



FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES

Specialized Vegetative Structures

The specialized vegetative structures include runners, suckers, crown, offsets, bulbs, corms, tubers, tuberous roots and stems, rhizomes and pseudo bulbs that function primarily in the storage of food, nutrients and water during adverse environmental conditions. Plants possessing these modified plant parts are generally herbaceous perennials, in which the shoot die down at the end of a growing season but the fleshy vegetative structure usually do not die and remains in the soil, which put forth new vegetative growth in the next season. Plants that survive as underground storage organs are called geotypes, which can withstand period of adverse growing conditions in their regular growth cycle. A brief description on propagation techniques used for species with specialized organs is as under:

Bulb: A bulb is a complicated structure, which consists of a short thickened stem bearing roots on the underside and thick fleshy leaves on the upper side. Bulbs are usually produced by monocotyledonous plants in which these are modified for storage of food and water and reproduction. Oxalis, is the one dicot genus that produces bulbs. Bulbs generally consist of bulb scales Fig.14.1 and Fig.14.2. The outer bulb scales are fleshy, which contain reserve food materials, where as inner scales do not function as storage organs and are leaf like. In the centre of the bulb, there is either a vegetative meristem or an unexpanded flowering shoot. Meristem develops in the axil of these scales to produce miniature bulbs, known as bulblets, which when grown to full size are known as offsets. In some species (e.g. Lilies), the bulblets are produced in the underground organs. Bulbs are of two type's tunicate i.e. (lamine) and non-tunicate (scaly).

Tunicate (lamine) bulbs: The examples of tunicate bulbs are onion, garlic, daffodil and tulip. These bulbs have outer bulb scales that are dry and membranous. This covering or tunic, provides protection from drying and mechanical injury to the bulb. The fleshy scales are in continuous, concentric layers or lamina to provide solid structure to the bulb.

Non-tunicate (scaly) bulbs: Non-tunicate bulbs are represented by the lily, have dry coverings, loosely arranged like the petals of a flower overlapping each other. In general, non-tunicate bulbs are easily damaged and must be handled more carefully. They must be kept moist because

they are injured by drying. The bulbs are propagated through offsets, bulb cuttings, scaling, scoring, stem cuttings, leaf cuttings, leaf buds and bulbils.

In case of scaling, individual bulb scales are separated from the mother bulb and placed 5-6 cm deep vertically in a suitable growing media. These scales usually develop 3-5 bulblets after 4-5 weeks of planting. In many advanced countries, there is a programme to produce forcible commercial bulbs after one growing season only from scaling with preformed bulblets in lilies. Basically four types of plant development take place in this method of scaling as under:

- Epigeous-type plant (ETP) in which direct bolting bulblet is produced with foliage leaves but no scales. It is considered as the most desirable development form.
- Hypoepigeous type plant (HETP) in which rosette structure is produced first with foliage scale, which bolts after attaining some growth.
- Hypogeous type plant (HTP) forms only a rosette structure with foliage scales. It is not a commercial method.
- Non-green leaf bulblet (NLB) does not produce any foliage because the bulblet remains dormant. It is also not desirable.

Scooping and scoring are commercially used for the propagation of Hyacinth and Scilla. Scooping and scoring methods are basically used to remove apical dominance and to encourage bulb let formation. In scooping, the entire basal plate of the mature bulb is scooped out with a special sharp and curved scalpel to destroy the main shoot. Adventitious bulblets will develop from the base of the exposed bulb scales.

In scoring, three straight cut are given across the basal plate and growing point of the bulb but the complete plate is not removed as in scooping. Growing point in the axils of bulb scales grow into bulb lets. After scoring and scooping, the bulbs are placed about 2.5 cm deep in dry sand or open trays at about 21°C for callusing. After callusing, the bulbs are incubated in trays at 21°C, which may be increased 29-32°C in dark or diffused light for 2 weeks and held at 80-90 percent relative humidity for 2-3 months. The mother bulb along with bulblets are planted 10cm deep in the nursery in the fall.

Tubers: A tuber is a swollen, modified underground stem, which primarily function as the storage organ of the plant. The potato, Caladium, Yam, *Jerusalem artichoke* are examples of tubers. The tuber has nodes (eyes), internodes, lateral and terminal buds. The eyes (nodes) of a tuber are spirally arranged, consisting of one or more small buds. Usually one bud in the eye sprouts and suppresses the growth of others, which shows the phenomenon of apical dominance. Usually, the removal of first sprout from the stem permits other buds to sprout.

Propagation by tubers is usually done either by planting whole tuber or by cutting the whole tuber into pieces, called as division. The each division or seed tuber should have one 'eye' or bud. The weight of a seed tuber should be between 28-56 g to provide sufficient food for the establishment of new plants. The seed tubers should be kept at 20°C with 90 percent relative humidity for 2-3 days prior to planting for rapid healing. These seed tubers may be treated with fungicides to prevent *Rhizoctonia* rot and scab. When whole tuber is used for propagation, its dormancy should be overcome by dipping the tubers in thiourea, ethrel or KNO₃. Sprouting takes place only after the dormancy is over. Tubers of *Begonia* and *Dioscorea* vines produce aerial tubers called as tubercles. These tubercles can also be used for raising new plants. Runners: It is a specified long slender stem that develops from the axil of leaf at the crown of a plant, which prostrate horizontally along the ground. The roots appear at one of the nodes having contact with soil. After root formation in the new plant, the contact with the mother plant is automatically detached and the new plant can be separated and planted. Strawberry is a typical runner. *Oxalis corniculata*, Boston fern, bugle (*Ajuga*) and spider plant (*Chlorophytum comosum*) are other examples of plants propagated through runners.

Suckers: A sucker is a shoot, which arises on a plant below the ground, arising from an adventitious bud on a root. The capacity of a plant to form suckers varies from species-to-species and even from variety-to-variety. Pineapple is usually propagated through suckers. In banana two types of suckers are produced water suckers and sword suckers (Fig.14.5). Water suckers are broad leaved, whereas, sword suckers are pointed and have sword shape. For propagation purpose, sword suckers are preferred over the water suckers. Suckers are separated from the mother plant and are either planted in the nursery or directly in the field for rooting. Multiplication of apple clonal rootstocks is also done by suckers.

Off-sets (off-shoots): An offshoot is a young plant produced laterally by the parent plant or branch that develops from the base of main stem in some plants, which can easily be detached from it. The term offset is generally applied to a shortened, thickened stem of rosette like appearance. It is also applied to lateral shoots arising on the stems of monocotyledonous fruit plants, like date palm, pineapple or banana. Similarly, some cacti and succulents also produce a cluster of small plants around the base and these offsets merely need separation. For propagation, well rooted offsets are cut close to the main stem with a sharp knife and planted in a suitable medium or soil. The development of offsets in the plants can be stimulated by way of heading back the crown of the plant.

Rhizome: A rhizome is a modified and specialized stem structure in which the main axis of the plant grows horizontally at or just below the soil surface. The stem is segmented having nodes and internodes. A leaf like sheath is attached to each node, which on expansion becomes the foliage. Usually, roots develop in the vicinity of the nodes. The flowering stems, called as culms, are either produced from the rhizome tip or from the lateral branches. The banana is a typical example of rhizome. Other rhizomatous plants are ginger, bamboo, iris, sugarcane and many grasses.

For propagation, the whole rhizome or piece of a clump or cutting may be used in rhizomatous plants but the division of rhizome is most commonly used propagating material. The mother rhizome is cut into sections, each having atleast one lateral bud or eye. These sections are planted in a suitable medium. Adventitious roots and new shoots will develop from the nodes and ultimately into plants, such as bamboos, the aerial shoot or culm is used as cutting. The cuttings or sections containing 3-4 nodes are planted vertically in the soil. The new branches arise from the nodes, producing an individual plant.

Corms: A corm is a short, solid, much swollen underground stem, enclosed by dry scale like leaves, with one or several buds near the top, a tuft of leaves at the upper side and a ring of thick fibrous roots around the base. At the apex of corm is terminal shoot, which usually develops into a flowering shoot or leaves. Gladiolus, crocus and water chestnut are examples of some typical cormous plants. Cormous plants can be propagated through new corms, cormels or corm

segments. Usually, a mother corm produces 2-3 new corms and 15-20 cormlets, the miniature corms.

In general, a corm flower within a year of planting, whereas it takes 2-3 growing seasons for a cormel to flower. Division of corm is also sometimes used as a method of propagation of cormous plants. While making segments, it must be ensured that at least one eye should be present in one piece. These segments are planted vertically 5 cm deep in soil, which later develop into a full plant. Micro propagation protocols are now standardized and commercially used in gladiolus even in our country.

Pseudo bulbs: Pseudobulb (false bulb) is an enlarged fleshy stem with several nodes. It is produced by some horticultural plants (mostly orchids), mainly for the storage of food. The plants producing pseudobulbs are usually propagated through offshoots, division or from black and green bulbs produced by them. The rooted shoots are cut from the mother bulb and planted in the nursery. Some orchids, like Cattleya, Laelia, Miltonia etc. are multiplied commercially through the division of pseudobulbs. The bulb is cut into different sections by a sharp knife during dormant season. Each section is sown and new growth begins at the nodes.