Quadrant II – Transcript and Related Materials

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Notes

<u>Fruit parts:</u>

A fruits starts to develop after the ovule is fertilized as a result of the process of pollination, the ovary begins to enlarge. The petals of the flower drop and the ovule develops into a seed

The fruit is a complex structure composed of many different parts. Some of the more common terms used for describing a fruit are:

• Pericarp : The fruit wall, often composed of three layers: epicarp , mesocarp , and endocarp .

• Epicarp or exocarp (also called ectocarp) The outermost layer of the pericarp (the skin) .

• Mesocarp : The middle layer of the pericarp (the fleshy pulp).

• Endocarp : The innermost layer of the pericarp (the stone or pit).

• Mericarp. A portion of fruit that seemingly matured as a separate fruit.

• Carpel : The basic unit of an ovary formed from one highly modified leaf.

• Locule : A chamber or cavity of a fruit.

• Pit or Stone : The hardened endocarp of a drupe or drupelet.

• Sarcocarp : Any internal fleshy layer of a fruit.

• Seed : Mature ovules composed of a seed coat, endosperm, and embryo.

• Funiculus: Seed stalk.

• Placenta: Region of attachment of seeds on inner fruit wall.

• Segment : A division or portion of a fruit. Usually these correspond to the locules.

• Septum or Dissepiment. : A partition between two fused carpels.

• Valves : The parts of the pericarp (fruit wall) that are separated at dehiscence.

• Peduncle: The stalk connecting a fruit to the main stem

Classification of Fruits

There are several ways in which fruits can be grouped or classified. In one method emphasis is placed on whether the fruit is dry or fleshy. Most of dry fruits are not preferably eaten by animals while fleshly fruits many a time attract and are depended on animal interactions for their dispersal.

A further classification of dry fruits puts emphasis on the way fruit open, the fruits may be called dehiscent fruits when they break open and release seeds, while the fruits that don't do this are called indehiscent fruits. Mostly the fleshy fruits are indehiscent in nature. These fruits are either eaten by animals or they depend on natural decay and rot to expose their seeds. The tough seeds shall break by various physical conditions around like wind, stream, rock beds etc. to expose the seeds.

The simplest fruits are those of grasses. Each fruit develops from one carpel

Containing single ovule. The grass fruits have least protect and negligible attraction for animals. The fruits of grasses are indehiscent and germinate close to the parent plant, the seeds during germination absorb water, swells and bursts open out of the weak fruit cover. The seeds of grasses are caryopses.

Simple fruits arise from one ovary in one flower. Examples include cucumber, peapod, walnut, tomato, orange, cherry, apple, dandelion, and maple helicopter. There are a number of types of simple fruit, each with its own official name.

Aggregate fruits arise from several ovaries in one flower. Examples include raspberry and strawberry.

Multiple fruits arise from ovaries in several, tightly-clustered flowers which grow together into one fruit. Examples include pineapple, mulberry, and breadfruit.

A fruit is termed simple if it is produced by a single ripened ovary in a single flower (apples, oranges, apricots). An aggregated fruit is a cluster of mature ovaries produced by a single flower (blackberries, raspberries, strawberries). A multiple fruit is a cluster of many ripened ovaries on separate flowers growing together in the same inflorescence (pineapple, mulberry, fig). A simple fruit may be fleshy or dry. A fleshy simple fruit is classified as a berry (grape, tomato, and papaya), pepo (cucumber, watermelon, pumpkin), hesperidium (orange), drupe (apricot), or pome (apple).

Dry simple fruits have a dry pericarp at maturity. They may or may not dehisce, or split, along a seam to release the seeds.

A dehiscent dry fruit is classified as legume or pod (pea, bean), silique or silicle (mustard), capsule (poppy, lily), or follicle (milkweed, larkspur, columbine). An indehiscent dry fruit that does not split to release seeds is classified as an achene (sunflower, buttercup, sycamore), grain or caryopsis (grasses such as corn, wheat, rice, barley), schizocarp (carrot, celery, fennel), winged samara (maple, ash, elm), nut (acorn, chestnut, hazelnut), or utricle (duckweed family). Some fruiting bodies contain non-ovary tissue and are sometimes called pseudocarps . The sweet flesh of apples and pears, for example, is composed not of the pericarp but the receptacle, or upper portion, of the flowering shoot to which petals and other floral organs are attached. Fruiting bodies of all kinds function to protect and disperse the seeds they contain. Protection can be physical (hard coverings) or chemical (repellents of seed predators). Sweet, fleshy fruits are attractive food for birds and mammals that consume seeds along with the fruit and pass the seeds intact in their fecal matter, which can act as a fertilizer.

Dry fruits are usually adapted for wind dispersal of seeds, as for example with the assistance of wing like structures or a fluffy pappus that provides buoyancy. The diversity of fruiting bodies reflects in part the diversity of dispersal agents in the environment, which select for different fruit size, shape, and chemistry.

Fleshy Fruits

Differences in flower structure result in several types of fleshy fruits. The fruit may form from a flower with a single pistil—the most common case—or it

may develop from a flower with several pistils. The ovary may have a single compartment, or carpel, which houses the ovule or ovules. Or the ovary may consist of two or more carpels, each of which may contain one or more ovules.

A drupe develops from an ovary with a single carpel and is characterized by an edible exocarp and mesocarp and an inedible, hard endocarp, or pit that encloses a singleseed. Cherries, peaches, apricots, and plums are examples of drupes. Almonds also are classified as drupes, but in almonds, the fleshy exocarp and mesocarp wither at maturity, and the endocarp, or shell, is cracked to obtain the edible, meaty, seed. Coconuts are drupes with a very fibrous, inedible exocarp and mesocarp. They are unusual in that they contain both a liquid and solid endosperm. The watery fluid often referred to as coconut milk is used as a drink, and the solid endosperm, or whitish coconut meat, is an important food in the tropics.

A berry develops from an ovary containing one or more carpels. Each carpel contains one or more ovules, so berries typically contain more than one seed. Examples include grapes and gooseberries. A tomato also is classified as a berry. Cut in half, a tomato displays distinct sections, each representing a separate carpel with many seeds.

There are several different types of berries. A true berry has a relatively soft pericarp with a thin exocarp or skin. Examples of true berries include the tomato, pepper, eggplant, grape, and persimmon. A pepo is a berry with a comparatively thick exocarp, or rind—cantaloupe, watermelon, pumpkin, cucumber, and squash are pepos. A hesperidium is a berry with a leathery skin containing oils. All citrus fruits, including oranges, lemons, and grapefruits, are hesperidiums. Some fruits with the word berry in their names, such as raspberry and strawberry, develop differently and are not really berries at all.

Most fruits consist of just the mature ovary and its seeds, but in some fruits

other flower structures are also part of the fruit. A pome is a fleshy fruit composed of the mature ovary along with other flower parts. These flower parts can include the petals, the colorful leaf like parts of the flower; the sepals, the small, green leaf like structures at the base of the petals; and the receptacle, the enlarged tip of the flower stem to which the flower is attached. Depending on the species, some or all of these flower parts grow and expand around the ovary forming a pome. Apples, pears, and quinces are pomes. An apple cut in half shows the enlarged, whitish, edible parts of the sepals and petals.

In flowers with more than one pistil, the pistils are adjacent and the ovary of each pistil develops into a tiny fruit, or fruitlet. The clumped fruitlets form a fruit, such as a raspberry, called an aggregate fruit. Each little bump on a raspberry represents the ripened ovary from one pistil.

In plants such as the pineapple, several flowers are clustered on one stem. Although the ovaries develop individually, all the fruitlets combine into a single larger fruit called a multiple fruit. Other multiple fruits include mulberries and Osage oranges.

Dry fruits

Dry fruits are classified by whether they remain intact at maturity or open to release seeds. There are several types of intact, dry fruits. In samaras, the pericarp is light, relatively thin, and partly or completely fused to the seeds. It enlarges slightly, forming one or two small wings that aid in wind dispersal. Maples, ashes, and elms produce beautiful samaras that can be seen twirling slowly in gusts of wind. Nuts, on the other hand, have a relatively hard, heavy pericarp. Examples include chestnuts, hazelnuts, and acorns. In achenes, the

seed is loosely attached to the pericarp, and the pericarp can be separated from the seed, as in sunflowers. Buckwheat and buttercups also produce achenes. A caryopsis, or grain, is a fruit in which the pericarp is tightly fused to the seed. A schizocarp is a twin fruit that separates into two one-seeded mericarps, types of fruit that often have tiny oil tubes in their walls.

Examples include caraway and dill, whose fruits are harvested for their flavorful oils. Dry fruits that open at maturity fall into several categories. Legumes, such as peas

and beans, are one-chambered pods that split apart along two seams, exposing the seeds that lie within. Siliques and silicles split along two seams but contain two chambers. Siliques are more than three times longer than they are wide, while silicles are shorter. Broccoli, cabbage, and wallflower produce siliques, while dollar plants and alyssum produce silicles. A follicle, on the other hand, splits along one seam only. Milkweed, columbine, and larkspur produce follicles. Capsules split open in several ways, often along or between three or more seams, or between the top and bottom halves, as in primrose. Certain poppies produce capsules with rows of pores that release seeds when the capsule is shaken by the wind.

Seeds:

The mature reproductive body of angiosperms and gymnosperms. Seeds also represents a resting stage which enables plants to survive through unfavorable conditions. The germination period varies widely from plant to plant.

Seeds that develop from the fertilized ovule are made up three main parts:

• Embryo. This is the essential living part of the seed. It consists of a radicle, which gives rise to the root, and a plumule, the growing part of a young shoot;

the part containing these two is called the hypocotyl. One or two seed leaves, or cotyledons, grow out from the hypocotyl and may or may not be taken above the ground during germination. Plants that produce one seed leaf are called monocotyledons and those that produce two, dicotyledons. The cotyledons may function, after germination, as leaves, or they may (in seeds like the bean) contain the food-store.

• Food-store. This is the reserve of food which supplies the embryo and growing plant until it is able to make its own food. The food-store may be in the cotyledons or in a part of the seed called the endosperm It is this stored food which is of nutritional value to humans and other animals.

Testa or seed-coat. This tough protective outer covering the seed. It often has outgrowths which help in dispersal of the seed. Flowering plants produce their seeds inside a fruit, but the seeds of conifers like naked on the scales of the cone. Distribution of seeds is usually by wind, animals or water and the form of seeds is often adapted to a specific means of dispersal.

Dispersal

Dispersal is a very important process that forms the basis of plant reproduction it helps to,

• Avoid competition with parent and siblings
• Colonize new habitats
• Avoid pathogens and predators
• Minimize inbreeding

Units of Dispersal — Different plant parts become modified for dispersal.

• Seeds are the units of dispersal, and the seeds are released from the fruits

ready for dispersal.

• Fruits, or parts of fruit, for dispersal.

• Other structures sometimes modified for dispersal — ovary wall, style, sepals, hypanthium, receptacle, bracts, even whole plant.

Methods of dispersal are often tied to certain habitats

• Wind — prairie/grasslands, mountains, forest trees, weedy areas

• External attachment to animals — forest plants relatively low to ground

• Ingestion by animals — forest plants

• Water — plants that grow in wetlands and along streams

• Ballistic — various; some parasitic plants, some forest plants, some weedy plants

Outline of dispersal mechanisms

Wind Dispersal

• Dust-like seeds - orchid seeds

• Tiny seeds - Grasses

• Winged Diaspores - Capsules releasing large winded seeds in Campsis radicans, trumpet creeper, Maple samaras

• Plumed diaspores - Milkweed seeds

• Balloons - Staphylea trifoliata, bladder pod fruits, Cardiospermum fruits

• Roller plants- plants of Cycloloma atriplicifolium, winged pigweed , tumbleweed blowing across a wintery road

Water Dispersal

• Splash cups- capsules of lousewort, Pedicularis canadensis

• Sea currents - map of sea currents, coconut trees on tropical beaches

,tropical "drift seeds" found on beaches in England

• Streams- Nelumbo flowers, Nelumbo fruits.

Animal Dispersal — Passive

• Simple adhesion- sticky, mucilaginous coating around seeds when wet ,mistletoe fruits enclosing seeds covered with sticky viscin

• Awns, hooks, & barbs- fruits attached to pants leg, Sock Removal Difficulty Unit (SRDU) Bidens, beggar's tick fruits, Geum, white avens fruits, Arctium minus, burdock fruits

Animal Dispersal — Active

• Carrying & caching- acorns of oak trees, bird caching acorns in bark of trees

• Ants (elaiosomes) - seeds of some Papaveraceae, poppy family, have elaisomes

• Ingestion- plants with fleshy fruits, in this case all members of the Rosaceae, the rose family, bird eating fleshy fruits, hornbills eating figs, durian fruits smell horrible but taste terrific & tigers like them, drupes of Prunus padus , fruits of a tropical Licania plant floating on water, Tambaqui fish eating the fruits

Mechanical Dispersal

• Ballistic fruits- capsules of Hamamelis with fruits open and seeds waiting to be ejected, dwarf mistletoe fruits, other ballistic fruits, fruits of the squirting cucumber, Echbalium

• shaker fruits- denticidal capsules of shooting star Dodecatheon meadia , poricidal capusles of papaver, Papaver

• Hygroscopic - the fruits of stork's bill, Erodium cicutarium, curl and uncurl with

changes of humidity, planting themselves.