

Seeds and Seed Dispersal

Seed Structure

bean seed

corn seed (still in its fruit)

Be familiar with the following terms: plumule, radicle, cotyledon, scutellum, coleoptile, coleorhiza, endosperm, testa, hilum, micropyle.

Seed Dormancy

The seeds of annual crop plants will germinate once the seed has imbibed and the temperature is moderate. These seeds were not dormant prior to germination; they were simply dry. The dry seeds were easy to store and transport between growing seasons.

Most plants that have not been domesticated produce dormant seeds. Even under conditions when we would expect the seeds to germinate, they won't until some additional requirement has been met.

Many seeds of desert plants contain chemicals that inhibit germination. If enough water is present to leach out the chemicals, then there is enough water to support establishment of the seedling.

Some seeds, like those of many woody temperate plants, require **stratification**. The imbibed seed must experience weeks to months of cold temperatures before it will germinate at a moderate temperature. This mechanism prevents the seed from germinating in the fall; it won't germinate until winter is over.

Some small seeds require an exposure to light once they have imbibed. If these seeds were to germinate too deep in soil, they would run out of food reserves before becoming established seedlings.

A number of seeds require **scarification**. Their seed coats or dry pericarps must be abraded before imbibition can take place. The abrasion could be from tumbling in sand, by passage through an animal's digestive tract, by the action of soil microorganisms, or by fire.

The tambalacoque tree (*Calvaria major*) grows on the island of Mauritius. The youngest trees are approximately 300 years old. The trees produce fleshy drupes with a thick endocarp. It is thought that the animal who ate the fruits and therefore dispersed the seeds was one of the ones that became extinct after Europeans found the island. The most likely candidate is the dodo. The action of the dodo's gizzard was needed to crack the hard endocarp. When turkeys are force fed the fruits, a few of the seeds will germinate. The animals left on Mauritius who eat the fruits apparently don't crack the endocarp.

Dormant seeds contribute to seed banks, the viable, ungerminated seeds in soil. Other seeds in

the seed bank might not germinate because of a lack of minerals or the presence of inhibitory chemicals from established plants. If conditions change, some of the seeds in the seed bank will germinate. For example, a fire might remove the plants that produced the inhibitory chemicals.

Seed Dispersal

Wind

- light weight seeds can just blow like dust (orchid)
- some fruits have wings that will carry the enclosed seed (maple)
- feathery plumes can also carry seeds: the calyx-derived pappus of dandelion; the plume directly attached to seeds of milkweed
- whole shoot system detaches from the root and is blown around (tumbleweed)

Water

- rain can wash fruits or seeds down a slope
- as long as a fruit or seed can float, it can be water dispersed ==> some seeds can float along irrigation ditches until they imbibe so much water that they sink
- some fruits are designed for prolonged floatation ==> the mesocarp of the coconut is a lightweight, fibrous material

Animals

- Some fruits stick to fur, socks, etc. via hooks (the source of the idea for Velcro), spines, barbs, and sticky secretions.

- Some fruits entice birds and mammals to eat them by being fleshy and sweet; the seeds then pass through the digestive tract, are regurgitated, or are simply spit out. In some cases, the seeds require an interaction with a digestive or gizzard in order to germinate.

How does a plant get an animal's attention when the seeds are ready to be dispersed? The fleshy fruit will go through specific changes as it ripens when the seeds are mature: the color changes from green to something a bit more obvious against a background of leaves; the fruit softens; the sugar content goes up as acids and starches decrease; various pleasant flavors and odors are made.

Some fruits are climacteric. As they ripen, they produce large amounts of ethylene and have a sharp increase in respiration. These fruits can be picked before they make their own ethylene and stored under conditions that inhibit or greatly slow ethylene synthesis. When we are ready to eat them, they can be exposed to ethylene to trigger ripening. Fruits that are not climacteric cannot be handled this way. These fruits don't store easily and are only available fresh when they are in season.

Ethylene is a plant hormone which happens to be a gas. As a gas, it can diffuse from one plant to another. It is involved in a number of plant responses, including responses to stress. Are you familiar with the saying about one bad apple spoiling the whole barrel? A bad apple is one that has been damaged; it is under stress and releasing ethylene. If that apple is packed in a barrel with other apples for storage, the ethylene will be trapped in the barrel and increase in concentration. On exposure to the ethylene, the other apples will overripen and spoil in storage.