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Guide to handling of tropical and subtropical forest seed

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GLOSSARY

Abdomen. In e.g. insects: the major body division posterior to the thorax.

Abnormal seedlings. In seed testing, seedlings which do not possess all normal structures required for growth, nor show the capacity for continued development.

Abortion. Loss of reproductive structure (e.g. a flower or an ovule) during development.

Abscission. Natural separation of leaves, flowers and fruits from plants, generally associated with deterioration of a specialised layer of thin-walled cells (= the abscission zone).

Absolute humidity. The amount of water vapour present in a given volume of atmosphere, usually indicated in grams of water per kg dry air, or g water per m³ air. See also saturated air and relative humidity.

Absorption. Here: the taking up of water from the atmosphere by cells or tissue in the seed-coat. Compare adsorption.

Accelerated ageing. Method of exposing seeds 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 seeds.

Achene. One-seeded, dry, indehiscent fruit, formed from one carpel.

Actinorhizal plants. Host plants establishing microsymbiosis with the microsymbiont *Frankia*.

Adsorption. The taking up of one substance on the surface of another, e.g. adhesion of a liquid or a substrate on a seed-coat. Compare absorption.

Aerobe. Biochemical process which implies presence of oxygen and by which oxygen is consumed, e.g. respiration. Ant. anaerobe.

After-ripening. The physiological maturation processes which occur in e.g. seeds and fruits after harvest or abscission. After-ripening is often necessary for seeds to become germinable if fruits are immature. Also used for the specific seed handling process itself, see pre-curing.

Agar. Medium used for culture of bacteria and fungi under laboratory conditions. The medium is normally sterilised and supplied with necessary nutrients for growth of the culture in question.

Ageing. Progression of cytological and biochemical events which ultimately leads to the death of the seed. See also deterioration and accelerated ageing.

Aggregate fruit. Many-seeded fruit derived from pistils of one flower that forms individual simple fruits e.g. samaras, drupes or nuts which may be separate or fused with each other and the receptacle, e.g. *Rubus* (fleshy), *Magnolia* (dry fruit).

Air-layering (marcotting). Procedure of vegetative propagation in which roots develop on an aerial part of a plant after girdling, wrapping with a moist medium (e.g. peat), and covering with polythene sheet.

Albumen. A collective term of the nutritional tissue between the embryo and the seed-coat, inclusive of perisperm and endosperm.

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

Anaerobe. A biochemical process which does not imply presence of oxygen, e.g. fermentation. Ant. aerobe.

Anatropous (= atropous) ovule. An 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.

Androecium. Collective term applying to all stamens in a flower.

Angiosperms. Botanical classification of the group of vascular flowering plants that produce seeds enclosed in an ovary, as different from gymnosperms. Among woody plants, the group includes bamboos, palms and most species of forest trees. The term 'hardwood' is sometimes used synonymous with angiospermous trees although the wood is not always harder than that of gymnosperms ('softwood'). Compare gymnosperms.

Anoxia. Dying from lack of oxygen, e.g. respiring seeds stored in an oxygen-free atmosphere.

Anther. The pollen-bearing part of the stamen.

Anthesis. The period or stage of bud opening and expansion of the flower. Sometimes specifically referring to the bursting of anthers to release pollen.

Apocarpous (Apocarpy). Having separate or partially united carpels. Apocarpy usually gives rise to aggregate fruits, e.g. *Magnolia* spp.

Apomixis. Here: production of seeds without occurrence of fertilization.

Arbuscules. Structures involved in nutrient exchange in vesicular arbuscular mycorrhiza (VAM).

Archegonium. In gymnosperms, the female reproductive organ which contains the ovule.

Aril (arilus). An additional integument or appendage formed on some seeds after fertilization. The aril is usually fleshy and nutritious and serves to attract dispersers.

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

Axial. Of an axis of the stem.

Berry. Fleshy fruit developed from a single pistil and with no hard layers. The fruit is usually many-seeded.

Bi-modal. Climate type prevailing in equatorial regions in which there are two rainy and two dry seasons per year. See also Intertropical Convergence Zone.

Bi-nucleate. Cell with two nuclei. Occurs after incomplete cell division where the nucleus divides but a cell membrane is not formed to make two new cells.

Bi-sexual. See hermaphrodite.

Blinding. Here: blocking of cleaning screens by seeds or particles of intermediate size which get stuck in the holes.

Bract. Modified leaf subtending a flower or floral axis in angiosperms, or a scale in female cones in gymnosperms (fig. 2.1).

Bracteole. A small bract.

Bruchid. Group of seed-infesting beetles mainly attacking seeds of Leguminosae.

Buffer. A substance or condition that counteracts changes caused by external impacts. In chemistry referring to a substance that minimises changes in pH when an acid or alkali is applied. In ecology e.g. referring to a vegetation zone that minimises the impact of climate changes. In connection with seed storage, a seed reserve.

Buffer zone. Isolation area/strip around seed production areas to minimise contamination by pollen from undesirable trees.

Calibration. Correlation between readings of an instrument and a standard e.g. a moisture meter and the standard oven-drying method.

Calyx. Collective term for the sepals of a flower.

Campolytropic ovule. An ovule where the micropyle is oriented with an angle to the placenta.

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).

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

Carpel. A simple pistil, or single members of a compound pistil. A follicle or a pod consists of one carpel, a capsule of several fused carpels.

Caruncle. A protuberance of the integument occurring near the micropyle on mature seeds. Compare strophiole.

Case hardening. The setting of cone scales as a result of over-rapid superficial drying, so that they fail to open and discharge their seeds.

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

Cauliflorous (cauliflory). Flowering habit in which the flowers appear from the stem rather than from the branchlets.

Certified seed. Seed collected from trees of proven genetic superiority as defined by a certifying agency, and produced under conditions that assure genetic identity. This could come from trees in a seed orchard, or from superior ('plus') trees in natural stands with artificial pollination.

Chaff. In eucalypts, sterile particles derived from infertile or non-fertilised ovules.

Chalaza. The base of an ovule, often conspicuous as the region below the point of union of the integument with the megasporangium. It usually coincides with the position of the funiculus, in these cases identical to the hilum on the seeds.

Chilling. Literally meaning cooling down. Generally used for the procedure of subjecting seeds to a cold moist environment to bring about after-ripening. See prechilling.

Chilling injury. Impaired viability caused by exposure to low temperature. The term applied to low-temperature damage to temperature-sensitive recalcitrant or 'intermediate' seed.

Cladodes. Modified scaly leaves in e.g. *casuarinas*.

Cleistogamous flower. Flower that does not open for pollination but is pollinated and fertilized by its own pollen within a closed system.

Clone. Population of genetically identical cells or individuals, e.g. plants raised by vegetative propagation.

Columella. A small column, e.g. the central part of capsules of *Meliaceae*.

Compatibility. Here: the ability of pollen to fertilise the egg.

Complete flower. Angiosperm flower containing both stamen, pistil, sepals and petals. Compare perfect flower.

Composite sample. Mix of several primary samples taken from different parts of the seed lot. See sample.

Conditioning. Hardening plants before they are transplanted from the nursery to adapt them to the harsher field conditions. Watering and sheltering are reduced and fertilization is stopped.

Cone. Many-seeded dry fruit of conifers derived from a female strobilus. 'Cone-like' angiosperm fruits, e.g. in *Casuarina*, are aggregate fruits. Sometimes also used for mature male strobili ('male cones').

Conifer. A member of the group of gymnospermous trees in which seeds are borne in cones, e.g. *Pinus*, *Araucaria*, *Agathis* etc. but not e.g. *Podocarpus* and *Taxus* spp.

Corolla. Floral part consisting of petals.

Cotyledons. In seeds, the embryonic leaves, which in many families 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).

Critical moisture content (CMC) The lowest moisture content to which seeds can be dried without losing their viability. CMC has been defined as the moisture content at which all seeds die, or the moisture content at which seeds have 60% germination.

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 rhizobia and frankiae. See also host specificity.

Cryopreservation. Maintaining tissues or seeds for the purpose of long term storage at ultralow temperature, typically between -150°C

and -190°C . In normal cryopreservation the sample is pretreated with a cryoprotective substance, followed by a slow controlled freezing. See also vitrification.

Cuticle. Here: the outermost, protective layer of the seed-coat.

Cutinization. Deposition of a waterproof, waxy substance (cutin) on or in the outer layers of cell walls at the surface of seeds, leaves and young stems.

Cutting. Detached part of stem or other plant part which, when rooted, produces a whole plant.

Damping-off. Death of seeds, germinants or young seedlings in the nursery resulting from attack by certain soil-living fungi. In seedlings, damping-off often attacks and causes rot of the stem near the surface of the soil.

Dehiscence. 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 tree, e.g. capsules, follicles and some pods. Ant. indehiscence.

Dehydrogenase. Group of enzymes catalysing the reactions involving the 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 viability (TTZ).

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.

Desiccant. Chemical compound that has a high moisture absorption affinity and thus can be used for desiccation or maintenance of low humidity of e.g. seeds when stored together. Common desiccants are SiO and CaO .

Desiccation sensitive. About seeds which do not tolerate drying below a certain (high) critical moisture content. Often used equivalent to recalcitrant.

Design. Here: the structure of a trial or an experiment, e.g. number and position of replicates.

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.

Deterioration of seed. The cytological and biochemical events taking place within a seed and ultimately leading to the death of the seed. See ageing.

Dew point. The temperature at which the relative humidity is 100% (saturated) and water condensates at further decrease in temperature.

Diapause. A state of dormancy during the development of insects, e.g. during the pupal stage.

Diaspore. The dispersal unit of a seed, e.g. a samara, nut or drupe.

Dichogamy. The 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).

Dicliny. The separation of male and female reproductive parts into different flowers. Diclinous plants may be either monoecious or dioecious. Ant. hermaphrodite.

Dicotyledons. One of the two subclasses of 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; all angiosperm forest trees are dicotyledons.

Differentiation. The process of cells or tissue becoming structurally specialized, e.g. floral differentiation.

Diffuse flowering. Flowering throughout the year or outside the main flowering season. Ant. gregarious flowering.

Dioecious. A species or other taxon in which individuals are unisexual (male or female), e.g. araucarias and some casuarinas. Compare monoecious.

Diploid. A cell or organism with two basic chromosome sets, symbolised by $2n$; the condition of vegetative tissues of most higher plants.

Disease. Physiological disorder caused by e.g. infection by a pathogen, which causes abnormal, restricted or delayed development or death of an organ or the whole plant.

Disseminule. The dispersed unit, the diaspore.

Dormancy. Physiological state in which a viable seed fails to germinate when provided with water and environmental conditions normally favourable to germination.

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

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 prechilling.

Dormancy, embryo (= endogenous). Dormancy as a result of conditions within the embryo itself, e.g. inhibiting substances or incompletely developed embryo.

Dormancy, exogenous. Dormancy caused by the outer structures of the seed or fruit, e.g. impermeability of the seed-coat or pericarp.

Dormancy, mechanical. Dormancy caused by mechanical resistance of the seed covering (normally the endocarp) to expansion of the embryo. Dormancy is overcome by physically breaking the restricting covering or extracting the seed.

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 also phytochrome.

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.

Dormancy, physiological. A type of embryo dormancy in which germination is prevented by a physiological inhibiting mechanism, e.g. chemical dormancy or thermo-dormancy.

Dormancy, primary. Dormancy that exists within the seed at the time of maturity on the plant or immediately afterwards.

Dormancy, secondary (= induced dormancy). Dormancy that develops within the moist seed after it has been removed from the plant if subjected to adverse environmental conditions.

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.

Dormancy, thermo. Primary or secondary dormancy in which the seed must be subjected to a 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.

Double fertilization. Fertilization in angiosperms in which two sperm cells unite with the female: one of the sperms with the egg and the other with the two polar nuclei.

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.

Ecotype. A distinct population within a species that has adapted genetically to its local habitat. Ecotypes may be referred to according to the main selective force or distinctive character e.g. climatic or edaphic ecotypes.

Ect-endo-mycorrhiza. Mycorrhiza type with appearance and mode of infection intermediate between that of ecto-mycorrhiza and endo-mycorrhiza.

Ecto-mycorrhiza. A type of mycorrhiza characterised by morphological changes of the infected roots. The hyphae grow between the cortical cells but do not penetrate the cells. The fungi form large fruiting bodies (sporocarps). Compare endo-mycorrhiza and ect-endo-mycorrhiza.

Ectoparasite. A parasite that lives on the exterior of its host plant. Ant. endoparasite.

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

Embryo sac. The mature female gametophyte of angiosperms.

Empty seed. A seed without any content, or without an embryo or embryo cavity if some residual tissue is present; the opposite of filled seed.

Endocarp. The inner layer of the pericarp; e.g. the hard, bony part of drupe fruits like neem, teak and *Gmelina*. See also pericarp and pyrene.

Endogenous. Originated within, or developed from a deep-seated layer of tissue. In a seed, developed from or occurring in the embryo.

Endo-mycorrhiza. Group of mycorrhiza in which the hyphae grow both between and within the cortical cells. The largest group of endomycorrhiza is VAM. Ant. Ecto-mycorrhiza.

Endoparasite. A parasite that lives within the tissue of its host plant. Ant. ectoparasite.

Endosperm. The term usually reserved for 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 gamete.

Enzyme. A catalyst produced by living organisms and acting on one or more specific substrates; a ferment.

Epicotyl. The apical end of the embryo which develops into the stem. In germinated seeds or seedlings referring to the part of the stem between the cotyledons and the leaves.

Epigeal (or epigeous) germination. The type of germination in which the cotyledons are forced above the ground by the elongation of the hypocotyl. Ant. hypogeal germination.

Epigyny (epigynous). The overgrowth of the ovary by the receptacle and/or bases of other floral organs, e.g. *Malus* (apple). Compare hypogyny.

Epiphyte. A plant that lives on the surface of other plants but does not derive water or nutrient from them. An epiphyte is thus not parasitic. Example of epiphytes are ferns that live on the trunks of forest trees.

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 *viz.* low for oily seeds and high for seeds rich in protein and carbohydrates.

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

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

Exocarp. Outermost layer of pericarp; the skin on fleshy fruits as in *Cornus*, *Malus* and *Prunus*.

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.

Exotic. A plant grown outside its natural range of distribution, e.g. teak in Africa.

Facultative mycotroph. A plant that will form mycorrhiza in the presence of a suitable fungus but can also live without mycorrhiza.

Facultative parasite. A saprophyte which can also exist as a parasite.

Facultative saprophyte. A parasite which can also exist as a saprophyte.

Female gametophyte. The haploid life cycle of a plant that bears the egg. In angiosperms reduced to a few cells. In gymnosperms the ovule is imbedded in the female gametophyte which develops during maturation into the storage tissue, i.e. becoming functionally equivalent to the angiospermous endosperm in seeds.

Fermentation. An 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 plant such as yeast or bacteria, or an enzyme. It may be accompanied by the production of heat and of toxic substances, hence the fermentation of fleshy fruits may adversely affect the seeds which they contain.

Fertilization. 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 some species, fertilization may occur months after pollination.

Filled seed. A seed where the seed cavity is filled with all tissues essential for germination. A filled seed is not necessarily alive. Syn: Full seed. Ant. empty seed.

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.

Floral initiation. The time or process of formation of specialized cells which develop into flowers (= sporogenesis). See differentiation.

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.

Flowering. The phenological period from appearance of flowers to fruit set. Flowering may be prolonged (diffuse) or short (gregarious).

Follicle. A dry dehiscent fruit formed from a single carpel, splitting along one side only, e.g. *Grevillea*.

Fruit. In a strict botanical sense, the mature pistil or pistils of the angiosperm flower, along with, in some types, associate structures like receptacle or perianth. In a less strict terminology it includes the mature seed-bearing organs in gymnosperms, e.g. cones.

Fumigation. Application of a toxic compound in gas form. Used for e.g. sterilization of nursery soil.

Fungicide. A pesticide applied for protection against or treatment of fungal diseases.

Funicle (funiculus). The stalk of an ovule or seed, attaching it to the ovary placenta.

Gamete. A male or female reproductive cell, typically the product of meiosis, capable of uniting, in the process of fertilization, with one of the opposite sex to form a zygote.

Gametophyte. The part of the plant that produces gametes or sex cells, i.e. female gametophyte and male gametophyte.

Gauge. A term used in the UK and elsewhere to define thickness of thin films such as polyethylene. 100 gauge (UK) = 1 mil (USA) and approximately = 25 microns or 0.025 mm.

Gene. The smallest transmissible unit of genetic material consistently associated with a single primary genetic effect. The genes are ultramicroscopic and act as if linearly arranged at fixed places (loci) on a chromosome.

Genetic. As related to heredity.

Genetic base. The total amount of genetic diversity within a population or a seed lot.

Genotype. 1) An individual's hereditary constitution, with or without phenotypic expression. It interacts with the environment to produce the phenotype. 2) Individuals characterised by a certain genetic constitution.

Geotropism. The tendency of plant organs to grow in relation to the direction of gravity, either towards the ground (positive geotropism) or away from the ground (negative geotropism).

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.

Germination capacity (= germination percentage). Proportion of a seed sample that has germinated normally within a specified test period, usually expressed as a percentage; cf. viability.

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 seven test days. The critical time of measurement can be chosen by several means.

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 optimal germination conditions of temperature, humidity and light for the species in question. Dormant seed must be pre-treated in order to break dormancy before the germination test. See also viability.

Grading. The practice of sorting seeds or seedlings into classes, normally based on 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 also 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. G. often results in masting. Ant. sporadic flowering.

Gymnosperms. The 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 *Podocarpus*, *Ginkgo* and *Taxus*.

Gynoecium. Collective term for the female part of the flower, i.e. aggregate of carpels.

Haploid. A cell or an organism with one basic chromosome set, symbolized by n ; the normal condition of gametes in plants, which are diploid in their vegetative tissues.

Hardening (off). The practice of preparing nursery seedlings for out-planting by imposing stress e.g. by reducing watering and removing shade; cf. conditioning.

Hard seeds. Seeds of the family Leguminosae in which imbibition is impeded by a hard impermeable seed-coat. 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 made permeable, e.g. by scarification.

Hermaphrodite (= bisexual, monoclinoous). Having functional male and female reproductive organs in the same flower.

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

Hilum. In angiosperms, the 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.

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

Husk. Outer coarse or fibrous pericarp, e.g. in teak and coconuts.

Hybrid. The offspring of genetically distinctly different parents. The term is applied to the progeny of matings within species (intraspecific) as well as to those between species (interspecific). Hybrids typically have morphological characters intermediate between their parents but sometimes show exceptional growth rate (hybrid vigour).

Hybrid sterility. The reduced ability of some hybrids to produce viable gametes and seeds.

Hygroscopic. Sensitive to moisture, absorbing or losing water. Cones and some other fruits may open and close according to humidity because they contain hygroscopic tissue.

Hypha (pl. hyphae). The individual thread-like filament of a fungal mycelium.

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.

Hypogeal (or hypogeous) germination. Type of germination in which the cotyledons remain in the seed below the ground while the epicotyl elongates. Ant. epigeal germination.

Hypogyny (hypogynous). Floral organization in which the pistil is at the apex of the receptacle, the other floral organs (sepals, petals, stamens) originating below it. Compare epigyny.

Identified stand. Stand of trees within a seed zone, regularly or occasionally used as a seed source, and for which the exact location can be described. The stand has not been subject to selection based on phenotypic characters. See also seed source.

IDS (Incubation-Desiccation-Separation). A method of separating (removing) filled dead or damaged seed from sound seed. The seeds are imbibed and incubated at optimal germination conditions for 2 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.

Imbibition. The process of initial water uptake by seeds prior to germination.

Immature embryo. Seed embryo which has not attained a development stage to make it capable of germination.

Imperfect flower (= unisexual flower). Flower having either only male or only female reproductive organs, i.e. male flower or female flower.

Impermeable. A barrier restricting passage of motile molecules, e.g. a seed-coat obstructing water passage and hence imbibition.

Inbred. An individual or population derived from inbreeding.

Inbreeding. Production of offspring after self pollination or after mating by closely related parents.

Indehiscence. Indehiscent anthers or fruits (e.g. some pods, samaras and nuts) that do not split open at maturity.

Indigenous. Species native to a country or an area. Ant. exotic.

Infection. Invasion or condition caused by endoparasites, i.e. parasites living inside the organism. Compare infestation.

Infestation. Invasion by an exterior organism, e.g. insects feeding on the plant or seed from the outside. Compare infection.

Inflorescence. The assembly of several or many individual flowers into large clusters from a common axis, e.g. a panicle.

Ingestive dispersal. Dispersal of seeds by animals which eat the fruit and void the seed by regurgitation or in their droppings.

Inheritance. Acquisition of characters or qualities by transition from parent to offspring, i.e. via genes.

Inhibition. Restraint or repression of a seed function, e.g. inhibitory substances in a fruit or seed restraining or repressing seed germination.

Inhibitor. Chemical compound which inhibits germination, e.g. coumarin and abscisic acid (ABA).

Inoculation. Here: application of a microsymbiont (inoculant or inoculum) to a host plant.

Instar. Insect at a particular stage between moults.

Integument. The one or two layers (often fused) of tissue covering and surrounding the nucellus of an ovule. When the ovule matures, the integument develops into the 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.

Intertropical Convergence Zone (ITCZ). A band of nearly continuous low pressure, light and variable winds, high humidity and intermittent heavy rain showers found near the equator. The ITCZ meanders with both longitude and season. The extreme positions occur in February and August when the temperatures are highest in the respective summer hemispheres.

Involucre. One or more whorls of bracts situated below and close to a flower or flower cluster; sometimes enclosing the carpels as in *Tectona*, *Castanea* and *Fagus*.

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

Kernel. The nucellus of an ovule or of a seed, i.e. the whole body within the seed-coat. More loosely applied to the morphological seed(s) within a drupe/pyrene.

Kiln. A drying device in which fruits and cones are exposed to above ambient temperature by solar or artificial heat. The most common kiln forms are stationary kilns and rotating drum kilns.

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.

Land race. A population of individuals, usually exotics, that have become adapted to a specific environment in which it has been planted.

Light line. A distinct line through the macrosclereids or palisade layer of certain legume seeds, visible in microscopic cross-sections.

Lipids. A group of organic compounds that are esters of fatty acids and are characterized by being insoluble in water but soluble in many organic solvents. Simple lipids include fats and oils and act as one form of storage material in plants and animals.

Lowest Safe Moisture Content (LSMC). The moisture content below which freshly collected seeds die when they dry. See also critical moisture content.

Loculus (locule). The cavity of an ovary or anther.

Longevity of seed. The period of time seed will maintain viability in storage.

Macerate. To soften by steeping in a liquid, with or without heat; to wear away or separate the soft parts by steeping.

Macrosclereids (= palisade cells). A layer of elongated cells perpendicular to the seed-coat surface.

Masting. Ecological term used to describe the strategy of some plant species to produce large crops of seeds at long intervals, e.g. dipterocarps and araucarias.

Mast year (= seed year). A year with large seed production. See also gregarious flowering.

Mature. Of plants: the stage of individuals after having passed the juvenile stage; often considered synonymous with reproductive age. Of fruits: the stage of fruits when the seeds are ready to be dispersed. Often visible by e.g. colour change, desiccation and opening struc-

tures. Of seeds: seeds which are fully germinable after extraction from their fruits and possible breakage of dormancy.

Megaspore. A spore arising by meiosis from a megasporocyte, potentially developing into a female gametophyte.

Megasporocyte. The megaspore mother cell that forms megaspores after meiosis.

Megasporophyll. A modified leaf bearing one or more megasporangia or ovules.

Meiosis. Specialised nuclear division prior to the formation of gametes. In a normal diploid organism meiosis reduces the number of chromosome sets from two ($2n$) to one (n).

Mesocarp. Middle layer of the pericarp; the pulp of berries and drupes.

Metabolism. The chemical changes within a cell that provide the energy required by a plant or animal.

Metamorphosis. In insects, a marked change in form from one stage of development to another, as of a larva to an adult. Metamorphosis may be of one of two types: (1) complete in which no intermediate forms exist between larva and adult; the full transformation takes place in the pupal stage. (2) incomplete or gradual in which the transformation takes place via several nymph stages.

Micro-organism. A microscopic organism such as a bacterium or a virus.

Micropyle. The minute opening in the integument 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 in 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.

Microsporophyll. A modified leaf bearing the male reproductive part. In angiosperms represented by the stamens and in gymnosperms by the scales of the male 'cone'.

Microsymbiont. Micro-organism living in symbiosis with a host plant e.g. rhizobia, mycorrhiza or *Frankia*.

Mitosis. Division of a nucleus into two identical daughter nuclei by a process that separates the twin chromatids of each of the paired chromosomes, so maintaining the diploid condition.

Moisture content (m.c.). The amount of water present in a material e.g. wood, soil or seed. May be expressed in terms of weight of moisture as a % 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 wet weight including water ('wetweight' or 'fresh-weight basis').

Monocarpic (= semelparous). Reproductive strategy of certain plants in which the plant grows purely vegetatively for a shorter or longer period and dies after just one event of flowering and fruiting. Rare in woody plants but occurs in bamboos. Ant. polycarpic.

Monocotyledons. Subclass of angiosperms characteristic by having only one cotyledon in the embryo. Differs from dicotyledons in a number of morphological characters like leaves, root and stem structure. Woody monocotyledons are bamboos, rattans and palms. Compare dicotyledons.

Monoecious. Species having functional male and female organs at separate places on the same plant. Ant. dioecious.

Mould. Fungi that produce distinct mycelium or spore mass on the surface of their host, e.g. *Mucor* and certain *Penicillium* spp.

Multilocular. Many-celled ovary. A multilocular fruit is made up of several fused carpels without development of septa between individual carpels.

Multiple fruit. Compound fruit made up by individual fruits of an inflorescence which may be either fused or separate but close together. E.g. *Casuarina* (dry) and *Artocarpus* (fleshy). Ant. simple fruit. See also aggregate fruit.

Multivoltine. Of insects: having more than one generation per year or fruit/seed season. Ant. univoltine.

Mutualism. The type of symbiosis in which both parts benefit.

Mycelium. A mass of branching more or less loosely interwoven hyphae that make up the vegetative body of most true fungi.

Mycorrhiza. [Myco = fungus; rhiza = root]. Fungi living symbiotically with plant roots. The fungus provides the plant with mineral nutrients and gets in return sugar and other organic compounds. See also endo-mycorrhiza, ecto-mycorrhiza, ect-endo-mycorrhiza and VAM).

Mycotroph. Plant living in symbiosis with a fungus, e.g. having mycorrhiza.

Naked stratification. Pre-chilling of seeds without the use of a moisture-holding medium.

Necrosis. Death of a plant part.

Nucellus. In angiosperm ovules, the tissue in the central part of the ovule inside the integument, within 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.

Nucleus. A body of specialised protoplasm found in nearly all cells and containing the chromosomes.

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.

Nymph. A juvenile form without wings or with incomplete wings of insects with incomplete metamorphosis.

Operculum. A dehiscent 'cap' or 'lid' structure of e.g. some anthers and capsules.

Origin. For indigenous stands, the place where the trees are growing or from where seeds were collected i.e. the same as provenance. For exotic stands, the origin is the place from where the seeds or plants were originally introduced.

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. Compare intermediate and recalcitrant.

Orthotropous ovule. An ovule where the micropyle is oriented opposite the placenta.

Osteosclereids. A layer of specialised cells between the macrosclereids and the parenchyma cells in legume seed-coats.

Ovary. The part of the pistil that contains the ovule or ovules and ripens to form the fruit or pericarp.

Ovule. The egg cell plus associated cells which develop into the seed after fertilization.

Ovuliferous scale. The ovule- (later seed-) bearing scales in the cones of conifers (cf. bract scales fig. 2.1).

Palisade cells. Same as macrosclereids.

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

Parasitoid. An organism alternately parasitic and free living.

Parenchyma. Undifferentiated live cells. In seed-coats a layer of parenchyma is often present beneath the hard seed-coat cells.

Parthenocarp. 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 fertilization, or a failure in embryo development.

Parthenogenesis. Reproduction from an unfertilised egg; a type of apomixis.

Pathogen. A disease-producing micro-organism like bacteria, small fungi or virus, but not e.g. insects.

Pathology, seed -. The science of diseases of seed, or seed borne pathogens.

Peak germination. A loose term which describes the point in time when rate of germination is highest; it may be calculated in many ways.

Peat. Organic planting medium manufactured from bogs or swamps. Peat has a high water holding capacity.

Pedicel. The individual flower stalk in an inflorescence.

Peduncle. The main axis of an inflorescence or, in the case of single flowers, the flower or fruit stalk.

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.

Pelleting. The procedure by which individual seeds are provided with a cover of adhesive material containing e.g. nutrients, microsymbiont inoculant and/or pesticides. In addition to providing these beneficial compounds, pelleting facilitates mechanical sowing by making the seed size uniform.

Perfect flower. Angiosperm flower containing both stamen and pistil. Ant. imperfect flower. Compare complete flower and hermaphrodite.

Perianth. The collective term for sepals and/or petals, usually applied when there are no distinctive difference between the two types of flower leaves.

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.

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. Compare seasonality.

Perisperm. A 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.

Permeable. Allowing passage of motile molecules, e.g. a gas or liquid. A seed-coat is permeable when water can be absorbed and the seed imbibes. A barrier may be semi or selective permeable if it allows only passage of small molecules, e.g. a polyethylene sheet which are permeable to gas but impermeable to water. Ant. impermeable.

Persistent fruit. Fruit or seed bearing structure, which remains firmly attached to the tree after maturity, often occurring in (but not restricted to) dehiscent fruits.

Pest. Here: any organism causing damage to seeds by infection, e.g. insects or microorganisms.

Phenology. Study of the relations between seasonal climatic changes (e.g. temperature, daylength and precipitation) and periodic biological phenomena such as flowering, fruiting, leaf flushing and dormancy.

Pheno-period. Abbreviation of phenological period i.e. a period of a phenological stage e.g. flowering.

Phenotype. All characteristics of a plant, morphological, anatomical, and physiological, as determined by the interaction between genotype and environment.

Physiological maturity. A general term for the stage in the life cycle of a seed when development is complete and the biochemical components necessary for all physiological processes are active or ready to be activated.

Phytochrome. A protein 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 also dormancy, photo-

Phytosanitary. [phyto = plant, sanitary = cleaning]. A term applying to the condition of potential transfer of seedborne pathogens.

Phytosanitary certificate (= Health certificate). Certificate issued as a result of a test carried out to ascertain that seed or plants are free from general or specific diseases or organisms, not endemic in or not desired to be introduced into another country. May only be issued after quarantine or disinfection.

Phytotoxic. A compound poisonous to plant tissue. Applies to e.g. side effects of pesticides.

Pistil. Ovule-bearing organ of angiosperms, composed of ovary, style and stigma. A pistil is made up of one or more carpels.

Placenta. The organ which bears the ovules in an ovary, often the margin of the carpellary leaves. Because of evolutionary development including reductions in the pistil, several types of placentation exist, e.g. basal, marginal and central.

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

Plumule. The embryonic shoot derived from the epicotyl. In dicotyledons situated between the cotyledons.

Plus tree. A tree selected for production or breeding based on superior phenotype for growth, form, wood quality and/or other desired characters.

Pod. A 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.

Pollen. The microspores of seed plants produced in the male part of the flower (anther) or strobili.

Pollen chamber. In gymnosperms, a modification of the apex of the megasporangium which receives the pollen, and in which the pollen remains dormant until fertilization can occur.

Pollen tube. The tubular protuberance of maturing male gametophytes in seed plants, occurring during fertilization.

Pollen vector. The vehicle by which pollen is transferred from a male flower or strobilus to a female flower or strobilus, e.g. wind, water, or animals.

Pollination. Deposition of pollen on the receptive part of the female flower. In angiosperms it is the stigmatic surface, in gymnosperms the ovule tip.

Pollination droplet. A 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.

Pollinator. A living organism transferring pollen, e.g. insect, bird or bat.

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

Polythene. Abbreviation of polyethylene, a material used for plastic sheet.

Pome. A 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.

- Prechilling.** Cold moist treatment similar to that of chilling but specifically applied to dormant seed and designed to overcome thermo-dormancy. See also stratification.
- 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 also after-ripening.
- Predation.** Consumption of a living organism by an animal predator, e.g. an insect eating a seed.
- Pre-treatment.** Any kind of treatment applied to seeds to overcome dormancy and hasten germination, e.g. stratification, scarification, pre-chilling.
- PREVAC.** (Pressure-vacuum). A 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.
- Primary sample.** A small sample drawn from a single position of a seed lot. Several primary samples make up a composite sample. See also 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.
- Propagule.** A plant part, e.g. root, bud or shoot, used to propagate an individual vegetatively.
- Protandry.** ('male-first'). Termination of pollen shedding of a plant or flower prior to pollen receptivity on the same plant or flower; cf. Dichogamy.
- Protogyny.** ('female-first'). Termination of pollen receptivity prior to maturation of pollen on the same plant or flower; cf. Dichogamy.
- Provenance.** The place in which a stand of trees is growing. For propagation material such as seed, it refers to the stand from where the material was collected. Compare origin.
- Provenance seed stand.** A stand raised from a known provenance seed source and planted with the primary aim of seed production. See also seed source.

Pure seed. The 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.

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.

Pyrene. The botanical term for the endocarp with enclosed seed in drupes. In seed-handling terminology the term 'stone' commonly applies to the pyrene.

Quarantine. A 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.

Quiescent. Inactive, resting. Applicable to non-dormant seeds during the interval between maturation on the parent tree and the onset of germination.

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.

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

Raphe. A ridge formed on the seed-coat if the funiculus is fused with the integument in part of its length in anatropous or campylotropous ovules.

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 also intermediate.

Receptacle. End of a flower stalk on which the floral organs are borne. In epigynous flowers the receptacle enlarges and encloses the ovary.

Receptivity. Condition of the female flower or cone that permits effective pollination.

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.

Replicate. Part of a test with the same experimental design.

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.

Respiration. Aerobic combustion of stored food reserves at physiological temperature by living organisms. Respiration is an essential part of the plants' metabolism. Oxygen is consumed during the process and water and CO₂ produced.

Rhizobium. A bacterial root symbiont infecting 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.

Samara. Dry, indehiscent, winged fruit with one or more seeds.

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.

Saprophyte. An organism that lives on dead or decaying organic matters.

Sarcotesta. Soft, fleshy outer layer of a testa.

Saturated (air). Air that contains the maximum amount of water at a given temperature. The relative humidity of saturated air is 100%.

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.

Scorching. A brief exposure to high temperature, e.g. open fire, applied for extraction of seeds from serotinous fruits or cones.

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.

Seed. In the strict botanical sense, the mature ovule which contains the embryo plus possible nutritive tissue, enclosed in protective layers of the testa or seed-coat (which originates 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.

Seed-bearing organ. A 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.

Seedborne pathogen. An infectious micro-organism carried in, on, or with the seed, whether it causes damage to the seed or not. Compare seed transmitted.

Seed-coat. Protective outer layers on a seed derived from the integument of the ovule. When two layers of the seed-coat are distinguishable, the outer coat is called the testa and the inner the tegmen. When only one layer can be distinguished, it is called testa.

Seed crop. The total seed production during one defined fruit/seed season.

Seedling. A 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.

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 of registration.

Seed orchard. A plantation established from propagation material from selected trees, usually of proven genetic quality, and managed for early and abundant seed production.

Seed production area (SPA). A stand of trees that has been selected for superior phenotypic performance, upgraded by removal of undesired trees and then managed for early and abundant seed production, typically by thinning.

Seed quality. A general term that may refer to the purity, germination capacity, vigour and genotypic quality of a seed lot.

Seed source. The stand of trees from which seeds are collected. Seed sources may be classified according to the following hierarchy with increasing genetic quality: seed zone → identified stand → selected stand → seed production area → provenance seed stand → seed orchard (see definitions under individual terms).

Seed stand. The same as seed production area.

Seed-transmitted pathogen. An 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.

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 weight indicating the weight in grams of 1000 pure seeds.

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. Compare masting.

Seed (collection) zone. The area or group of areas subject to sufficient uniform ecological conditions on which are found stands showing similar phenotypic or genetic characters.

Selected stand. A stand of trees selected for seed production based on mean superior phenotypes for the prevailing ecological conditions. Compare identified stand, seed zone and seed production area. See also seed source.

Semelparous. Same as monocarpic.

Semi-permeable. Permeable to small molecules only.

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* and *Hakea* spp.

Simple fruit. Fruit developed from the gynoecium of a single flower, e.g. follicle, berry and capsule. Compare multiple fruit and aggregate fruit.

Singularization. Separation of clusters of seeds to ease cleaning in cleaning machines and sowing individual seeds by sowing machines.

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

Sound seed. Healthy, viable seed without major damages.

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 seed-certifying agencies.

Specific gravity. Mass (weight) of a substance relative to that of an equal volume of water.

Sperm. The motile male gamete (or nucleus).

Spike. An elongate inflorescence with sessile flowers, the youngest at the base.

Sporadic flowering. Flowering in a small proportion of a population of a species with pronounced periodicity. Ant. gregarious flowering.

Squash test. A 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 seed plus chaff (in eucalypts) or per 100 (in larger seeds) provides a rough estimate of viability.

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

Stigma. The part of the pistil on which pollen must be deposited in order to germinate and reach the ovule.

Stone. Common term for the hard endocarp of a drupe containing the seed; same as pyrene.

Stratification. Pretreatment 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 pretreatment 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 also naked stratification and pre-chilling.

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.

Strophiole. Small excrescences arising from various parts of the seed testa e.g. the funiculus in anatropous or campylotropous ovules. See also micropyle.

Style. The stalk of the pistil between stigma and ovary.

Submitted sample. The sample of seed submitted to a seed testing station.

Substrate. Here: the matter on which a fungus or germinating seedling grows.

Suspensor. Here: a filament attached to the radicle end of a gymnosperm embryo.

Suture. Here: a line of opening or dehiscence in dehiscent fruits.

Symbiosis. Literally 'living together'. Applying 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 on the expense of the other, it is called parasitism.

Syncarp. A multiple or fleshy aggregate fruit, as the mulberry or *Magnolia*.

Syncarpous (syncarpy). Composed of two or more united carpels.

Systemic pesticide. Pesticides which are absorbed by and then distributed within the plant (or seed). Ant. contact pesticide.

Tegmen. The inner seed-coat, usually thin and delicate. See also seed-coat.

Testa. The outer coat of a seed; usually hard or tough, but may be soft in some species (sarcotesta). Often used as synonymous with seed-coat.

Tetrazolium. See TTZ.

Thorax. In insects, the body part between head and abdomen which bears the wings and the legs.

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

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.

Treatment, seed. Application of pesticides to seeds. Should not be confused with pretreatment.

Triploid. A cell or organism with three basic chromosome sets, symbolized by $3n$. Applicable to cells of the endosperm in seeds of angiosperms, which have three times the number of chromosomes in the reproductive cells.

TTZ. 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 oxidizing enzymes present in living cells.

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.

Turnover. Continuous replacement and rejuvenation of aged cells, organelles and other constituents by breakdown of aged material and synthesis of new cells and their constituents.

Unisexual. Same as imperfect flower.

Univoltine. Of insects: producing one generation per year. Ant. multivoltine.

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.

VAM (Vesicular Arbuscular Mycorrhiza). A group of endomycorrhizae in which the fungal hyphae form special structures, vesicles and arbuscules within the root. Vesicles are storage and reproductive structures; arbuscules facilitate nutrient exchange between fungus and host.

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 on e.g. cutting test or TTZ staining. See also dormancy and vigour.

Viable seed. A seed which can germinate under favourable conditions, provided that any dormancy that may be present is removed.

Vigour. The seed properties which determine the potential for rapid, uniform emergence and development of normal seedlings under a wide range of field conditions.

Vitrification. Procedure for long term storage at ultralow temperature in which samples (tissue or embryos) are placed for pretreatment in extremely concentrated cryoprotective solutions, then frozen ultrarapidly (in liquid nitrogen) in order to avoid formation of intracellular ice crystals. See also cryopreservation.

Viviparous (vivipary = precocious germination). Seeds germinating while still attached to the parent plant, e.g. *Rhizophora* spp.

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).

Working sample. A reduced seed sample taken from the submitted sample in the laboratory, on which some test of seed quality is made. See sample.

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.

Zygote. The fertilised egg.