- June Drop

Usually occurs in early June. The fallen fruits are approximately 1/2 to 1 inch in diameter. The shedding of fruit is often due to the competition among the developing fruit for carbohydrate, water, and nutrients.

- Pre-harvest Drop

Occurs in the ripening phase prior to horticultural maturity. The severity of drop is correlated with cultivar. This apple fruit abscission influenced by developmental and environmental cues

Table 1.1. Common names and chemical names of compounds effective at reducing preharvest drop.

NAA	naphthaleneacetic acid
NAAm	naphthalene acetamide
Fenoprop, 2,4,5-TP	2-(2,4,5-trichlorophenoxy)propionic acid
Daminozide, SADH	butanedioic acid mono(2,2-dimethylhydrazide)
Dicamba	3,6-dichloro-2-methoxybenzoic acid
Dichlorprop, 2,4-DP	2-(2,4-dichlorophenoxy) propanoic acid
AVG	Aminoethoxyvinylglycine hydrochloride N-(phenylmethyl)- 1H-purine-6-amine
2,4-D	(2,4-dichlorophenoxy) acetic acid
lactidichlor ethyl	benzoic acid 3,6-dichloro-2 methoxy, 2-ethoxy, 1-methyl, 2- oxoethyl ester
triclopyr	[(3,5,6-trichloro-2-pyridinyl)oxy] acetic acid
fenclopyr, CPPU	N-(2-chloro-4-pyridyl)-N'-phenylurea
No common name	triethanolamine salt of 2-(2,4,5-trichlorophenoxy)propionic acid
No common name	2-methyl, 4-chlorophenoxyacetic acid
No common name, 2,4,5-TA	triethanolamine salt of 2,4,5,-trichlorophenoxyacetic acid
No common name, 2,4,5-TAA	2,4,5-trichlorophenoxyacetamide
MCPB	4-(2-methyl-4-chlorophenoxy)butyric acid