STEM

Characteristics:

•Aerial ascending axis of plant

• develops from plumule of embryo

• Positively phototropic

• Negatively geotropic

• with nodes & internodes

•Axil

• Presence of buds

• types of buds- terminal/apical (stem tip)- stem elongation

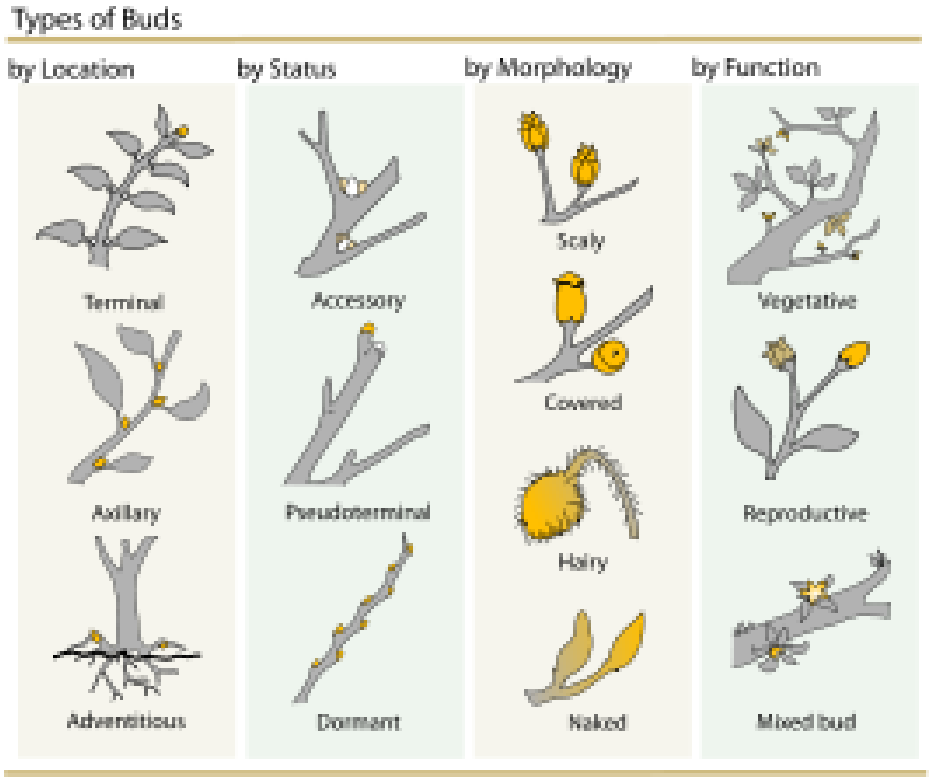
• Axillary/ Lateral – veg./repr. Shoot

• Accessory buds – lateral branches

• Adventitious buds – {roots, leaf/stem}- veg. propagation

From roots – (radical buds) Sweet potato, artocarpus

From leaf – (Foliar/ Epiphyllous)- Bryophyllum



Categories:

- Based on stem nature,

i) Herbs – small, short living, soft nonwoody stem; naked buds

ii) Shrubs – long living, short, bushy with woody stem;profuse branching

iii) Tress – large, long living, tall, extensive branching

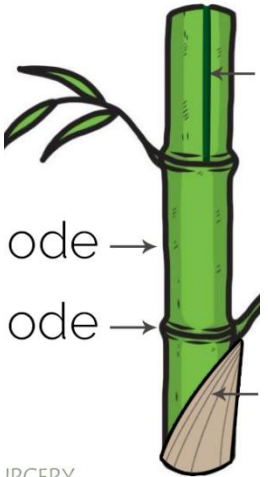
- Based on type of stem,

i)Caudex – straight, unbranched,
columnar with crown of leaves (palms)

ii)Excurrent – main axis indefinite growth,
(tree conical)- Polyalthia

iii) Deliquescent –spreading,
Apical suppression, lateral growth – Ficus

iv) Culm – nodes & internodes, Solid/hollow
(grass)



•Based on life span

i) Ephemerals – short living herbs, few weeks, one season /one year(Peperomia)

ii) Annuals – 1 year. 1 season, herbs(Paddy, tobacco)

iii) Biennials – life 2 year, 1st year-veg. growth, 2nd-repr.gorwth, temperate regions. (Radish, carrot

iv) Perennials – several year, reproduces every year once mature. Trees & shrubs (mangifera)

v) Multiennials – many years, no flowers every year (agave)

General categorization:

Monocarpic plants – flowering only once in their life (ephemerals, annuals, biennials, multiennials)

Polycarpic plants – flower many times in the lifecycle. (Perennials)

•Based on branching

i) Monopodial – main stem from single terminal bud, branches acropetal (Casuarina)

ii) Sympodial – main stem stops growth, lateral branches active (Delonix)

•Based on stem strength, i)Strong/erect , ii) weak

❖**Weak stemmed plants** – grow on ground/ support

•<u>Weak stemmed Horizontal plants</u> (grow on ground)- either Caulescent (with nodes & internodes aerial)/ acaulescent (condensed stem, infl. Above ground, radical leaves.

1.Cespitose – closely matted, in turfs

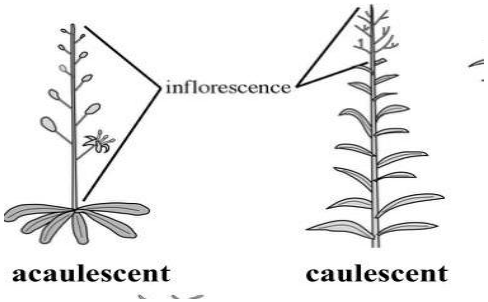
2. Prostrate – trailing on ground

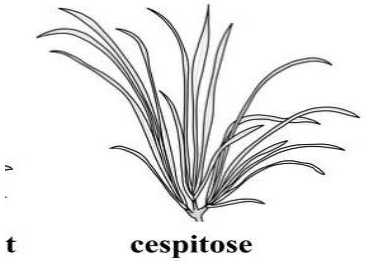
a. Prostrate procumbent – trailing fully flat on ground

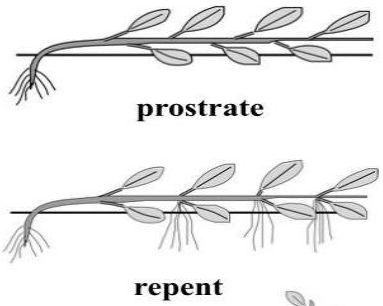
b. Prostrate decumbent – lies on ground, apex rises.

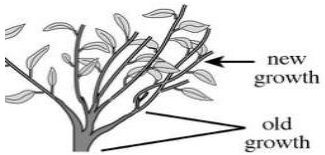
3. Repent – Prostrate & rooting

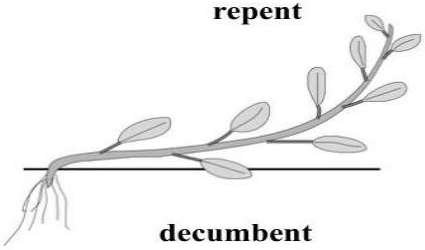
4. Suffrutescent – shrubby, braches die after flowering, persistent woody base (Ocimum)











•Weak stemmed Climbing Plants

a)Twiners – coil on support, slender stem, long internodes

show *nutation* – rotatory air movement, sensitive to touch, less growth at irritated part, helps in coiling.

Coil dextral (Clock-wise), sinustral(anticlockwise), no specificity

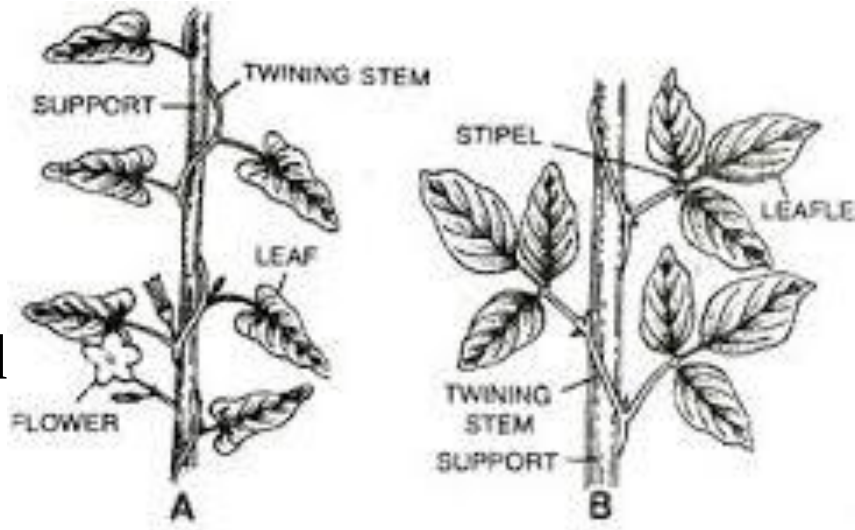


Fig. 5.29. Twiners. A, Sinistrorse twiner of *Convolvulus arvensis* (Hiran Khuri). B, dextrorse twiner of *Lablab*

b) Climbers – special organs for climbing

❖ Tendril climbers – slender, spiral coils, sensitive to contact, organs modified.

Terminal bud –Cissus, axillary bud – Passiflora, stipules – Smilax, terminal leaflets – Pisum,leaf tip – Gloriosa, petiole – Clematis, floral axis - Antigonon

❖ Hook climbers – strong & thick. Becomes woody on attaching. Eg; Artabotrys (Flower stalks modified)

❖Thorn stragglers – downward pointing, cling to support, superficial (emergences/ prickles – Lantana, rosa)/ plant organs modified (Zizyphus – Stipules, Bougainvillaea – Axillary buds

❖Root Climbers – aerial adventitious roots (betel vine, pepper vine)

❖Lianas – large, woody perennial long stems, tropical forests (Aristolochia, Bougainvillaea, Allamanda)

STEM MODIFICATIONS

•Modified for additional purposes

• 3 types – Underground, Sub-aerial, Aerial

❖ Underground – for perennation, storage of food & vegetative propagation

Nongreen, can be identified as stem by presence of nodes, internodes, scale leaves, axillary & terminal buds.

•Rhizome – horizontal, short, thick, fleshy, irregularly branched underground stem

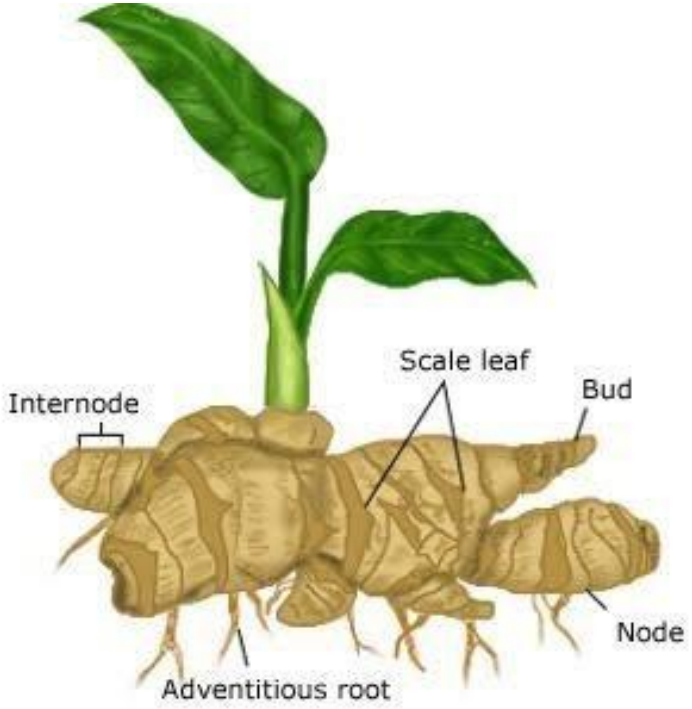
• Presence of nodes, internodes, terminal bud, leaf scars

• nodes with adv. Roots & scale leaves.

• axillary buds in axil of scale leaves

• terminal bud grows out & produce leafy shoot& flowers

*perennating, veg. propagation, reserve food storage.



•Corm - short, thick, massive, spherical undergound stem

• nodes, internodes, scale leaves, axillary b apical bud, adventitious roots

•Apical bud massive

• several scale leaves surrounding

• each with small bud in axil

• develop to cormlets

• Perennating organ, vegetative organ, store house of food

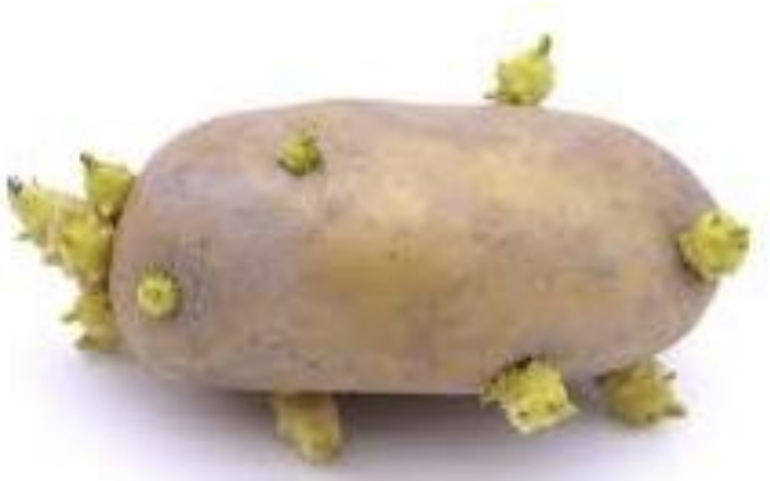
• Amorphophallus, Colocasia, Gladiolus, Dioscorea

• Stem Tuber - swollen tips of underground branches, rich storage of reserve food

• no adventitious roots

• nodes & internodes

• nodes with leafscar& axillary bud (EYE o potato) eg- Helianthes, Cyperus



* Bulb - Fleshy, much reduced highly condensed disc like, compressed nodes & internodes

•In monocots for food storage & reproduction
• outer scale leaves (tunica)- protect
• inner fleshy – store water, food
• terminal bud – flowering shoot
•axillary buds – bulblets form plants
•adv. Roots from stem base
• eg- Allium, garlic

❖ <u>Sub-Aerial stem modifications: modified branches on / below ground</u>

•2 types – creepers & trailers
• creepers – prstrate plants with adv. Roots at nodes
• Trailers – grow without roots at nodes

* Creepers
- runner
- offset
- sucker
- stolon

* Runner - horizontal creeping stem
•Long internodes
• aerial shoots from axillary buds
• each node, produce shoot up & adv. Root down
• internode decay & daughter plants separate
• Oxalis, centella, cynodon
• Offset – short, runner like, horizontal creeping shoot
• short & thick internodes
• develop from axillary buds of main stem
• produce adv. Roots below & cluster of leaves above.
• breakof to form new plants
• eg: pistia, eicchornia

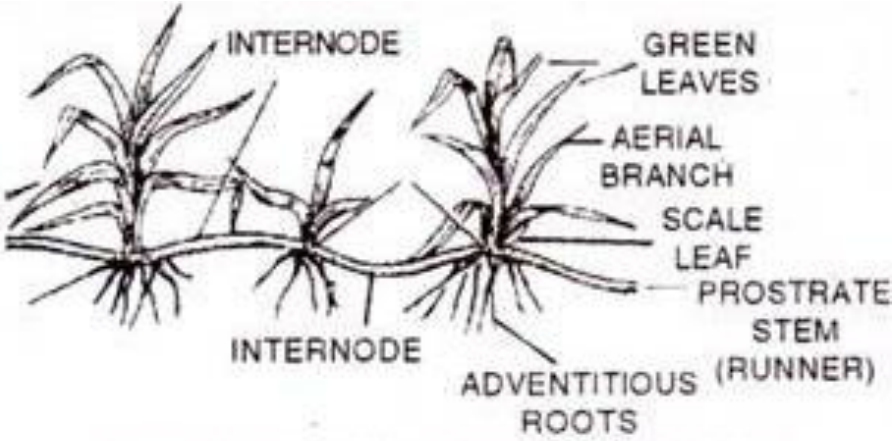
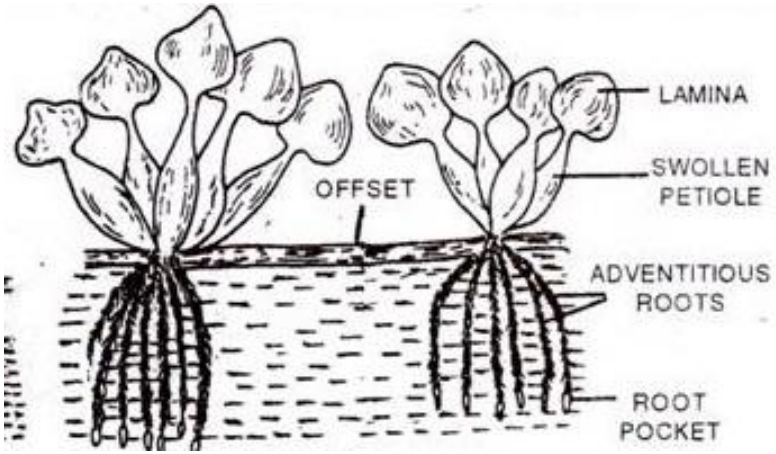
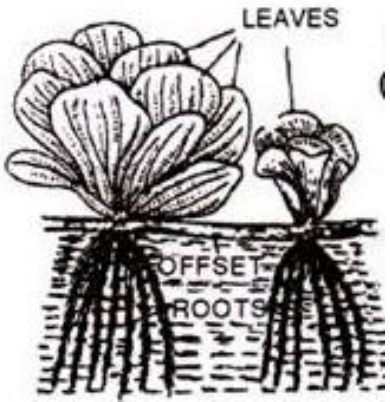


Figure 3.7. Runner of lawn grass (*Cynodon*)





•Sucker – underground adv. Branch
• from axillary bud of subterranean buds
• short, stout than runner
•Grows horizontal,then come up
•Form leafy shoot]
• chrysanthemum, musa
•Grow as new one after root formation

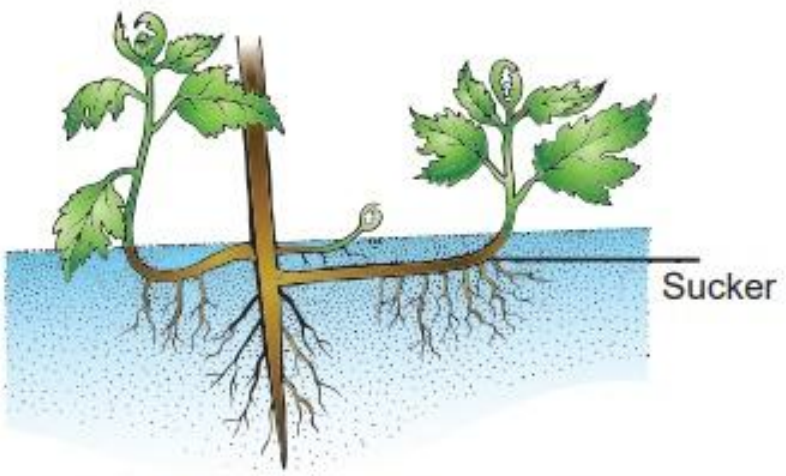
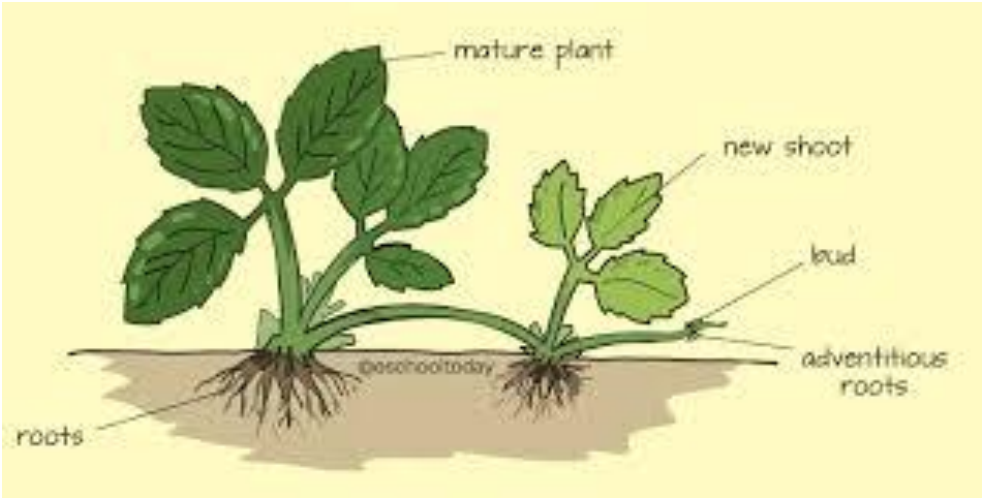


Figure 4b: Sucker - *Chrysanthemum*

•Stolon- slender lateral from main stem base
•Grows aerially,arch down
•Touch ground, form shoot and root
• jasminum, colocasia, mentha



•<u>Aerial stem modification –</u> climbing, support, protection, water storage, veg propagation, photosynthesis

• tendril, thorn, phylloclades, cladode, bulbils, pseudobulbs

❖1. Tendril- long, slender, spiral, spring like, climbing

•From leaf, stem, inflorescence

• (3 types - leaf tendril, stem tendril & inflorescence tendril)

• Leaf tendril – gloriosa, lathyrus

• Stem tendril – Terminal buds (Vitis), Axillary bud (passiflora), bracteoles(snake gourd). If terminal buds, sympodial growth results.

❖ Thorns – hard, sharp pointed woody structures from terminal buds or axillary buds

•support/ protection
• endogenous (with vascular connections)
• defensive – Citrus
• support – Bougainvillaea

❖ Phyllocades (Cladodes) – green, flat/globose, photosynthetic with nodes & internodes (Opuntia, Muehlenbeckia, Euphorbia)

•Xerophytic adaptation
• prevent transpiration loss
• leaves absent/ small/ protuberances/ Scale leaves/ spines
•Nodes with modified leaves
• flowers/ branches from nodes (not frequent)
• swollen in many to store water

❖ Cladodes – green, short, flat, photosynthetic internode, functions as leaf.

•Actual leaves reduced/ functionless, xerophytic adaptation, reduce water loss

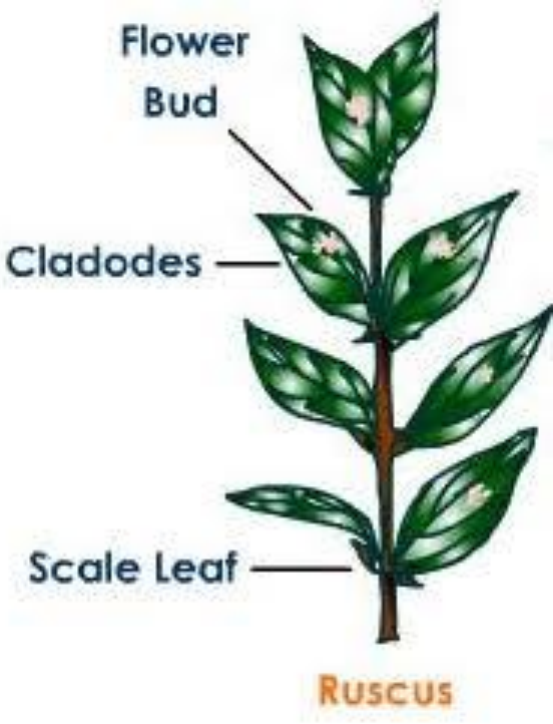
• axillary buds – asparagus-single internode, sickle shaped, green

• lvs. Reduced to spines

• Axillary branches – Ruscus
(flat, leaf like with veins)

• with terminal buds & flowers

• lvs. Reduced to scale leaves


Flower
Bud
Cladodes
Scale Leaf
Ruscus

FUNCTIONS OF STEM

•Support to leaves, flowers & fruits

• Transport of water & minerals to leaves, food From leaves to different parts

• storage of food & water in bulbs, corms etc.

*veg. propagation & perennation (underground stem modifications)

•Defence, support,

•control transpiration, water loss