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Glossary of seed biology and technology

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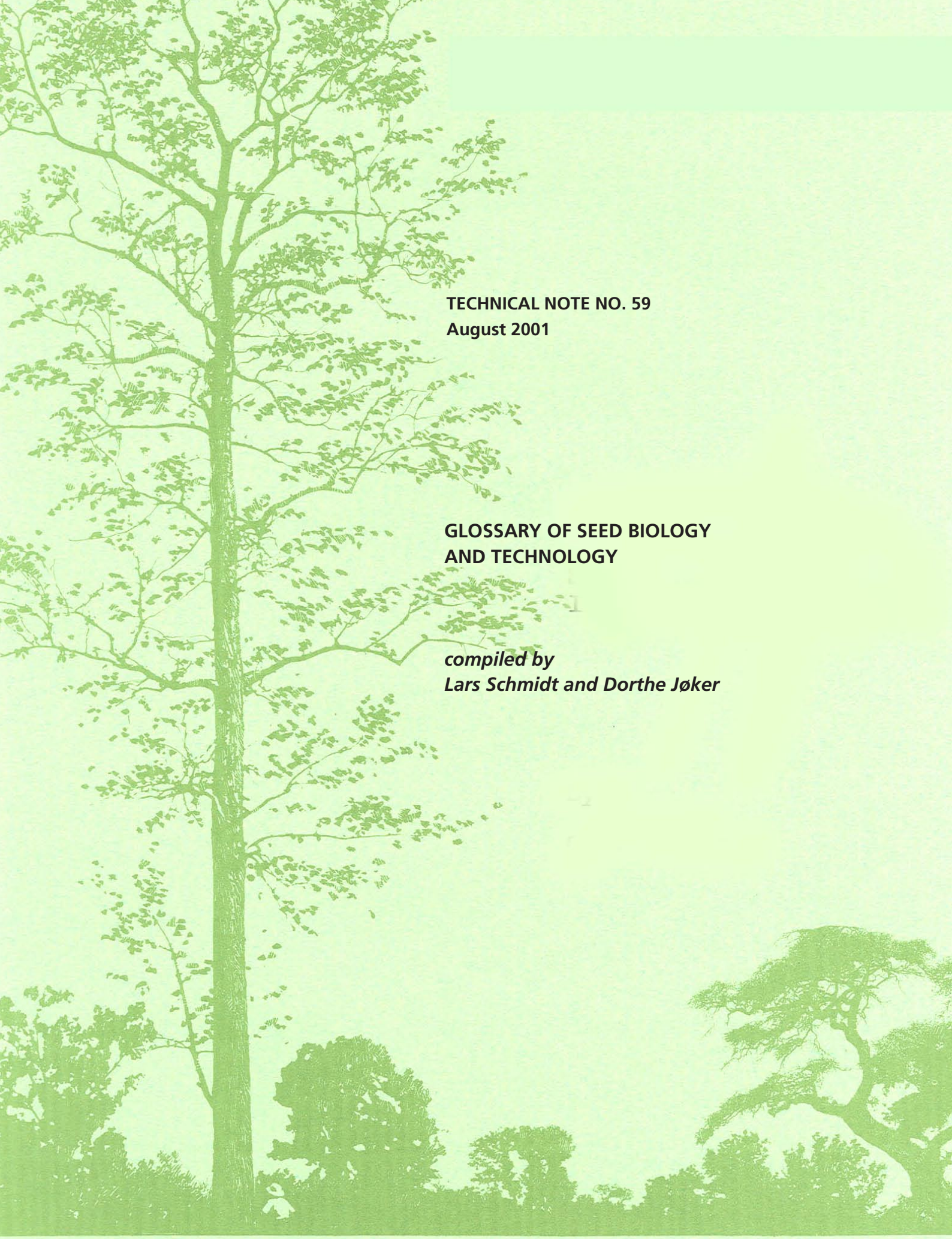
Publication date:
2001

Document version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Jøker, D. (2001). *Glossary of seed biology and technology*. Danida Forest Seed Centre. Technical Note no. 59

Download date: 17. Nov. 2026



TECHNICAL NOTE NO. 59
August 2001

GLOSSARY OF SEED BIOLOGY AND TECHNOLOGY

compiled by
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DANIDA FOREST SEED CENTRE

Titel
Glossary of seed biology and technology

Authors
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Publisher
Danida Forest Seed Centre

Series - title and no.
Technical Note no. 59

DTP
Melita Jørgensen

Citation
Schmidt. L. and D. Jøker. 2001. Glossary of seed biology and technology

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PREFACE

This glossary was compiled to meet an expressed need for a concise, precise glossary of terms of seed biology and practical seed handling to be used, e.g. during translation of technical papers. This glossary is based on the glossary of a new seed handbook published by Danida Forest Seed Centre. A number of terms, specifically related to the text of that book (e.g. ecological terms), have however been omitted in the present glossary in order to keep it strictly to seed biology and seed technology.

In order to avoid too much overlap with the already existing Tree Improvement Glossary (published as DFSC Technical Note No. 46), most terms relating to tree breeding, tree improvement, vegetative propagation, conservation and seed production have been omitted here as they were already defined in the former glossary. However, a few terms frequently used in connection with seed biology and seed handling have been repeated here, so that one does not necessarily need both glossaries; the border area between seed biology and seed handling on one side and tree improvement and breeding on the other is obviously blurred.

In order to make the two glossaries complementary, the style followed in the Tree Improvement Glossary has been maintained e.g. cross reference to other related terms and provision of explanatory illustrations where considered relevant (reference terms written in italics are explained elsewhere in the glossary; underlined reference terms contain an explanatory illustration).

Double-words are usually explained under the alphabetic initial of the most prevalent word (Processing, seed; Extraction, seed etc rather than Seed processing and Seed extraction). In some cases it has, however, been relevant for easy reference to group terms, e.g. all dormancy terms listed under Dormancy.

A

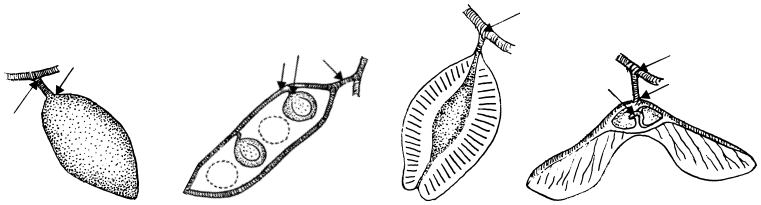
Abnormal seedling. In seed testing, a seedling which does not possess all normal structures required for growth, nor shows the capacity for continued development.
See *Necrosis, Seedling, Seed testing.*

Abortion. Loss of reproductive structure (e.g. a flower or an ovule) during development.
See *Nut, Ovule.*

Abscission. The shedding of leaves, flowers, fruits or other plant parts usually after formation of an abscission zone.
See *Abortion, Abscission zone, Dehiscence.*

Abscission zone. Zone at the base of leaf, flower, fruit or other plant part which contains an abscission (= separation) layer of thin-walled cells. The breakdown of the cells in the abscission layer causes shedding of the plant part.
See *Abscission, Dehiscence.*

Cell structure in abscission zone



Examples of location of abscission zones in fruits

Absolute humidity. The amount of water vapour present in a given volume of atmosphere, usually indicated in g water per kg dry air, or g water per m^3 air.
See *Relative humidity, Saturated air.*

Absorption. Here: Uptake of water from the atmosphere by cells or tissue in the seed-coat.
See *Adsorption, Imbibition.*

Accelerated ageing (AA). A method of exposing seed to an unfavourable storage environment of high temperature and humidity in order to speed up the natural ageing process. The method is used as a vigour test and to predict storage life of seed.
See *Ageing, Deterioration, Vigour, Vigour test.*

Achene. One-seeded, dry, indehiscent fruit, formed from one carpel.
See *Fruit*, *Dehiscence, Dry fruits, Follicle, Indehiscence, Carpel, Nut, Samara.*

Actinorhizal plants. Host plants establishing microsymbiosis with the microsymbiont *Frankia*.
See *Frankia, Microsymbionts*.

Adsorption. The taking up of one substance at the surface of another, e.g. adhesion of a liquid or a substrate on a seed-coat.
See *Absorption.*

Aerobic. Biochemical process which implies presence of oxygen and in which oxygen is consumed, e.g. respiration. Ant. *Anaerobic*.
See *Respiration*.

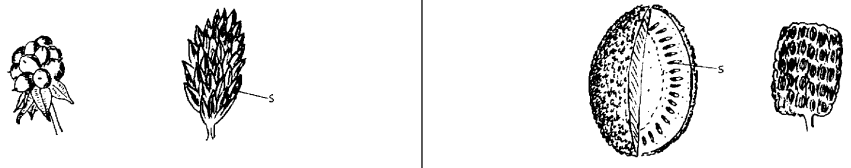
After-ripening. The physiological maturation processes which occur in e.g. seeds and fruits after harvest or abscission. After-ripening is often necessary for immature seeds to become germinable. Also used for the seed handling process itself.
See *Dormancy, Immature embryo, Mature, Precure, Stratification.*

Ageing (aging). Progression of cytological and biochemical events which ultimately leads to the

death of the seed.
See *Accelerated ageing, Deterioration, Senescence.*

Aggregate fruit. Many-seeded fruit derived from an *apocarpous* ovary in which the pistils form individual simple fruits, e.g. samaras, drupes or nuts which may be separate or fused with each other and the receptacle. With the ripening of the fruit a single unit is formed.
See *False fruit, Fruit, Multiple fruit, Cone, Simple fruit.*

Aggregate fruit *Multiple fruit*



Fleshy (Rubus) *Dry (Michelia)* *Fleshy (Artocarpus)* *Dry (Casuarina)*

Albumen. Collective term for the nutritional tissue between the embryo and the seed-coat, including perisperm and endosperm.
See *Endosperm, Perisperm, Seed.*

Ambient conditions. Normal surrounding temperature, humidity and light without the use of artificial means.

Anaerobic. Biochemical process which does not imply presence of oxygen, e.g. fermentation. Ant. *Aerobic*.
See *Anoxia, Fermentation.*

Anatropous ovule. Ovule orientation in which the ovule is inverted with respect to its funiculus; the micropyle accordingly at the same level as the base of the funiculus.
See *Campylotropous, Orthotropous, Ovule orientation, Placentation.*

Androecium. Collective term for the stamens of a flower. Ant. *Gynoecium.*
See *Anther, Stamen, Flower.*

Andromonoecious. Having male and hermaphrodite flowers on the same plant.
See *Dicliny, Dioecious, Monoecious.*

Angiosperms [angio=cover, sperm=seed]**.** Flowering plants; sub-division of Spermatophytae, the seed plants. Distinguished from the other sub-division, Gymnospermae, by having the ovules borne in an ovary. After fertilisation the ovary becomes a fruit, enclosing the seeds. The group includes among woody plants bamboos, palms and most species of forest trees. The term 'hardwood' is sometimes used synonymous to angiospermous trees although the wood is not always harder than that of gymnosperms ('softwood').
See *Flower*, *Fruit,* G*ymnosperms.*

Anoxia. Dying from lack of oxygen, e.g. respiring seeds stored in an oxygen free atmosphere.
See *Anaerobic, Aerobic.*

Anther. Pollen-bearing part of the stamen.
See *Androecium, Flower.*

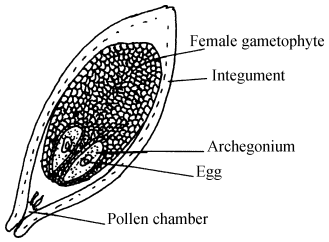
Anthesis. The period or stage of bud opening and expansion of the flower, i.e. in angiosperms the same as flowering. Sometimes specifically referring to the bursting of anthers to release pollen.
See *Flowering, Phenology, Phenoperiod.*

AOSA (Association of Official Seed Analysts). American based seed testing system used in North and South America.
See *ISTA, Seed Testing.*

Apex (pl. apices). Tip, topmost part, pointed end.

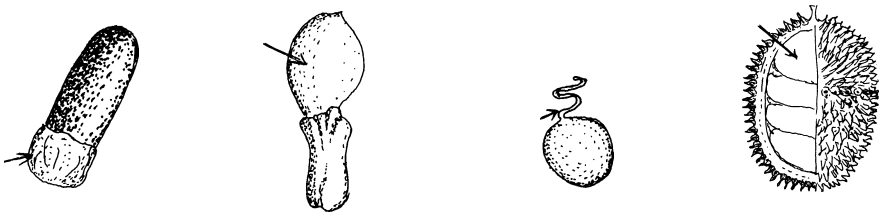
Apocarpous (Apocarpy). Having separate or partially united carpels. Apocarpy often gives rise to aggregate fruits, e.g. *Magnolia* and *Manglietia*.
See *Aggregate fruit, Carpel, Flower.*

Apomixis. Here: production of seeds without fertilisation.
See *Fertilisation.*



Archegonium. In gymnosperms (and spore plants like mosses and ferns) the female sex organ which contains the egg-cell.
See *Female gametophyte, Gymnosperms*.

Aril (arillus). Outgrowth on the surface of certain seeds. Normally a distinction is made between *true aril* which is an outgrowth of the funiculus and *arilloid*, an outgrowth from other parts of the seed. The aril is usually fleshy and nutritious and serves to attract dispersers. Arils may enclose the seed partly such as in *Afzelia* and *Taxus*, or completely such as in *Podocarpus* and *Durio*.
See *Arilloid, Dispersal, Hilum, Fleshy fruits*.



Afzelia *Podocarpus* *Acacia* *Durio*

Arilloid. Outgrowth on the seed from other parts than the funiculus. Arilloids occurring on the *raphe* are called *strophioles* and those occurring near the micropyle *caruncles*.
See *Aril, Hilum, Seed.*

Assimilation. In plants, the process by which organic molecules are built up from inorganic ones from the environment, e.g. during photosynthesis.
See *Respiration.*

B

Berry. Fleshy fruit developed from a single pistil and with no hard layers in the pericarp. The fruit is usually many-seeded, but one-seeded berries occur in e.g. *Persea* (avocado).
See *Drupe, Fleshy fruit, Fruit.*

Bisexual. Same as *hermaphrodite.*

Blinding. Here: blocking of cleaning screens by seeds or particles of intermediate size which get stuck in the holes.
See *Cleaning (seed).*

Bract. Modified leaf subtending a flower or floral axis in angiosperms or a scale in female cones in gymnosperms.
See *Bracteole*, *Cone, Ovuliferous scale*.

Bracteole. A small bract.
See *Bract, Cone.*

Bruchid. Group of seed-infesting beetles attacking seed of e.g. Leguminosae.

Buffer. A substance or condition that counteracts changes caused by external impact. In chemistry

referring to a substance that minimises changes in pH when acid or alkali is applied. In ecology e.g. referring to a vegetation type or zone that minimises the impact of climatic changes (e.g. forest cover reducing diurnal fluctuations of temperature). In tree breeding usually referring to a zone around a seed stand to avoid contamination with foreign pollen.

C

Calibration. Correlation between reading of an instrument and a standard e.g. a moisture meter and the standard oven-drying method for determination of moisture content.
See *Moisture meter, Oven-dry.*

Calyx. Collective term for the sepals of a flower.
See *Corolla, Flower*.

Campylotropous. Ovule where the micropyle is oriented at an angle to the placenta. In a seed developed from a campylotropous ovule, hilum and micropyle are positioned in between that of an *orthotropous* and an *anatropous.*
See *Hilum, Micropyle, Ovule orientation*.

Capsule. Dry, usually many-seeded dehiscent fruit composed of two or more fused carpels that split at maturity to release their seeds, e.g. *Swietenia* and *Eucalyptus*. Capsules may have one or more rooms (locules).
See *Dehiscence, Dry fruits, Fruit, Locules.*

Carabiner. Metal safety clip used in connection with tree climbing with ropes. The carabiner can be locked in the closed position as an insurance against accidental opening during climbing and fruit harvesting.

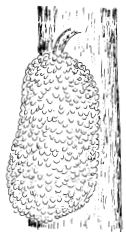
Carbon dioxide (CO_2). Gas produced by respiration. The gas is occasionally used for fumigation of seed to kill infesting insects. The gas does not damage dry orthodox seed in which metabolism is very low.
See *Fumigation*, *Metabolism, Orthodox, Pest, Respiration, Treatment*.

Carpel. A simple pistil, or single member of a compound pistil. A pod is developed from one carpel, a capsule from several carpels.
See *Compound pistil*, *Dry fruits, Pistil, Placentation*.

Caruncle. Arilloid (type of outgrowth on the seed) occurring near the micropyle.
See *Aril, Arilloid, Funiculus, Hilum, Ovule orientation, Seed.*

Case hardening. Setting of cone scales as a result of over-rapid superficial drying, so that they fail to open and discharge their seed.
See *Cone, Dehiscence, Extraction*.

Catkin. Spike-like inflorescence of unisexual flowers found in some angiosperms, e.g. *Alnus* and *Betula.*
See *Inflorescence*.



Cauliflorous (cauliflory). Flowering habit in which flowers, and later fruits, appear from the stem or tree trunk rather than from branchlets, e.g. *Arthocarpus* and *Ficus* spp.
See *Fruit.*

Certified seed. Seed collected from trees of proven genetic superiority as defined by a certifying agency, and produced under conditions that assure genetic identity. The seed can be from trees in a seed orchard, or from superior ('plus') trees in natural stands with artificial pollination.
See *Source identified seed.*

Chaff. In eucalypts, sterile particles derived from infertile or non-fertilised ovules.
See *Empty seed*.

Chalaza. Region in the ovule opposite the micropyle where the integuments fuse with funiculus.
See *Hilum*, *Ovule orientation*, *Pistil*, *Seed*.

Chilling. Literally meaning cooling down. Generally used for the procedure of subjecting seeds to a cold moist environment to bring about after-ripening or break dormancy.
See *After-ripening, Chilling injury, Dormancy, Pre-chilling, Pre-treatment*.

Chilling injury. Impaired viability caused by exposure to low temperature. The term is applied to low temperature damage to temperature sensitive seed.
See *After-ripening, Chilling.*

Cladodes. Reduced leaves in e.g. casuarinas. Cladodes are often similar in size and form to seeds and can be difficult to separate from seeds by ordinary cleaning methods.
See *Cleaning (seed).*

Cleaning (seed). Here: separation of seed from other species and non-seed fragments such as fruit fragments, leaves or stems. Cleaning may be undertaken by sifting, blowing, winnowing, flotation etc. The degree to which seed is cleaned is called purity.
See *Pure seed, Purity, Seed testing*.

Cleistogamous flower. A flower that does not open for pollination but is pollinated and fertilised by its own pollen within a closed system. Species with cleistogamic flowers are essentially self pollinating and inbreeding.

Climax tree species. Tree species which are the climatic and edaphic optimum for a particular site during more or less stable ecological conditions. Climax species are usually long-lived and reproduce late in age as compared to pioneers which are the ecological contrast.
See *Pioneer species*.

Collection (seed). Collective term of the procedures and methods of gathering seeds and fruits. In phenology also referring to the time of collection i.e. maturation of seed.
See *Harvest, Maturity, Seed, Seed handling, Procurement*.

Columella. A small column, e.g. the central part of the capsule of some Meliaceae.
See *Capsules.*

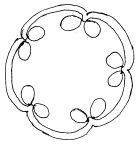
Compatibility. Here: the ability of pollen to fertilise the egg. Ant. Incompatibility.
See *Fertilisation*.

Complete (flower). Angiosperm flower containing both stamens, pistil, sepals and petals.
See *Flower, Incomplete flower, Perfect (flower).*

Composite sample. Mix of several primary samples taken from different parts of a seed lot.
See *Primary sample, Sample, Seed testing, Seed lot, Working sample.*

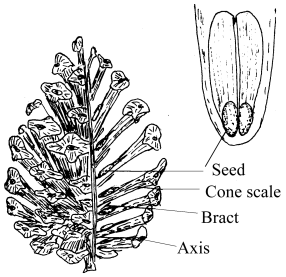
Compound fruit. Fruit made up of several pistils. Where the pistils originate from a single flower it is called an *aggregate fruit*; where the pistils are from different flowers, it is called a *multiple fruit*.
See *Carpel, Compound pistil, Pistil, Simple fruit*.

Compound pistil. Pistil made up of several fused carpels. The pistil (and later the fruit) may form several rooms (locules) according to the number of carpels, or one room with several ovules (or seed).
See *Carpel, Compound fruit, Locules, Pistil, Placentation, Simple fruit.*



Compound pistil of 5 carpels

Cone. The seed-bearing structure of conifers consisting of a central stem, woody or fleshy scales, bracts, and seeds. Sometimes also used for mature male strobili ('male cones'). 'Cone-like' angiosperm fruits, e.g. in *Casuarina*, are *aggregate fruits*.
See *Bracht, Gymnosperms, Strobilus*.



Conifer. The group of gymnospermous trees in which seeds are borne in cones, e.g. *Pinus*, *Araucaria*, and *Agathis*, but not e.g. *Podocarpus* and *Taxus* spp.
See *Cone, Gymnosperms*.

Corolla. Collective term for the petals of a flower.
See *Calyx, Flower, Perianth*.

Corolla tube. The tube-like part of a corolla where the petals are united.
See *Calyx, Corolla, Flower, Perianth*.

Cotyledons. In seeds, the embryonic leaves, which in many species have absorbed the entire or the major part of the nucellus and endosperm, hence becoming the principal nutrient storage tissue. Monocotyledons have one, dicotyledons two and conifers often many cotyledons. During germination the cotyledons may remain underground (hypogeal germination) or be pushed above the soil to become the first photosynthesising leaves (epigeal).
See *Embryo, Epigeal, Germination, Hypogeal, Seed, Seedling*.

Critical moisture content (CMC). Normally referring to recalcitrant or intermediate seed: the lowest moisture content to which seed can be dried without losing their viability, i.e. in practice equivalent to Lowest Safe Moisture Content. CMC has been defined differently as 1) the moisture content at which all seeds die, or 2) the moisture content at which the seed lot have 60% germination.
See *Intermediate seed, Recalcitrant seed, Lowest Safe Moisture Content, OLDA*.

Cross inoculation group. A group of species whose microsymbionts will inoculate other species within the same group. The term is used in connection with species specificity of *Rhizobium* and *Frankia*.
See *Host specificity, Inoculation, Microsymbionts.*

Cryopreservation. Maintaining tissues or seeds for the purpose of long time storage at ultralow temperature, typically between -150°C and -190°C. In normal cryopreservation the sample is pre-treated with a cryoprotective substance, followed by slow, controlled freezing.

Cupula. Small cup-like enclosure of fruits of Fagaceae e.g. *Quercus*, *Fagus* and *Castanopsis* spp.
See *Involucre*.

Cuticle. Layer of waterproof fatty substance (cutin) on the surface of seeds, leaves and stems.

Cutting (test). Here: rapid viability test in which the seed is cut to examine the colour and condition of the embryo, or for e.g. cones to examine the number of seeds visible on the cut surface in order to estimate the total seed content in the cone.
See *Viability*.

D

Damping-off. Death of seeds, germinants or young seedlings in the nursery resulting from attack by certain soil-living fungi. Damping off in seedlings often causes rot of the stem near the surface of the soil.
See *Seed transmitted pathogen.*

Dehiscence. The splitting open of an anther or a dry fruit to discharge its content. In fruit terminology dehiscent fruits are those that split open at maturity upon drying, usually while still attached

to the plant, e.g. capsules, follicles and some pods. Ant. *Indehiscence.*
See *Capsule*, *Dry fruits*.

Dehydration. Loss of water from tissue e.g. during drought or drying of seed.
See *Desorption*.

Dehydrogenase. Group of enzymes catalysing reactions involving transfer of hydrogen from a substrate to a hydrogen acceptor. The reaction is typical of biochemical processes in living plants, and the activity of dehydrogenase is taken as an indication of seed viability through TTZ test.
See *TTZ, Viability.*

Denaturation. Alteration in the structural properties of a protein, caused by e.g. heat, change in pH, or radiation, and in enzymes and hormones resulting in change of activity.
See *Ageing.*

Depulping. Extraction of seeds or stones by removal of the fleshy part (pulp) of fruits like berries and drupes. Depulping may be carried out by soaking and fermentation followed by pounding, maceration or mechanical treatment e.g. by coffee depulper.
See *Fleshy fruits, Maceration, Pulp*.

Desiccant. Chemical compound that has a high moisture absorption affinity and can be used for desiccation or maintaining a low humidity when stored together with e.g. seeds. Common desiccants are SiO, CaO.
See *Absorption, Equilibrium moisture content, Moisture content.*

Desiccation sensitive. About seeds which do not tolerate drying below a certain (high) critical moisture content. Often used equivalent to *recalcitrant*.
See *Intermediate (seed), Moisture content, OLDA, Orthodox, Recalcitrant, Critical Moisture Content, Lowest Safe Moisture Content.*

Desiccator. Large air-tight glass or plastic container used when testing moisture content in order to prevent seeds from absorbing moisture from humid air during cooling.
See *Desiccant, Moisture content.*

Desorption. Loss of moisture from a relatively moist hygroscopic material, such as seeds, to a relatively dry atmosphere until the two reach equilibrium. Ant. *Absorption*.
See *Desiccation, Dehydration, Equilibrium moisture content*.

Deterioration (seed). The cytological and biochemical events taking place within a seed and ultimately leading to the death of the seed.
See *Accelerated ageing, Ageing, Longevity*.

De-winging. Removal of fruit or seed wings during processing, e.g. by slight hydration (pine seed), tumbling or brushing, or manually.
See *Cleaning (seed), Processing (seed), Wings (seed).*

Dew point. Temperature at which the relative humidity is 100% (saturated) and water condenses at further decrease in temperature.
See *Relative humidity, Saturated.*

Diaspore. Any plant part which is dispersed from the parent plant and functions in reproduction. The diaspore can be a seed, a fruit or a vegetative structure.
See *Dispersal, Seed.*

Dichogamy. Maturation of male and female organs on the same plant at separate periods, so that pollen presentation and pollen receptance do not coincide. Dichogamy fosters natural cross-pollination. The two types of dichogamy are '*protandry*' (male first), and '*protogyny*' (female first).
See *Dicliny.*

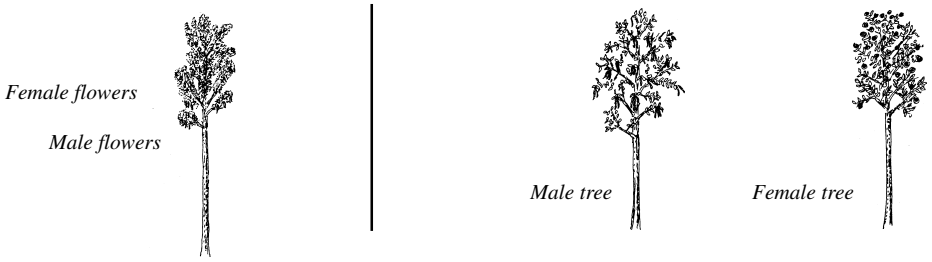
Dicliny. Separation of male and female reproductive structures into different flowers. Diclinous plants may be either monoecious or dioecious.

See *Monoecious, Dioecious, Unisexual.*

Dicotyledons. One of the two sub-classes in angiosperms (the other being monocotyledons) the main distinctive feature of which is the presence of two cotyledons in their embryos. Other characteristics of the group are branching veins of the leaves, persistent primary root and vascular bundles in rings. Dicotyledons comprise both herbs and woody plants. Ant. *Monocotyledons.*
See *Cotyledons, Embryo, Seed, Seedling*.

Differentiation. The process of cells or tissue becoming structurally specialised, e.g. floral differentiation and embryo differentiation.
See *Embryo*, *Floral initiation*, *Seasonality*.

Diffuse flowering. Flowering throughout the year or outside the main flowering season. Ant. *Gregarious flowering.*
See *Flowering, Phenology, Periodicity.*



Monoecious *Dioecious*

Dioecious [di = two, oikos = house]**.** Species with male and female sexual reproductive organs borne on different individuals; e.g. rattan species. Ant. *Monoecious.*
See *Dicliny*.

Diploid. Cell or organism with two basic chromosome sets, symbolised by 2n; the condition of the vegetative tissues of most higher plants. Ant. *Haploid.*
See *Fertilisation, Sporophyte.*

Dispersal. For seed: the physical removal and displacement of the dispersal unit (diaspore) from the mother tree to some distance away longer than vertical falling. Dispersal in forest trees usually by wind (anemochory) or animals (zoochory). Time of dispersal usually coincides with maturity and hence seed harvest.
See *Ingestive dispersal, Maturity index, Wings (seed).*

Disseminule. Dispersed unit, in seed equivalent to the *diaspore*.
See *Dispersal*.

Dormancy. Physiological state in which a viable seed fails to germinate when provided with water and environmental conditions normally favourable to *germination*.
See *Pre-treatment, Quiescent.*

Dormancy, chemical. Dormancy caused by inhibitory substances in the fruit or seed. Dormancy may be overcome by *leaching*.
See *Inhibitor, Inhibition.*

Dormancy, combined (or double). Dormancy as a result of two primary factors, such as seed-coat dormancy and embryo dormancy. Both types of dormancy must be broken for germination to proceed, e.g. *scarification* followed by *pre-chilling*.
See *Pre-treatment.*

Dormancy, embryo (= endogenous). Dormancy as a result of conditions within the embryo itself, e.g. inhibiting substances or incompletely developed embryo. Ant. *Dormancy, exogenous.*
See *Embryo, Dormancy, Dormancy (chemical).*

Dormancy, exogenous. Dormancy related to the outer covering of seed and/or fruit i.e. pericarp or seed-coat. Exogenous dormancy may e.g. be mechanical, or photo-dormancy. Ant. *Endogenous dormancy.*
See *Dormancy (mechanical), Dormancy (photo), Dormancy (physical).*

Dormancy, induced.
See *Dormancy (secondary)*.

Dormancy, mechanical. Dormancy caused by mechanical resistance of the seed covering (often the endocarp) to expansion of the embryo. Dormancy is overcome by weakening the restricting covering or by extracting the seed.
See *Dormancy (physical), Extraction, Scarification.*

Dormancy, photo. Secondary dormancy developed in light sensitive seeds. Dormancy is caused by high level of phytochrome P_r which must be changed to phytochrome P_{fr} by exposure to red light (660-760 nm) or full day light after imbibition for germination to proceed.
See *Dormancy (secondary).*

Dormancy, physical. Dormancy caused by an impermeable seed-coat (hard seed). The embryo is quiescent (non-dormant) but is sealed inside the impermeable covering at low moisture content. Principal dormancy type in Leguminosae.
See *Hard seed, Legume seed, Quiescence, Scarification.*

Dormancy, physiological. Type of embryo dormancy in which germination is prevented by a physiological inhibiting mechanism, e.g. chemical dormancy or thermo-dormancy.
See *Dormancy (endogenous).*

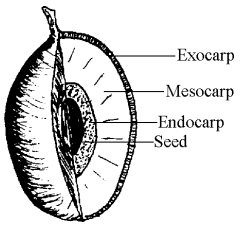
Dormancy, primary. Dormancy that exists within the seed at the time of maturity on the plant or immediately afterwards. Ant. *Dormancy (secondary)*.
See *Dormancy*.

Dormancy, secondary (= induced dormancy). Dormancy that develops in the moist seed after it has been released from the plant if subject to adverse environmental conditions. Ant. *Dormancy, primary.*
See *Dormancy (combined), Dormancy (primary)*.

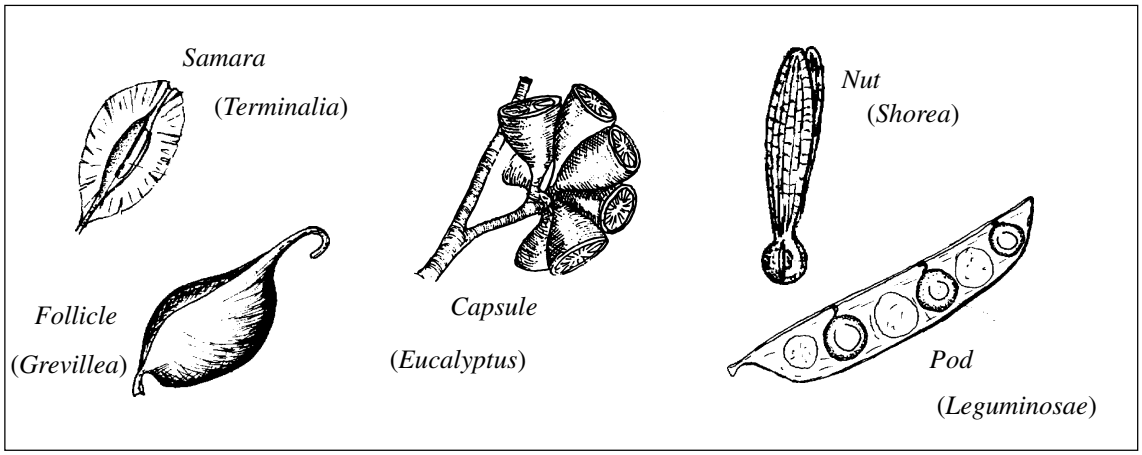
Dormancy, seed-coat. Dormancy as a result of seed-coat conditions e.g. impermeability (physical dormancy) or phytochrome system (photo-dormancy). Dormancy may be overcome by scarification or complete removal of the seed-coat.
See *Dormancy (physical), Dormancy (mechanical), Dormancy (photo)*.

Dormancy, thermo. Primary or secondary dormancy in which the seed must be subjected to a high, low or fluctuating temperature prior to germination. In temperate regions thermo dormancy is overcome by pre-chilling or stratification; in tropical regions by exposing the seeds to normal diurnal fluctuations in temperature prior to germination.
See *Dormancy (primary), Dormancy (secondary), Pre-chilling, Stratification.*

Drupe. Fleshy fruit consisting of an outer exocarp (fruit skin), a mesocarp (usually of fleshy or leathery substance) and an inner hard endocarp enclosing one or more seeds. The outer part is usually removed during processing leaving the endocarp with enclosed seeds (stone or pyrene) as the storage unit. Some drupes have dry rather than fleshy mesocarp, e.g. coconut and teak.
See *Berry, Fleshy fruits, Fruit, De-pulping, Husk, Pulp, Pyrene, Simple fruit*.



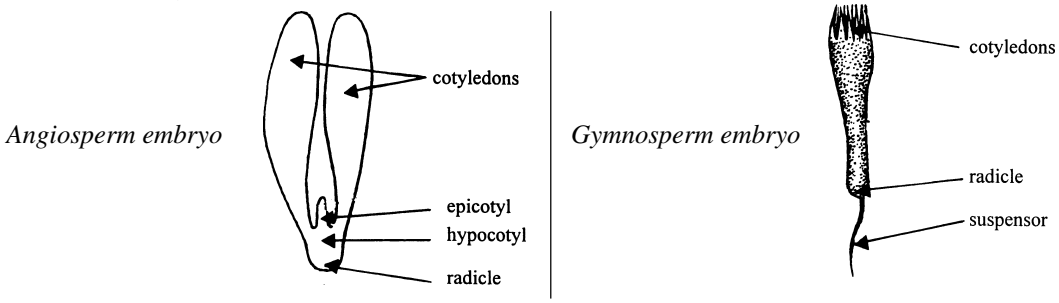
Dry fruits. Category of fruits which dehydrate or dry during maturation. Drying often causes dehiscence (opening) of the fruit and release of seed. Dry fruits are e.g. capsules, pods, follicles, cones and some aggregate and multiple fruits.
See *Aggregate fruit, Capsule, Dehydration, Follicle, Fleshy fruits, Extraction, Pod, Simple fruit.*



E

Elaiosome. Oil-rich outgrowth on seed or fruit which is eaten by ants and thus serves to disperse the seed.
See *Dispersal*.

Embryo. The non-self-supporting immature organism formed from the zygote by cell division and differentiation; the rudimentary plant within the seed.
See *Seed, Seedling*.



Embryo sac. The mature female gametophyte of angiosperms containing the egg cell.
See *Embryo, Female gametophyte, Fertilisation, Gametophyte, Ovule*.

Empty seed. Seed without any content, or without an embryo or embryo cavity if some residual tissue is present. Ant. *Filled seed.*
See *Chaff, Flotation*.

Endocarp. Inner layer of the pericarp (fruit wall); e.g. the hard part of drupe fruits like in neem, teak and *Gmelina.*
See *Drupe, Fleshy fruits, Pericarp, Pyrene*.

Endogenous. Originated within, or developed from a deep-seated layer of tissue. In a seed, developed from, or occurring in the *embryo*.
See *Dormancy (endogenous) Dormancy (seed-coat)*.

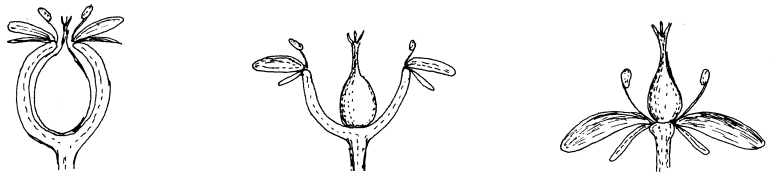
Endosperm. Term usually reserved to the triploid nutrient storage tissue surrounding the embryo in seeds of angiosperms. Sometimes also used for the haploid storage tissue of gymnosperms which is derived from tissue associated with the female gametophyte. The endosperm is normally hard at seed maturity but remain liquid in coconuts. In many seeds the endosperm is digested by

the developing embryo.
See *Seed, Gymnosperm, Albumen, Angiosperm, Nucellus, Perisperm.*

Epicotyl. The shoot end of the embryo which develops into the stem. In germinated seeds or seedlings referring to the portion of the stem between the cotyledons and the first leaves.
See *Embryo, Hypocotyl, Plumule, Seedling.*

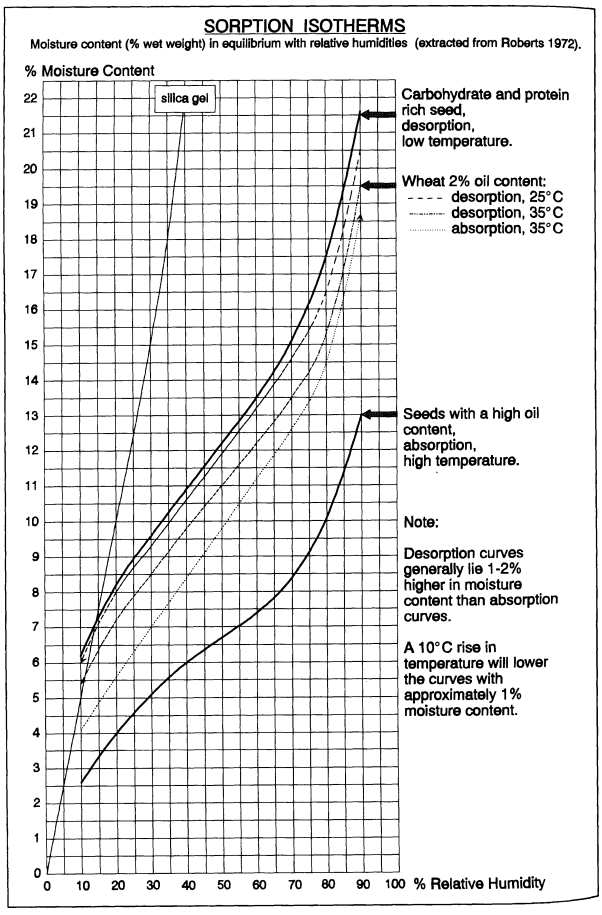
Epigeal (or Epigeous) germination. Type of germination in which the cotyledons are forced above the ground by the elongation of the hypocotyl. Ant. *Hypogeal germination*.
See *Epicotyl, Germination, Seedling*

Epigyny. Floral structure where sepals, petals and stamens are positioned above the ovary (inferior ovary). Ant. *Hypogyny.*
See *Flower, Perigyny*.



Epigyny *Perigyny* *Hypogyny*

Equilibrium moisture content (EMC). Moisture content of seeds in equilibrium with atmospheric humidity at a given temperature. The EMC is influenced by hygroscopic character of the seed storage material *viz.* low for oily seeds and high for seeds rich in protein and carbohydrates.
See *Absorption, Dehydration, Desiccant, Moisture content, Relative humidity.*



Etiolation. The appearance of plants growing in the dark. The plants lack chlorophyll and are therefore pale. They develop long slender stems and have rudimentary leaves.
See *Necrosis, Stress.*

Evaporation. Escape of water molecules from liquid into vapour stage, e.g. during seed drying.
See *Dehydration.*

Exocarp. Outermost layer of pericarp; the skin on fleshy fruits as in *Cornus*, *Malus* and *Prunus*.
See *Drupe, Fleshy fruit, Fruit, Pericarp*.

Exogenous. Developed from a superficial layer of tissue. In seeds, developed from, or occurring in, the covering of the seed, either seed-coat or pericarp. Ant. *Endogenous*.
See *Dormancy (seed-coat).*

Extraction. Separation of seeds from the fruit. Extraction may be complete or partial, the latter e.g. of drupes in which part of the fruit (endocarp) is normally kept enclosing the seed. For dehiscent dry fruit, extraction is simply carried out by drying. Other fruit types may require mechanical treatment such as threshing (dry fruits) or maceration (fleshy fruits).
See *Depulping, Maceration, Threshing, Tumbling.*

F

False fruit (= Pseudocarp). Common term for fruit types in which other floral structures than the pistil (gynoecium) is incorporated, often the receptacle (e.g. pomes). False fruits may be formed from single flowers, thus including *aggregate fruits* and from a whole inflorescence i.e. *multiple fruits*.
See *Flower, Fruit, Pome, Receptacle, Simple fruit*.

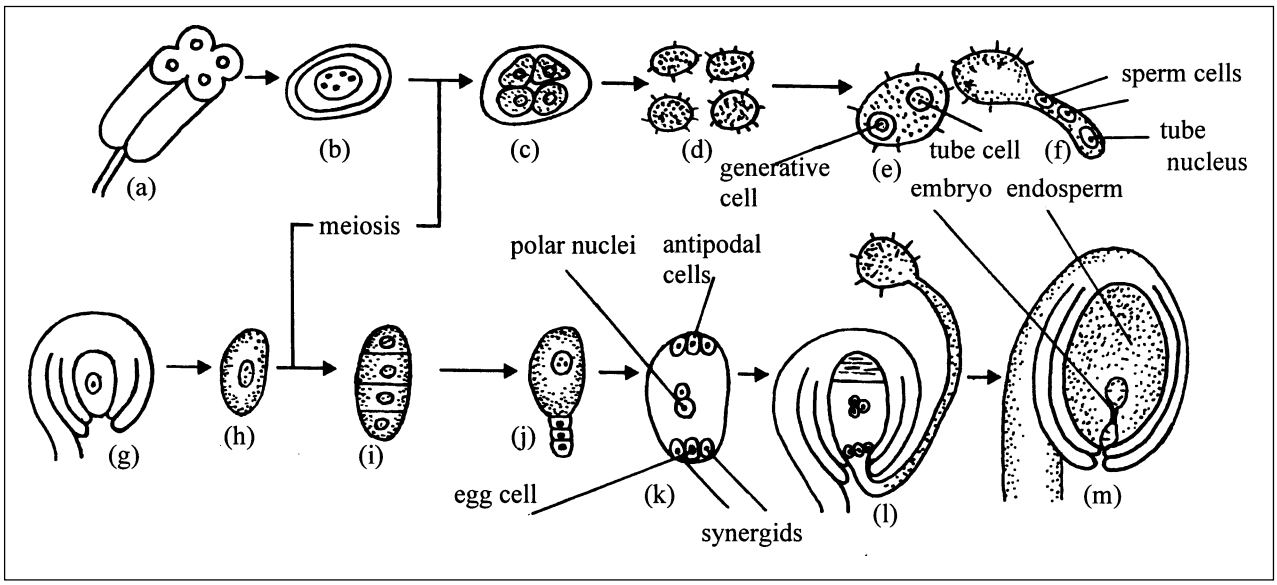
Female gametophyte. The haploid generation in a plants life cycle that produces the egg cell. In angiosperms the female gametophyte is called the *embryo sac*. It is generally composed of seven cells among them the egg cell and the central cell which after fertilisation develops into the endosperm. In gymnosperms, after fertilisation of the egg cell, the female gametophyte becomes gorged with reserve material and forms a storage tissue which is functionally equivalent to the angiospermous endosperm.
See *Archegonium, Embryo sac, Fertilisation, Endosperm, Pollen.*

Fermentation. Anaerobic (without oxygen) decomposition of organic material. The chemical equation for simple alcoholic fermentation is: $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$. Fermentation may be caused by the catalytic action of a 'ferment', which may be an independent organism such as yeast or bacteria, or an enzyme. It may be accompanied by the production of heat and of toxic substances, and the fermentation of fleshy fruits may adversely affect the seeds which they contain.
See *Anaerobic, Respiration*.

Fertilisation. The union of the nucleus and other cellular constituents of a male gamete (sperm) with those of a female gamete (egg) to form a zygote. In gymnosperms fertilisation may occur months after pollination. In angiosperms there is a double fertilisation in which one of the two sperm nuclei from the pollen unites with the egg nucleus to form a diploid zygote and the other sperm nucleus unites with two of the nuclei of the embryo sac to form the triploid endosperm.
See *Female gametophyte, Embryo sac, Endosperm, Zygote.*

Filled seed. Seed where the seed cavity is filled out with all tissues essential for germination. A filled seed is not necessarily alive. Syn: Full seed. Ant. *Empty seed.*
See *Chaff, Empty seed, Flotation*.

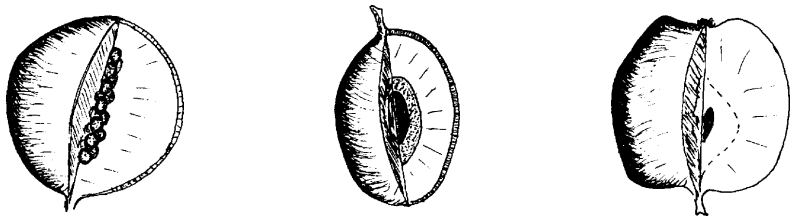
Flail. Tool for threshing dry indehiscent fruits by hand to extract the seeds. It consists of a wooden staff or handle, at the end of which a stouter and shorter pole or club is so hung as to swing freely.
See *Threshing, Extraction*.



Double fertilisation in angiosperms

Double fertilisation, summary of the reproductive processes in angiosperms. The microspore mother cell (b) in the anther tissue (a) undergoes a meiotic division to form four haploid microspores (c) that develop into pollen grains (d). The pollen grains contain two cells, a tube cell and a generative cell (e). At pollination the pollen are deposited on the stigma of the ovule, where they germinate and develop pollen tubes that grow through the stylar tissue and into the embryo sac. During the growth of the pollen tube, the generative cell undergoes a division to form two sperm nuclei (f). The microspore mother cell (h) within the ovule (g) undergoes a meiotic division giving rise to four megaspores (i), each containing a haploid, 'n', chromosome set. Usually only one of the megaspores survives to give rise to an embryo sac whereas the others abort (j). The nucleus within the embryo sac undergoes three successive divisions to form 8 nuclei: an egg nucleus, 2 synergid nuclei, 3 antipodal nuclei and 2 polar nuclei (k). After penetration of the embryo sac (l), one of the sperm nuclei unites with the egg nucleus to form a zygote whereas the other fuses with the two polar nuclei in the embryo sac to form a triploid, '3n', nucleus that undergoes a division to give rise to the endosperm (m). Further development of the zygote leads to the formation of the embryo.

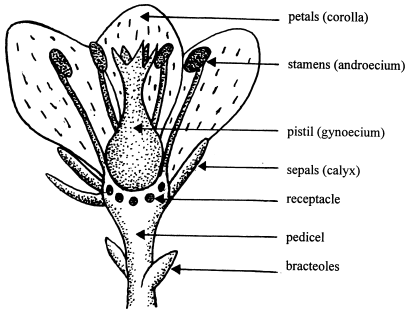
Fleshy fruits. Fruits are often classified as dry or fleshy types. In fleshy fruits the seeds are surrounded by or imbedded in a fleshy, usually sweet substance with a high water content. They include fruit types such as berry, pome, drupe and some aggregate and compound fruits. Fleshy fruits are normally dispersed by animals (zoochory). They usually change colour and develop sweet taste and/or smell upon maturity to attract dispersal agents.
See *Aggregate fruit, Berry, Dispersal, Drupe, Ingestive dispersal, Dry fruits, Simple fruit.*



Berry *Drupe* *Pome*

Floral (= flower) initiation. The time or process of formation of specialised cells which develop into flowers.
See *Differentiation.*

Flotation. Method for cleaning seeds from particles with higher or lower specific density by submerging in water or other liquid. Used e.g. for separation of empty and filled seed and mechanically damaged seed, sometimes in connection with pressure (PREVAC) or incubation (IDS).
See *Cleaning seed, IDS, PREVAC.*



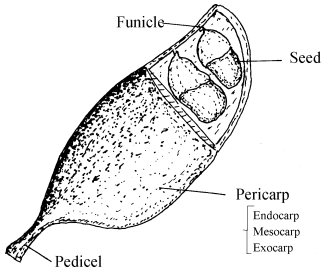
Flower. Angiosperm reproductive structure bearing pistils, stamens, or both, and usually also sepals and petals. So-called flowers in gymnosperms are male and female strobili before and during pollination.
See *Angiosperm, Fruit, Gymnosperm, Strobilus*.

Flowering. The phenological period from appearance of flowers to fruit set. Flowering may be prolonged (diffuse) or short (gregarious). Also used for the period of pollination and female receptivity in gymnosperms, although these have no flowers in the strict botanical sense.
See *Anthesis, Flower, Phenology*.

Follicle. Dry dehiscent fruit formed from a single carpel, splitting along one side only, e.g. *Grevillea.* Some aggregate fruits are made up of single fruits of follicles, e.g. *Manglietia* and *Magnolia*.
See *Aggregate fruits, Dry fruits.*

Frankia. Group of microsymbionts inoculating and making symbiosis with certain plants such as *Alnus* and casuarinas. Host plants are called *Actinorhizal plants.*
See *Microsymbionts, Mycorrhiza, Rhizobium, Inoculation.*

Fruit. In a strict botanical sense, the mature pistil or pistils of the angiosperm flower, in some types is also included associate structures like receptacle or perianth. In a less strict terminology it includes the mature seed-bearing organs in gymnosperms, e.g. cones, multiple and aggregate fruits. Fruit wall (pericarp) is sometimes divided into three separate layers viz. *exocarp*, *mesocarp* and *endocarp*.
See *Aggregate fruit, Compound fruit, Cone, Drupe, Dry fruits, False fruit, Fleshy fruits, Seed bearing organ, Simple fruit.*



Fruiting. The phenological period from end of flowering to fruit maturity and dispersal. In common terminology often referring to the period of fruit maturity only i.e. fruit collection or harvest. Also used for gymnosperms with no fruits in the strict botanical sense.
See *Flowering, Fruit, Harvest, Maturity, Phenology.*

Fumigation. Application of a chemical compound in gas form e.g. CO_2.
See *Carbon dioxide, Treatment*.

Funicle (funiculus). The stalk of an ovule or seed, attaching it to the ovary placenta.
See *Aril, Fruit, Hilum, Ovule, Pistil, Placenta, Seed.*

G

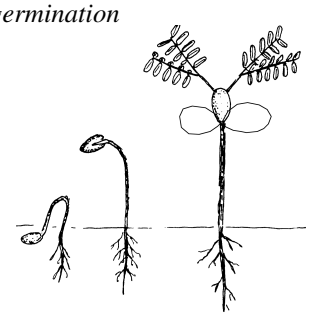
Gamete. Reproductive cell whose nucleus and often cytoplasm fuses with that of another gamete (fertilisation), the resulting cell (zygote) developing into a new individual. Gametes are haploid. In higher plants the gametes are differentiated into female gamete (egg cell) and male gamete (sperm cell).
See *Fertilisation, Gametophyte.*

Gametophyte. That plant generation which produces gametes from which, after fertilisation, the sporophyte develops. The gametophyte has haploid (n) chromosome number.
See *Embryo sac, Female gametophyte, Sporophyte*.

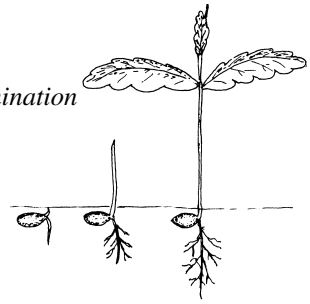
Geotropism. The tendency of plant organs to grow in relation to the direction of gravity, either towards the ground (positive geotropism, usual for roots and radicles) or away from the ground (negative geotropism, typical for shoots).
See *Germination, Radicle, Seed.*

Germination. The physiological processes in the first stages of growth of seed (and pollen grain). In seed germination, resumption of active growth in the embryo of a seed is demonstrated by the protrusion of the radicle. In seed testing (ISTA definition), resumption of active growth in an embryo which results in its emergence from the seed and development of those structures essential to normal plant development.
See *Abnormal germination, Epigeal, Germination capacity, Germination test, Hypogeal, Imbibition, ISTA, Lag phase, Seedling, Viability.*

Epigeal germination



Hypogeal germination



Germination capacity (= germination percentage). Proportion of a seed sample that has germinated normally in a specified test period, usually expressed as a percentage. It should be noted that in earlier literature the term 'germination capacity' has been used to express viability.
See *Germination, Viability, Vigour.*

Germination energy. The proportion of germination which has occurred up to the time of peak germination, or the time of maximum germination rate, or up to some pre-selected point, usually 7 test days. The critical time of measurement can be chosen by several means.
See *Germination capacity, Germination test, Peak germination, Vigour, Viability.*

Germination percentage. See: *Germination capacity.*

Germination test. Standard test carried out to determine the quality of a seed lot, i.e. the percentage of germinable seeds. The germination test is carried out under prescribed standard conditions under the, for the particular species, optimal germination conditions of temperature, humidity and light. Dormant seed must be pre-treated in order to break dormancy before the germination test.
See *Germination capacity, Germination energy, Pre-treatment, Seed testing, Viability.*

Grading. The process of sorting seeds or seedlings into classes, normally according to size. Grading often implies removal of a certain amount (normally the smaller size) of seeds or seedlings from a seed lot or seedling population.
See *Upgrading.*

Gregarious flowering. Mass flowering in a population of trees of a species with pronounced periodicity. Flowering tends to be synchronised within a population or part of a population. Gregarious flowering often results in masting. Ant. *Diffuse flowering.*
See *Flowering, Masting, Phenology, Periodicity.*

Gymnosperm [gymno=naked, sperm=seed]**.** Botanical classification of the group of vascular

seed plants in which the ovule (and later the egg) is not enclosed in an ovary (as different from angiosperms). Most gymnosperms produce seeds in cones (common name conifers). Non-cone-producing gymnosperms are e.g. *Podocarpus*, *Ginkgo* and *Taxus*.
See *Angiosperms, Cone, Conifers, Seed bearing organ, Seed plants.*

Gynoecium. Collective term for the female part of the flower, i.e. *pistil*. Ant. *Androecium.*
See *Female gametophyte, Flower, Fruit.*

H

Haploid. Cell or organism with one basic chromosome set, symbolised by n; the normal condition of gametes, i.e. egg cell and sperm cell.

Hard seed. Seeds with hard, impermeable seed-coat that prevents imbibition. The hard seed-coat also serves as protection against physical damage. In order to make hard seeds imbibe and germinate, the seed-coat must be perforated, e.g. by scarification.
See *Dormancy (physical), Impermeable, Legume seed, Pre-treatment, Scarification*.

Harvest. Fruit collection directly from the tree e.g. after shaking or during climbing.
See *Collection (seed), Maturity, Harvestable seed crop.*

Harvestable seed crop. The amount of the total seed production which is practically possible to harvest. The non-harvestable crop encompasses inaccessible fruits, early or late crop or fruits left on the tree in order to minimise damage to the tree - the latter specifically referring to collection methods where fruit bearing branches are cut.
See *Collection (seed)*, *Seed crop.*

Health test. Test for pathogen infection of seed.
See *Pathogen, Phytosanitary, Seed testing.*

Hermaphrodite (= bisexual, monoclinous). Having functional male and female reproductive organs in the same flower. Ant. *Dicliny* or *Unisexual*.
See *Perfect (flower).*

Hilum. In angiosperms, scar on the seed-coat left by the funiculus. Gymnosperms have no funiculus, but a hilum-like scar may appear where the seed has been attached to the megasporophyll.
See *Chalaza*, *Flower, Funiculus, Seed, Strophiole.*

Hiltner test. Vigour test method in which the ability of germinants to overcome physical stress is evaluated by germinating seeds under a layer of crushed brick stone gravel.
See *Vigour, Seed testing, Stress.*

Host specificity. The degree to which e.g. insect predators, fungi, or microsymbionts are associated with smaller or larger number of host species.
See *Microsymbionts, Cross-inoculation group*.

Husk. Outer coarse or fibrous pericarp, e.g. in teak and coconuts used e.g. for planting medium.
See *Pericarp, Peat, Water holding capacity.*

Hybrid. The offspring of genetically distinctly different parents. The term is applied to progeny of mating within species (intraspecific) or between species (interspecific). Hybrids typically have morphological characters intermediate between their parents but may sometimes show exceptionally growth rate (hybrid vigour). Species hybrids often produce few seeds and of poor quality.

Hygroscopic. Sensitive to moisture, absorbing or losing water. Cones and many dry dehiscent fruits may open and close according to humidity because they contain hygroscopic tissue.
See *Equilibrium moisture content, Extraction, Moisture content.*

Hypocotyl. The axial part of the embryo between the cotyledons and the radicle. In seedlings, the juvenile stem which is between the cotyledons and the root system.

See *Embryo, Germination, Seedling.*

Hypogeal (or hypogeous) germination. Type of germination in which the cotyledons remain below the ground while the epicotyl elongates. Ant. *Epigeal germination.*
See *Seedling, Germination.*

Hypogyny. Floral structure where sepals, petals and stamens are positioned below the ovary (superior ovary). Ant. *Epigyny*.
See *Flower, Perigyny*.

I

IDS (Incubation-Desiccation-Separation). Method of separating (removing) filled dead or damaged seed from sound seed. The seeds are imbibed and incubated at optimal germination conditions for approx. two days, then dried shortly and separated by flotation. As filled dead and damaged seeds tend to lose water quicker than sound seed during desiccation, they will float in water while sound seeds will sink.
See *Cleaning (seed), Empty seed, Flotation, PREVAC.*

Imbibition. The process of initial water uptake by seeds prior to germination. Imbibition is an entirely physical process and also non-viable seeds imbibe.
See *Absorption, Germination, Lag-phase.*

Immature embryo. Seed embryo which has not attained a development stage to make it capable of germination.
See *Dormancy (embryo), After-ripening, Mature.*

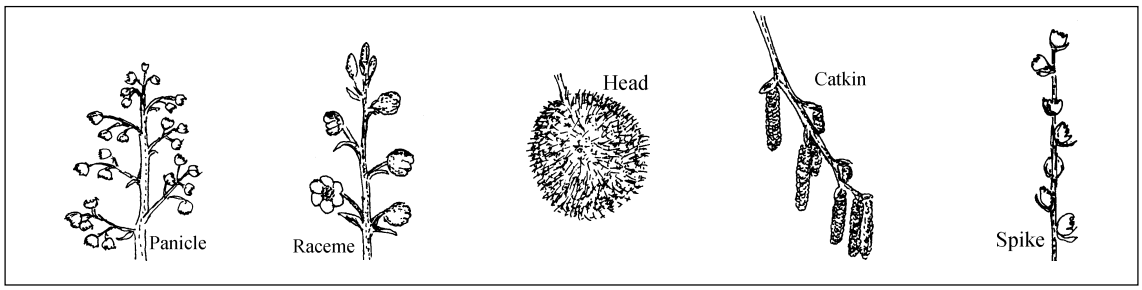
Imperfect flower (= unisexual flower). Having either only male or only female reproductive organs in the flower, i.e. male flowers or female flowers.
See *Dichogamy*, *Dicliny*, *Flower, Perfect (flower).*

Impermeable. Barrier restricting passage of motile molecules, e.g. a seed or fruit coat obstructing water passage and hence imbibition.
See *Dormancy (physical)*, *Imbibition, Hard seed, Semi-permeable.*

Indehiscent (of anther or fruit). Not opening spontaneously at maturity to release their pollen or seeds, e.g. some pods, samaras and nuts. Ant. *Dehiscence*.
See *Dry fruits, Extraction.*

Indigenous. Species native to a country or an area, not introduced. Ant. Exotic.

Inflorescence. Flowering shoot; the assembly of a few or many individual flowers into large clusters from a common axis. Inflorescences are grouped according to the manner of branching.
See *Catkin, Flower, Infructescence, Pedicel, Peduncle.*



Some types of inflorescences

Infructescence. Fruit stand; cluster of fruits or arrangements of fruits on a plant.
See *Aggregate fruit, Inflorescence, Fruit, Multiple fruit.*

Ingestive dispersal (= endozoochory). Seed dispersal by animals that eat (ingest) the fruit and void the seed by regurgitation or in their faeces.
See *Fleshy fruits, Dispersal.*

Inhibition: Here: restraint or repression of a seed function, e.g. inhibitory substances in a fruit or seed restraining or repressing seed germination.
See *Dormancy (chemical), Inhibitor, Leaching.*

Inhibitor. Chemical compound which inhibits germination, e.g. coumarin and abscisic acid (ABA)
See *Dormancy (chemical), Inhibition, Leaching.*

Inoculation. Here: application of a microsymbiont (inoculant or inoculum) to a host plant.
See *Cross inoculation, Host specificity, Microsymbionts.*

Integument. The one or two layers (often fused) of tissue covering and surrounding the nucellus of an ovule. When the ovule matures, the integuments develop into the seed-coat.
See *Flower, Micropyle, Ovule, Ovule orientation, Pistil, Seed-coat.*

Intermediate (seed). In relation to storability, seeds that can be dried to a moisture content as that of orthodox seeds but are sensitive to low temperatures typically employed for orthodox seeds.
See *Chilling damage, OLDA, Orthodox seed, Recalcitrant seed.*

Involucre. One or more bracts situated below and close to a flower or flower cluster; sometimes enclosing the carpels as in *Tectona*.
See *Flower, Cupula.*

Isotherm. Here: graph showing the relationship between relative humidity of the surrounding air and moisture content of e.g. a seed or an embryo at a given temperature.
See *Equilibrium moisture content, Relative humidity.*

ISTA (International Seed Testing Association). International association which issues rules and regulations for standard seed testing on agricultural, horticultural and forest tree seed. Revised and updated rules and regulations are issued every three years. ISTA rules are mainly followed in Europe, Africa and Asia, while a slightly different system is used in North and part of South America.
See *AOSA, Seed testing.*

J

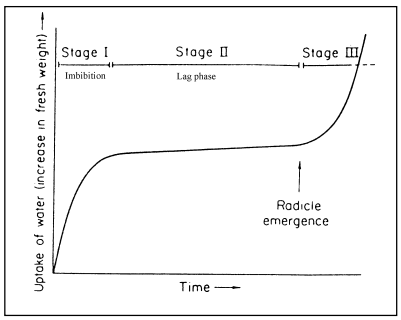
Juvenile. Young or non-mature stage of a tree or population. The juvenile stage of a tree often refers to the age prior to first flowering. Ant. *Mature*.

K

Kiln. Drying device in which fruits and cones are exposed to above ambient temperature by solar or artificial heat source to make them open. The most common kiln forms are stationary kilns and rotating drum kilns.
See *Extraction, Scorching, Serotinous, Tumbling.*

L

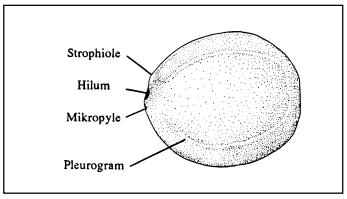
Lag phase. In connection with germination, the phase after imbibition and before radicle elongation. During the lag phase there is no or very little water absorption and no or very little sign of development.
See *Absorption, Germination, Imbibition.*

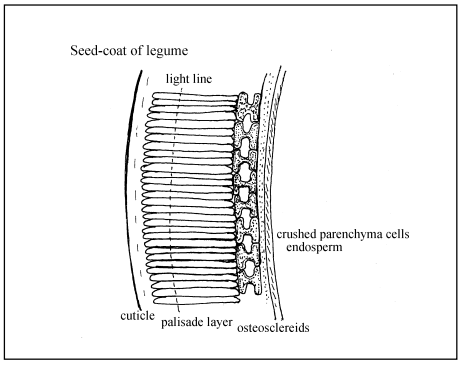


Leaching. Removal of chemical inhibitors in fruits or seeds by washing in running water.
See *Dormancy (chemical), Inhibitor*.

Legume. Generally referring to fruits of the family Leguminosae, here used equivalent to 'pod'. Some Leguminosae have, however, modified fruit types such as samaras or follicles. The term should be reserved to the prevalent fruit type in Leguminosae viz. a multi-seeded dry fruit that may or may not open at maturity.
See *Pod, Dehiscence, Indehiscence.*

Legume seed. Seeds of the plant family Leguminosae. The seeds are often hard and impermeable. Seed-coat consists of three distinct layers of which the outer two, the cuticle and the palisade layer provide impermeability to water and protect against desiccation.
See *Dormancy (physical), Hard seed, Legume, Light line.*





Light line. In legume seed-coats, a distinct line across the cells in the palisade layer. Impermeability is generally believed to be connected to the light line.
See *Legume seed, Macrosclereids (=palisade cells).*

Locule (loculus). Cavity of an ovary or anther. Where several carpels make up a compound pistil, these may form separate locules (multilocular) or one large locule (unilocular)
See *Compound pistil, Fruit, Placenta*.

Longevity, seed. The period of time seed will maintain viability in storage under a given set of storage conditions. Often used equivalent to *storability*.
See *Ageing, Orthodox seed, Recalcitrant seed, Viability.*

Lowest Safe Moisture Content (LSMC). Moisture content below which freshly collected seeds die when the seed lot desiccates, same as *critical moisture content (CMC)*.
See also *OLDA, Intermediate (seed), Recalcitrant.*

M

Maceration. The process of softening (fleshy fruits) by steeping in a liquid, with or without heat; to wear away or separate the soft parts, by steeping.
See *Depulping, Fleshy fruits*.

Macrosclereids (= palisade cells). Layer of elongated cells perpendicular to the seed-coat surface.
See *Legume seed, Light line, Impermeability.*

Masting. Ecological term used to describe the strategy of some plant species to produce large crops of seeds at long intervals, e.g. some dipterocarps and araucarias.
See *Mast year*, *Periodicity, Seed crop*.

Mast year (= seed year). Year with large seed production.
See *Gregarious flowering, Masting, Periodicity, Seed crop*.

Mature. Of plants: the stage of individuals after having passed the juvenile stage; often considered synonymous with reproductive age. Of fruits: the stage of the fruit when seeds are ready to be dispersed; usually, but not always, coinciding with germinability of the seeds. Often visible by e.g. colour change, desiccation and opening structures. Of seeds: seeds which are fully germinable after extraction from their fruits and possible breakage of dormancy.
See *Maturity index, Physiological maturity*.

Maturity index (pl. indices). Changes of fruit and seed appearance indicating maturity e.g. change of colour, odour, drying, dehiscence, softening of fruit pulp and hardening of the seed-coat and endosperm. Maturity indices are used to schedule seed collection.
See *Mature, Harvest.*

Megaspore (= macrospore). The (haploid) female spore from which the female gametophyte develops. Megaspores are formed in the ovule when a diploid cell, called megasporocyte, undergoes meiosis.
See *Female gametophyte, Fertilisation.*

Megasporophyll (= macrosporophyll). Leaf or modified leaf bearing macrosporangia. In angiosperms, the carpel producing ovules. In gymnosperms the megasporophyll is called ovuliferous scale or cone scale.
See *Cone, Carpel, Microsporophyll, Ovuliferous scale.*

Mesocarp. Middle layer of the pericarp; the pulp of berries and drupes.
See *Drupe, Endocarp, Fruit, Pericarp.*

Metabolism. The chemical changes within a cell that provide the energy required by a plant or animal.
See *Fermentation, Respiration.*

Micropyle. Minute opening in the integuments of an ovule through which the pollen grain or pollen tube passes to reach the embryo sac. On mature seeds the micropyle is sometimes visible as a small pore on the seed-coat. In seeds derived from orthotropic ovules the micropyle and hilum lie distant to each other, from anatropous ovules close to each other and from campylotropous ovules intermediate. The radicle of the embryo always faces the micropyle.
See *Flower, Ovule orientation, Pistil, Seed,*

Microsporophyll. A leaf or modified leaf bearing the male reproductive part. In angiosperms the stamens, in gymnosperms the scales of the male strobili.
See *Cone, Flower, Megasporophyll, Strobilus*.

Microsymbionts. Micro-organisms living in close association (symbiosis) with a host plant. Microsymbionts are rhizobia and *frankia*.
See *Cross inoculation group, Inoculation, Host specificity, Mycorrhiza, Frankia, Rhizobia.*

Moisture content (m.c.). The amount of water present in a material, e.g. wood, soil or seed. It is normally expressed on a weight basis, either as the weight of the water in % of the material's oven-dry weight ('dry-weight basis') or, preferably in the case of seeds and fruits, as a % of the material's fresh weight including water ('wet-weight' or 'fresh-weight basis').
See *Calibration, Critical moisture content, Equilibrium moisture content, Oven-dry, Processing, Moisture-meter, Seed testing.*

Moisture meter. Instrument for quick measurement of moisture content of seed without drying. The instrument measures the electrical properties of the seed tissue, which is correlated with the content of water (moisture content). Moisture meters must be calibrated for each species with standard method of moisture content measurement i.e. oven-drying.
See *Calibration, Oven-dry, Moisture content.*

Monocotyledons. Subclass of angiosperms characteristic by having only one cotyledon in the embryo. Differ from dicotyledons in a number of morphological characters like leaf, root and stem

structure. Woody monocotyledons are e.g. bamboos and palms. Ant. *Dicotyledons*.
See *Angiosperms.*

Monoecious[mono = one, oikos = house]**.** A species with male and female sexual reproductive organs borne on the same individual. Ant. *Dioecious.*
See *Dicliny*.

Mould. Fungi that produce distinct mycelium or spore mass on the surface of their host, e.g. mucor and certain *penicillium* species.

Multilocular. Ovary with two or more locules each containing one or many seeds.
See *Capsules, Compound pistil, Loculus, Placenta*.

Multiple fruit. Fruit derived from an inflorescence, of combined gynoecia of many flowers. E.g. *Casuarina* (dry) and *Artocarpus* (fleshy).
See *Aggregate fruit, Simple fruit*.

Mycorrhiza. [Myco = fungus; rhiza = root]. Fungi living in symbiosis with plant roots. The fungus provides the plant with mineral nutrients and gets in return sugar and other organic compounds.
See *Microsymbiont, Inoculation, Rhizobia, Frankia.*

N

Naked stratification. Pre-chilling of seeds without the use of a moisture-holding medium.
See *Dormancy (embryo), Dormancy (secondary), Pre-treatment, Stratification,*

Necrosis. Death of a plant part.
See *Abnormal seedling.*

Nucellus. In angiosperm ovules, the tissue in the central part of the ovule inside the integument, in which the embryo sac is embedded. During maturation the nucellus is usually absorbed but develops in some species into a nutritive tissue, surrounding the endosperm. The nucellus is of entirely maternal origin and hence diploid.
See *Albumen, Embryo sac, Endosperm, Female gametophyte, Gametophyte.*

Nut. Fruit derived from more than one carpel but in which all but one or few ovules abort, leaving the fruit one or few-seeded. Nuts have hard pericarp and the seeds very thin testas, e.g. *Quercus* and dipterocarps.
See *Abortion, Dry fruits.*

O

OLDA (Orthodox with Limited Desiccation Ability). Category of storage behaviour intermediate of that of orthodox and recalcitrant seed.
See *Critical moisture content*, *Intermediate (seed), Orthodox, Recalcitrant.*

Operculum. Dehiscent 'cap' or 'lid' structure of e.g. some anthers and capsules.
See *Capsule*.

Orthodox. Term used to describe seeds which can be dried down to a low moisture content of around 5% and successfully stored at low or sub-freezing temperatures for long periods. There is practically no metabolism in dry, cooled orthodox seeds, but they may deteriorate by general ageing and thus ultimately lose their viability. Ant. *Recalcitrant*.
See *Ageing*, *Intermediate (seed), Metabolism, OLDA, Temperate recalcitrant*.

Orthotropous (= atropous). Ovule orientation in which the ovule develops in an upright position from the placenta, consequently with hilum and micropyle located at opposite ends of the developing seed.

See *Anatropous, Campylotropous, Ovule orientation.*

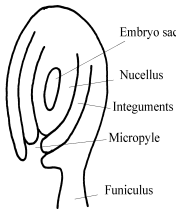
Osteosclereids. Layer of specialised cells between the macrosclereids and the parenchyma cells in legume seed-coats.
See *Macrosclereids, Legume seed.*

Ovary. The part of the pistil that contains the ovules and ripens to form the fruit.
See *Ovule, Pistil.*

Oven-dry. In connection with moisture content, the standard ISTA / AOSA method of drying seeds at 103° C for 20 hours to reveal weight loss, which is an indication of moisture content of the seed.
See *Calibration, Moisture content, Moisture meter.*

Ovule. A structure in seed plants consisting of the nucellus which contains the female gametophyte, one or two integuments and the funiculus. After fertilisation of the egg cell the ovule differentiates into the seed.
See *Embryo sac*, *Fertilisation, Ovary, Pistil*.

Ovule orientation. Position of the ovule within the ovary, which may be upright (orthotropous), completely inverse so that the micropyle faces the placenta (anatropous) or at an angle to the placenta (campylotropous). Ovule orientation is visible on the seed as the position of the micropyle in relation to the hilum and chalaza.
See *Ovule, Placenta*.



Anatropous

Orthotropous (atropous)

Campylotropous

Ovuliferous scale. The ovule- (later seed-) bearing scales in the cones of conifers (contrast bract scales).
See *Bract, Cone, Ovule.*

P

Palisade cells. Same as *Macrosclereids.*

Panicle. See *Inflorescence*.

Parasite. Organism that lives on and at the expense of another living organism (host).

Parenchyma. Tissue consisting of undifferentiated, living cells. In seed-coats a layer of parenchyma is often present beneath the hard seed-coat cells.
See *Legume seed.*

Parthenocarpy. Development of a fruit without viable seed. The fruits may be either seedless or seeds may lack embryos. May result from a failure of pollination, a failure in fertilisation, or a failure in embryo development.
See *Empty seed*.

Parthenogenesis. Reproduction from an unfertilised egg, a type of apomixis.
See *Apomixis.*

Pathogen. Disease-producing micro-organism like bacteria, small fungi or vira, but not e.g. insects.

See *Pathology, Phytosanitary, Seed-borne pathogen, Seed-transmitted pathogen*.

Pathology, seed. The science of seed diseases or seed-borne pathogens.
See *Health, Pathogen, Phytosanitary*.

Peak germination. A loose term which describes the point in time when rate of germination is highest; it can be calculated in several ways.
See *Germination energy.*

Peat. Organic planting medium manufactured from bogs or swamps. Peat has a high water holding capacity. Also used as a carrier of rhizobium inoculates.
See *Husk, Water holding capacity*.

Pedicel. The individual flower stalk in an inflorescence.
See *Inflorescence, Flower, Fruit, Peduncle.*

Peduncle. The main axis of an inflorescence or, in the case of single flowers, the flower or fruit stalk.
See *Inflorescence, Pedicel, Fruit.*

Pelleting. Procedure by which individual seeds are provided with an envelope of adhesive material containing e.g. nutrients, microsymbiont inoculant and/or pesticides. In addition to providing these beneficial compounds, pelleting facilitates mechanical sowing because of the more uniform seed size.
See *Inoculation, Pre-treatment.*

Perfect flower. Angiosperm flower containing both stamen and pistil. Ant. *Imperfect flower.*
See *Complete flower, Flower, Hermaphrodite*.

Perianth. Collective term for the outer part of flower comprising calyx and corolla. Term usually applied to species showing little differentiation in calyx and corolla.
See *Calyx, Corolla, Flower.*

Pericarp. Wall of a ripened ovary i.e. fruit wall. The pericarp is homogeneous in some genera and in others it is composed of three distinct layers: exocarp, mesocarp and endocarp.
See *Drupe, Fruit.*

Perigyny. Flower type in which the receptacle partly encloses the pistil, e.g. in most eucalypts.
See *Epigyny, Flower, Receptacle*.

Periodicity. The tendency, in individuals, stands or species, to produce seed crops at long but often more or less regular intervals, e.g. many dipterocarps. Periodicity is closely connected to gregarious flowering and masting. Periodicity indicates the interval (in years) between good seed or cone crops. Compare *seasonality*.
See *Masting, Phenology, Seed crop.*

Perisperm. Layer of nutritional tissue of diploid maternal origin arisen from the nucellus and often surrounding the endosperm. It is usually completely absorbed before maturation but forms the principal nutritive tissue in e.g. some Caryophyllaceae.
See *Albumen, Endosperm, Female gametophyte, Nucellus, Seed.*

Perlite. An inorganic, very light planting material manufactured from volcanic lava. It has a very high water holding capacity. Used primarily to improve the aeration of a planting medium.
See *Husk, Peat, Vermiculite, Water holding capacity.*

Permeable. Allowing passage of motile molecules, e.g. a gas or liquid. A seed-coat is permeable when water can be absorbed for the seed to imbibe. A barrier may be selective or semi-permeable if it allows only passage of small molecules, e.g. a polyethylene sheet which is permeable to gas but impermeable to water. Ant. *Impermeable.*
See *Absorption, Hard seed, Semi-permeable.*

Persistent fruit. Fruit or seed-bearing structure which remains firmly attached to the tree after maturity; often occurring in dehiscent fruits.

See *Dehiscence.*

Pest. Here: any organism causing damage to seeds by infestation, e.g. insects or micro-organisms.
See *Pathogen*.

Phenology. Study of the relations between seasonal climatic changes (e.g. temperature, day length and precipitation) and periodic biological phenomena such as flowering, fruiting, leaf flushing and dormancy.
See *Pheno-period, Periodicity, Seasonality.*

Pheno-period. Abbreviation of phenological period i.e. a period of a phenological stage such as flowering or fruiting.
See *Flowering, Fruiting, Phenology, Seasonality.*

Physiological maturity. General term for the stage in the life cycle of a seed when development is complete and the necessary biochemical components for all physiological processes are active or ready to be activated.
See *Mature, Maturity index.*

Phytochrome. Pigment involved in photo-reactions, e.g. light stimulated germination. Phytochrome exists in two forms P_r and P_{fr}, which can interchange to either form by the influence of light. P_r absorbs red light by which it is transformed to P_{fr}; P_{fr} absorbs far-red light by which it converts into P_r.
See *Dormancy (photo), Dormancy (secondary).*

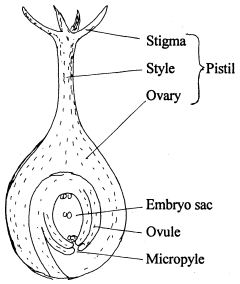
Phytosanitary. [phyto = plant, sanitary = cleaning]. A term applying to the condition of potential transfer of *seed-borne pathogens*.
See *Health test, Pathogen, Quarantine*.

Phytosanitary certificate (= Health certificate). Certificate issued as a result of a test carried out to ascertain that seeds or plants are free from general or specific diseases or organisms. May only be issued after quarantine or disinfection.
See *Certified seed, Phytosanitary, Health test, Quarantine.*

Phytotoxic. A compound poisonous to plant tissue. Applies to e.g. side effects of pesticides.
See *Seed treatment*.

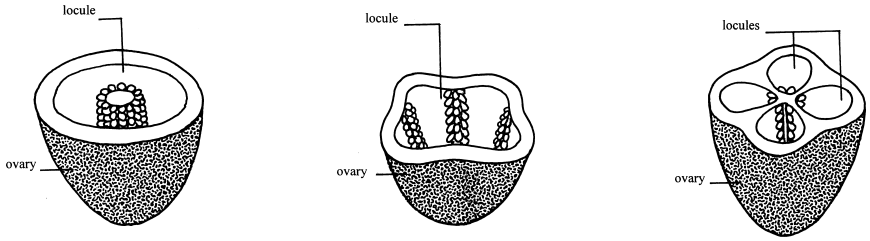
Pioneer species. Ecological term referring to the group of species appearing as early colonisers of exposed land and openings in primary forest. During succession, pioneer species are normally replaced by climax forest tree species. Pioneers are characterised by rapid growth, young reproductive age, large production of relatively small seed, and usually easy propagation. Ant. *Climax species*.

Pistil. Ovule-bearing organ of angiosperms, composed of ovary, style and stigma. A pistil is made up of one (simple pistil) or more (compound pistil) carpels.
See *Carpel, Compound pistil, Flower, Fruit, Gynoecium, Simple fruit.*



Placenta (pl. plancentae). Region in the ovary where the ovules originate and are attached to the carpel.
See *Loculus, Ovary, Ovule orientation.*

Placentation. The position of the placenta in the ovary.



free central *parietal* *axile*

Pleurogram. A distinct horse-shoe formed line occurring on either side of certain legume seeds e.g. acacias and albizias.
See *Legume seed*.

Plumule. The embryonic shoot derived from the epicotyl. In dicotyledons situated between the cotyledons.
See *Embryo, Epicotyl.*

Pod. One or many-seeded dehiscent or indehiscent dry fruit formed from a single carpel. Resembles the follicle but differs from it in splitting along both sides. Prevailing fruit type in Leguminosae. Also found in some Sterculiaceae.
See *Legume, Dry fruits, Dehiscence.*

Pollen. The male gametophyte of seed plants produced in the anther or in strobili. Wind pollinated species have a large production of light (in conifers usually winged) pollen. Animal pollinated species often have sticky pollen.
See *Anthesis, Fertilisation*.

Pollen chamber. In gymnosperms, a modification of the apex of the megasporangium which receives the pollen, and where the pollen remains dormant until fertilisation can occur.
See *Fertilisation.*

Pollen sac. Locule in the anther containing the pollen grains.
See *Flower, Stamen.*

Pollen tube. Tubular protuberance of maturing male gametophytes in seed plants, occurring during fertilisation. In angiosperms the pollen germinates on the stigma and grows through the style to reach the ovule. In gymnosperms the pollen germinates at the tip of the ovule.
See *Fertilisation*.

Pollen vector. The vehicle by which pollen is transferred from the male flower or strobilus to a female flower or strobilus, e.g. wind, water, or animals. In animal pollinated species usually called a *pollinator*.
See *Pollination*.

Pollination. Deposition of pollen on the receptive part of the female flower. In angiosperms it is the stigma, in gymnosperms the ovule tip.
See *Fertilisation*.

Pollination droplet. Droplet of fluid exuded from the micropyle of gymnosperms at pollination, the function of which is to catch the pollen and later upon evaporation draw the pollen into the *pollen chamber*.
See *Pollen tube*.

Pollinator (= pollination agent). A living organism transferring pollen, e.g. insects, birds or bats.
See *Pollen vector*.

Polyembryony. Production of two or more embryos from a single ovule and in a single seed.

See *Embryo, Seed.*

Polythene. Abbreviation of polyethylene, a material used for plastic sheet and pots (slang: 'polypot').

Pome. Many-seeded fruit derived from a compound pistil embedded in a fleshy hypanthium (cup-shaped receptacle in perigynous flowers) or floral tube of epigynous flowers. E.g. apple.
See *Epigyny, Fleshy fruits, Receptacle.*

Pre-chilling. Cold moist treatment similar to that of chilling but specifically applied to dormant seed and designed to overcome thermo-dormancy.
See *Chilling, Dormancy (thermo)*, *Pre-treatment, Stratification*.

Precocious germination. Same as *vivipary*.

Precuring. The deliberate storage and slow air drying under shade of fruits and contained seeds in order to ease extraction and after-ripen the seeds.
See *After-ripening*.

Predation. Consumption of a living organism by an animal predator, e.g. an insect eating a seed.
See *Dispersal, Pest*.

Pre-treatment. Any kind of treatment applied to seeds to overcome dormancy and hasten germination, e.g. *stratification*, *scarification*, *pre-chilling*.
See *After-ripening, Priming, Treatment.*

PREVAC (pressure-vacuum). Method of separating mechanically damaged seed from sound seed in a seed lot. Dry seeds are exposed to vacuum in water. When the pressure is released, damaged seeds absorb water quicker than undamaged seeds. During subsequent flotation, damaged seeds tend to sink while undamaged seeds float.
See *Empty seed, Flotation, IDS.*

Primary sample. Small sample drawn from a single position of a seed lot. Several primary samples make up a *composite sample*.
See *Sample, Working sample.*

Priming (osmotic). Pre-treatment method to promote rapid and uniform germination. The seeds are soaked in a liquid solution (e.g. polyethylene glycol (PEG), sugar or salt) of sufficiently low water potential to regulate moisture content at a level where the germination process initiates but radicle protrusion is prevented.
See *Germination, Imbibition, Pre-treatment*.

Processing, seed. Seed handling methods from collection to storage, usually a collective term applied to extraction, cleaning and drying.
See *Collection (seed), Seed handling*.

Procurement, seed. Practical methods of seed handling from collection to sowing including e.g. methods of collection, processing, storage and pre-treatment.
See *Seed handling*.

Propagule. A plant part, e.g. root, bud or shoot, used for vegetative propagation. Ant. *Seed*.

Protandry ('male-first'). The condition in which the male reproductive organs (stamens) of a flower mature before the female ones (carpels), thereby ensuring that self-fertilization does not occur.
See *Dichogamy*, *Protogyny*.

Protogyny. ('female-first'). The condition in which the female reproductive organs (carpels) of a flower mature before the male ones (stamens), thereby ensuring that self-fertilization does not occur.
See *Dichogamy, Protandry*.

Pseudocarp. See *False fruit.*

Pulp. Fleshy part of fruits which may make up the entire pericarp (berries) or only the exo- and

mesocarp (drupes). Also including aril and sarcotesta in some species.
See *Aril*, *Depulping, Drupe, Extraction, Fleshy fruits, Sarcotesta.*

Pure seed. That component of a seed lot which consists of seeds of the designated species. According to ISTA rules, it includes not only mature, undamaged seeds but also undersized, shrivelled, immature and germinated seeds provided they can be positively identified as the designated species, and pieces of seed resulting from breakage which are more than half their original size.
See *Cleaning (seed), Purity, Seed testing, Thousand grain weight.*

Purity. Proportion of clean, intact seed (according to pure seed definition) of the designated species in a seed lot, usually expressed as a percentage by weight.
See *Cleaning (seed), Pure seed, Seed testing.*

Pyrene. Botanical term for the endocarp with enclosed seed in drupes. In seed-handling terminology the term 'stone' commonly applies to the pyrene.
See *Drupe, Endocarp, Stone.*

Q

Quarantine. Period during which seeds are kept under observation and examination for possible seed-borne pests and pathogens. Transfer over international borders are often subject to quarantine regulations.
See *Health test, Phytosanitary.*

Quiescent. Inactive, resting. Applicable to non-dormant seeds during the interval between maturation on the parent tree and the onset of germination. Sometimes mistakenly called imposed dormancy.
See *Dormancy, Soil seed bank.*

R

Radicle: The embryonic root, i.e. the part of the seed embryo that develops into the primary root. In seeds, the radicle is always facing the micropyle.
See *Embryo, Ovule, Seed, Seedling*.

Radiograph. Image created on a film or photographic paper after radiation e.g. by X-rays.
See *X-radiograph*.

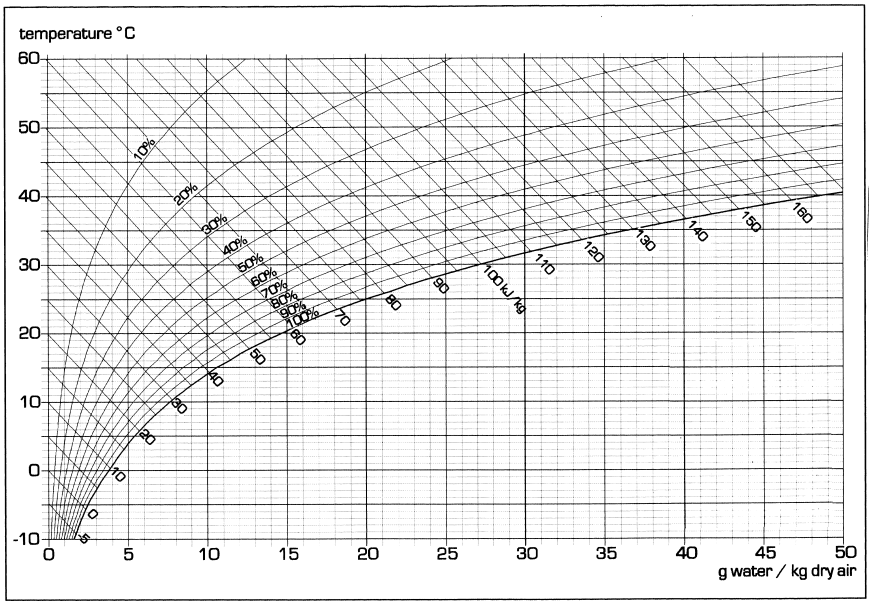
Raphe. Ridge formed on the seed-coat if the funiculus is fused with the integument in part of its length in anatropous or campylotropous ovules.
See *Ovule orientation, Seed*.

Recalcitrant. Term used to describe seeds that cannot survive drying below a relatively high moisture content (30-40%) and, for tropical species, do not tolerate low temperature. The seeds rapidly lose their viability and cannot be successfully stored for long periods. Ant. *Orthodox.*
See *Intermediate (seed), Lowest Safe Moisture Content, OLDA, Temperate recalcitrant.*

Receptacle. End of a flower stalk on which the floral organs are borne. In epigynous flowers the receptacle enlarges and encloses the ovary.
See *Epigyny, Flower, Hypogyny, Pome*.

Receptivity. Condition of the female flower or cone that permits effective pollination.
See *Anthesis, Flowering*.

Relative humidity (RH). The actual amount of water vapour in the atmosphere as a percentage of that contained in an atmosphere saturated with water at the same temperature.
See *Absolute humidity, Dew point, Equilibrium moisture content, Saturated.*



Relationship between absolute humidity, temperature and relative humidity. The curved lines represent the relative humidity.

Replicate. Part of a test with the same experimental design, or where the same measurement is conducted e.g. moisture content on 3 replicates.
See *Sample, Seed testing, Tolerance.*

Reproductive age. The age at which the tree produces its first fruit crop, i.e. the demarcation from juvenile to mature in respect to reproduction.
See *Mature*, *Physiological maturity*.

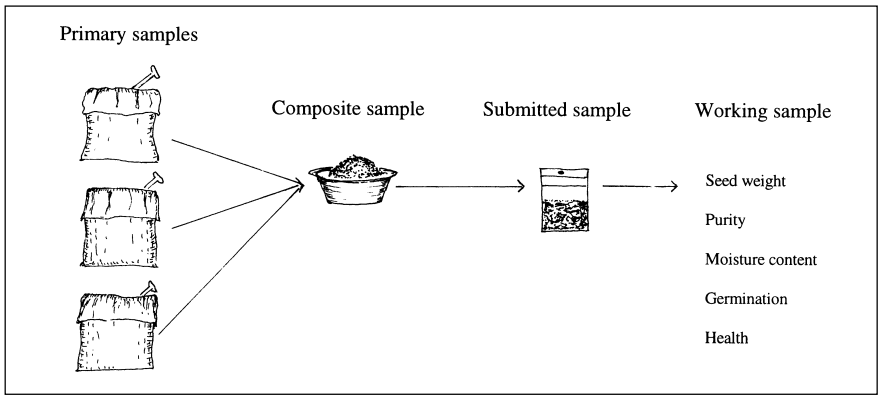
Respiration. Normally distinction is made between external and internal respiration. External respiration is taking oxygen from the environment and giving off carbon dioxide. Internal respiration are the chemical reactions in which energy is released by the breaking down of organic compounds. If oxygen is consumed during this process it is called aerobic respiration, if not, anaerobic respiration. External and internal respiration occur in both plants and animals.
See *Aerobic, Fermentation, Metabolism*.

Rhizobium. Bacterial root symbiont that infects roots of plants of the family Leguminosae. During infection the plant forms root nodules, in which the bacteria fix atmospheric nitrogen which benefits plant growth.
See *Microsymbiont*.

S

Samara. Dry, indehiscent, winged fruit with one or more seeds.
See *Dry fruits, Nut, Pod, Wings (seed)*.

Sample. In the context of seed testing, a small representative quantity drawn from a seed lot. The different types of samples in seed testing are *primary sample*, *composite sample*, *submitted sample* and *working sample*.
See *Seed testing*.



Sarcotesta. Soft, fleshy outer layer of a testa.
See *Aril*, *Drupe*, *Fleshy fruit*, *Pulp, Seed-coat, Testa, Tegmen.*

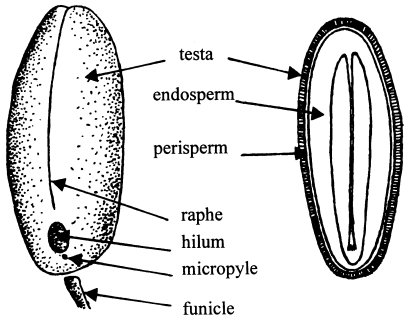
Saturated air. Air that contains the maximum amount of water at a given temperature. The relative humidity of saturated air is 100%.
See *Equilibrium moisture content*, *Relative humidity.*

Scarification. Disruption of hard seed-coats, usually by mechanical abrasion or by brief chemical treatment in a strong acid, to increase their permeability to water and gases, or to lower their mechanical resistance.
See *Dormancy (physical), Hard seed, Permeable, Pre-treatment.*

Scorching. Brief exposure to high temperature, e.g. open fire or kiln, applied for extraction of seeds from serotinous fruits or cones.
See *Kiln, Pre-treatment, Serotinous*.

Seasonality. Phenological periods of seed production occurring tightly connected to distinct climatic season over the year, e.g. rainy season, dry season, summer, winter. Compare *periodicity*.
See *Flowering, Fruiting, Periodicity, Phenology*.

Seed. In the strict botanical sense, the mature ovule, consisting of an embryo, and possible nutritive tissue, enclosed by the protective seed-coat derived from the integuments. In a broad sense, the term refers to the whole dispersal unit (diaspore or disseminule), e.g. in indehiscent fruits, to the morphological seed (as defined above) plus the whole or part of the fruit that continues to enclose the seed during processing and handling, e.g. pyrene (stone), samara, or nut.
See *Fruit, Pure seed, Pyrene, Seed bearing organ, Seed plants*.



Seed-bearing organ. Common term for all seed-enclosing structures in seed plants, which comprise fruits in angiosperms (true fruits and multiple fruits), and cones and other structures in gymnosperms
See *Cone*, *Fruit*, *Gymnosperms*.

Seed-borne pathogen. Infectious micro-organism carried in, on, or with the seed, whether it causes damage to the seed or not. Compare *seed-transmitted.*
See *Pathogen*.

Seed-coat. Protective outer layer(s) on a seed derived from the integuments. When two layers of the seed-coat are distinguishable, the terms testa for the outer coat and tegmen for the inner is often used.
See *Sarcotesta, Tegmen, Testa.*

Seed crop. The total seed production during one defined fruit/seed season.
See *Harvestable seed crop*, *Fruiting, Masting, Periodicity.*

Seed handling. Practical methods of seed procurement from collection to sowing. Sometimes used synonymously with seed procurement but generally it covers a wider range e.g. sowing techniques.
See *Procurement (seed).*

Seedling. Plant produced from a seed as different from plants produced by vegetative propagation. The latter are called cuttings, stumps, or plantlets depending on mode of propagation.
See *Embryo, Epigeal germination, Hypogeal germination, Propagule.*

Seed lot. A specified quantity of seed of the same species, provenance, date of collection and handling history, and which is identified by a single number in the seed documentation system.
See *Sample, Seed testing.*

Seed quality. General term that may refer to the purity, physiological quality (germination capacity, vigour) and genotypic quality of a seed lot.
See *Seed testing.*

Seed testing. Examination of physiological seed quality of a seed lot, normally consisting of four standard parameters *viz.* purity, seed weight, moisture content and viability or germination percentage. Sometimes also including special parameters such as vigour or health test. Standard rules and procedures for seed testing are issued by ISTA (Europe) or AOSA (America).
See *AOSA, Germination test, Health test, ISTA, Moisture content, Purity, Sample, Seed weight, Submitted sample, Thousand grain weight, Viability.*

Seed-transmitted pathogen. Infectious micro-organism carried in, on or with the seed with the potential of causing disease of the seedling or the plant, but harmless to the seed itself. Compare *seed-borne pathogen*.
See *Health test, Pathogen, Phytosanitary,*

Seed weight. Seed weight is indicated in number of seeds per weight unit (usually kg) of the seed lot including impurities. Another measure is the thousand seed (grain) weight indicating the weight in grams of 1000 pure seeds.
See *Seed testing, Thousand grain weight*.

Seed year. In respect of any species, particularly trees of irregular or infrequent seed production, a year in which it produces an adequate amount of seed, either as an individual or a crop, Many periodic seeders produce heavy ('bumper') seed crops during their seed years. Same as *mast year*.
See *Masting, Periodicity, Seed crop*.

Semi-permeable. Permeable to small molecules only.
See *Impermeable, Permeable*.

Senescence. Same as ageing.
See *Ageing, Deterioration, Seed.*

Serotinous. Coming late, particularly applied to plant species or individuals that flower or fruit late in the season and to fruits or cones that remain on the tree without opening for one or more years e.g. *Pinus contorta*. Serotinous fruits normally need high temperature for opening and seed extraction.
See *Case hardening, Extraction, Kiln, Scorching.*

Simple fruit. A fruit formed from one pistil, e.g. a follicle, berry or capsule. Compare *multiple fruit* and *aggregate fruit*.
See *Compound fruit, Compound pistil, Dry fruit, Fleshy fruit, Flower, Fruit, Pistil.*

Soil seed bank. Dormant, viable seeds of one or several species accumulated in the soil over one to several years.
See *Dormancy, Quiescent*.

Sound seed. Healthy, viable seed without major damages.
See *Health test, Seed testing, Viable seed.*

Source-identified seed. Seeds collected from natural stands where geographical origin (source and elevation) is known and specified, or from seed orchards or plantations of known provenance, specified by a seed-certifying agency.
See *Certified seed*.

Spike. An elongate inflorescence with sessile flowers.
See *Inflorescence, Infructescence*.

Spore plants. Group of lower plants whose main characteristic is reproduction by wind-borne spores. The spores are haploid and germinate into haploid gametophytes, which in these groups are independent plants. Spore plants include e.g. mosses and ferns. Ant. *Seed plants.*
See *Gametophyte, Sporophyte*.

Sporophyte. An individual of the diploid generation of the life cycle of a plant. It is the dominating part of all higher plants where the gametophyte (the haploid generation) is reduced to a dependent organ in of the sporophyte (embryo sac in angiosperms). In some lower plants, the sporophyte is reduced and the dominating generation is the gametophyte.
See *Embryo sac, Female gametophyte, Gametophyte*.

Squash test. Simple, indirect test of viability, by which seeds are first allowed to imbibe water and are then squashed with a pair of forceps to reveal the condition of the embryo. The number of seeds appearing fresh and healthy per unit weight of seeds plus chaff (eucalypts) or per 100 seeds (larger seeds) provides a rough estimate of viability.
See *Seed testing, Viability*.

Stamen. The pollen bearing organs in angiosperms, consisting of anther and filament. All stamens of a flower make up the *androecium*.
See *Flower*.

Stigma. The part of the pistil on which pollen must be deposited in order to germinate and reach the ovule.
See *Flower, Gynoecium, Pistil, Pollen tube.*

Stone. Common term for the hard endocarp of a drupe containing the seed; same as *pyrene*.
See *Drupe, Fleshy fruits*.

Storability. Potential life time of seed under optimal storage conditions, cf. *longevity*.
See *Ageing, Deterioration, Orthodox, Seed*.

Stratification. Pre-treatment of dormant seeds by storing them for a prolonged period in an imbibed stage at a certain temperature. Cold, moist stratification refers to the traditional pre-treatment of temperate seeds by storing the imbibed seeds under cold conditions (originally in alternate layers with a moist medium). Under warm, moist stratification the seeds are kept at a temperature of physiological activity; this practice is used e.g. to after-ripen seeds.
See *After-ripening*, *Naked stratification, Pre-chilling*.

Stress. Sub-optimal growth conditions like shortage of water, too high or too low temperature, shortage of light or fertiliser etc.
See *Hiltner test, Vigour*.

Strobilus (pl. strobili). A spiral arrangement of modified leaves bearing the reproductive organs in conifers and certain other plants, functionally equivalent to angiosperm flowers. Male strobili bear microsporophylls, female strobili megasporophylls. As female strobili grow after pollination, they are called conelets, then as reaching their full size, cones.
See *Cone, Conifer, Gymnosperms, Seed bearing organ.*

Strophiole. Arilloid (type of outgrowth on a seed) occurring on the raphe. In legume seeds the

strophiole is often the weakest spot on the seed-coat and the place where e.g. hot water treatment has impact and imbibition begins.
See *Aril, Arilloid, Funicle, Legume seed, Ovule orientation, Seed.*

Style. The stalk of the pistil between stigma and ovary.
See *Flower, Gynoecium, Pistil.*

Submitted sample. The sample of seed submitted to a seed testing station. It is part of the *composite sample*.
See *Sample, Seed testing*.

Suspensor. Line of cells that differentiates in the early development of the embryo and anchors it to the parental tissue. In some gymnosperm seeds, it persists as a filament attached to the radicle end of the embryo.
See *Embryo*.

Suture. Here: line of opening or dehiscence in dehiscent fruits.
See *Dehiscence, Maturity index*.

Symbiosis. Literally 'living together'. Applies to two organisms of different species forming an association with one another. If the symbiosis is of mutual benefit, it is properly called mutualism; if one of the symbionts benefits at the expense of the other, it is called parasitism.
See *Microsymbionts, Mycorrhiza, Rhizobium, Frankia*.

Syncarpous (syncarpy). Fruit composed of two or more united carpels.
See *Compound fruit, Compound pistil, Fruit, Pistil.*

T

Tegmen. Part of the seed-coat produced by the inner integument, usually thin and delicate.
See *Integument, Seed-coat, Testa, Sarcotesta.*

Temperate recalcitrant. A group of recalcitrant seed that are sensitive to desiccation and do not tolerate storage with low moisture content but are tolerant to low temperature, a difference from tropical recalcitrant seed. Includes many temperate forest species such as *Quercus* and *Acer* species.
See *Intermediate, Orthodox, Recalcitrant, Storability.*

Testa. The seed-coat; by some authors it refers only to that part of the seed-coat that is produced by the outer integument.
See *Sarcotesta, Seed, Seed-coat, Tegmen*.

Tetrazolium. See TTZ.

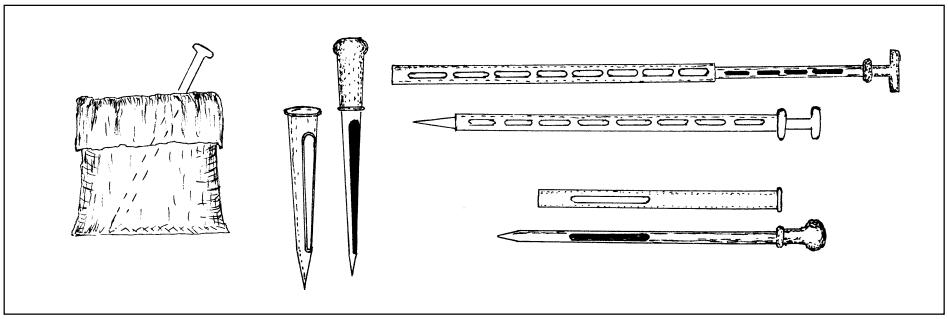
Thousand (1000) seed (grain) weight. Seed weight expressed as the weight of 1000 pure seeds; a standard measure during seed testing
See *Seed weight, Seed testing.*

Threshing. Disintegration and extraction of seeds from dry fruits by mechanical impact to the fruit, e.g. flailing, beating, trampling, stamping, or by threshing machines.
See *Extraction, Flail.*

Tolerance. An environmental amplitude within which living organisms can survive, e.g. temperature tolerance and moisture tolerance. In seed testing, a permitted deviation (plus or minus) from a standard, e.g. the permitted difference between replicated measurements beyond which the measurements must be repeated.
See *Replicate, Seed testing*.

Treatment, seed. Application of pesticides to seeds. Should not be confused with pre-treatment.
See *Carbon dioxide*, *Fumigation*, *Pathogen, Phytotoxic, Pre-treatment*.

Trier. A tube-like devise to take out samples from a seed lot. The trier consists of two tubes, one fitting into the other. Openings in the two tubes permit seed to flow into the tube when the holes are at the same position; the holes are closed by turning the inner tube.
See *Sample*.



Various types of trier for sampling in large seed lots

TTZ. Tetrazolium or topographical tetrazolium. Chemical used for examination of living tissue. TTZ stains living cells red by the reduction of a colourless tetrazolium salt to form red formazan. The reduction is caused by dehydrogenases, a group of oxidising enzymes present in living cells.
See *Dehydrogenase, Seed testing, Viability.*

Tumbling. The operation by which cones or fruits are placed in a rotating drum, which rolls and tosses them around to induce the release of the contained seeds. Tumbling may be used in connection with artificial heat in a rotating kiln.
See *Extraction, Kiln*.

U

Unisexual. In flowers the same as *imperfect.*
See *Hermaphrodite*.

Upgrading. Improving the average quality or performance by removing inferior individuals. In connection with seeds, the increase of viability and vigour of a seed lot by removal of small, immature, empty and otherwise inferior seeds from a seed lot. In connection with seed sources, the culling or roguing of inferior phenotypes to improve the genetic quality, e.g. used in connection with establishment of seed production areas.
See *Grading*.

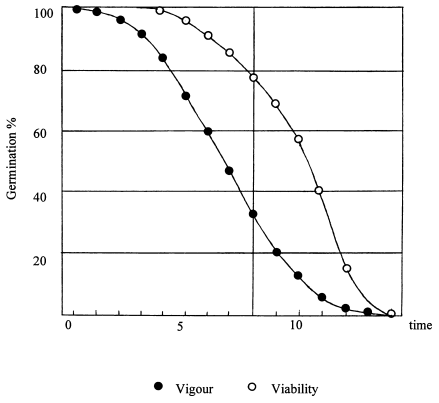
V

Vermiculite. Mineral with high water holding capacity; used as medium for germination tests.
See *Husk, Peat, Perlite, Water holding capacity.*

Viability. Seeds which are capable of germination when given water and appropriate environment (including breakage of possible dormancy) for reactivation of their biochemical processes are said to be viable. Viability tests are not necessarily the same as germination tests since viability may be measured indirectly by e.g. cutting test or TTZ staining.
See *Cutting test, Germination capacity, Dormancy, Vigour*.

Viable seed. A seed which can germinate under favourable conditions, provided that any dormancy that may be present is removed.
See *Germination, Seed test, Viability, Vigour.*

Vigour (Vigor). The seed properties which determine the potential for rapid, uniform emergence and development of normal seedlings under a wide range of field conditions. Loss of vigour normally foregoes loss of viability, hence showing a steeper decrease (e.g. as measured in a germination test under stress) than viability (e.g. measured under optimal germination conditions).
See *Accelerated ageing*, *Ageing, Stress, Viability.*



Vigour test. Germination test usually carried out under sub-optimal conditions (stress) or after accelerated ageing in order to reveal deterioration of seed lots, not evident during normal germination test.
See *Accelerated ageing, Germination capacity, Hiltner test, Stress, Viability, Vigour.*

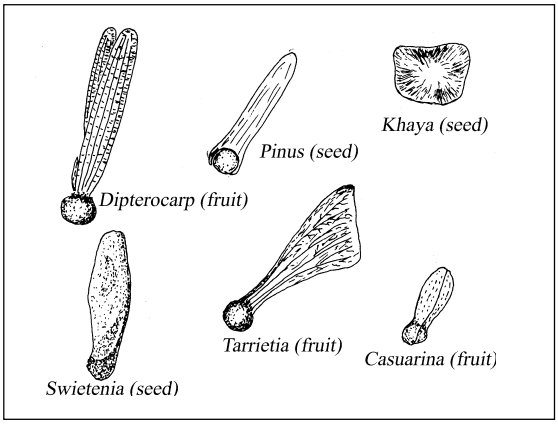
Viviparous (vivipary = precocious germination). Seeds germinating while still attached to the parent plant, e.g. *Rhizophora* spp. Viviparous seeds are extremely difficult to store.
See *Recalcitrant*.

W

Water holding capacity. The amount of water that can be retained by a substrate after free drainage. Gravel and sand have low water holding capacities while peat and other organic substrates have high ones.
See *Peat, Perlite, Vermiculite.*

Water potential. The energy status of water in the soil, root, seed etc. Water will flow from a place with high water potential to a place with low potential. Water potential is, depending on type, influenced by e.g. osmotic potential, gravitational potential, turgor potential. Measured in negative pressure units (- bars).
See *Water holding capacity*.

Wings (seed). Dry appendices on fruits and seeds facilitating dispersal by wind (anemochory). Wings may originate from outgrowth of the seed-coat (e.g. *Khaya* and *Swietenia*), modified fruit structure (*Pterocarpus*) or persistent modified structures of the flower (*Gluta*, dipterocarps). Wings may be thin and papery as in pines and casuarinas, or woody as in *Acer* and *Tarrietia* spp. Wings are usually removed during processing in order to reduce volume and facilitate handling.
See *De-winging, Samara.*



Working sample. A reduced seed sample taken from the submitted sample in the laboratory on which the seed quality tests are made.
See *Sample, Submitted sample, Seed testing*.

X

X-radiograph. The image (picture) of an object on a photographic film when exposed to X-rays.

X-radiography (= X-ray radiography). A non-destructive method of examining seed quality by exposing them to X-ray and capturing the images on photographic film on which the condition of the embryo can be assessed.

X-ray. Electromagnetic rays with very short wavelength used for X-radiography.

Z

Zygote. The fertilised egg.
See *Fertilisation*.