The Nursery-Book

BAILEY

L. H. Bailey

THE

NURSERY-BOOK

A COMPLETE GUIDE

TO THE

Multiplication and Pollination of Plants

By L. H. BAILEY

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1891

By the Same Author.

Horticulturist's Rule-Book.

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ELECTROTYPED AND PRINTED
BY J. HORACE M'FARLAND, HARRISBURG, PA.

PREFACE.

THIS little handbook aims at nothing more than an account of the methods commonly employed in the propagation and crossing of plants, and its province does not extend, therefore, to the discussion of any of the ultimate results or influences of these methods. All such questions as those relating to the formation of buds, the reciprocal influences of cion and stock, comparative advantages of whole and piece roots, and the results of pollination, do not belong here.

In its preparation I have consulted freely all the best literature of the subject, and I have been aided by many persons. The entire volume has been read by skilled propagators, so that even all such directions as are commonly recommended in other countries have also been sanctioned, if admitted, as best for this. In the propagation of trees and shrubs and other hardy ornamentals, I have had the advice of the head propagator of one of the largest nurseries in this country. The whole volume has also passed through the hands of B. M. Watson, Jr., of the Bussey Institution of Harvard University, a teacher of unusual skill and experience in this direction, and who has added greatly to the value of the book. The articles upon orchids and upon most of the different genera of orchids in the Nursery List, have been contributed by W. J. Bean, of the Royal Gardens, Kew, who is well known as an orchid specialist. I have drawn freely upon the files of magazines, both domestic and foreign, and I have made particular use of Nicholson's Illustrated Dictionary of Gardening, Vilmorin's Les Fleurs de Pleine Terre, Le Bon Jardinier, and Rümpler's Illustriertes Gartenbau-Lexikon.

It is believed that the Nursery List contains all the plants which are ordinarily grown by horticulturists in this country either for food or ornament. But in order to give some clew to the propagation of any which are omitted, an ordinal index has been added, by which one can search out plants of a given natural order or family. It cannot be hoped that the book is complete, or that the directions are in every case best for all regions, and any corrections or additions which will be useful in the preparation of a second edition are solicited.

L. H. BAILEY.

ITHACA, N. Y., *Jan. 1, 1891.*

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CHAPTER VII.

NURSERY.—*An establishment for the rearing of plants. In America the word is commonly used in connection with the propagation of woody plants only, as fruit trees and ornamental trees and shrubs. This is erroneous. The word properly includes the propagation of all plants by whatever means, and in this sense it is used in this book.*

Tabular Statement of the Ways in which Plants are Propagated.

4. By Seeds.—*Seedage.*

By Buds . .
- I On their own roots . . . .
  - 1. By undetached parts.—*Layerage.*
    - Root-tips.
    - Runners.
    - Layers proper:
      - Simple.
      - Serpentine.
      - Mound.
      - Pot or Chinese.
  - 2. By detached parts . . . .
    - 1. By undivided parts.—*Separation* (Bulbs, corms, bulbels, bulblets, bulb-scales, tubers, etc).
    - 2. By divided parts.—*Cuttage.* .
      - Division.
      - Cuttings proper:
        - Of tubers.
        - Of roots.
        - Of stems.
        - Of leaves.
- II. On roots of other plants.—*Graftage.*
  - 1. By detached scions . . .
    - I. Budding: Shield, flute, veneer, ring, annular, whistle or tubular.
    - II. Grafting:
      - Whip.
      - Saddle.
      - Splice.
      - Veneer.
      - Cleft.
      - Bark.
      - Herbaceous.
      - Seed.
      - Double.
      - Cutting.
  - 2. By undetached scions.—Inarching.

CHAPTER I.

SEEDAGE.

Seedage.—The process or operation of propagating by seeds or spores, or the state or condition of being propagated by seeds or spores.

THERE are three external requisites to the germination of seeds—moisture, free oxygen, and a definite temperature. These requisites are demanded in different degrees and proportions by seeds of different species, or even by seeds of the same species when differing widely in age or degree of maturity. The supply of oxygen usually regulates itself. It is only necessary that the seeds shall not be planted too deep, that the soil is porous and not overloaded with water. Moisture and temperature, however, must be carefully regulated.

Regulation of Moisture.—Moisture is the most important factor in seedage. It is usually applied to the seeds by means of soil or some similar medium, as moss or cocoanut fiber. Fresh and vigorous seeds endure heavy waterings, but old and poor seeds must be treated sparingly. If there is reason to suspect that the seeds are weak, water should not be applied to them directly. A favorite method of handling them is to sow them in a pot of loose and sandy loam which is set inside a larger pot, the intermediate space being filled with moss, to which, alone, the water is applied. This device is illustrated in Fig. 1. The water soaks through the walls of the inner pot and is supplied gradually and

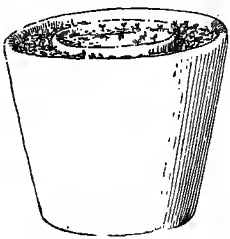

Fig. 1. Double Seed-Pot.

constantly to the soil. Even in this case it is necessary to prevent soaking the moss too thoroughly, especially with very weak seeds. When many pots are required, they may be simply plunged in moss with the same effect. The soil should be simply very slightly moist, never wet. Moisture is sometimes supplied by setting the seed-pot in a shallow saucer of water, or it may be sufficient to simply place it in the humid atmosphere of a propagating-box. Large seeds may be laid upon the surface of the soil in a half-filled pot, covered with thin muslin, and then covered with loose and damp loam. Every day the pot is inverted, the covering taken off and fresh soil is added. A modification of this plan for small seeds can be made by placing the seeds between two layers of thin muslin and inserting them in damp loam, which is frequently renewed to avoid the extremes which would result from watering or from allowing the soil to become dry. In these last operations, no water is applied to the seeds and they constitute one of the most satisfactory methods of dealing with seeds of low vitality. They are essentially the methods long ago used by Knight, who laid such seeds between two sods cut from an old and dry pasture.

Even sound and strong seeds should be watered with care. Drenchings usually weaken or destroy them. The earth should be kept simply damp. To insure comparative dryness in in-door culture, some loose material, as pieces of broken pots or clinkers, should be placed in the bottom of the pot or box to afford drainage. It should be borne in mind, however, that the seed bed should be approximately equally moist throughout its depth. The waterings should therefore be copious enough to moisten the soil throughout. A wet or moist surface over a dry substratum should always be avoided. Error is common here. It is usually best to apply water with a watering-pot, as watering with a hose is apt to wash out the seeds and to pack the soil, and the quantity of water is not so easily regulated.

At first thought, it would appear that the apparently good results following soaking of seeds in many cases, are a contradiction of these statements that seeds may be over-watered. But soaking is usually beneficial only when practiced for a comparatively short time. It is not good practice to soak delicate seeds before sowing, and it is of doubtful utility in most other cases, unless it is necessary to soften the integuments of hard-shelled species, as discussed on page 17. The gain in rapidity of germination following soaked, as compared with dry seeds, is really fictitious, inasmuch as germination actually begins in the soaked seeds before the dry samples are sown. The soaked seeds are sown in water rather than in soil, and as conditions are more uniform there, a gain apparently due to soaking may result. In the case of strong seeds which must be planted out-doors in cold or uncongenial soil, a preliminary soaking of from 12 to 24 hours may be beneficial, as it lessens the period which the seeds would otherwise pass in untoward conditions. But soaked seeds, unless of very hardy species, should never be sown out-doors until the soil has become rather dry and warm.

To prevent too rapid drying out, the soil should be firmly pressed about the seeds. The pot or box should be given a shady place, or some covering may be applied to check evaporation. A pane of glass is often placed over the box, being tilted a little at intervals to allow of ventilation and to prevent the soil from becoming soggy or "sour." A seed-case, with a glass cover, as shown in Fig. 2, is neat and handy in the treatment of small seeds. A thin covering of fine moss is sometimes given, or a newspaper may be thrown over the soil.

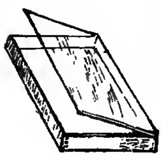

Fig. 2. Seed-Case.

In out-door culture, only a naturally dry and well drained soil should be chosen for all ordinary seeds, especially for such as are sown in the fall or remain in the ground a long time before germinating. Soils which contain a liberal amount of sand or gravel are especially valuable for this purpose.

To prevent drying in out-door culture, it is important that the earth be well firmed over the seeds. Walking on the row, placing one foot directly ahead of the other, is usually the most expeditious and satisfactory operation, at least with large seeds.

Or the earth may be firmed with a hoe or the back of a spade, or a board may be placed upon the row and then be thoroughly settled by walking over it. In the sowing of celery and other small and slow seeds, it is a frequent practice to leave the board on the row until the seeds appear in order to hold the moisture. This is a doubtful expedient, however, for the young plants are apt to be quickly dispatched by the sun when the board is removed. If the board is employed, it should be raised an inch or two from the ground as soon as the plants begin to appear. But the shade of the board is too dense and plants do not grow stocky under it. It is better to use brush or lath screens if protection is desired; or fine litter, if free from weed seeds, may be used. In most cases, however, screens will not be needed by celery and similar seeds if the ground is in the proper condition and is well firmed at planting time. It is always advisable, nevertheless, to place the beds for slow and small seeds where they can be watered occasionally.

There are many kinds of screens in use to prevent the drying out of small seeds in out-door seedage and to protect the young seedlings. These are used also in the shading of cuttings. The common lath screen (Fig. 3) is the most useful for general purposes. It is simply a square frame made from common laths laid at right angles in a double series. The interstices between the laths are equal in width to the laths themselves. These screens are laid horizontally upon a light frame-work a few inches above the seeds. The passage of the sun constantly moves the shadows over the bed, and sufficient shade is afforded while thorough ventilation is allowed. This and all other ele-

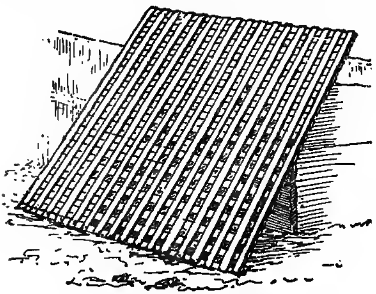
Fig. 3. Lath Screen.

vated screens are useful in shading and protecting the young plants as well, but when used for this purpose they are usually raised a greater distance above the beds. A brush screen con-

Fig. 4. Brush Screen.

sisting of a low frame covered with boughs, is often used, as shown in Fig. 4. This is cheaper than the lath screens, and is equally as good for most purposes. The brush is often laid directly upon the ground, especially in large beds. This answers the purpose of shading, but it does not allow of weeding and it must be taken off soon after the seeds germinate, or slender plants will be injured in its removal. Brush screens are sometimes raised three or four feet to allow of weeding. A screen for frames is shown in Fig. 5. It is a simple covering of muslin stretched over the top and sides of a rough frame-work. The cloth is usually omitted from the front side. This style of screens is much used by nurserymen, especially for cutting beds.

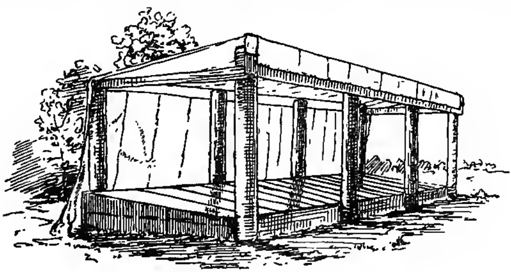

Fig. 5. Screen for Frames.

Whitewashing the sashes also affords good shading, A more elaborate and permanent screen is shown in Fig. 6. It is built of slats, usually 3-inch stuff. This shed screen is oftenest used for the protection of tender plants, but it affords an exceedingly useful and convenient place for the storage of pots and boxes of slow-germinating seeds.

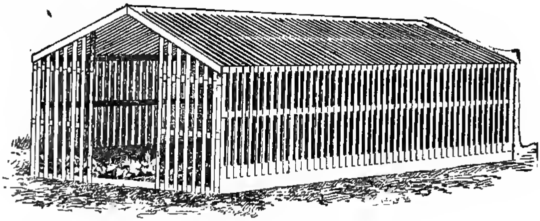

Fig. 6. Shed Screen.

Various frames and covers are employed for in-door seedage, but they are designed to regulate atmospheric moisture and to control temperature. They are more commonly employed in the growing of cuttings, and are therefore described in Chapter IV.

Requirements of Temperature.—Variations in temperature exercise less influence upon seeds than variations in moisture. Yet it is important that the extremes of temperature should not be great, especially in small, delicate or weak seeds. Seeds will endure greater extremes of temperature when dry than when moist. This indicates that germinating seeds must be kept in a comparatively uniform temperature. For this reason it is poor practice to place seed-boxes in a window in full sunlight. Partial or complete shade serves the double purpose of preventing too great heat and too rapid evaporation. Various covered seed-boxes are used for the purpose of maintaining approximately the required temperature, but as they are oftener used in bud-propagation, they are discussed in that connection.

Bottom heat is helpful to germination in most seeds, but, except in the case of certain tropical species, it should not be strong. It is a common practice to place the seed-boxes on moderately cool pipes under benches in a greenhouse. Seeds of hardy annuals and perennials do not require bottom heat, although they may be benefitted by it. If the soil in seed beds should become too cool, watering with warm or tepid water will be found helpful.

It is impossible to give rules for the determination of the proper temperature for different kinds of seeds. In general, it may be said that seeds germinate most rapidly at a temperature a few degrees above that required for the best development of the plant itself. Hardy plants require a temperature of from 50° to 70°, conservatory plants from 60° to 75° or 80°, and tropical or stove plants from 75° to 95.° The plantlets should be removed from these highest temperatures, as a rule, as soon as germination is completed,

In out-door culture, depth of planting has a direct relation to temperature. Seeds may be planted deeper late in the season than early, when the soil is cold and damp. Deep planting probably as often kills seeds because of the absence of sufficient heat as from the lack of oxygen or the great depth of earth through which the plantlet is unable to push.

Preparatory Treatment of Seeds.—Many seeds demand some treatment preparatory to sowing. Nearly all hard and bony seeds fail to germinate, or at least germinate very irregularly, if their contents are allowed to become thoroughly dry and hard. The shells must also be softened or broken in many cases before the embryo can grow. Nature treats such seeds by keeping them constantly moist under leaves or mold, and by cracking them with frost. This suggests the practice known to gardeners as *stratification*, an operation which consists in mixing seeds with earth and exposing them to frost or to moisture for a considerable time.

Stratification is practiced, as a rule, with all nuts, the seeds of forest trees, shrubs, the pips of haws and often of roses, and in many cases with the seeds of common fruits. It should be performed as soon as possible after the seeds are mature. Small seeds are usually placed in thin layers in a box alternating with an inch or two of sand. Sometimes the seeds are mixed indiscriminately in the sand, but unless they are large it is difficult to separate them out at sowing time. The sand is often sown with the seeds, however, but it is difficult in such cases to distribute the seeds evenly, and in sowing large quantities the handling of the sand entails a considerable burden and becomes an item of expense. It is advisable to pass the sand through a sieve of finer mesh than the seeds, and the seeds can then be sifted out at sowing time. If the seeds are very small or very few in number they may be placed between folds of thin muslin, which is then laid in the sand. Any shallow box, like a gardener's "flat," is useful in making stratifications, or with small lots of seeds pots may be used. A flat four inches deep might contain two or three layers or strata of seeds the size of peas.

The disposition of the boxes when filled varies with different operators. Some prefer to bury them. In this case a well-drained sandy slope is chosen. The flats are placed in a trench from one to two feet deep, covered with a single thickness of boards, and the trench is then filled with earth. The seeds usually freeze somewhat, although freezing is not considered necessary unless in the case of nut-like seeds. The object attained in burying is to keep the seeds moist and fresh, inducing the rotting or softening of the coverings, while they are buried so deep that they will not sprout. Seeds of most forest trees should be treated in this manner. They are commonly left in the ground until the second spring, when they are taken up and sown in drills in mellow ground. If good loam to which has been added a little well rotted manure is used, the seeds or nuts of hardy trees and shrubs may be allowed to germinate and grow for one season in the flats. At the end of the season or the next spring the plants can be transplanted without losing one. This is, perhaps, the best way to handle rare and difficult subjects.

Many growers place the boxes on the surface in some protected place, as under trees or in a shed, and cover them a foot deep with clean straw or leaves. This is a good method for all seeds which are to be sown the following spring, as those of many fruits. If boxes are piled on top each other they should be mulched with moss, else the under ones may become too dry. Or the boxes may be placed without covering in a shed, but they must be examined occasionally to see that they do not become too dry. Precaution must also be taken to keep away mice, squirrels, blue-jays and other intruders.

Large nut-like seeds or fruits, like peach-pits, walnuts and hickory-nuts, are usually buried in sand or light loam where they will freeze. Or sometimes the large nuts are thrown into a pile with earth and allowed to remain on the surface. Freezing serves a useful purpose in aiding to crack the shells, but it is not essential to subsequent germination, as is commonly supposed. All seeds, so far as known, can be grown without the agency of frost if properly handled.

Fall sowing amounts to stratification, but unless the soil is mellow and very thoroughly drained the practice is not advisable. The seeds are liable to be heaved or washed out, eaten by vermin, and the soil is apt to bake over them. Under proper conditions, however, the seeds of fruits and many forest trees thrive well under fall sowing. The seeds should be sown as soon as they are ripe, even if in mid-summer; or if the ground is not ready for them at that time, they may be temporarily stratified to prevent too great hardening of the parts. It is best, however, to allow all green or moist seeds to dry off a few days before they are stratified. Fall sown seeds should always be mulched.

Some seeds rarely germinate until the second year after maturity, even with the best of treatment. The thorns, mountain ash, hollies, viburnums, some roses, and many others belong to this category. Some growers sow them regularly as soon as they are ripe and allow the beds to remain until the seeds appear. This is a waste of land and of labor in weeding, and the best way is to stratify them and allow them to remain until the second spring before sowing,

Partial substitutes for stratification are soaking and scalding the seeds. Soaking may be advantageously practiced in the case of slow and hard seeds, which are not enclosed in bony shells, and which have been allowed to become dry. Seeds of apple, locust and others of similar character, are sometimes treated in this manner. They are soaked for 24 or 36 hours, and it is commonly supposed that if they are exposed to a sharp frost in the meantime, better results will follow. While still wet the seeds are sown. Scalding water may be poured over locust and other seeds to soften their covering. But seeds should not be boiled, as sometimes recommended.


Fig. 7. Bored Seed.

The germination of bony seeds is often facilitated by filing or cutting away the shell very carefully near the germ, or by boring them. A bored nelumbium seed is shown in Fig. 7.

Treatment with various chemicals has been recommended for the purpose of softening integuments, and also for some power which strong oxidizing agents are supposed to exert in hastening germination itself, but the advantages are mostly imaginary. Secret and patented "germinator" compounds had better be avoided.

Pulpy and fleshy coverings should be removed from seeds before sowing. Soft fruits, like berries, are broken up or ground into a pulp and the seeds are then washed out. This separation may be performed immediately in some cases, but when the pulp adheres to the seed, the whole mass is usually allowed to stand until fermentation and partial decay has liberated the seeds. The pulp will then rise, in most instances, leaving the seeds at the bottom of the vessel. Seeds can be liberated quickly by adding a stick of caustic potash to each pail of water. After the mass has stood an hour or so, the seeds can be rubbed out easily. Even tomato seeds can be cleaned with safety in this manner, Seeds which have thin coverings, as the viburnums and many haws, can be prepared by rubbing them through the hands with sharp sand. Or the scant pulp of such seeds may be allowed to rot off in the stratification box. Fleshy coverings of hard and bony seeds may be removed by maceration. Allow them to stand in water at a temperature of about 75° for one to three weeks, and then wash them out. Resinous coverings are sometimes removed by mixing the seeds with fresh ashes or lime, or by treating them with lye. Hard, thick-walled seeds are rarely injured by the decay of the pulpy covering, but thin-walled seeds should be cleaned, to avoid the possibility of damaging them.*

Sowing.—The soil in which seeds are sown, especially in in-door culture, should be such as to allow of perfect drainage and, at the same time to hold moisture. Good potting soil, with a liberal allowance of sharp sand, is the best for general purposes. Pure sand becomes too dense, and leaf mold alone is usually too loose and open. A proper combination of the two corrects both faults. It is impossible to describe a good potting or seed-bed soil. Some experience is essential to the best results in preparing it. It should be of such character that when a damp portion is firmly compressed in the hand it will fall apart when released. It should never bake. Good old garden loam, to which an equal quantity of sand has been added, is usually a good soil for common in-door seedage. There should be no manure in soil used for seeds which produce a delicate growth, as rhododendrons and kalmias. In all such cases, rotted sod or leafy peat forms the best basis. The soil should be sifted and thoroughly fined before seeds are put into it. Seeds usually require lighter soil than that in which the growing plant will flourish. Cocoanut fiber is sometimes used in place of the soil, as it holds moisture, allows of almost perfect drainage, and does not become "sour." Fine dead sphagnum moss may also be used. Orchid seeds are usually sown on the live moss in which the parent plant is growing; or they may be sown on damp wood or cork. (See under Orchids, Chap. VI.) Small seeds, like those of cineraria and calceolaria, germinate well in very old cow-dung obtained from a pasture; the unctuous matters have disappeared, leaving a fibrous remainder. But all things considered, well-prepared soil is the most satisfactory medium which can be used. Seeds of aquatic plants which are to be sown in a pond may be placed in a ball of clay and dropped into the water.

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*An admirable paper upon the propagation of hardy trees and shrubs from seeds and the treatment of the young seedlings, by Jackson Dawson, may be found in Trans. Mass. Hort. Soc. 1885, part I, 145, and also in Rep. Sec. Mass. Bd. Agr. 1885, 468.

Shallow boxes or "flats" and earthen seed-pans and lily-pans are usually preferable to pots in which to grow seeds. They give more surface in proportion to their contents and require less attention in drainage. If pots are used, the four to six-inch sizes are best.

If delicate seeds are sown out-doors, they should be given some protection, if possible. An ordinary hot-bed frame gives the best results. In warm weather or a sunny exposure it will be found desirable to substitute a cloth screen for the sash. A thin or medium water-proof plant cloth, either commercial or home-made, is excellent for this purpose. It may be tacked upon a simple and light rectangular frame which is strengthened at the corners by iron "carriage-corners." These cloth-covered frames are handy for many purposes, particularly for protecting and supplying some warmth to seed-pans and young seedlings.

It is essential that good drainage be given all in-door seed-pots or seed-beds. A layer of broken pots or other coarse material is placed on the bottom. Many growers place a thin layer of fine dead sphagnum moss or of peat over this drainage material, and it certainly makes a useful addition. It is particularly useful in isolated pots or small boxes, as it holds enough moisture to prevent too rapid drying out, while all surplus water is quickly taken off by the coarse material beneath. Over the moss coarse siftings from the soil may be placed, while on top only the finest and best soil should be used. The smaller the seeds, the more care must be exercised in the sowing.

The proper depth for sowing varies directly with the size of the seed. The chief advantage of very fine soil for small seeds is the greater exactness of depth of covering which it allows. Very small seeds should be sown upon the surface, which has previously been well firmed and levelled, and then covered with a very thin layer of finely sifted soil or a little old and dead moss rubbed through a sieve. This covering should be scarcely deeper than the thickness of the seeds; that is, the seeds should be barely covered. Many prefer pressing the seeds into the soil with a block. Or if one has a close propagating-box, the seeds may remain upon the surface and sufficient moisture will be supplied from the atmosphere. Such fine seeds are rarely watered directly, as even the most careful treatment would be likely to dislodge them. The soil is usually well watered before the seeds are sown, or moisture may be supplied by inserting the pot in water nearly to its rim for a few moments. If water is applied from a rose, a thin cloth should first be spread on the soil to hold it. Celery seeds, in out-door beds, are often sown upon a nicely prepared surface and are then pressed in by means of the feet or a board. Some cover to prevent evaporation should be given all small seeds. This may be a board or a slate slab at first, but as soon as the plants appear glass should be substituted to admit light. (See pp. 11 to 14.)

Large seeds demand much less care as to depth of covering, as a rule. One-fourth or one-half inch is a good depth for most coarse seeds in-doors. If one wishes to guage the depth accurately, the drills may be made by a planting stick, like that shown in Fig. 8. Its flange is made of the required thickness, and it is pressed into the soil until the cap strikes the surface. This is a useful implement in seed testing. Another device for regulating the depth of sowing, particularly in seed testing, is the Tracy planter, shown in Fig. 9. It consists of two strips of heavy tin plate about three inches wide, hung upon two wire pivots or hinges some two inches long. At their upper edges and equidistant from either end, the plates are joined by a firm spiral spring, which serves to throw the upper edges apart, and to cause the lower edges to join. This trough is now filled with the required number of seeds, and is then inserted into the earth to a given depth, when the fingers push inward on the spring and the trough opens and delivers the seeds.

Fig. 8. Planting Stick.

Miscellaneous Matters.—The influence which light exerts upon germination is not definitely understood. It is known, however, that seeds will often germinate in full sunlight, if the proper conditions of moisture and temperature can be maintained. Seeds sown upon a moist surface and covered with a glass present an interesting study. But it is well known, on the other band, that some seeds will not germinate, or will at least

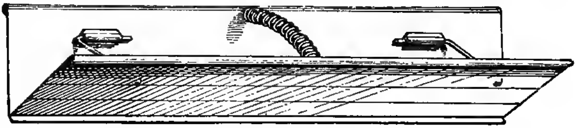

Fig. 9. Tracy Planter.

appear unevenly, if subjected to sunlight. At least some of the delphiniums, papavers and adonises germinate very imperfectly, if at all, in direct light. It is always advisable to keep germinating seeds in shade or partial darkness, especially as there is nothing to be gained by exposing them. Of course the soil itself is sufficent protection if the seeds are covered.

It is a common statement that seeds can never revive if allowed to become thoroughly dry after they have begun to sprout. This is an error. Wheat, oats, buckwheat, maize, pea, onion, radish and other seeds have been experimented upon in this direction, and they are found to re-germinate readily, even if allowed to become thoroughly dry and brittle after sprouting is well progressed. They will even re-germinate several times. Wheat, peas and other seeds have been carried through so many as seven germinations after the radicle had grown a half inch or more and the seeds had been sufficiently dried in each trial to render them fit for grinding.

Damping-off is a common ailment of young seedlings and cuttings. The stem becomes brown and constricted at or near the surface of the soil, and it soon rots and falls over. The top of the plant often remains alive and fresh for several days after it has fallen. A fungus is supposed to cause damping-off. The conditions which seem to particularly favor the development of this fungus are a moist and close atmosphere, crowding and careless watering. Plants are particularly liable to damp-off if only sufficient water is applied to keep the surface moist while the under soil remains dry. Hot sand, sifted over the plants, will check it, but there is no complete remedy. Attention to the above suggestions will serve as a preventive.

The transportation of certain kinds of seeds over long distances, especially on sea voyages, is often beset with difficulties. Thick-meated or soft seeds may become too dry if stored in a warm place or too moist if stored in a cool one. The humid atmosphere of the ocean is fatal to some seeds unless they are well protected, and the moist and hot climates of some tropical countries destroy many seeds of cooler regions before they can be planted. Thin-coated seeds demand dryness and air, and bony seeds usually need moisture and a more confined atmosphere. Most seeds may be sent dry and loose in coarse paper packages under all ordinary circumstances; but if they are to traverse very hot and moist climates, they should be sealed in tin cases or very securely wrapped in oiled paper, in which case the seeds should be thoroughly dried before being packed. Small seeds which are liable to become moldy may be packed in finely powdered charcoal. Apple and pear seeds are often imported in this manner. The seeds or fruits of woody plants require more careful management. They should generally be transported in some sort of stratification. A favorite method is to place them in boxes or jars, mixed with naturally moist sand or sawdust, or slightly moist dead sphagnum moss. Some prefer to seal the packages hermetically, but under ordinary conditions this is unnecessary. In transit, the packages should be stored in a medium and uniform temperature. Even acorns, which are often difficult to transport over long voyages, may be carried in this manner with safety. It is important that the soil should not be wet. Natural soil from a dryish and loamy pasture is excellent. In some cases it is better to sprout the seeds in the native country and ship the seedlings in a closed or Wardian case.

It should be borne in mind that actual plantings rarely give so good results as seed tests, from the fact that conditions are more variable. There is often a variation of over fifty per cent. even when the planting has been carefully done. This is proof that liberal seeding should always be practiced.

Spores.—Ferns, lycopodiums and selaginellas are often grown from spores. The general conditions adapted to the germination of seeds are also suitable for the germination of spores, but extra care must be taken with the drainage. If a pot is used, it should be half or more filled with drainage material, and the soil should be rendered loose by the addition of bits of brick, charcoal, cinders or other porous materials. The surface soil should be fine and uniform. Some place a thin layer of brick dust upon the surface, in which the spores are sown. It is a frequent practice to bake the soil to destroy other spores which might cause troublesome growths. The spores should be sprinkled upon the surface and should not be covered. The pot should be set in a saucer of water and it should be covered by paper or a pane of glass if the sun strikes it. Better results are obtained if the pot or pan is placed inside a propagating-frame or under a bell-glass. In place of earth, a block or small cubes of firm peat or sandstone may be employed. The block is placed in a saucer of water and the spores are sown upon its surface. Water should not be applied directly to the spores, as it is apt to dislodge them.

The period of germination varies in different species, but three to six weeks may be considered the ordinary limits. While still very small, the plantlets should be pricked out, and for some time thereafter they should be subjected to the same conditions as before. Spores are so exceedingly small and light that the greatest care must be exercised in growing them. In order to gather them, the fronds may be cut as soon as the sori or fruit-dots turn brown, and stored in close boxes or paper bags.

NOTE.—For tables of weights and longevities of seeds and quantities required for given areas, consult Horticulturist's Rule-Book.

CHAPTER II.

SEPARATION.

Separation.—The act or process of multiplying plants by means of naturally detached asexual organs, or the state or condition of being so multiplied.

SEPARATION is effected by means of bulbs, bulbels, bulb-scales, bulblets, corms, tubers, offsets, crowns and sometimes by buds.

Bulbs of all kinds are specialized buds. They are made up of a short and rudimentary axis closely encased in transformed and thickened leaves or bulb-scales. These thickened parts are stored with nutriment which is used during subsequent growth. Bulbs occur only in plants which are accustomed to a long period of inactivity. Many bulbous plants are peculiar to dry and arid regions, where growth is impossible during long periods. A bulb is, therefore, a more or less permanent and compact leaf-bud, usually occupying the base of the stem underground and emitting roots from its lower portion. Bulbs are conveniently divided into two great classes—the scaly, or those composed of narrow and mostly loose scales, as in the lily, and laminate or tunicate, or those composed of more or less continuous and close-fitting layers or plates, as in the onion.

Fig. 10. Bulb of Lilium candidum.

Bulbs often break up or divide themselves into two or more nearly equal portions, as in *Lilium candidum*, shown one-third natural size in Fig. 10. The parts may be separated and treated as complete bulbs for purposes of propagation. This division or separation of bulbs proceeds in a different manner in nearly every species, yet it is so obvious that the novice need not be perplexed by it. Almost any breaking apart of these loose bulbs, if only a "heart" or central axis remains in each portion, is successful for purposes of slow multiplication; but when flowers are desired it is usually inadvisable.

Bulbous plants multiply most easily by means of *bulbels*—often also called bulbules and offsets—or small bulbs which are borne about a large or mother bulb. In some lilies, as *Lilium candidum*, the bulbels form at the top or crown of the mother bulb, and a circle of roots will be found between them and the bulb; in others, as *L. speciosum* and *L. auratum*, they form on the lower part of the flower stalk. In some species the bulbels are few and very large, or even single, and they bloom the following year. In such cases the bulb undergoes a progressive movement from year to year after the manner of rootstocks, the bulb of one year forming a more or less distinct one above and beyond it which continues the species, while the old one becomes weak or dies. This method of bulb formation is seen in the cut of *Lilium pardalinum*, Fig. 11. In the hyacinth the bulbels form at the base of the bulb.

Fig. 11. Bulb of Lilium pardalinum.

Bulbels vary greatly in size and frequency in different species. Sometimes they are no larger than a grain of wheat, and in other plants they are as large as hickory-nuts. In some species they are borne habitually underneath the scales of the mother bulb. These bulbels are often removed when the mother bulbs are taken up, and they are usually planted in essentially the same manner as the bulbs themselves, although it is desirable to place them, at least for the first year, in a bed or border by themselves. Or if they are especially small and delicate they may be planted in pots or flats and be treated about the same as single eye cuttings. In some lilies the bulbels are allowed to remain attached and the whole mass is planted in the fall in close drills. Sometimes tbe larger lily bulbels will produce flowers the following season, but they usually require the whole of the season in which to complete their growth. The second fall they are ready to be permanently planted. Bulbels of some plants require a longer time in which to mature into bulbs.

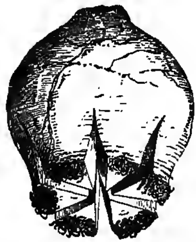

Fig. 12. Cut Hyacinth Bulb.

Bulbels are often produced by an injury to the bulb. Growth of stem and leaves is prevented or checked and the energy is directed to the formation of minute buds, or bulbs, in the same manner as adventitious buds form upon a wounded stem. Advantage is taken of this fact to multiply some bulbous plants, and in the case of the hyacinths, at least, the mutilation of bulbs for this purpose is practiced to a commercial extent. Hyacinth bulbs are cut in two, or are slashed in various ways. The favorite method is to make two or three deep transverse cuts into the base of the bulb. The strongest bulbs should be chosen and the operation is performed in spring or early summer when the bulb is taken up. The bulbs are sometimes hallowed out from the under side for half or more of their length. This operation is sometimes performed later in the season than the other, and precaution should be exercised that the bulbs do not become too moist, else they will rot. Hollowed bulbs should be well dried before being planted. Both methods of preparing hyacinth bulbs are shown in Figs. 12 and 13. which are adapted from Gardeners' Chronicle. Fig. 14 shows a portion of the base of

Fig. 13. Hollowed Hyacinth Bulb.

a cross-cut bulb, with the adventitious bulbels. The mutilated bulbs are stored during summer, and are planted in fall or spring. The wounded bulbs produce very little foliage, but at the end of the first season the bulbels will have formed. The bulbels are then separated and planted by themselves in prepared beds. Several years are required for the bulbels to mature into flowering bulbs. Some of the strongest ones may produce flowering bulbs in three years, but some of them, especially those obtained from the hollowed bulbs, will not mature short of six years. This method of propagating hyacinths is confined almost entirely to Holland.

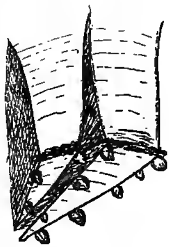

Fig. 14. Cross-Cut Bulb.

The scales of bulbs are often employed to multiply scarce varieties. From ten to thirty of the thicker scales may be removed from the outside of the bulb without serious injury to it. These are treated in the same manner as single eye cuttings. They are usually handled in flats or propagating-frames, and are pressed perpendicularly into a light and loose soil—half sharp sand and half leaf mould—for nearly or quite their entire length, or are scattered in damp moss. Keep the soil simply moist, and for hardy and half-hardy species keep the temperature rather low—from 45° to 60° Slight bottom heat may sometimes be given to advantage. In from three to ten weeks a little bulbel, or sometimes two or more, will appear at the base of the scale, as shown in Fig. 15.

Fig. 15. Bulb-Scale.

These pots or flats may be plunged out-doors during summer if the planting was done in winter, or the scales may be potted off or transferred to the open border as soon as rootlets have formed. It is the common practice with most hardy species to allow the scales to remain in the original flats during summer and to cover them the next fall, allowing them to remain out-doors over winter. The succeeding spring they are shifted into a bed or border, and by the next fall—having had two summers' growth—most species will be ready for permanent planting in the flower border.

A *bulblet* is a small bulb borne entirely above ground, usually in the axil of a leaf or in the inflorescence. Familiar examples occur in the tiger lily and in "top" onions. In the former instance the bulblets are direct transformations of buds, while in the onion they are transformed flowers. It is impossible to draw any line of separation between bulblets and buds. In some plants, certain buds detach themselves and fall to the ground to multiply the species. Sometimes these buds vegetate before they fall from the plants, as in the case of various ferns. For purposes of propagation, bulblets are treated in the same way as bulbels, and like them, they reproduce the variety upon which they grow. They will develop into full grown bulbs in from one to three years, according to the species.

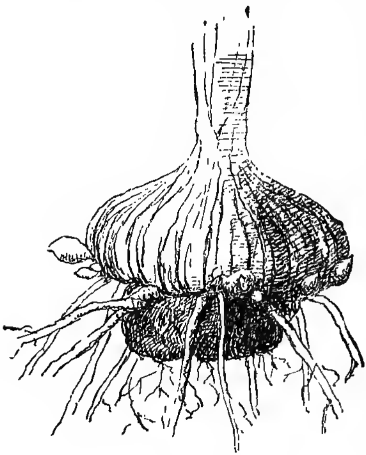
Fig. 16. Gladiolus Corm.

A *corm* is a bulb-like organ which is solid throughout. Familiar examples occur in the gladiolus and crocus Cormous plants are multiplied in essentially the same manner as bulbous species. As a rule, a new corm is produced each year above the old one, and this commonly bears flowers the following season. This renewal is well shown in the gladiolus, Fig. 16. The illustration shows a gladiolus bottom, half size, when taken up in November. At the base are seen the withered remains of the corm which was planted in the spring, and above it the new corm which will furnish bloom the following season. A number of *cormels* or "spawn" have also appeared. These may be planted out in a border or bed and will produce mature bulbs in one or two seasons. The larger ones, under good treatment, will often produce bulbs an inch in diameter the first season. Some growers keep the cormels a year and a half before planting them out, as they are thought to vegetate more evenly under such treatment; in this case they should be placed in sand to prevent too great drying out.

Adventitious cormels may be produced by various methods of wounding the mother corm, and this practice of exciting them is often necessary, as some varieties do not produce cormels freely. Each bud on the top or side of the corm may be made to produce a separate corm by cutting a deep ring around it, so as to partly divide it. Or the corm may be directly cut into as many separate pieces as there are buds or eyes, after the manner of cutting potatoes, but these pieces are usually handled in flats where temperature and moisture can be controlled. Almost any injury to such vigorous corms as those of the gladiolus and crocus will result in the production of cormels, if care is taken that the corms do not become so cold and wet that they will rot.

A *tuber* is a prominently thickened portion of a root or stem, and it is usually subterranean. The potato, sweet potato and dahlia furnish good examples. Tuberiferous plants are multiplied by planting these tubers whole, or the tubers may be cut into small portions as described in Chapter IV, in the descriptions of cuttings. In hardy species, the tubers may be allowed to remain in the ground during winter, but they are generally dug in the fall and stored in a dry and cold place, but where they will not freeze.

An *offset* is a crown or rosette of leaves, usually borne next the surface of the ground, which detaches itself and forms an independent plant. The best examples occur in the house-leeks, plants which are more familiarly known as "hen and chickens" and "man and wife." These offsets take root readily, and in propagating there is no other care necessary than to remove and plant them.

A *crown* is a detachable portion of a root-stock bearing roots and a prominent bud. Rhizomes or root-stocks multiply individuals and extend the distribution of the species by means of a progressive movement of the crowns. The root-stock grows during summer, and at the end of the season each branch develops a strong terminal bud which usually produces a flowering stem the following season. The root-stock gradually dies away at its old extremity, and in a few years a single individual gives rise to a considerable patch. This is well shown by the common May-apple or podophyllum.

In some species these crowns are removed in the autumn and are planted and handled in much the same manner as bulbs. The crown or pip of the lily of the valley, shown half size in Fig. 17, is obtained in this manner

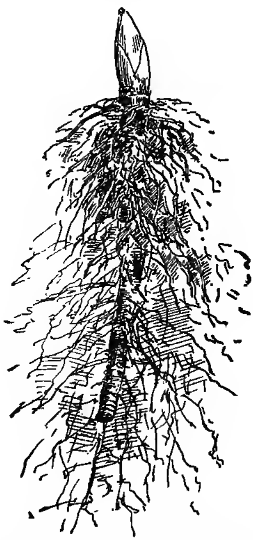

Fig. 17. Lily of the Valley Crown.

CHAPTER III.

LAYERAGE.

Layerage.—The operation or practice of making a layer, or the state or condition of being layered.

Layer.—A shoot or root, attached to the parent plant, partially or wholly covered with earth with the intention that it shall take root and then be severed from the parent.

Stolon.—A decumbent shoot which, without the aid of man, takes root and forms an independent plant.

MANY plants habitually propagate by means of decumbent shoots and runners. These shoots become more or less covered with earth or leaves, and roots are emitted, usually at the joints. In many cases, the old shoots die away and an entirely independent plant arises from each mass of roots. In other plants, the shoots remain attached to the parent, at least for a number of years, so that the plant comprises a colony of essentially distinct individuals. Great numbers of plants which do not propagate naturally by means of layers are readily increased by this means under the direction of the grower. In most cases it is only necessary to lay down the branches, cover them with earth, and allow them to remain until roots are well formed, when they can be severed from the parent. Layering is one of the simplest methods of propagation, as the mother plants nurse the layer plants until they can sustain themselves. It is a ready means of multiplying hard-wooded plants which do not grow well from cuttings.

All vines, and all plants which have runners or long and slender shoots which fall to the ground, may be multiplied readily by layerage. Among fruits, the black-cap raspberry is a familiar example. The canes of the current year bend over late in summer and the tips strike the earth. If the tip is secured by a slight covering of earth, or if it finds lodgment in a mellow soil, roots are emitted and in the fall a strong bud or "crown" or "eye" is formed for next year's growth. The parent cane is severed in the fall or spring, some four or six inches above the ground, and an independent plant, known as a "root-tip," as shown in Fig. 18, is obtained. In this instance, as in most others, it is immaterial at what point the parent stem is severed, except that a short portion of it serves as a handle in carrying the plant, and also marks the position of the plant when it is set. The black raspberry propagates itself naturally by means of layers, and it is only necessary, in most cases, to bring the soil into a mellow condition when the tips begin to touch the ground in order that they may find anchorage. This layering by inserting the growing point has the advantage of producing very strong "crowns" or plants in autumn from shoots or canes of the same year, and it should be more generally practised. Even currants, gooseberries, and many other plants can be handled in this way.

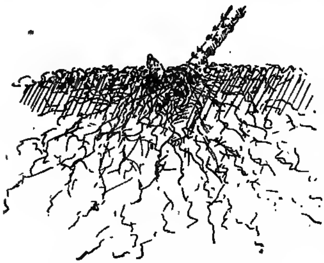

Fig. 18. Raspberry tip.

Fig. 19. Covered Layer of Viburnum.

In most cases of layerage it is necessary to lay down the branches and to cover them. The covering may be continuous, as in Fig.

19, or it may be applied only to the joints or restricted portions of the shoot, as illustrated in Fig. 20. In either case, the covering should be shallow, not exceeding one to three inches. If the shoot is stiff a stone or sod may be placed upon it to hold it down; or a crotched stick may be thrust down over it, as in the "pegging down" of propagators.

The strongest plants are usually obtained by securing only one plant from a shoot, and for this purpose the earth should be applied only at one point, preferably over a bud somewhere

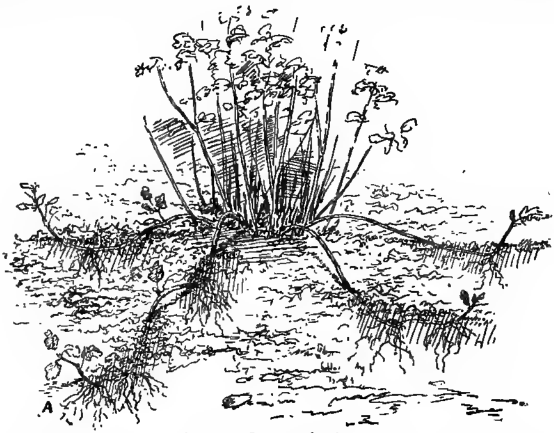

Fig. 20. Layered Shoots.

near the middle of the shoot. If the buds are close together, all but the strongest one may be cut out. If more plants are desired, however, *serpentine layering* may be practiced, as shown at A in Fig. 20. The shoot is bent in an undulating fashion, and from every covered portion roots will form and a plant may be obtained. The covered layer also possesses the advantage of giving more than one plant, but the roots are apt to form so continuously that definite and strong plants are rarely obtained; these rooted portions may be treated as cuttings, however, with good results. The grape is sometimes propagated by serpentine layering.

Stiff and hard-wooded plants do not often "strike" or root readily, and in order to facilitate rooting the branch is wounded at the point where a new plant is desired. This wounding serves to induce formation of adventitious buds at that point, and to check the growth of the branch at the tip. It is a common practice to cut the branch about half in two obliquely, on the lower side. This operation is known as "tongueing." "Ringing" or girdling, twisting, notching, and various other methods are employed, none of which, perhaps, possess any peculiar advantages in general practice. Some propagators cut all the buds from the covered portion. In this case the free and protruding end of the layer is expected to form the top of the new plant. "Arching," or very abrupt bending, as in serpentine layering, serves the same purpose and is the only attention necessary in most vines.

When large numbers of plants are desired, as in commercial nurseries, it is often necessary to cut back the parent plant to the ground, or very nearly so, for the purpose of securing many shoots fit for layering. A plant which is cut back in the spring will produce shoots fit for layering the following spring; or some species will produce them in abundance the same year if layers of green or immature wood are desired. These parent or stock plants are called "stools" by nurserymen.

In many species layerage is performed to best advantage by heaping earth over the stool and around the shoots. This is known as *mound* or *stool layering*. The shoots send out roots near the base and straight, stocky plants are obtained. The English gooseberries are almost exclusively propagated in this manner in this country. Fig. 21 shows a row of mound-layered gooseberries. The shoots are allowed to remain in layerage two years, in the case of English gooseberries, if the best

Fig. 21. Mound Layering of Gooseberry.

plants are wanted, but in many species the operation is completed in a single season. Quinces and Paradise apple stocks are extensively mound-layered. The practice is most useful in those low plants which produce short and rather stiff shoots.

As a rule, the best season for making layers is in spring when the leaves are forming. Rooting progresses rapidly at that season. Many plants "bleed" if layered earlier in the season. Hardy shrubs may be layered in the fall, either early or late, and if an incision is made, a callus will have formed by spring. If rapid multiplication is desired, the soft and growing shoots may be layered during the summer. This operation is variously known as "summer," "herbaceous," "green" and "soft" layering. Comparatively feeble plants usually result from this practice, and it is not in common favor.

Pot layering, *circumposition*, *air layering* and *Chinese layering* are terms applied to the rooting of rigid stems by means of surrounding them, while in their natural position, by earth or moss, or similar material. The stem is wounded—commonly girdled—and a divided pot or box is placed about it and filled with earth (Fig. 22). The roots start from above the girdle, and when they have filled the pot the stem is severed, headed back, and planted. Pot layering is practiced almost exclusively in greenhouses, where it is possible to keep the earth uniformly moist.

Fig. 22. Pot layerage.

But even there it is advisable to wrap the pot in moss to check evaporation from the soil. Some plants can be readily rooted by wrapping them with moss alone. Pot layering is employed not only for the purpose of multiplying plants, but in order to lower the heads of "leggy" or scraggly specimens. The pot is inserted at the required point upon the main stem, and after roots have formed abundantly the top may be cut off and potted independently, the old stump being discarded.

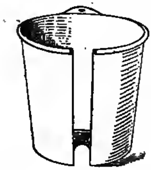

Fig. 23. Layering pot.

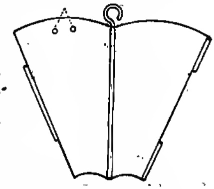

Fig. 24. Layering cone.

The French have various handy devices for facilitating pot layering. Fig. 23 shows a layering pot, provided with a niche in the side to receive the stem, and a flange behind for securing it to a support. Fig. 24 represents a layering cone. It is made of zinc or other metal, usually four or five inches high, and is composed of two semi-circular wings which are hinged on the back and are secured in front, when the instrument is closed, by means of a hinge-pin. A cord is inserted in one side with which to hang it on a support. A cup or pot with a removable side is also used. This is shown open in Fig. 25 and closed in Fig. 26. An ingenious compound layering pot is shown in Fig. 27. The main stem or trunk of the plant is carried through the large opening, and the branches are taken through the smaller pots at the side. Kier's layering boxes or racks are

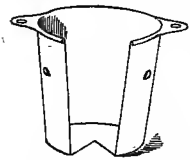

Fig. 25 Layering cup.

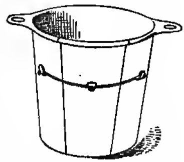

Fig. 26. Layering cup.

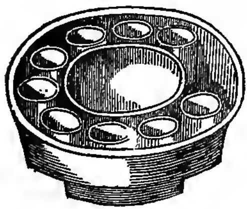

Fig. 27. Compound layering pot.

shown in Figs, 28 and 29. The trays are filled with earth and the branches are laid in through the chinks in the border and are treated in the same manner as ordinary out-door layers. These racks supply a neat and convenient means of increasing green-house plants which do not readily strike from cuttings.

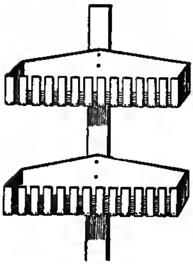

Fig. 28. Kier's layering rack.

It is well to bear in mind that when layers do not give strong plants, they can be divided into portions and treated as ordinary cuttings. This is an important operation in the case of rare varieties which are multiplied by means of soft or green layers, as some of the large-flowered clematises and grapes. The weak small plants are handled in a cool greenhouse or under frames, usually in pots, and they soon make strong individuals

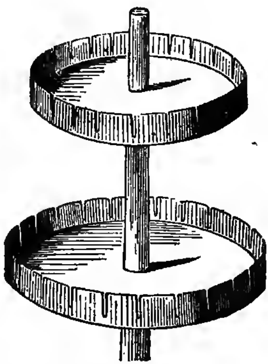

Fig. 29. Kier's circular layering rack.

CHAPTER IV.

CUTTAGE.

Cuttage.—The practice or process of multiplying plants by means of cuttings, or the state or condition of being thus propagated.

Cutting.—A severed portion of a plant, inserted in soil or water with the intention that it shall grow; a slip.

CUTTINGS, particularly of growing parts, demand a moist and uniform atmosphere, a porous soil and sometimes bottom heat.

Devices for Regulating Moisture and Heat.—In order to secure a uniform and moist atmosphere, various propagating-frames are devised. Whatever its construction, the frame should be sufficiently tight to confine the air closely, it should admit light, and allow of ventilation. The simplest form of propagating-frame is a pot or box covered with a pane of glass. To admit of ventilation the glass is tilted at intervals, or two panes may be used and a space be allowed to remain between them. A common bell-glass or bell-jar (*cloche* of the French) makes one of the best and handiest propagating-frames because it admits light upon all sides and is convenient to handle. These are in universal use for all difficult and rare subjects which are not propagated in large numbers. A hand-glass or hand-light (Fig. 30) answers the same purpose and accommodates a

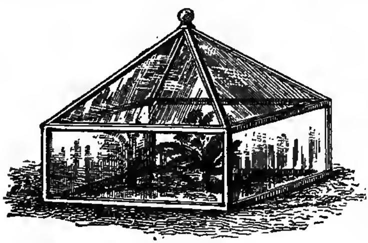

Fig. 30. Hand-glass.

larger number of plants. A useful propagating-box for the window garden or amateur conservatory is shown in Fig. 31.

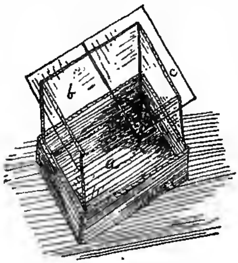

Fig. 31. Small Propagating-box.

A box two or three inches high is secured, and inside this a zinc or galvanized iron tray, *a*, is set, leaving sufficient space between it and the box to admit a pane of glass upon every side. These panes form the four sides of the box, and one or two panes are laid across the top. The metal tray holds the soil and allows no water to drip upon the floor. One of the best boxes for general purposes is made in the form of a simple board box without top or bottom, and fifteen or eighteen inches high, the top being covered with two sashes, one of which raises upon a hinge (Fig. 32). our by three feet is a convenient size. An ordinary light hot-bed

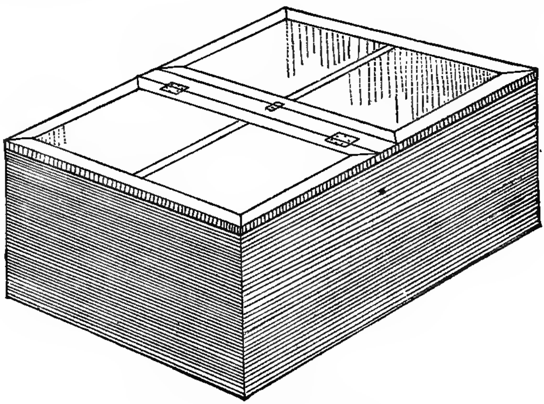
Fig. 32. Propagating-box.

frame is sometimes constructed upon the bench of a greenhouse and covered with common hot-bed sash. Propagating houses are sometimes built with permanent propagating frames of this character throughout their length.

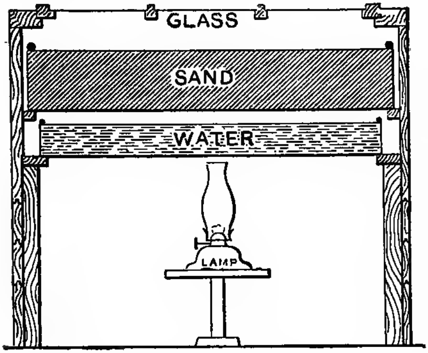

Fig. 33. Simple Propagating-oven.

In all the above appliances heat is obtained from the sun or from the bench-pipes or flues of a greenhouse. There are various contrivances in which the heat is applied locally, for the purpose of securing greater or more uniform heat. One of the simplest and best of these is the propagating-oven shown in Fig. 33. It is a glass covered box about two feet deep, with a tray of water beneath the soil, and which is heated by a lamp. A similar but somewhat complicated apparatus is illustrated in Figs. 34, 35, 36 This is an old form of oven, which has been variously modified by different operators. Fig. 34 shows a sectional view of the complete apparatus. The box, A A, is made of wood and is usually about three feet square. L is a removable glass top. B represents a zinc or galvanized iron tray which is filled with earth in which seeds are sown or pots are plunged. C is a water tray to which the water is applied by means of a funnel extending through the box. A lamp, D,

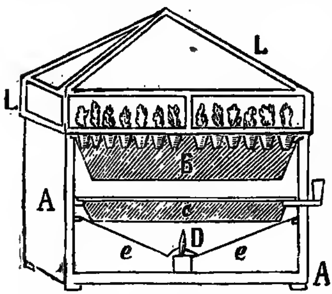

Fig. 34. Propagating-oven.

supplies the heat. A funel of tin, *e e*, distributes the heat evenly. Holes should be provided about the bottom of the box to admit air to the flame. A modified form of this device is shown in Figs. 35 and 36. The water tray, G, slides in upon ledges so that it can be removed, and the heat funnel, L D L, slides in similarly and is made to surround the flame like a chimney. The front side of the apparatus is removable, and the top of the frame, K, is made of metal. The cover for this apparatus is figured in Fig. 36. The ends, *a a*, are made of wood, with openings, indicated by the arrows, to allow of ventilation. The front and top, *g g*, are made of glass. The frame work, *c c c*, is made of metal. The cover is hinged on, or held with pegs, I I, Fig. 35.

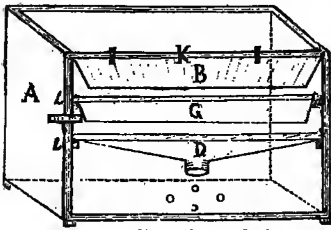

Fig. 35. Modified form of Fig. 34.

Chauvière's propagating-frame, an apparatus used by the French, is shown in Fig. 37. It is essentially a miniature greenhouse. The sashes are seen at *c c*, and above them is a cloth or matting screen. The sides below the sashes are enclosed, preferably with glass. The bottom or floor is moveable, and it is sometimes divided into two or three sections to allow for the accommodation of plants of different sizes and requirements. These sections are raised or lowered and are held by pegs. At *a* is shown a section of floor elevated, and at the left another section occupying a lower position. Heat is supplied usually by hot water in the tubes, *d d*. A very elaborate circular French device, known as Lecoq's propagating-oven, is illustrated in Fig. 38. It is an interesting apparatus,

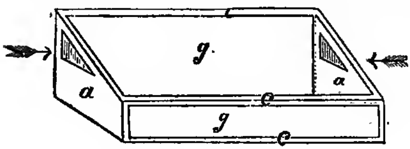

Fig. 36. Cover for Fig. 35.

and is worth attention as showing the care which has been taken to control the conditions of vegetation and germination. It is

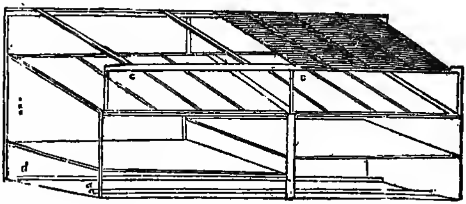

Fig. 37. Chauvière's Propagating-oven.

too elaborate for common purposes, and yet for the growing of certain rare or difficult subjects it might find favor among those who like to experiment; and it affords an accurate means of studying plant growth under control. The apparatus is sold in France for about $6. All the portion below the glass top, *P p*, is made of earthenware. The base, *a a*, holds a lamp, *d*; *e* is a

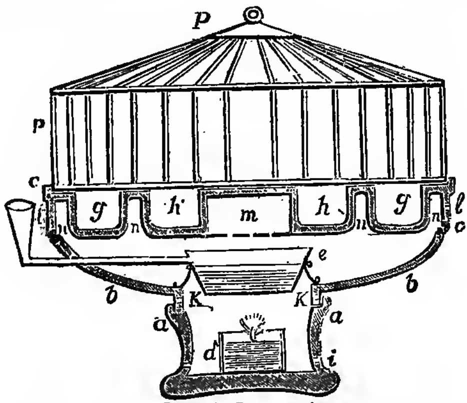

Fig. 38. Lecoq's Propagating-oven.

water reservoir to which water is supplied by means of the funnel, *j*. A vase or rim, *b b*, rests upon the base, and upon it a plate or disc, *c c*, is fitted. Above this is a glass top, *P p*. Air is admitted to the apparatus at *i*, *K K*, and between the vase and plate, as at *c* on the right. The plate contains two circular grooves, *g g* and *h h*. In these grooves the soil is placed or pots plunged. The heat circulates in the valleys *m* and *n n n n*, and supplies a uniform temperature to both sides of the plants.

Barnard's propagating-tank, Fig. 39, is a practicable device for attachment to a common stove. A similar apparatus may be attached to the pipes of a greenhouse. The tank consists of a long wooden box made of matched boards, and put together with paint between the joints to make the box water-tight. The box should be about three feet wide and ten inches deep, and may be from ten to thirty feet long, according to the space required. In the middle of the box is a partition, extending nearly the whole length of the box, and on the inside, on each side, is a ledge or piece of moulding to support slates to be laid over the entire surface of the box. The slates are supported by the ledges and by the central partition, and should be fastened down with cement to prevent the propagating sand from falling into the tank. One slate is left out near the end, next the fire, to enable the operator to see the water and to keep it at the right level. On the slates sand is spread, in which the cuttings may be struck, the sand nearly filling the box. At one end of the box is placed a common cylinder stove, with pipe to the chimney. Inside the stove is a lead or iron pipe (iron is the best) bent in a spiral. This coil, which is directly in the fire, is con-

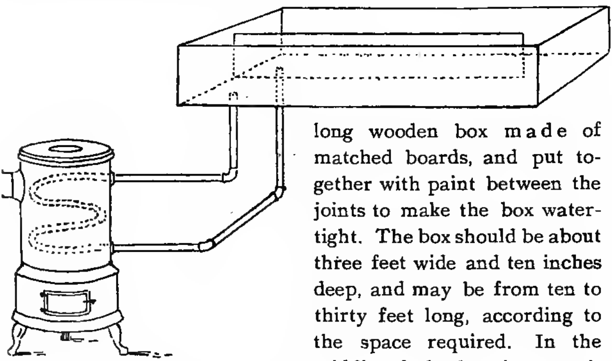
Fig. 39. Barnard's Propagating-tank.

nected by iron pipes with the tank, one pipe leading to one side of the partition and the other to the opposite side, as shown in the drawing. If water is placed in the tank it will fill the pipes and form a continuous circulating system through the pipes and up one side of the box past the end of the partition, and down the other side. A fire in the stove causes the water to circulate through the tank and impart to the bed a genial warmth.

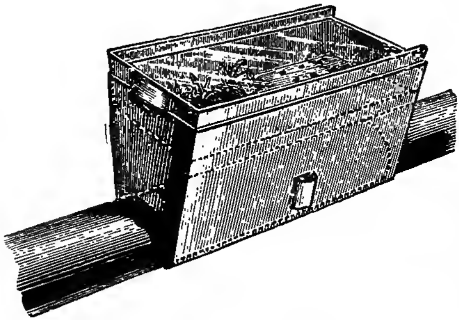

Fig. 40. Zinc Propagating-tank.

There are various tanks designed to rest upon the pipes in a greenhouse. The principle of their construction is essentially the same as of those described in previous pages—bottom heat, a tray of water, and a bed of soil. Earthenware tanks are commonly employed, but a recent English device, Fig. 40, is made of zinc. It is about seven inches deep, and holds an inch or two of water in the bottom. A tray five inches deep sets into the tank. The water is supplied through a funnel at the base.

Cuttings usually "strike" better when they touch the side of the pot than when they are wholly surrounded by soil. This is because the earthenware allows greater uniformity in moisture than the earth, and supplies air and a mild bottom heat. Various devices are employed for the purpose of securing these advantages to the best effect. These are usually double pots, in one of which water is placed. A good method is that represented in Fig. 41, which shows a pot, *b*, plugged with plaster of Paris at the bottom, placed inside a larger one. The earth is placed between the two, drainage material occupying the bottom, *a*, and fine soil the top, *c*. Water stands in the inner pot as high as the dotted line and feeds uniformly into the surrounding soil. The positions of the water and soil are frequently reversed, but in that case there is less space available for cuttings. Neumann's cutting-pot is shown in Fig. 42. This contains an inverted pot in the center, *a*, designed to supply drainage and to admit heat into the center of the mass of soil.

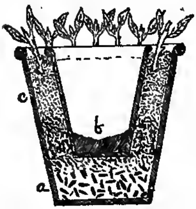

Fig. 41. Forsyth's Cutting-pot.

Some kind of protection, commonly combined with bottom heat, is always given cuttings made from the soft and growing parts. In in-door work, any of the devices named above may be employed, but a box like that shown in Fig. 32 is one of the most useful for common operations. Or the greenhouse itself may afford sufficient protection, especially if the cuttings are shaded when first set to check evaporation from the plant and soil, and to prevent too great heat. This shading is usually supplied by whitewashing the glass, or a newspaper may be laid over the cutting bed for a few days. A greenhouse table or bench prepared for the growing of cuttings is known as a "cutting bench." If the cuttings become too dry or too hot, they will wilt or "flag." In out-door work soft cuttings are usually placed in an ordinary cold frame, and these frames must be shaded. They may be placed under trees or on the shady side of a building, or if they are numerous, as in commercial establishments, a cloth screen should be provided as shown in Fig. 5, page 13.

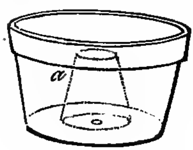

Fig. 42. Neumann's Cutting-pot.

Soils and General Methods.—Soil for all cuttings should be well drained. It should not be so compact as to hold a great quantity of water, nor should it be so loose as to dry out very quickly. It should not "bake" or form a crust on its surface. As a rule, especially for cuttings made of growing parts, the soil should not contain vegetable matter, as such materials holds too much water and it is often directly injurious to the cutting. A coarse sharp, clean sand is the best material for use in-doors. Very fine sand packs too hard, and should not be used. Some propagators prefer to use fine gravel, composed of particles from an eighth to a fourth of an inch in diameter, and from which all fine material has been washed. This answers well for green cuttings if a propagating-frame is used to check evaporation and attention is given to watering, because drainage is so perfect and the material so quickly permeable that uniformity of treatment is secured. Damping-off is less liable to occur in such material than in denser soils. The same advantages are to some extent present in sphagnum moss and cocoanut fibre, both of which are sometimes used in place of earth. The "silver sand" used by florists is a very clean and white sand which derives its particular advantages from the almost entire absence of any vegetable matter. But it is not now considered so essential to successful propagation as it was formerly, and fully as good material may often be found in a common sand-bank. Cuttings which strike strongly and vigorously may be placed in a soil made of light garden loam with twice its bulk of sand added to it. All soils used for in-door cuttage should be sifted or screened before using to bring them to a uniform texture.

Hard-wood cuttings are commonly planted out-doors in mellow and light loam, well trenched. Only fine and well-rotted manure should be applied to the cutting bed, and it should be well mixed with the soil. In most cases, a well-drained soil gives best results, but some cuttings root and grow well in wet soils or even in standing water, as poplars, willows, some of the dogwoods, plane-tree and others.

Bottom heat is always essential to the best success with cuttings. In out-door work this is supplied by the natural heat of the soil in spring and summer, and it is often intensified by burying hard-wooded cuttings bottom end up for a time before planting them. This operation of inverting cuttings is often practiced with grapes, particularly with the Delaware and others which root with some difficulty. The cuttings are tied in bundles and are buried in a sandy place, with the tops down, the butts being covered two or three inches with sand. They may be put in this position in the fall and allowed to remain until the ground begins to freeze hard, or they may be buried in spring and allowed to remain until May or June and then be regularly planted. In out-door cuttage, the cuttings which are of medium length, from six to eight inches, derive more bottom heat than the very long ones, such as were formerly used for the propagation of the grape. In in-door work bottom heat is obtained artificially. Cutting benches should have abundant piping beneath, and in the case of many tropical and sub-tropical species the bottom heat may be intensified by enclosing the benches below so that no heat can escape into the house. Doors can be placed in the partition alongside the walk to serve as ventilators if the heat should become too intense. In all cuttings, bottom or root growth should precede top growth, and this is aided by bottom heat.

Fig. 43 Grape cutting.

As a rule, roots arise most readily from a joint, and it is therefore a common practice to cut off the base of the cutting just below a bud, as shown in the grape cutting, Fig. 43. Sometimes the cutting is severed at its point of attachment to the parent branch, and a small portion, or "heel," of that branch is allowed to remain on the cutting. This heel may be nothing more than the curved and hardened base of the cutting at its point of attachment, as in the cornus cutting, Fig. 44. Sometimes an entire section of the parent branch is removed with the cutting, as in the "mallet" cuttings of grapes, Fig. 45. Of course, comparatively few heel or mallet cuttings can be made from a plant, as only one cutting is obtained from a branch, and it is advisable, therefore, to "cut to buds" rather than "cut to heels;" yet there are many plants which demand a heel, if satisfactory results are to be obtained. The requirements of the different species in this direction can be learned only by experience, but it may be said that in general the hardest or closest wooded plants require a heel or a joint at the base. Willows, currants, basswoods, and others with like soft wood, emit roots readily between the buds, yet even in these cases propagators quite usually cut to buds.

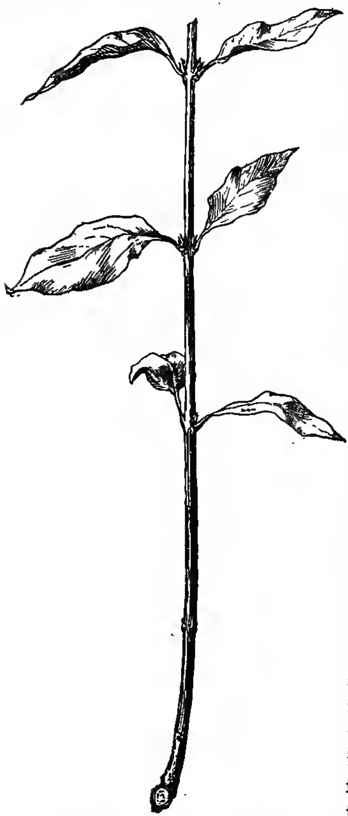

Fig. 44. Heel cutting of Cornus.

Wounds upon plants begin to heal by the formation of loose cellular matter which gives rise to a mass of tissue known as a *callus*. This tissue eventually covers the entire wound, if complete healing results. As a rule, the first apparent change in a cutting is the formation of a callus upon the lower end, and it is commonly supposed that this process must be well progressed before roots can form. But roots do not necessarily arise from the callus, and in many plants they appear to bear no relation to it in position. In willows, for instance, roots arise from the bark quite irregularly and at some distance from the callus. Yet, as a matter of practice, best results are obtained from callused cuttings, particularly if the cuttings are made from mature wood, but this is probably due quite as much to the fact that considerable time is required for the formation of the adventitious buds which give rise to the roots as from any connection between the callusing and rooting processes themselves. Hard-wood cuttings give better results when kept dormant for some time after they are cut. They are usually made in the fall, and stored during the winter in sand, sawdust or moss in a cool cellar, or buried in a sandy and well-drained place. This, at least, is the practice with hard-wood cuttings of deciduous plants. Hard-wood evergreen cuttings, when taken in the fall, are usually set at once, as their foliage will not allow them to be buried with safety; but in this case, the cuttings are kept "quiet" or dormant for a time, to allow callusing to progress. If cuttings are buried so deep that they cannot sprout, callusing may be hastened by placing them in a mild temperature. Single-eye grape cuttings are sometimes packed between layers of sand in a barrel and the barrel is set under a forcing-house bench where the temperature is about 50°. Eight or ten inches of sand is usually placed over the top layer. In this manner, cuttings which have been obtained in winter or spring can be callused before planting time.

Fig. 45. Mallet cutting of grape.

It is a singular fact that the lower end of the cutting, as it stood upon the parent plant, produces roots and the upper end produces leaves and shoots, even if the cutting is inverted. And if the cutting is divided into several parts, each part will still exhibit this same differentiation of function. This is true even of root cuttings, and of other cuttings which possess no buds. The reasons for this localization of function are not yet clearly understood, although the phenomenon has lately been the subject of study. Upon this fact depends the hastening of the rooting process in inverted cuttings by the direct application of heat to the bottoms, and it likewise indicates that care must be taken to plant cuttings in approximately their natural direction if straight and handsome plants are desired.

The particular method of making the cutting and the treatment to which it should be subjected, must be determined for each species or genus. Some plants, as many maples, can be propagated from wood two or three years old, but in most cases the wood of the previous or present season's growth is required. Nearly all soft and loose wooded plants grow readily from hardwood cuttings, while those with dense wood are often multiplied more easily from soft or growing wood. Some plants, as oaks and hickories, are propagated from cuttings of any description only with great difficulty. It is probable, however, that all plants can be multiplied by cuttings if properly treated. It often happens that one or two species of a closely defined genus will propagate readily from cuttings while the other species will not, so that the propagator comes to learn by experience that different treatment is profitable for very closely related plants. For instance, most of the viburnums are propagated from layers in commercial establishments, but *V. plicatum* is grown extensively from cuttings.

Particular Methods—Kinds of Cuttings.—Cuttings are made from all parts of the plant. In its lowest terms, cuttage is a division of the plant itself into two or more nearly equal parts, as in the division of crowns of rhubarb, dicentra, and most other plants which tend to form broad masses or stools. This species of cuttage is at times indistinguishable from separation, as in the dividing of lily bulbs (page 25), and at other times it is essentially the same as layerage, as in the dividing of stools which have arisen from suckers or layers. This breaking or cutting up of the plants into two or more large parts which are already rooted is technically known as *division*. It is only necessary, in dividing plants, to see that one or more buds or shoots remain upon the portions, and these portions are then treated in the same manner as independent mature plants; or sometimes, when the divisions are small and weak, they may be handled for a time in a frame or forcing-house in the same manner as ordinary cuttings.

Cuttings proper may be divided into four general classes: 1, of tubers; 2, of roots and root-stocks; 3, of stems; 4, of leaves.

1. **Tuber Cuttings.**—Tubers are thickened portions of either roots or stems, and tuber cuttings therefore fall logically under classes 2 and 3; but they are so unlike ordinary cuttings that a separate classification is desirable. Tubers are stored with starch, which is designed to support or supply the plant in time of need. Tuber cuttings are therefore able to support themselves for a time if they are placed in conditions suited to their vegetation. Roots rarely arise from the tubers themselves, but from the base of the young shoots which spring from them. This fact is familiarly illustrated in the cuttings of Irish and sweet potatoes. The young sprouts can be removed and planted separately and others will arise from the tuber to take their places. This practice is employed sometimes with new or scarce varieties of the Irish potato, and three or four crops of rooted sprouts can be obtained from one tuber. The tuber is cut in two lengthwise and is then laid in damp moss or loose earth with the cut surface down, and as soon as the sprouts throw out roots sufficient to maintain them they are severed and potted off. Sweet potatoes are nearly always propagated in this manner.

In making tuber cuttings, at least one eye or bud is left to each piece, if eyes are present; but in root-tubers, like the sweet potato, there are no buds, and it is only necessary to leave upon each portion a piece of the epidermis from which adventitious buds may develop. The pseudo-bulbs of some orchids are treated in this manner, or the whole bulb is sometimes planted. A shoot, usually termed an off-shoot, arises from each pseudo-bulb or each piece of it, and this is potted off as an independent plant. (See Orchids, in Chapter VI.)

Cuttings made from the ordinary stems of some tuberiferous plants will produce tubers instead of plants. This is the case sometimes with the potato. The cutting produces a small tuber near its lower extremity, or sometimes in the axil of a leaf above ground, and this tuber must be planted to secure a new plant. Leaf cuttings of some tuberiferous or bulbiferous plants produce little tubers or bulbs in the same way. Hyacinth leaves, inserted in sand in a frame, will soon produce little bulblets at their base, and these can be removed and planted in the same manner as the bulbels described in Chapter II.

Fig. 46. Root cutting of Blackberry.

Many tubers or tuber-like portions, which possess a very moist or soft interior and a hard or close covering, vegetate more satisfactorily if allowed to dry for a time before planting. The pseudo-bulbs of orchids, crowns of pine-apples and cuttings of cactuses are examples. Portions of cactuses and pine-apples are sometimes allowed to lie in the sun from two to four weeks before planting. This treatment dissipates the excessive moisture and induces the formation of adventitious buds.

2. **Root Cuttings.**—Many plants can be multiplied with ease by means of short cuttings of the roots, particularly all species which posses a natural tendency to "sucker" or send up sprouts from the root. All root-stocks or underground stems can be made into cuttings. True root cuttings possess no buds whatever; the buds develop after the cutting is planted Roots are cut into pieces from one to three inches long and are planted horizontally in soil or moss. These cuttings thrive best with bottom heat, but blackberries and some other plants, grow readily with ordinary out-door treatment. A root cutting of the black-

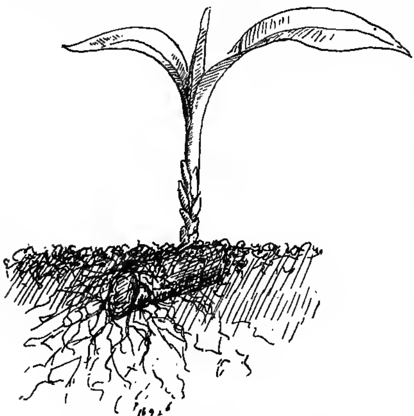

Fig. 47. Root cutting of Dracæna.

berry is shown in Fig. 46. (See Blackberry, in Chapter VI.) A growing dracæna cutting is exhibited in Fig. 47. The cuttings of this plant are handled in a propagating frame or on a cutting bench in a warm greenhouse. The bouvardias and many other plants can be grown in the same manner. Many of the fruit trees, as peach, cherry, apple and pear; can be grown readily from these short root cuttings in a frame. Variegation cannot always be transmitted by root-cutting, *e. g.*, *Symphytum asperrimum, variegatum*. Among kitchen garden plants, the horse-radish is the most familiar example of propagation by root-cuttings. The small side roots, a fourth inch or so in diameter, are removed when the horse-radish is dug in fall or spring, and are cut into four to six inch lengths, as seen in Fig. 48. These cuttings are known as "sets" among gardeners. (See Horse-radish, Chap-

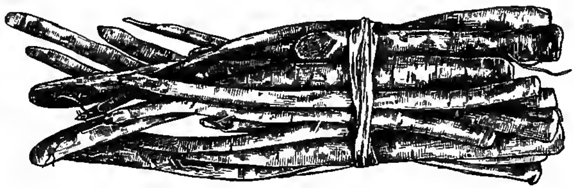

Fig. 48. Horse-radish root cuttings.

ter VI.) When the crowns of horse-radish are cut and used for propagation, the operation falls strictly under division, from the fact that buds or eyes are present; and the same remark applies to rhubarb, which, however, is not propagated by true root-cuttings.

3. **Stem Cuttings.**—Cuttings of the stem divide themselves into two general classes: those known as cutting of the ripe, mature or hard wood, and cuttings of the green, immature or soft wood. The two classes run into each other; no hard and fast lines can be drawn.

Hard-wood cuttings, are made at any time from late summer to spring. It is advisable to make them in the fall in order to allow them to callus before the planting season, and to forestall injury which might result to the parent plant from a severe winter. They may be taken as early as August, or as soon as the wood is mature, and be stripped of leaves. Callusing can then take place in time to allow of fall planting. Or the cuttings taken in early fall may be planted immediately and be allowed to callus where they stand. All fall cutting beds should be mulched to prevent the heaving of the cuttings. As a rule, however, hard-wood cuttings are buried on a sandy knoll or are stored in moss, sand or sawdust in a cellar until spring. (See page 50.)

Fig. 49. Currant cutting.

There is no general rule to govern the length of of hard-wood cuttings. Most propagators prefer to make them six to ten inches long, as this is a convenient length to handle. Two buds are always to be taken, one bud or one pair at the top and also at the bottom, but in "short-jointed" plants more are obtained. Sometimes all but the top buds are removed to prevent the appearance of too many shoots. Grape cuttings are now commonly cut to two or three buds (Fig. 43), two being the favorite number for most varieties. (See Grape, Chapter VI.) Currant and gooseberry cuttings (Fig. 49) usually bear from six to ten buds. All long hard-wood cuttings are set perpendicularly, or nearly so, and only one or two buds are allowed to stand above the surface.

When the stock is rare, cuttings are made of single eyes or buds. This is particularly the case with the grape (see Chapter VI), and currants and many other plants are occasionally grown in the same manner. Fig. 50 shows a single eye grape cutting. These cuttings, whatever the species, are commonly started under glass with bottom heat, either upon a cutting bench or in a hot-bed. The soil should be kept uniformly moist, and when the leaves appear the plants should be frequently sprinkled. In from thirty to forty days the plants are ready to pot off. Single eye cuttings are usually started about three or four months before the season is fit for out-door planting, or about February in the northern states. The most advisable method of treatment varies with the season and locality as well as with the species or variety. It is well known, for instance, that the Delaware grape can be propagated more easily in some regions than in others. A common style of single-eye cutting is made with the eye close to the top end, and a naked base of an inch or two. This is inserted into the soil perpendicularly, with the eye just above the surface. It is much used for a variety of plants.


Fig. 50. Single-eye Grape cutting.

Many coniferous plants are increased by cuttings on a large scale, especially retinosporas, arbor-vitæs, and the like. Cuttings are made of the mature wood, which is planted at once (in autumn) in sand under cover, usually in a cool greenhouse. Most of the species root slowly and they often remain in the original flats or benches a year, but their treatment is usually simple. In some cases junipers, yews and *Cryptomeria Japonica* will not make roots for nearly twelve months, keeping in good foliage however, and ultimately giving good plants. (For more explicit directions, see Thuya and Retinospora in Chapter VI.)

Most remarkable instances of propagation by means of portions of stems are on record. Chips from a tree trunk have been known to produce plants, and the olive is readily increased by knots or excrescences formed upon the trunks of old trees. These excrescences occur in many plants and are known as *knaurs*. They are often abundant about the base of large plane-trees. But they are not often used for purposes of propagation. Whole trunks will sometimes grow after having been cut for many months, especially of such plants as cactuses, many euphorbias and yuccas. And sections of these spongy trunks will grow, also. Even saw-logs of our common trees, as elm and ash, will sprout while in the "boom," or water.

Green-wood cuttings are more commonly employed than those from the mature wood, as they "strike" more quickly, they can be handled under glass in the winter, and more species can be propagated by them than by hard-wood cuttings. "Slips" are green-wooded cuttings, but the term is often restricted to designate those which are made by pulling or "slipping" off a small side-shoot. All soft-wooded plants and many ornamental shrubs are increased by green cuttings. There are two general classes of green-wood cuttings: those made from the soft and still growing wood, and those made from the nearly ripened green-wood, as in *Azalea Indica*, oleander, ficus, etc. House plants, as geraniums, coleuses, carnations, fuchsias, and the like, are grown from the soft young wood, and many harder-wooded plants are grown in the same way. Sometimes truly hard wood is used, as in camellia.

In making cuttings from soft and growing shoots, the first thing to learn is the proper texture or age of shoot. A very soft and flabby cutting does not grow readily, or if it does it is particularly liable to damp off, and it usually makes a weak plant. Too old wood is slow to root, makes a poor plant and is handled with difficulty in many species. The ordinary test for beginners is the manner in which the shoot breaks. If, upon being bent, the shoot snaps off squarely so as to hang together with only a bit of bark, as in the upper break in Fig. 51, it is in the proper condition for cuttings; but if it bends or simply crushes, as in the lower portion of the figure, it is either too old or too young for good results.

Fig. 51. Tough and brittle wood.

The tips of the shoots of soft-wooded plants are usually employed, and all or a portion of the leaves are allowed to remain.

They are inserted in sharp sand to a sufficient depth to hold them in place, and the atmosphere and soil must be kept moist to prevent wilting or "flagging" The cuttings should also be shaded for the first week or two. A propagating-frame is often employed. Soft cuttings are commonly cut below a bud or cut to a heel, but this is unnecessary in easily rooted plants like geranium, coleus, heliotrope, etc. Fig. 52 shows an oleander cutting at *a*, a carnation at *b*, and a geranium at *c*. A coleus cutting is illustrated in Fig. 53. Sometimes the growth is so short or the stock so scarce that the cutting cannot be made long enough to hold itself in the soil. In such case a toothpick or splinter is tied to the cutting to hold it erect, as in the cactus cutting, Fig. 54, or the geranium cutting, Fig. 55. In the window garden, soft cuttings may be started in a deep plate which is filled half or two-thirds full of sand and is then filled to the brim with water, and not shaded; this method, practiced on a larger scale, is sometimes useful during the hot summer months. If bottom heat is desired, the plate may be set upon the back part of the kitchen stove. Oleanders usually root best when mature shoots are placed in bottles of water.

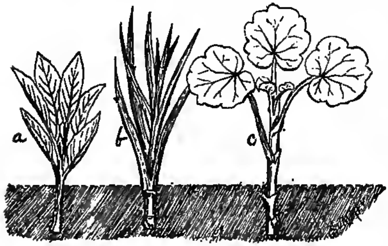

Fig. 52. Soft cuttings.


Fig. 53. Coleus cutting.

Cuttings from the nearly mature green wood are employed for hard-wooded trees and shrubs, as diervillas (weigela), roses, hydrangeas, lilacs, etc. They are cut in essentially the same manner as the hard-wood cuttings described on page 55. They are often taken in summer when the buds have developed and the wood has about attained its growth. They are cut to two to four or five buds and are planted an inch or two deep in shaded frames. They are kept close for some days after setting, and the tops are sprinkled frequently. Care must be taken not to set them too deep; they are rarely put in over an inch, if the cutting is six or seven inches long. "June stock cuttings" are sometimes advantageously made; here the young shoots of hardy shrubs are taken, when about two to three inches long, the leaves partly removed, and they are planted under glass, precisely as the geranium is treated in the autumn. Several weeks are required for rooting, but good plants are obtained which, when wintered in a cold frame, can be planted out in beds the next spring. Great care must be given to shading and watering. *Hydrangea paniculata* var. *grandiflora*, and *Akebia quinata* are examples; or any deutzia or more easily handled plant of which stock is scarce may be cited.

Fig. 54. Cactus cutting held by splinter.

Part of the leaves are removed, as a rule, before the cuttings are set, as shown in the rose cutting, Fig. 56, and the hydrangea cutting, Fig. 57. This is not essential, however, but it lessens evaporation and the tendency to "flag" or wilt. In most species the top can be cut off the cutting, as seen in Figs. 44 and 57, but in other cases it seriously injures the cutting. Fig. 58 shows a weigela cutting from which the top was clipped. An unusually large callus formed at the bottom, but the leaves shrivelled and the cutting is dead. This frequently occurs in what some nurserymen call "end growers," among which may be mentioned weigelas (properly diervillas), the shrubby altheas, *Cercis Japonica*, and

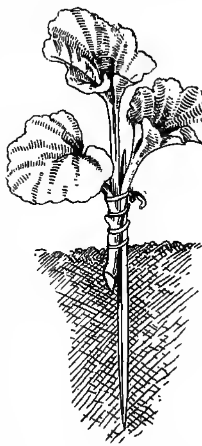

Fig. 55. Cutting held by toothpick.

such spireas as *S. cratægifolia*, *S. rotundifolia* var. *alba* and *S. Cantonensis* (*S. Reevesii* of the trade) var. *robusta*.

Fig. 56. Rose cutting.

These hardened cuttings, about two inches long, are often made in the winter from forced plants. This is particularly the case with roses (which see in Chapter VI). Cuttings taken in February, in the north, will be ready to transfer to borders or nursery beds when spring opens. Stout, well-rooted stock-plants are used from which to obtain these cuttings, and they are cut back when taken to the house in the fall in order to induce a good growth. Many hardy shrubs can be easily propagated in this way when the work is difficult in the open air, *e. g.*, *Spiræa Cantonensis* (*S. Reevesii* of the catalogues) and *S. Van Houttii*. Stock plants of the soft species, like coleus, lantanas and geraniums, are obtained in like manner.

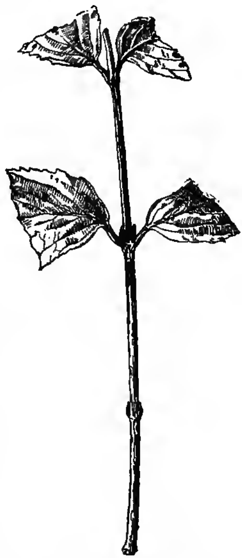

Fig. 57. Hydrangea cutting.

4. Leaf Cuttings.—Many thick and heavy leaves may be used as cuttings. Leaf cuttings are most commonly employed in the showy-leaved begonias, in succulents, and in gloxinias, but many plants can be propagated by them. Even the cabbage can be made to grow from leaf cuttings. The whole leaf may be used, as shown in Fig. 59. It is simply laid upon moist sand in a frame and held down by splinters thrust through the ribs. The wound made by the peg induces the formation of roots and a young plant arises. A half dozen or more plants can be obtained from one leaf. Some operators cut off the ribs, instead of wounding them with a prick. Many gardeners prefer to divide the leaf into two nearly equal parts, and then set each part, or the better one, upright in the soil, the severed edge being covered. This is shown in Fig. 60. Fewer plants — often only one — are obtained in this manner, but they are strong.

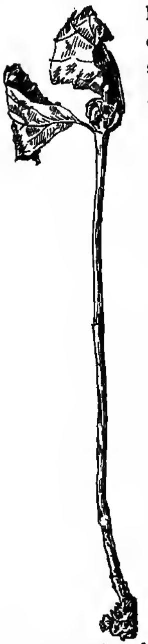

Fig. 58. Clipped Weigela cutting.

When stock is scarce the leaf may be cut into several fan-shaped pieces. The whole leaf may be divided into as many triangular portions as can be obtained with a portion of the petiole, a strong rib, or vein at the base; these inserted and treated like coleus cuttings will all root and make good plants within a reasonable time, say six months. This form of cutting should be two to three inches long by an inch or inch and one-half wide. Ordinarily, in this style of leaf-cutting, the petiole or stalk is cut off close to the leaf and the lower third or fourth of the leaf is then cut off by a nearly straight cut across the leaf. This somewhat triangular base is then cut into as many wedge-shaped pieces as there are ribs in the leaf, each rib forming the center of a cutting. The point of each cutting should contain a portion of the petiole. The points of these triangular portions are inserted in the soil a half inch or so, the cutting standing erect

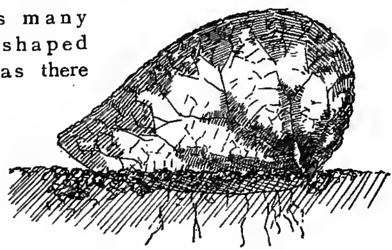

Fig. 60. A upright Begonia leaf cutting.

or nearly so. Roots form at the base or point in the ordinary manner.

Leaf cuttings are handled in the same manner as soft stem-cuttings so far as temperature and moisture are concerned. There are comparatively few species in which they form the most available means of multiplication. In some cases, variegation will not be reproduced by the rooted leaf. This is true in the ivy-leaved geranium L' Elegante ; a good plant can be obtained, but it reverts to the plain-leaved type.

Fig. 59. Begonia leaf cutting

CHAPTER V.

GRAFTAGE.

Graftage.—The process or operation of grafting or budding, or the state or condition of being grafted or budded.

Grafting.—The operation of inserting a bud or a cion in a stock. It is commonly restricted to the operation of inserting cions of two or more buds, in distinction from budding, or the operation of inserting a single bud in the stock; but there are no essential differences between the two operations.

Stock.—In graftage, a plant or part of a plant upon which a cion or bud is set. A *free stock* is a seedling, in distinction from a grafted stock.

Cion or Scion.—A portion of a plant which is mechanically inserted upon the same or another plant (stock) with the intention that it shall grow.

GENERAL CONSIDERATIONS.—Graftage is rarely employed for the propagation of the species, as seedage and cuttage are more expeditious and cheaper. Its chief use is to perpetuate a variety which does not re-produce itself from seeds and which cannot be economically grown from cuttings.

Nearly all the named varieties of tree fruits and many of those of ornamental trees and shrubs are perpetuated by means of graftage. In some species which present no marked varieties, however, propagation by seeds or cuttings is for various reasons so difficult or uncertain that recourse must be had to graftage. This is particularly true in many of the firs and spruces which do not produce seeds to any extent in cultivation. In other cases graftage is performed for the purpose of producing some radical change in the character or habit of the plants, as in the dwarfing of pears by grafting them upon the quince, the elevation of weeping tops by working them upon upright trunks, and the acceleration of fruit-bearing by setting cions in old plants. It is sometimes employed to aid the healing of wounds or to repair and fill out broken tops. And it has been used to make infertile plants fertile, by grafting in the missing sex in diœcious trees, or a variety with more potent pollen as practiced in some of the native plums. All these uses of graftage fall under three heads: 1. To perpetuate a variety. 2. To increase ease and speed of multiplication. 3. To produce some radical change in nature or habit of cion or stock.

Probably all exogenous plants—those which possess a distinct bark and pith—can be grafted. Plants must be more or less closely related to each other to allow of successful graftage of the one upon the other. What the affinities are in any case can be known only by experiment. As a rule, plants of close botanical relationship, especially those of the same genus, graft upon each other with more or less ease; yet this relationship is by no means a safe guide. A plant will often thrive better upon a species of another genus than upon a congener. The pear, for instance, does better upon many thorns than upon the apple. Sometimes plants of very distinct genera unite readily. Thus among cacti the leafless epiphyllum grows remarkably well upon the leaf-bearing pereskia. It should be borne in mind that union of tissues is not a proof of affinity. Affinity can be measured only by the thrift, healthfulness and longevity of the cion. The bean has been known to make a union with the chrysanthemum, but it almost immediately died. Soft tissues, in particular, often combine in plants which possess no affinity whatever, as we commonly understand the term. Neither does affinity refer to relative sizes or rates of growth of stock and cion, although the term is sometimes used in this sense. It cannot be said that some varieties of pear lack affinity for the quince, and yet the pear cion grows much larger than the stock. In fact, it is just this difference in size and rate of growth which constitutes the value of the quince root for dwarfing the pear. When there is a marked difference in rate of growth between the stock and cion, an enlargement will occur in the course of time, either above or below the union. If this occurs upon the stem, it makes an unsightly tree. If the cion greatly outgrows the stock a weak tree is the result.

Graftage can be performed at almost any time of the year, but the practice must be greatly varied to suit the season and other conditions. The one essential point is to make sure that the cambium layers, lying between the bark and wood, meet as nearly as possible in the cion and stock. This cambium is always present in live parts, forming woody substance from its inner surface and bark from its outer surface. During the season of greatest growth it usually occurs as a soft, mucilaginous and more or less unorganized substance, and in this stage it most readily repairs and unites wounded surfaces. And for this reason the grafting and budding of old trees are usually performed in the spring. Later in the season, the cambium becomes firmer and more differentiated, and union of woody parts is more uncertain. It is also necessary to cover the wounds in order to check evaporation from the tissues. In out-door work wax is commonly used for all species of graftage which wound the wood itself, but in budding, the loosened bark, bound down securely by a bandage, affords sufficient protection. It is commonly supposed that an ordinary cleft graft cannot live if the bark of the stock immediately adjoining it is seriously wounded, but the bark really serves little purpose beyond protection of the tissues beneath. A cion will grow when the bark is entirely removed from the stub if some adequate protection can be given which will not interfere with the formation of new bark. The cion must always possess at least one good bud. In most cases, only buds which are mature or nearly so are used, but in the grafting of herbs very young buds may be employed. These simple requirements can be satisfied in an almost innumerable variety of ways. The cion or bud may be inserted in the root, crown, trunk or any of the branches; it may be set under the bark simply or inserted into the wood itself in almost any fashion; and the operation may be performed either upon growing or dormant plants at any season. But in practice there are comparatively few methods which are sufficiently simple and expeditious to admit of general use.

Graftage may be divided into three general divisions, between which, however, there are no decisive lines of separation: 1. Bud-grafting or budding, in which a single bud is inserted upon the surface of the wood of the stock. 2. Cion-grafting or grafting proper, in which a detached twig bearing one or more buds is inserted into or upon the stock. 3. Inarching or grafting by approach, in which the cion remains attached to the parent plant until union takes place. Each of these divisions can be almost endlessly varied and sub-divided, but in this discussion only the leading practices can be detailed. The following enumeration, after Baltet, will give a fair idea of the kinds of grafting which have been employed under distinct names :

1. Bud-Grafting or Budding.

1.—Grafting with shield-buds.
Bud-grafting under the bark, or by inoculation.
" " ordinary method.
" " with a cross-shaped incision.
" " " the incision reversed.
" " by veneering.
Bud-grafting, the combined or double method.
2.—Flute-grafting.
" " common method.
" " with strips of bark.

2. Cion-Grafting or Grafting Proper.

1.—Side-grafting under the bark.
" " with a simple branch.
" " with a heeled branch.
" " in the alburnum.
" " with a straight cleft.
" " with an oblique cleft.
2.—Crown-grafting.
Ordinary method.
Improved method.
3.—Grafting *de precision.*
Veneering, common method.
" in crown-grafting.
" with strips of bark.
Crown-grafting by inlaying.
Side-grafting by inlaying.
4.—Cleft-grafting, common single.

Cleft-grafting, common double.
" " oblique.
" " terminal.
" " " woody.
" " " herbaceous.
5.—Whip-grafting, simple.
" " complex.
Saddle-grafting.
6.—Mixed-grafting.
Grafting with cuttings.
When the cion is a cutting.
When the stock is a cutting.
When both are cuttings.
Root-grafting of a plant on its own root.
" " " " the roots of another plant.
Grafting with fruit buds.

3. Inarching or Grafting by Approach.

1.—Method by veneering.
" " inlaying.
English method.
2.—Inarching with an eye.
" " a branch.

Particular Methods.—*Budding*. Budding is the operation of inserting a single bud, bearing little or no wood, upon the surface of the stock. The bud is nearly always inserted under the bark of the stock, but in flute-budding a piece of bark is entirely removed and the bud is used to cover the wound. There is no general rule to determine what species of plants should be budded and which ones cion grafted. In fact, the same species is often multiplied by both operations. Plants with thin bark and an abundance of sap are likely to do best when grafted; or if they are budded, the buds should be inserted at a season when the sap is least abundant to prevent the "strangulation" or "throwing out" of the bud. In such species the bark is not strong enough to hold the bud firmly until it unites; and solid union does not take place until the flow of sap lessens. Budding is largely employed upon nearly all young fruit-trees, and almost universally so upon the stone-fruits. It is also used in roses, and many ornamental trees. Budding is commonly performed during the growing season, usually in late summer or early fall, because mature buds can be procured at that time and young stocks are then large enough to be worked readily. But budding can be done in early spring, just as soon as the bark loosens; in this case perfectly dormant buds must have been taken in winter. Budding is always best performed when the bark slips or peels easily. It can be done when the bark is tight, but the operation is then tedious and uncertain.

SHIELD-BUDDING.—There is but one style of budding in general use in this country. This is known as shield-budding, from the shield-like shape of the portion of bark which is removed with the bud. Technically, the entire severed portion, comprising both bark and bud, is called a "bud." A shield bud is shown natural size in Fig. 61. This is cut from a young twig of the present season's growth. It is inserted underneath the bark of a young stock or branch, and is then securely tied, as shown in Fig. 65.

The minor details of shield-budding differ with nearly every operator. In commercial practice, it is performed in the north from early July until the middle of September. In the southern states it usually begins in June. As a rule, apples and pears are budded before peaches. This is due to the fact that peach-stocks are nearly always budded the same season the pits are planted, and the operation must be delayed until the stocks are large enough to be worked. Most other fruit-stocks, especially apples and pears, are not budded until two years after the seeds are sown. The plants grow for the first season in a seed-bed. The next spring they are transplanted into nursery rows, and budded when they become large enough, which is usually the same year they are transplanted. The nurseryman reckons the age of his stock from the time of transplanting, and the age of the marketable tree from the time when the buds or grafts

Fig. 61. Shield-bud.

begin to grow. The young stocks are "dressed" or trimmed before being set into the nursery. This operation consists in cutting off a fourth or third of the top and the tap root. This causes the roots to spread and induces a vigorous growth of top because it reduces the numbers of shoots; and such stocks are more expeditiously handled than long and untrimmed ones.

Fig. 62. A stick of buds.

Stocks should be at least three-eighths inch in diameter to be budded with ease. Just before the buds are set, the leaves are removed from the base of the stock so that they will not interfere with the operation. They are usually rubbed off with the hand for a space of five or six inches above the ground. They should not be removed more than two or three days in advance of budding, else the growth of the parts will be checked and the bark will set; any branches, too, as in the quince, which might impede the work of the budder, are to be cut off at the same time. The bud is inserted an inch or two above the surface of the ground or as low down as the budder can work. The advantage of setting the bud low is to bring the resulting crook or union where it will not be seen. It is a common and good practice, also, to place the bud upon the north side of the stock to shield it from the sun.

The buds are taken from strong and well hardened shoots of the season's growth and of the desired variety. Usually the whole of the present growth is cut, the leaves are removed, but a part of the petiole or stalk of each leaf is left (as in Figs. 61 and 62) to serve as a handle to the bud. This trimmed shoot is then called a "stick." A stick may bear two dozen good buds when the growth has been strong, but only ten or twelve buds are commonly secured. The upper buds, which are commonly not fully grown and which are borne on soft wood, are usually discarded. The buds are cut with a thin-bladed sharp knife. Various styles of budding knives are in use, and the budder usually has decided preferences for some particular pattern.

The essentials of a good budding knife are these: the very best steel, a thin blade which has a curved cutting end (as shown in Figs. 63 and 66), and lightness. The curved end of the blade is used for making the incisions in the stock. The handle of the budding-knife usually runs into a thin bone scalpel at the end, and this portion is designed for the lifting or loosening of the bark on the stock. Some budders, however, raise the bark with the blade. A good form of blade, but one seldom made, has a rounded end, the upper side of the curve being ground simply to a thin edge. This blade may be used both for cutting the bark and loosening it, thus overcoming the necessity of reversing the knife everytime a bud is set. If this form of blade were commonly known it would undoubtedly soon come into favor. The blade of a common budding-knife can be ground to this shape.

The bud is usually cut about an inch long. Most budders cut from below upwards, but some prefer to make a downward incision. It does not matter just how the bud is cut, if the surfaces are smooth and even and the bud is not too thick. On a stick a fourth or three-eighths inch through, the cut, at its deepest point just under the bud, is about one-fourth the diameter of the twig. A bit of wood is therefore removed with the bud, as shown in Fig. 61. There is some discussion as to whether this wood should be left upon the bud, but no definite experiments have been made to show that it is injurious to the resulting tree. Some budders remove the wood with the point of the knife or by a deft twist as the bud is removed from the stick. But buds appear to live equally well with wood attached or removed. Some propagators cut the buds as they go, while others prefer to cut a whole stick before setting any, letting each bud hang by a bit of bark at the top and which is cut off squarely when wanted, as shown in Fig. 62.

The wound or matrix which is to receive the bud is made by two incisions, one vertical and one transverse (Fig. 63). These are light cuts, extending only through the bark: The vertical slit is usually made first and by the rounded end of the blade. This is an inch or inch and a half long. The transverse cut is made across the top of the vertical cut by one rocking motion of the blade towards the body The corners of the bark may be lifted a little by an outward motion of the blade so as to allow the bud to be pushed in, but unless the bark slips very freely it will have to be loosened by the end of the blade or by the scalpel on the reverse end of the handle, as previously described. The bud is now inserted in the cleft of the bark. It is pushed down part way by the fingers, as in Fig. 64, but it is usually driven home by pushing down upon the leaf-stalk handle with the back of the knife-blade. The entire bud should pass into the cleft; or if a portion of it should project above it should be cut off. If the bark peels freely, the bud will slip in easily and will follow the cleft, but if it sticks somewhat, more care is necessary to prevent the bud from running out. If the bark is very tight, it may have to be loosened with the knife throughout the length of the cleft; but budding should be performed, if possible, when such pains are not necessary.

Fig. 63. Preparing the stock.

The bud must now be tied. The whole matrix should be closed and bound securely, as represented in Fig. 65. The dotted lines parallel with the cleft show the extent to which the bud projects under the bark. The string is usually started below the bud, the end being held by lapping the second course over it, and the upper end being secured by drawing a bow through under the upper course. Care should be taken not to bind the string over the bud itself. The strings are previously cut the required length—about a foot—and the tying is performed very quickly. Any soft cord can be employed. Yarn and carpet warp are sometimes used. The most common material, at least until the last few years, has been bass matting. This is the inner bark of the bass-wood or linden. The bark is stripped in early summer, and the inner portion is macerated or "rotted" in water for four or five weeks. It is then removed, cut into the desired lengths, and stripped into narrow bands — one-fourth to one-half inch wide — when it may be sorted and stored away for future use. If it is stiff and harsh when it comes from the maceration, it should be pounded lightly or rubbed through the hands until it becomes soft and pliable. The best tying material which we now have is undoubtedly raffia It is an imported article, coming from the eastern tropics (the product of the palm *Raphia Ruffia*), but it is so cheap that it will probably supersede even bass-bark. It is strong and pliable, and is an excellent material for tying up plants in the greenhouse, or small ones out-doors. The greatest disadvantage in its use in the budding field is its habit of rolling when it becomes dry.

Fig. 64. Bud entering matrix.

In two or three weeks after the bud is set it will have "stuck" or united to the stock. The bandage must then be removed or cut. It is the common practice to draw a budding-knife over the strings, on the side opposite the bud, completely severing them and allowing them to fall off as they will. If the strings are left on too long they will constrict the stem and often kill the bud, and they also have a tendency to cause the bud to "break" or begin to grow. The bud should remain perfectly dormant until spring, for if it should begin to grow it will be injured and perhaps killed by the winter. It should remain green and fresh ; if it shrivels and becomes brown, even though it still adheres to the stock, it is worthless. Advantage can be taken, when cutting the tyings, to rebud any stocks which have failed. If the bud should begin to grow, because of a warm and wet fall or other reasons, there is little remedy except perhaps to head the shoot back if it should become long enough If the stocks are protected by snow during winter, some of the buds at the base of the shoot may pass the cold in safety.

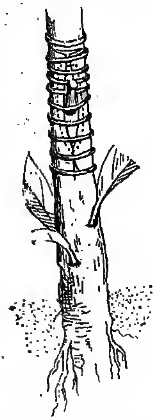
Fig. 65. The bud tied.

The next spring the stock should be cut off just above the bud (Fig. 66), in order to throw the entire force of the plant into the bud. If the root is strong and the soil good, the bud will grow two or three feet the first year; or peaches and cherries will grow from two to three times that height. All sprouts should be kept rubbed off the stock, and the bud should be trained to a single stem. In some weak and crooked growers, the new shoot must be tied, and some propagators in such cases cut off the stock five or six inches above the bud and let it serve as a stake to which to tie. The stock, of course, must not be allowed to grow. Late in the season the stock is cut down close to the bud, as in Fig. 66. Peaches and some other fruits are sold after having made one season's growth from the bud, but pears, apples, and most other trees are not often sold until the second or third year.

"June budding" is a term applied to the budding of stocks in early summer while they are yet growing rapidly. It is employed mostly at the south where the stocks can be grown to sufficient size by the last of June or first of July. Small stocks are usually employed—those ranging from one-fourth to one-third inch being preferred. A few strong leaves should be left on the stock below the bud, and after the bud has "stuck" the whole top should not be cut off at once, else the growing plant will receive a too severe check. It is best to bend the top over to check its growth or remove the leaves gradually. The bandages should not be left on longer than six to ten days if the stock is growing rapidly. To prevent the constriction of the stem, muslin bands are sometimes used instead of bass or raffia. In hot and dry climates the bud should be set an inch or two higher in June budding than in the ordinary practice, to escape the great heat of the soil. June budding is used upon the peach more than any other tree, although it can be employed for any species which will give large enough stocks from seed by the June following the sowing. In peaches, the bud will produce a shoot from three to five feet high the same season the buds are set, so that marketable budded trees can be produced in one season from the seed.

Fig. 66. Cutting off the stock.

A different kind of early summer budding is sometimes performed upon apples and other fruit-trees. In this case the stocks are one or two years old from the transplanting, and dormant buds are used. These buds are cut the previous fall or winter in the same manner as cions, and when spring approaches they are put on ice—in sawdust, sand or moss—and kept until the stocks are large enough to receive them. The particular advantage of this method is the distributing of the labor of budding over a longer season, thereby avoiding the rush which often occurs at the regular budding time.

Budders usually carry a number of "sticks" with them when they enter the nursery. These may be carried in the pocket, or thrust into the boot-leg; or some budders carry four or five sticks in the hand. The budder follows a row throughout its length, passing over those trees which are too small to work. It is a common practice to rest upon one knee while budding, as shown in Fig. 67, but some prefer to use a low stool. The tying is usually done by a boy, who should follow close behind the budder in order that the buds shall not dry out. An expert budder will set from 1,000 to 3,000 buds a day, in good stock, and with a boy (or two of them for the latter speed) to tie. Peach stocks are more rapidly budded than most others, as the bark is firm and slips easily, and some remarkable records are made by skillful workmen.

Fig. 67. Budder at work.

Budding is sometimes employed the same as top-grafting for changing over the top of an old tree from one variety to another. The buds cannot be easily inserted in very old and stiff bark, but in all smooth and fresh bark they work readily. Sometimes old trees are severely pruned the year before the budding is to be done, in order to obtain young shoots in which to set the buds. In fruit-trees six or seven years old or less, budding is fully as advantageous as grafting. New varieties are also budded into old branches in order to hasten bearing for the purpose of testing the variety. Here budding has a distinct advantage over grafting, as it uses fewer buds, and the wood of new sorts is often scarce.

FLUTE-BUDDING.—An occasional method of budding is that known under the general name of flute-budding. In this method the bud is not covered by the bark of the stock as in shield-budding. Fig. 68 illustrates it A portion of bark is removed entirely from the stock, and a similar piece is fitted into its place. When the wound extends only part way about the stem, as in the illustration, the operation is sometimes known as veneer-budding. When it extends entirely around the stem it is called ring or annular-budding. Flute-budding is usually performed late in spring. It is best adapted to plants with very thick and heavy bark. The bud is tied and afterwards treated in essentially the same manner as in shield-budding.

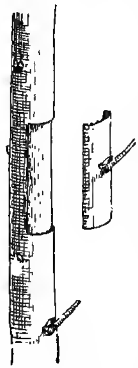

Fig. 68. Flute-budding.

A species of flute-budding in which a ring of bark is slipped down upon the tip of a shoot, which has been girdled for the purpose, is called whistle-budding or tubular-budding.

Grafting.—Grafting is divided in various ways, but chiefly with reference to the position of the union upon the plant and to the method in which the scion and stock are joined. In reference to position, there are four general classes: 1. Root-grafting, in which the stock is entirely a root. 2. Crown-grafting, which is performed upon the crown or collar of the plant just at the surface of the ground, an operation which is often confounded with root-grafting. 3. Stem-grafting, in which the cion is set on the trunk or body of the tree below the limbs, a method occasionally employed with young trees. 4. Top-grafting, or grafting in the branches of the tree. Any method of inserting the cion may be employed in these classes. The best classification, particularly for purposes of description, is that which considers methods of making the union. Some of these kinds of grafting are catalogued on page 66. For our purposes, we shall need to consider only the whip, saddle, splice, veneer, cleft and bark-grafting,

WHIP-GRAFTING.—Whip or tongue-grafting is employed only on small stocks, usually upon those one or two years old. Both the cion and stock are cut across diagonally, the cut surface extending from one to two inches according to the size of the part. A vertical cleft is then made in both, and the two are joined by shoving the tongue of the cion into the cleft of the stock. The operation can be understood by reference to Figs. 69, 70 and 71. Fig. 69 shows the end of a cion, cut natural size. The stock is cut in the same manner, and the two are joined in Figs. 70 and 71. The parts are held firmly by a bandage passed five or six times around them. If the graft is to stand above ground, the wound must be protected by applying wax over the bandage. (Recipes for wax can be found at the end of this chapter.)

Fig. 69. Whip-graft.

Root-grafting, especially of fruit stocks, is performed almost entirely by the whip-graft. This operation is performed in winter. The stocks, either one or two years old, are dug and stored in the fall. In January or February the grafting is begun. In true root-grafting, only pieces of roots are used, but some prefer to use the whole root and graft at the crown. In piece-root-grafting, from two to four trees are made from a single root. A piece of root from two to four inches long is used, as shown in Fig. 71. The parts are usually held by winding with waxed string or waxed bands. The string should be strong enough to hold the parts securely and yet weak enough to be broken without hurting the hands. No. 18 knitting cotton answers this purpose admirably. It should be bought in balls, which are allowed to stand for a few minutes in melted wax. The wax soon saturates the ball. Waxed bands are made by spreading melted wax over thin muslin, which is cut into narrow strips when dry. The string is the more useful for rapid work. The grafts are packed away in sand, moss or sawdust in a cool cellar until spring, when the two parts will be firmly callused together. Some propagators are now discarding all tying of root-grafts. The grafts are packed away snugly, and if the storage cellar is cool—not above 40°—they will knit together so that they can be planted without danger of breaking apart. If the cellar is warm the grafts will start into growth and be lost.

Fig. 70. Whip-graft in position.

Cions are cut in fall or winter, or any time before the buds swell in spring. Only the previous year's growth is used in all ordinary cases, but in maples and some other trees older wood may be used. In the grafting of peaches—which is very rarely done—the best cions are supposed to be those which bear a small portion of two-year-old at the lower end. This portion of old wood probably serves no other purpose than a mechanical one, as the recent wood is soft and pithy. It is a common opinion that cions are worthless if cut during freezing weather, but this is unfounded. The cions are stored in sand, moss or sawdust in a cool cellar, or they may be buried in a sandy place. Or sometimes, when a few are wanted for top-grafting, they are thrust into the ground beside the tree into which they are to be set the following spring. Only well-formed and mature buds should be used. Sometimes flower-buds are inserted for the purpose of fruiting a new or rare variety the following year.


Fig. 71. Root-graft.

In common root-grafting in the east and south, the cion bears about three buds, and the root is about the same length, or perhaps shorter. The variable and unknown character of these roots as regards hardiness, renders it important in very severe climates that roots should be obtained from the same plant as the cion, the hardiness of which is known. It is, therefore, the practice in the prairie countries to use a very long cion—eight inches to a foot —and to set it in the ground to the top bud. The piece of root serves as a temporary support, and roots are emitted along the cion. When the tree is ready for sale the old piece of root is often removed, or sometimes it falls away of itself. In this manner own-rooted trees are obtained, and it is for this reason that root-grafting is more universally practiced west of the Great Lakes than budding. Even cions of ordinary length often emit roots, as seen in Fig. 72, but the cions are not long enough to reach into uniformly moist soil. Some varieties of fruit trees are found in practice to root more readily than others.

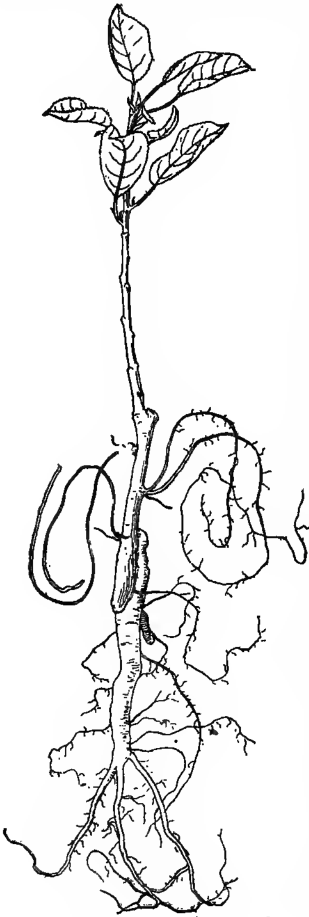

Fig. 72. Growing Root-graft.

There is much discussion as to the relative merits of budding and root-grafting fruit-stocks, but the observations are usually so indefinite or irrelevant that safe conclusions cannot be drawn from them. We have seen that root-grafting serves an indispensable purpose in the cold prairie regions by enabling nurserymen to secure own-rooted trees of known hardiness. Aside from this it may be said that root-grafting is cheaper than budding, as it is performed when labor is cheap and two or more trees are made from one stock. Budded or crown-grafted trees possess a greater root and usually make a stronger growth, at least the first year or two, and it has been said that their roots are more numerous and more symmetrically disposed. But there is not yet a sufficient knowledge of the subject in all its details to allow of dogmatic expressions upon it.

Saddle-Grafting.—Saddle-grafting is a simple and useful method for the shoots of small, growing plants. The stock is cut to a wedge-shaped end by two cuts, and the cion is split and set upon the wedge (Fig. 73). The union is then tied and waxed in the same way as exposed whip-grafts. It is oftenest employed when a terminal bud is used, as the wood in such cions is usually too weak to work well with a tongue.

Fig. 73. Saddle-graft.

SPLICE-GRAFTING.—The simplest form of grafting is that shown in Fig. 74, in which the two parts are simply cut across diagonally and laid together. The parts are held only by the string, which, together with the wax, is applied in the same way as upon the whip-graft. Splice-grafting is frequently used upon soft or tender wood which will not admit of splitting. It is adapted only to small shoots.

VENEER-GRAFTING.—Fig. 75 shows a style of grafting which is much used, particularly for ornamentals and for rare stocks which are grown in pots. An incision is made upon the stock just through the bark and about an inch long (*A*, Fig. 75), the bit of bark being removed by means of a downward sloping cut at its base. The base of the cion is cut off obliquely, and upon the longest side a portion of bark is removed, corresponding to the portion taken from the stock. The little tongue of bark on the stock covers the base of the cion, when it is set. The cion is tied tightly to the stock (*B*, Fig. 75), usually with raffia. This method of grafting makes no incision into the wood, and all the wounded surfaces are completely covered by the matching of the cion and stock. It is not necessary, therefore, to wax over the wounds, as a rule. The parts grow together quickly and uniformly, making a solid and perfect union as shown at *D*, Fig. 75. So far as the union of the parts is concerned, this is probably the ideal method of grafting. This method, which is nothing but the side-graft of the English gardeners with the most important condition of

Fig. 74. Splice-grafting.

the longer tongue on the stock, is known by various names, but it is oftenest called veneer-grafting in this country.

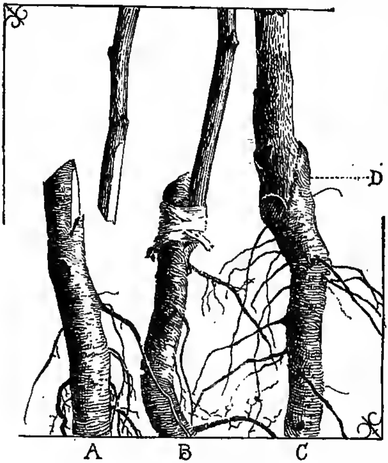

Fig. 75. Veneer-grafting.

Veneer-grafting is employed mostly from November to March upon potted plants. Stocks which are grown out-doors are potted in the early fall and carried in a cool house or pit. The cion is applied an inch or two above the surface of the soil, and the stock need not be headed back until the cion has united. (See Fig. 76.) Both dormant and growing cions are used. All plants in full sap must be placed under a frame in the house, in which they can be almost entirely buried with sphagnum, not too wet, and the house must be kept cool and rather moist until the cions are well established. Some species can be transferred to the open border or to nursery rows in the spring, but most plants which are grafted in this way are handled in pots during the following season. Rhododendrons, Japanese maples and many conifers are some of the plants which are multiplied by veneer-grafting. This method, when used with hardy or tender plants, gives a great advantage in much experimental work, because the stock is not at all injured by a failure and can be used over again many times, perhaps even in the same season; the manipulation is simple and easily acquired by inexperienced hands.

Cleft-Grafting.—In cleft-grafting the stock is cut off squarely and split, and into the split a cion with a wedge-shaped base is inserted. It is particularly adapted to large stocks and is the method universally employed for top-grafting old trees. Fig. 77 represents the operation. The end of the stock, technically called a "stub," is usually large enough to accommodate two cions, one upon either side. In fact, it is better to use two cions, not only because they double the chances of success but because they hasten the healing of the stub. Cleft-grafting is at best a harsh process, especially upon large limbs, and its evils should be mitigated as much as possible. In common practice, the cion (Fig. 78) contains three buds, the lowest one standing just above the wedge portion. This lowest bud is usually entirely covered with wax, but it pushes through without difficulty. In fact, being nearest the source of food and most protected, its chances of living are greater than those of the higher buds. The sides of the cion must be cut smoothly and evenly. A single draw cut on each side with a sharp blade is much better than two or three partial cuts. A good grafter makes a cion by three strokes of the knife, one to cut off the cion and two to shape it. The outer edge of the wedge should be a little thicker than the inner one so that the stock will bind upon it and hold it firm at the point where the union first takes place. These cions are taken in late fall or winter, and kept in the same manner as directed for whip-grafting on pages 77 and 78.

Fig. 76. Veneer-graft.

The stock or stub must be cut off squarely and smoothly with a sharp and preferably fine-toothed saw. If one desires to be especially careful in the operation, the end of the stub, or at least two opposite sides of it, may be dressed off with a knife so that the juncture between the bark and the wood may be more easily seen. Professional grafters rarely resort to this practice, however. The stub is then split to the depth of an inch and a half or two inches. Various styles of "grafting-knife" are used to split the stub. The best one is that shown in Fig. 79. It is commonly made from an old file by a blacksmith. The blade is curved so that the bark of the stub is drawn in when the knife is entering, thereby lessening the danger of loosening the bark. Upon the end of the knife is a wedge, about four or five inches long, for opening the cleft. The wedge is driven into the cleft and allowed to remain while the cions are being placed. If the cleft does not open wide enough to allow the cions to enter, the operator bears down on the handle of the knife. The cions must be thrust down to the first bud, or even deeper, and it is imperative that they fit tightly. The line of separation between the bark and wood in the cion should meet as nearly as possible the similar line in the stock. The cions are usually set a trifle obliquely, the tops projecting outwards, to ensure the contact of the cambium layers. Writers usually state that it is imperative to success to have the exact lines between the bark and wood meet for at least the greater part of their length, but this is an error. The callus or connecting tissue spreads beyond its former limits when the wounds begin to heal. The most essential points are rather to be sure that the

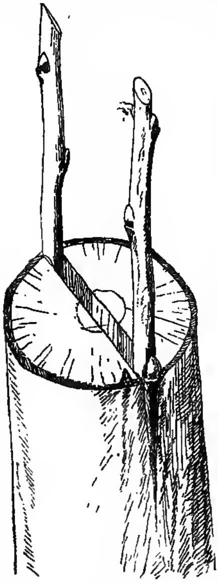
Fig. 77. Cleft-grafting.

cion fits tightly throughout its whole length, and to protect the wound completely with an air-tight covering.

Fig. 78. Cleft graft cion.

□The wounds must now be covered with wax. Fig. 80 illustrates a stub after the covering has been applied. If the grafting is done in early spring when the weather is cold, the wax will have to be applied with a brush. The wax is melted in a glue-pot, which is carried into the tree. But if the weather is warm enough to soften the wax, it should be applied with the hands. The hands are first greased to prevent the wax from sticking. The two side or vertical portions are applied first. The end of the mass of wax in the hand is flattened into a thin portion about a half inch wide. This portion is then laid over the bud and held there by the thumb of the other hand, while the wax is drawn downwards over the cleft, being pressed down firmly upon the bark by the thumb of the first hand. The wax gradually tails out until it breaks off just below the lowest point of the cleft. The flattened upper part is then wrapped around the cion upon either side, completely and tightly encircling it. A simple deft wrapping of the wax about the cion makes a tighter joint than can be secured in twice the time by any method of pinching it into place. Another portion of wax is now flattened and applied over the end of the stub. Many grafters apply a bit of wax to the tops of the cion also. All the wounds must be covered securely.

The top-grafting of large trees is an important operation, and there are many men who make it a business. These men usually charge by the stub and warrant, the warrant meaning that one cion of the stub must be alive when the counting is done late in summer. From two to

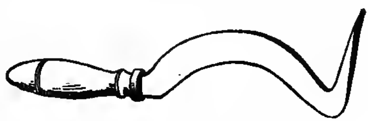

Fig. 79. A cleft grafting-knife.

three cents a stub is a common price. A good grafter in good "setting" can graft from 400 to 800 stubs a day and wax them himself. Much depends upon the size of the trees, their shape, and the amount of pruning which must be done befere the grafter can work in them handily. Every man who owns an orchard of any extent should be able to do his own grafting. The most important factor in the top-grafting of an old tree is the shaping of the top. The old top is to be removed during three or four or five years and a new one is to be grown in its place. If the tree is old, the original plan or shape of the top will have to be followed in its general outlines. The branches should be grafted, as a rule, where they do not exceed an inch and a half in diameter, as cions do better in such branches, the wounds heal quickly and the injury to the tree is less than when very large stubs are used. The operator should endeavor to cut all the leading stubs at approximately equal distances from the center of the tree. And then, to prevent the occurrence of long and pole-like branches, various minor side-branches should be grafted. These will serve to fill out the new top and to afford footholds for pruners and pickers. Fig. 81 is a good illustration of an old apple tree just top-grafted. Many stubs should be set, and at least all the prominent branches should be grafted if the tree has been well-trained. It is better to have too many stubs and to be obliged to cut out some of them in after years, than to have too few. In thick-topped trees, care must be exercised not to cut out so much the first year that the inner branches will sunburn. All large branches which must be sacrificed ought to be cut out when the grafting is done, as they increase in diameter very rapidly after so much of the top is removed. One horizontal branch lying directly over or under another should not be grafted, for it is the habit of grafts to grow upright rather than horizontally in the direction of the

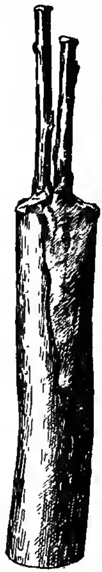

Fig. 80. A waxed stub.

branch. It is well to split all stubs on such branches horizontally, that one cion may not stand directly under another.

Top-grafting is performed in spring. The best time is when the leaves are pushing out, as wounds made then heal quickly and cions are most apt to live. But when a large amount of grafting must be done, it is necessary to begin a month or even

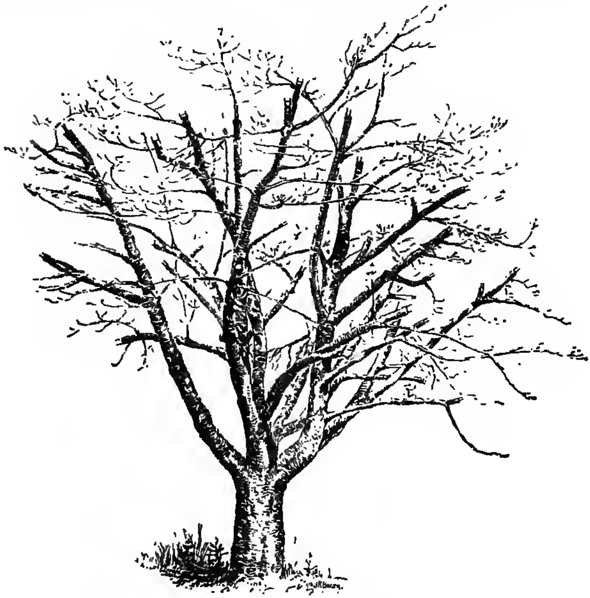

Fig. 81. Top-grafted old tree.

two before the leaves start. On the other hand, the operation can be extended until a month or more after the leaves are full-grown, but such late cions make a short growth, which is likely to perish the following winter. Professional grafters usually divide their men into three gangs, one to do the cutting of the stubs, one to set the cions, and one to apply the wax. The cions are all whittled before the grafter enters the tree. They are then usually moistened by dipping into a pail of water and are carried in a high side-pocket in the jacket. The handiest mallet is a simple club or billy, a foot and a half long, hung over the wrist by a loose soft cord (Fig. 82). This is brought into the palm of the hand by a swinging motion of the forearm. This mallet is always in place, never drops from the tree, and is not in the way. The knife shown in Fig. 79 is commonly used. A downward stroke of the mallet drives the knife into the tree and an upward motion immediately following strikes the knife on the outer end and removes it. Another downward motion drives in the wedge. The sharpened nails and sticks commonly pictured as wedges in cleft-grafting are useless for any serious work. And the common style of grafting knife sold by seedsmen, comprising a thin, broad blade set in a heavy back piece, is also worthless. The blade is too thin to split the stub. The various combined implements which have been devised to facilitate cleft-grafting are usually impracticable in serious operations. A very good grafting-knife for small stocks or trees in nursery row is shown in Fig. 83. This is the Thomas knife. The larger arm is made entirely of wood. At its upper end is a grooved portion into which the blade closes. This blade can be made from the blade of a steel case-knife, and it should be about two and a half inches long. It is secured to an iron handle. The essential feature of this implement is the draw cut which is secured by setting the blades and the pivot in just the positions shown in the figure. The stock is cut off by the shears, and the cleft is then made by turning the shears up and making a vertical cut. The cleft is therefore cut instead of split, insuring a tight fit of the cions. This tool is particularly useful upon hard and crooked-grained stocks.

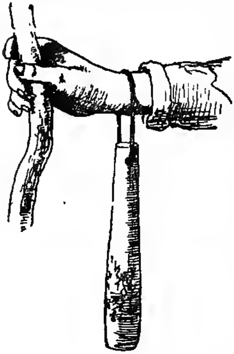

Fig. 82. Grafting-mallet.

Cleft-grafting is often employed for other purposes than the top-grafting of old trees. It is in common use on soft and fleshy stocks, as cactuses, and various fleshy roots. Fig. 84 shows a cleft-graft on cactus. The cion is held in place with a pin or cactus spine, and it is then bound with raffia or other cord. Waxing is not necessary. Fig. 85 illustrates a cleft root-graft of peony. The cleft in the thick root is cut with a knife, and the stock is bound up securely, usually with wire, as cord, unless waxed, rots off too quickly. Wax is not used, as the graft is buried to the top bud. The peony is grafted in summer. Dahlias are often grafted after the same fashion, although some operators prefer, in such fleshy subjects, to cut out a section from the side of the stock to receive the cion, rather than to make a cleft. Hollyhocks, ipomœas, gloxinias and other thick-rooted plants may be similarly treated.

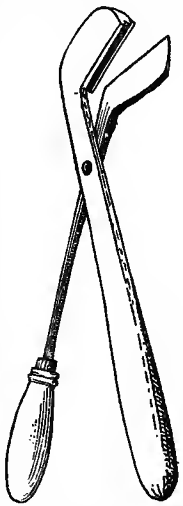
Fig. 83. Thomas' grafting-knife.

Bark-grafting.—A style of grafting suited to large trees is shown in Fig. 86. The stock is not cleft, but the cions are pushed down between the bark and wood. The cion must be cut very thin so that they will not break the bark on the stock. Fig. 87 represents a good style of cion. It is cut to a shoulder upon either side. Several cions can be placed in a single stub, and as no splitting is necessary, it is a useful method for very large limbs. It is especially useful in repairing trees when very large branches are broken off. A dozen or more cions may be set about the broken portion, after it is dressed off, and a few of them may be allowed to remain after the wound has been healed. Bark-grafting can be performed to advantage only when the bark peels readily. The cions should be held in place by a tight bandage, as seen in Fig. 86, and then


Fig. 84. Cleft-graft of cactus.

wax should be applied in essentially the same manner as for cleft-grafting. (See Fig. 80.) This is sometimes called crown-grafting, and is useful under certain conditions.

Fig. 85. Peony root-graft.

A special form of bark-grafting is sometimes employed for covering girdles about the base of an old tree, made by mice, gophers or rabbits. The edges of the bark are trimmed, and cions are cut a couple inches longer than the width of the girdle. These are sharpened at both ends. One end is inserted under the bark below the girdle and the other above it. The cions are placed close together entirely around the tree. This operation is said to be necessary to keep up the connection between the root and the top, but this is in most cases an error. A good dressing of cow-dung, wax or clay, held on with stout bandages, is much better than the grafting. This method of grafting is sometimes, but erroneously, called inarching. A complete girdle made during the spring or early summer will usually heal over readily if it is well bandaged; and in some cases even the bandage is not necessary.

Herbaceous-grafting.—In the preceding pages, the discussions have had to do with cions which are dormant or at least well-hardened, and with stocks which contain more or less hard woody substance. But herbaceous shoots can be grafted with ease. All such plants as geraniums, begonias, coleuses and chrysanthemums can be made to bear two or more varieties upon the same individual. Almost any style of grafting can be employed, but the veneer, cleft and saddle-grafts are preferred. Shoots should be chosen for stocks which are rather firm, or in the condition for making good cuttings. The cions should be in a similar condition, and they may be taken from the tips of branches or made of a section of a branch. The union should be bound snugly with raffia, and the plant set in a propagating frame, where it must be kept close for a few days. It is not necessary, in most cases, to use wax, and upon some tender stocks the wax is injurious. Moss may be bound about the graft, but unless the union is first thoroughly covered by the bandage, roots will start into the moss and the parts will fail to unite. The growing shoots of shrubs and trees can also be grafted, but the operation is rarely employed. In various coniferous trees (as pines and spruces) the young shoots are sometimes cleft or saddle-grafted in May, the parts being well bandaged with waxed muslin or raffia, and shaded with paper bags. The walnut and some other trees which do not work readily are sometimes treated in this manner.

Fig. 86. Bark-grafting.

A little known species of herbaceous-grafting is the joining of parts of fruits. It is easily performed upon all fleshy fruits, like tomatoes, apples, squashes and cucumbers. When the fruit is half or more grown, one-half is cut away and a similar half from another fruit is applied Better results follow if the severed side of the parent or stock fruit is hollowed out a little, so as to let the foreign piece set into the cavity. The edges of the epidermis of the stock are then tied up closely against the cion by means of bass or raffia. The two parts are securely tied together, but no wax is required. This operation succeeds best under glass, where conditions are uniform and winds do not blow the fruits about.

Even leaves may be used as stocks or cions. Any such succulent and permanent leaves as those of the house-leeks, crassula, and the like may have young shoots worked upon them, and leaves which are used as cuttings can often be made to grow on other plants.

Seed-grafting.—A novel kind of grafting has been described in France by Pieron, which consists in using a seed as a cion.

This has been used upon the grape. A seed is dropped into a gimlet-hole made near the base of the vine while the sap is flowing in the spring. The seed germinates, and after a time the plantlet unites with the stock.

Fig. 87. Cion for bark-grafting

DOUBLE-GRAFTING.—Grafting upon a grafted tree is known as double-grafting or double-working. It is employed for the purpose of growing a variety upon an uncongenial root or of securing a straight and vigorous stock for a weak and poor grower. Some sorts of pears do not unite well with the quince, and if it is desired to secure dwarfs of these varieties, some variety which unites readily with the quince must first be put upon it. The Angouleme takes well to the quince, and upon Angouleme dwarfs the Seckel and some other varieties are often worked. The last cion is usually set after the first one has grown one season, although both may be set at the same time. Double-grafting for the purpose of securing a better growth is often practiced. The Canada Red apple, for instance, is such a poor grower that it is often stem-worked or top-worked upon the Northern Spy or some other strong stock. The Winter Nelis and the Josephine de Malines pears are often double-worked for the same reason.

CUTTING-GRAFTING.—Cuttage and graftage are combined in various ways. Cuttings of plants which root with difficulty are sometimes grafted upon those which root easily. When the plants are transplanted, the following autumn or spring, the nurse or stock can be removed, the cion having taken root. Root-grafting with a long cion, described on a previous page (78), is virtually a grafting of cuttings. In other cases, union with an uncongenial stock is facilitated by allowing the cion to project downwards beyond the point of union and to stand in the soil or moss or a dish of water. Fig. 88 is a good illustration of the practice. The cion extends into the soil nearly as far as the root itself. After union has taken place, the lower part of the cion is removed. This method can be used for some magnolias, mulberries, birches, and many other plants of which some kinds root with more or less difficulty. Bottle-grafting, described in most of the books, is essentially this method, modified by letting the end of the cion drop into a bottle of water. Sometimes a portion of the bandage is allowed to hang in water, to keep the cion fresh until the parts join.

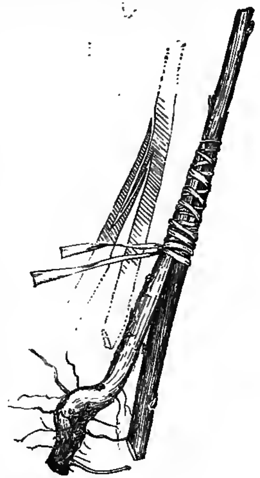
Fig. 88. Cutting-grafting.

Inarching.—Inarching or grafting by approach is the process of grafting contiguous plants or branches while the parts are both attached to their own roots. When the parts are united, one of them is severed from its root. Fig. 89 explains the operation. In this case, the larger plant is designed for the stock. When the smaller plant has united, it is cut off just below the union and it thenceforth grows upon the other plant. Limbs of contiguous trees are sometimes grafted in this way. It is the process employed by nature in what is called natural grafting. Grape-vines are often inarched. A thrifty young branch may be inarched into the stem of a fruit upon the same tree, thus supplying the fruit with additional food and causing it to grow larger than it might if undisturbed.

To join the parts, it is only necessary to remove the barks between the stock and cion and then tie the two together snugly. If out-doors, the junction should be waxed over ; and it is then necessary, also, to secure the branches in such manner that the wind cannot loosen them. The parts are sometimes joined by a tongue, after the manner of a whip-graft, but this is rarely necessary. Oranges and camelias were often propagated by inarching in the old practice, but this work is now much more easily done by the veneer-graft.

Grafting-waxes.—There are great numbers of recipes for waxes or mastics for protecting grafts and covering wounds upon trees. In this country the resin and beeswax waxes are most used, although some of the alcoholic waxes are popular in some regions. In Europe, many clay and pitch waxes are in common use. For most purposes, the wax No. 1 in the following list will be found one of the best, especially for applying by the hand. In making the resin and beeswax waxes, the materials are first broken up finely and melted together. When thoroughly melted, the liquid is poured into a pail or tub of cold water. It soon becomes hard enough to handle, and it is then pulled and worked over until it becomes tough or "gets a grain," at which stage it becomes the color of very light-colored manilla paper. When wax is applied by hand, the hands must be well greased. Hard tallow is the best material for this purpose. In top-grafting large trees it is well to carry a supply of tallow when waxing by smearing the backs of the hands before entering the tree.


Fig. 89. Inarching.

1. Common Resin and Beeswax Waxes.

1. Resin, 4 parts by weight; beeswax, 2 parts; tallow, 1 part.
2. Resin, 4 lbs.; beeswax, 1 lb.; tallow, 1 lb.
3. Resin, 6 lbs.; beeswax, 2 lbs.; linseed oil, 1 pt.
4. Resin, 6 lbs.; beeswax, 1 lb.; linseed oil, 1 pt.; apply hot with a brush, one-eighth of an inch thick over all the joints.
5. Resin, 4 lbs.; beeswax, 1 lb.; and from half to a pint of raw linseed oil; melt all together gradually, and turn into water and pull. The linseed oil should be entirely free from cotton-seed oil. For use in warm weather.

6. Resin, 6 parts; beeswax, 1 part; tallow, 1 part. To be used warm, in the house.

7. Resin, 4 or 5 parts; beeswax, 1½ to 2 parts; linseed oil, 1 to 1½ parts. For out-door work.

2. *Alcoholic Waxes.*

8. Lefort's Liquid Grafting Wax, or Alcoholic Plastic.—Best white resin, 1 lb.; beef tallow, 1 oz.; remove from the fire and add 8 ozs. of alcohol. Keep in closed bottles or cans.

9. Alcoholic Plastic with Beeswax.—Melt 6 parts white resin with 1 part beeswax; remove from stove and partially cool by stirring, then add gradually—with continued stirring—enough alcohol to make the mixture, when cool, of the consistency of porridge. In the temperature of the grafting-room it will remain sufficiently plastic to permit applying to the cut surfaces with the finger.

10. Alcoholic Plastic with Turpentine.—Best white resin, 1 lb.; beef tallow, 1 oz.; turpentine, 1 teaspoonful; add enough alcohol (13 to 15 fluid ozs. of 95 per cent. alcohol) to make the wax of the consistency of honey. Or, less alcohol may be added if the wax is to be used with the fingers.

3. *French and Pitch Waxes.*

11. Common French.—Pitch, ½ lb.; beeswax, ½ lb.; cow-dung, 1 lb. Boil together, melt and apply with a brush.

12. Common French Bandage Wax.—Equal parts of beeswax, turpentine and resin. While warm spread on strips of coarse cotton or strong paper.

13. Grafting Clay.—⅓ cow-dung, free from straw, and ⅔ clay, or clayey loam, with a little hair, like that used in plaster, to prevent its cracking. Beat and temper it for two or three days until it is thoroughly incorporated. When used it should be of such a consistency as to be easily put on and shaped with the hands.

14. Resin, 2 lbs. 12 ozs.; Burgundy pitch, 1 lb. 11 ozs. At the same time, melt 9 ozs. of tallow; pour the latter into the former, while both are hot, and stir the mixture thoroughly.

Then add 18 ozs. of red ochre, dropping it in gradually and stirring the mixture at the same time.

15. Black pitch, 28 parts; Burgundy pitch, 28 parts; beeswax, 16 parts; grease, 14 parts; yellow ochre, 14 parts.

16. Black pitch, 28 lbs.; Burgundy pitch, 28 lbs.; yellow wax, 16 lbs.; suet or tallow, 14 lbs.; sifted ashes, 14 lbs. When used, warm sufficiently to make it liquid, without being so hot as to injure the texture of the branches.

17. Melt together 1¼ lb. of clear resin and ¾ lb. of white pitch. At the same time melt ¼ lb. of tallow. Pour the melted tallow into the first mixture, and stir vigorously. Then before the stuff cools add, slowly stirring meantime, ½ lb. of Venetian red. This may be used warm or cold.

4. Waxed String and Bandage.

18. Waxed String for Root-grafting.—Into a kettle of melted wax place balls of No. 18 knitting cotton. Turn the balls frequently, and in five minutes they will be thoroughly saturated, when they are dried and put away for future use. This material is strong enough, and at the same time breaks so easily as not to injure the hands. Any of the resin and beeswax waxes may be used. When the string is used, it should be warm enough to stick without tying.

19. Waxed Cloth.—Old calico or thin muslin is rolled on a stick and placed in melted wax. When saturated it is allowed to cool by being unrolled on a bench. It is then cut in strips to suit. Or the wax may be spread upon the cloth with a brush.

5. Waxes for Wounds.

20. Any of the more adhesive grafting waxes are excellent for dressing wounds, although most of them cleave off after the first year. Stiff and ochreous paints are also good.

21. Coal-tar.—Apply a coating of coal-tar to the wound, which has first been pared and smoothed. If the wound contains a hole, plug it with seasoned wood.

22. Hoskins' Wax.—Boil pine tar slowly for three or four hours; add ½ lb. of beeswax to a quart of the tar. Have

ready some dry and finely sifted clay, and when the mixture of tar and wax is partially cold, stir into the above named quantity about 12 ozs. of the clay; continue the stirring until the mixture is so stiff, and so nearly cool, that the clay will not settle. This is soft enough in mild weather to be easily applied with a knife or spatula.

23. Schæfell's Healing Paint.—Boil linseed oil (free from cotton-seed oil) one hour, with an oz. of litharge to each pt. of oil; then stir in sifted wood ashes until the paint is of the proper consistency. Pare the bark until smooth. Paint the wound over in dry weather, and if the wound is very large, cover with a gunny-sack.

24. Tar for Bleeding in Vines.—Add to tar about 3 or 4 times its weight of powdered slate or some similar substance. Apply with an old knife or flat stick.

25. Hot Iron for Bleeding in Vines.—Apply a hot iron to the bare surface until it is charred, and then rub into the charred surface a paste made of newly-burnt lime and grease.

26. Collodion for Bleeding in Vines.—It may be applied with a feather or small brush. In some extreme cases two or three coats will be needed, in which case allow the collodion to form a film before applying another coat, Pharmaceutical collodion is better than photographic.

CHAPTER VI.

THE NURSERY LIST.

Aaron's Beard. See Hypericum.

Aaron's Rod. See Verbascum.

Abelia. *Caprifoliaceæ.*

In spring by layers under a frame, and in summer by cuttings.

Abies (Fir, Spruce). *Coniferæ.*

Propagated by seeds, which are usually kept dry over winter and sown in spring in frames or in protected borders. Cones should be fully matured before being gathered. If they hold the seeds tightly they should be placed in a dry place, sometimes even in an oven, until the scales spread. In order to obtain stocky plants, the seedlings should be transplanted the following spring. The named varieties and the species which do not produce sufficient seed are winter-worked upon seedling stocks which are potted from the seed-beds in the fall. One-year-old stocks are commonly used, but in some cases the requisite size is not reached until the second year. Any of the common operations of grafting may be employed. The conifers are not difficult to graft. The European silver fir (*Abies pectinata*) may be used as a stock, but the common Norway spruce is now the most popular stock for species of both Abies and Picea.

Abobra. *Cucurbitaceæ.*

Propagated by seeds, or rarely by soft cuttings.

Abroma. *Sterculiaceæ.*

By seeds sown in March. By cuttings made in spring from half-ripened wood, and placed under a bell-glass.

Abronia (Sand Verbena). *Nyctaginaceæ.*

Propagated by seeds sown in autumn or spring, after the outer skin has been peeled off. Sow in pots of sandy soil, and keep in a frame until the following spring; then place in their flowering quarters. By young cuttings, set in spring, in sandy soil.

Abrus. *Leguminosæ.*

Propagated by seeds raised in heat or by cuttings under a hand-glass, in sand.

Abuta. *Menispermaceæ.*

Propagated by cuttings planted in a pot of sand, with a hand-glass placed over them, in heat.

Abutilon. *Malvaceæ.*

Sow seeds in pans, with same soil and temperature as for cuttings. By cuttings from young wood, at almost any season; the best time, however, is spring or fall. Insert in pots, in a compost of equal parts peat, leaf mould, loam and sand, and place in a temperature of 65° to 75°.

Acacia. *Leguminosæ.*

Propagate by seeds sown as soon as ripe, in sandy peat; about one-fourth inch deep, or a little more for large seeds. Soak in hot water 24 hours if seeds are not fresh. Keep temperature about 55° or 60° and pot off when large enough to handle. By cuttings of the half-ripened wood, put in with a heel, in equal parts peat and sand, covered with pure sand. Insert the cuttings as soon as made; water, and leave them in the shade till dry. Place under a bell-glass, shade and water to prevent flagging. Pot off when rooted and keep in a close pit or house until the plants are thoroughly established. *A. pubescens* and some others strike readily from root cuttings.

Acæna. *Rosaceæ.*

Propagated by seeds, divisions, creeping rootlets and cuttings.

Acalypha. *Euphorbiaceæ.*

Propagated by cuttings in sandy soil under a glass, in stove heat, during late winter or in spring.

Acanthephippium. *Orchideæ.*

Propagated by dividing the pseudo-bulbs as soon as growth commences. (See under Orchids.)

Acantholimon. *Plantagineæ.*

Propagated by seeds sown carefully on a warm but rather shaded border; by very carefully made divisions; and by cuttings made in late summer and placed in frames to remain during the winter.

Acanthophœnix. *Palmæ.*

Propagated by seeds, sown in a moist bottom heat, in a well decomposed compost of one part loam, one of peat, one of leaf mould, and one of sand.

Acanthorhiza. *Palmæ.*

Propagated by seeds in a moist hot-bed in spring.

Acanthostachyum. *Bromeliaceæ.*

Propagated by suckers, which strike readily in bottom heat.

Acanthus (Bear's Breech). *Acanthaceæ.*

Propagated by seeds sown in gentle heat, or by division of the root in autumn or early spring. Also by root-cuttings. Water carefully.

Acer (Maple). *Sapindaceæ.*

Stocks are grown from stratified seeds, which should be sown an inch or two deep. Some species, as *A. dasycarpum*, come readily if seeds are simply sown as soon as ripe. Varieties are often layered, but better plants are obtained by grafting. The Japanese sorts are winter-worked on imported *A. polymorphum* stocks, either by whip or veneer grafting. Varieties of native species are worked upon common native stocks. Maples can also be budded in summer, and they grow from cuttings of soft and ripe wood.

Aceras. *Orchideæ.*

Propagated by carefully made divisions of the tubers. (See under Orchids.)

Aceratium. *Tiliaceæ.*

Propagated by ripe cuttings, which root readily in sand, in heat, under a hand-glass.

Achania. See Malvaviscus.

Achillea. Including Ptarmica (Milfoil), *Compositæ.*

Propagated by seeds, root divisions and cuttings, during spring.

Achimenes, including Scheeria. *Gesneraceæ.*

Propagated by seeds, carefully sown in well-drained pans, which are filled nearly to the rim, levelled, and well watered with a fine rose. Sow seed and cover lightly with sand, and place in shady position. Keep moist and apply water very lightly. Place a sheet of glass over the seed-pan. After large enough to be pricked off, treat like rooted cuttings. The best time for all modes of grafting is early spring By scales from the corms, carefully rubbed off and sown like seeds, in pots or pans of the same compost, barely covered with sand, and placed in bottom heat. By leaves, severed from the stems, and pricked into pots of similar soil to the cuttings, placing all the petiole below the surface, and placed in bottom heat. By cuttings from any portion of the stem; insert in a soil of equal parts of peat and sand, in well-drained pots, and place in bottom heat.

Achras. See Sapota.

Achyranthes. See Iresine.

Achyronia. See Priestleya.

Aciphylla. *Umbelliferæ.*

Propagated in spring by seeds or divisions.

Acis. See Leucoium.

Acisanthera. *Melastomaceæ.*

Increased by cuttings, which root freely in a mixture of loam, sand and peat, in stove temperature.

Acmadenia. *Rutaceæ.*

Increased by cuttings pricked in a pot of very sandy soil, covered with a bell-glass.

Acmena. *Myrtaceæ.*

Propagated by placing half-ripened cuttings in sand under a glass without heat.

Aconitum (Aconite, Monk's Hood, Wolf's Bane). *Ranunculaceæ.*

Seeds should be sown as soon as ripe in a cold-frame or border; also by division. Roots should not be left about, for they are very poisonous.

Acontias. See Xanthosoma.

Acorns. See Quercus.

Acorus. *Aroideæ.*

Propagated during spring by divisions.

Acradenia. *Rutaceæ.*

Propagated by seeds and cuttings under a bell-glass.

Acridocarpus. *Malpighiaceæ.*

Propagated by imported seeds, and by cuttings in bottom heat.

Acrocomia. *Palmeæ.*

Propagated by suckers.

Acronychia. *Rutaceæ.*

Propagated in July by cuttings inserted in sand, under a bell-glass.

Acrophyllum. *Cunoniaceæ.*

Increased by cuttings of the half-ripened shoots which strike freely in a soil of sand and peat ; cover with a hand-glass, and place in a cool house. The roots should be kept moist.

Acrostichum. See Ferns.

Acrotriche. *Epacridaceæ.*

Propagated by cuttings made of young shoots, pricked in sand, covered with a bell-glass, and placed in a cool house ; afterwards treated like Epacris.

Actæa (Baneberry). *Ranunculaceæ.*

Propagated by seed and by division of root during spring.

Actinella, Picradenin. *Compositæ.*

Propagated in spring by divisions.

Actinidia. *Ternstrœmiaceæ.*

Propagated by seeds, layers or cuttings. The cuttings should be put in sandy soil, in autumn, under a hand-light.

Actinocarpus. *Alismaceæ.*

Propagated by seeds and divisions during spring.

Actinomeris, Pterophyton. *Compositæ.*

Increased in spring, by seeds and division. Use a warm border, with or without hand-lights, or a cold frame.

Actinophyllum. See Sciadophyllum.

Actinotus. *Umbelliferæ.*

Increased by seeds sown on a hotbed in spring, and in May the seedlings may be transplanted to the open border in a warm situation, where they will flower and seed freely. Divisions of the roots grow readily.

Acyntha. See Sanseviera.

Ada. *Orchideæ.*

Propagated by divisions as soon as the plant commences growth. (See under Orchids.)

Adamia. *Saxifrageæ.*

Increased by seeds ; by cuttings, which will root readily in a compost of loam, peat and sand, under a hand-glass.

Adamsia. See Puschkinia.

Adam's Needle. See Yucca.

Adenandra. *Rutaceæ.*

Increased by cuttings made from the young tops, before they begin to throw out their buds, planted in a pot of sand, with a bell-glass or frame placed over them.

Adenanthera. *Leguminosæ.*

Increased by cuttings taken off with a heel and planted in a pot of sand in heat, placing a bell-glass over them.

Adenanthos. *Proteaceæ.*

Propagated by cuttings, in spring, placed in sandy soil, under a bell-glass, with gentle bottom heat.

Adenilenia. See Neillia.

Adenium. *Apocynaceæ.*

Increased by half-ripened cuttings, which strike root well in sand, under a hand-glass.

Adenocalymna. *Bignoniaceæ.*

Propagated by cuttings, which will root in sand, under a bell-glass, with bottom heat.

Adenocarpus. *Leguminosæ.*

Seeds may be sown in March, the hardy species out-doors, and the others in a cold house. Young cuttings root freely in sand, covered with a hand-glass.

Adenophora. *Campanulaceæ.*

Propagated by seeds, sown as soon as ripe, in pots placed in cold frames. Also by suckers.

Adenostoma. *Rosaceæ.*

Propagated by cuttings of the young shoots, placed in sand, under glass, in spring or autumn.

Adenotrichia. See Senecio.

Adesmia. *Leguminosæ.*

Seeds. Cuttings should be placed in sand, covered by a hand-glass, in a gentle heat.

Adhatoda. See Justicia.

Adiantum. See Ferns.

Adike. See Pilea.

Adina. *Rubiaceæ.*

Propagated by cuttings placed in rich, loamy soil, under a hand-glass, in heat.

Adlumia (Mountain Fringe). *Fumariaceæ.*

Propagated by seeds. The plant is a biennial, blooming the second season only.

Adonis. *Ranunculaceæ.*

Propagated by seeds. The perennials may be divided at the root.

Ægiphila. *Verbenaceæ.*

Propagated by cuttings, which will root in sand, under a glass, with bottom heat.

Ægle (Bengal Quince). *Rutaceæ.*

Propagated by ripe cuttings, which will root in sand under a hand-glass, in heat, if not deprived of any of their leaves.

Æolanthus. *Labiatæ.*

Increased by seeds.

Æonium. See Sempervivum.

Ærides. *Orchideæ.*

The only method of propagating this genus is by removing the upper portion and planting it separately. It should always be severed low enough to include a few roots, otherwise a large proportion of leaves will be lost. A somewhat dense shade, a moist atmosphere and careful watering are essential until the young plant is established. The old stool will soon send out lateral growths, which, in time, may be separated and treated similarly. Vanda, Saccolabium, Angræcum, Renanthera are increased in the same way. (See under Orchids.)

Æschynanthus. *Gesneraceæ.*

Propagated by seeds, which are very unsatisfactory. By cuttings, which root freely in a well-drained pot, filled with a light compost, and having a surface of pure white sand, about one inch deep, during spring. The best are obtained from half-ripened wood, cut into two or three inch lengths, and all leaves, with the exception of one or two at the top, removed. Cover the cuttings with a bell-glass, and place in moderate bottom heat. When rooted, transfer singly to small pots, place under hand-glasses, until thoroughly established, then gradually harden off.

Æschynomene. *Leguminosæ.*

Propagated seeds, those of the herbaceous species requiring a good heat to start them into growth. By cuttings, placed in sand under a bell-glass, in a brisk heat.

Æsculus (Horse Chestnut, Buckeye). *Sapindaceæ.*

Propagated by stratified seeds sown in single rows in spring, and by layers made in the spring or fall; or by grafting or budding on the common horse chestnut or native buckeyes, usually under glass.

Æthionema. *Cruciferæ.*

Propagated by seeds sown in May, and by cuttings planted in summer.

Agalmyla. *Gesneraceæ.*

Propagated by half-ripened cuttings, in heat under glass.

Aganisia. *Orchideæ.*

Propagated by dividing the pseudo-bulbs just before starting into new growth. (See under Orchids.)

Aganosma. *Apocynaceæ.*

Propagated by cuttings in sand, under glass, with bottom heat.

Agapanthus (African Lily). *Liliaceæ.*

Propagated by offsets, or by divisions of the old plants in early spring.

Agapetes. *Vacciniaceæ.*

Increased by young hardened cuttings, in sandy soil, under a hand-glass, in high temperature.

Agaricus. See Mushroom.

Agastachys. *Proteaceæ.*

Propagated by cuttings of ripened wood, in sandy soil under a glass, in a cool house.

Agathæa. *Compositæ.*

Seeds and layers. Young cuttings root freely, in a gentle heat, at all times.

Agathomeris. See Humea.

Agathosma (Bucco, Dichosma). *Rutaceæ.*

Increased by cuttings, which, when young, root freely in a pot of sand, under a bell-glass, in a cool house. They require to be shaded somewhat in the summer.

Agathotes. See Swertia.

Agati. *Leguminosæ.*

Increased by cuttings, which will root in a pot of sand with a hand-glass over them, placed in heat.

Agave. *Amaryllideæ.*

Increased by seeds, to secure the production of which the flowers should be pollinated. Usually by suckers which spring naturally from the old plant.

Ageratum, Cælestina. *Compositæ*

Sow the seeds in January, in heat, in sandy soil When large enough, prick them off into thumb pots, and keep in heat till they grow freely, then place them in a cooler house. Cuttings are commonly used for propagation.

Aglaia. *Meliaceæ.*

Propagated by cuttings ripened at the base, and taken off at a joint. They will root in sand under a hand-glass in heat.

Agrimonia. *Rosaceæ.*

Propagated by root-division.

Agrostemma (Rose Campion). *Caryophylleæ.*

Propagated by seeds and by division.

Agrostis (Bent Grass). *Gramineæ.*

Increased easily by seeds, sown in spring in the open border.

Ailantus (Tree of Heaven). *Xanthoxylaceæ.*

Propagated by suckers; and by pieces of the roots and planted in a pot with their points above the ground, and placed in a hot-bed. Also by stem cuttings. Seeds are used when large quantities are desired.

Ainslæa. *Compositæ.*

Propagated by divisions of the root.

Aitonia. *Meliaceæ.*

Increased by cuttings, which must not be put in very close together ; they will root in sand, under a bell-glass, with bottom heat.

Aizoon. *Portulacaceæ.*

Propagated by seeds and cuttings.

Ajax. See Narcissus.

Ajuga (Bugle). *Labiatæ.*

Perennials propagated by seeds sown in the open border, during spring or autumn; by divisions. Annuals by seeds.

Akebia, Rajania. *Berberideæ.*

Seeds. Layers of young or ripe wood. Dormant cuttings in bottom heat, and under glass in summer.

Alangium. *Alangiaceæ.*

Increased by cuttings, which root readily if planted in a pot of sand, with a hand-glass over them, in heat.

Albuca. *Liliaceæ.*

Propagated by seeds and by offsets (bulbels) from the old bulb.

Alcanna. See Lawsonia.

Alchemilla (Lady's Mantle). *Rosaceæ.*

Propagated by seeds or by divisions of the root.

Aldea. See Phacelia.

Aletris. See Tritonia

Aleurites. *Euphorbiaceæ.*

Propagated by ripe cuttings in sand, under a hand-glass. Do not remove leaves.

Alexandrian Laurel. See Ruscus.

Algaroba Bean. See Ceratonia.

Alhagi (Manna Tree). *Leguminosæ.*

Increased by seeds sown in a hot-bed ; and by cuttings rooted in sand, with a bell-glass over them, in heat.

Alibertia. *Cinchonaceæ.*

Increased by cuttings, which root freely in a mixture of loam and peat, under a hand-glass, in heat.

Alisma, Actinocarpus (Water Plantain). *Alismaceæ.*

Increased by seeds, which should be sown in a pot immersed in water and filled with loam, peat and sand ; also by divisions, which root well in a moist loamy soil.

Allamanda. *Apocynaceæ.*

Layers. Root cuttings will root well at any time of the year in a bottom heat from 70° to 80.° The usual time is, however, in spring, when the old plants are pruned back. Choose the tops of the shoots, retaining two or three joints to each cutting. Place in a compost of sand, and peat or leaf mould in equal proportions, singly, in pots, and plunge the pots in the propagating bed.

Allium, including Porrum, Schœnoprasum. *Liliaceæ.*

Increased by seeds sown thinly in light soil in early spring. By bulbels, planting them in autumn or spring one to four inches deep. (See Onion.)

Allosorus. See Ferns.

Almeidea. *Rutaceæ.*

Increased by partly ripened cuttings, which will root in sand, under a hand-glass, in heat.

Almond (*Prunus communis*). *Rosaceæ.*

The almond is worked the same as the peach and apricot. Seedling almond stocks are best, but the peach is often used. Apricot stocks are sometimes employed, but they are not to be recommended.

Alnus (Alder Tree). *Cupuliferæ.*

Propagated usually by seeds, which are gathered in the fall and well dried. Then they are sprinkled lightly on the ground and covered very thinly. Towards the end of the year the seedlings are planted in rows one and one-half feet apart, and six inches from each other, where they may remain for two years, after which they can be placed where they are intended to stand. Planting is best done in October or April. They are also increased, but rarely, by suckers, by cuttings and by grafting.

Alocasia. *Aroideæ.*

Increased by seeds and divisions.

Aloe. *Liliaceæ.*

Commonly propagated by suckers which spring from the base of the plant. Seeds are sometimes employed.

Alomia. *Compositæ.*

Propagated by cuttings.

Alona. *Nolanaceæ.*

Increased by cuttings, which root freely in sandy loam, with a very gentle bottom heat.

Alonsoa. *Scrophularineæ.*

Propagated by seeds, sown in spring; also by cuttings in sandy soil, in gentle heat. The herbaceous species may be treated as out-door summer annuals, and should be raised in little heat, and planted out in May.

Aloysia (Sweet-scented Verbena, Lemon Verbena). *Verbenaceæ.*

Increased easily in spring by young wood. They will root in about three weeks, in sandy soil with gentle heat. Also by cuttings of ripened wood in autumn.

Alpinia. *Zingiberaceæ.*

Increased by division after the young shoots have made an inch of growth in spring.

Alsodeia. *Violarieæ.*

Propagated by cuttings, which root readily under a bell-glass, if planted in sand, in heat.

Alsophila. See Ferns.

Alstonia. *Apocynaceæ.*

Propagated by cuttings rooted in sand, in heat.

Alstrœmeria. *Amaryllideæ.*

Increased by seeds. By a careful division of the fleshy roots, during fall or spring.

Alternanthera. *Amarantaceæ.*

Commonly raised from cuttings of growing wood. For spring and summer bedding, the plants are started in late winter. The stock plants, from which cuttings are taken, are procured from cuttings made late in summer. Seeds are little used.

Althæa (Marsh-Mallow, Hollyhock). *Malvaceæ.*

Increased by seeds, and by divisions. The biennial species must be raised from seeds every year.

Alum Root. See Heuchera.

Alyssum, including Psilonema, Ptilotrichum, Schivereckia (Madwort). *Cruciferæ.*

Increased by seed sown in the open border or in pans of sandy soil. By divisions. By layers. By cuttings made from young shoots two to three inches in length, placed in sandy loam, early in the season, in a shady place.

Amaranthus. *Amarantaceæ.*

Propagated by seeds sown in hot-beds in spring, and thinned out when about one-half inch high. About the end of May, they can be transplanted out-doors in their permanent situation, or into pots.

Amaryllis. *Amaryllideæ.*

Propagated by seeds and offsets. Seedlings will bloom in from one to two years.

Amber Tree. See Anthospermum.

Amblyanthera. See Mandevilla.

Ambrosinia. *Aroideæ.*

Increased by seeds sown as soon as ripe, in a cool house: and by divisions made just previous to new growth in spring.

Amelanchier. *Rosaceæ.*

Seeds. Layers and cuttings in autumn. By grafting, in early spring, on the Mountain Ash, Hawthorn or the Quince, or the weaker on the stronger-growing species. See June-berry.

Amellus. *Compositæ.*

Increased by divisions; or by cuttings under glass in spring.

Amherstia. *Leguminosæ.*

Propagated by seeds; also by cuttings of the half-ripened wood inserted in sand under a glass, in bottom heat of about 80.°

Amianthemum. See Zygadenus.

Amicia. *Leguminosæ.*

Propagated by cuttings, which will root in sand under a hand-glass, in heat.

Ammodendron. *Leguminosæ.*

Increased by seeds and layers.

Ammyrsine. See Leiophyllum.

Amomophyllum. Spathiphyllum.

Amorpha (Bastard Indigo). *Leguminosæ.*

Increased by seeds, usually. Layers or cuttings, taken off at the joint, strike readily if placed in a sheltered situation early in autumn. They should remain undisturbed till the following autumn.

Amorphophallus. *Aroideæ.*

Propagated by offsets, or cormels, and by seeds, which, however, are usually sparingly produced in cultivation.

Ampelopsis, Quinaria. *Ampelideæ.*

Increased by seeds, especially the one known as *A. Veitchii.* Layers or cuttings made in spring from the young soft wood, root freely in gentle heat. By cuttings having a good eye, if taken in September and pricked under hand-lights in sandy soil on the open border, or in pots. Hard wood cuttings are commonly employed in this country for *A. quinquefolia.*

Amphicarpæa. *Leguminosæ.*

Propagated by seeds, which should be sown in the open border, in spring, in a sunny place.

Amphicome. *Bignoniaceæ.*

Increased by seeds, sown in early spring, in pots of sandy soil placed in a greenhouse. By young shoots inserted in sandy soil in gentle heat in spring.

Amphilophium, Amphilobium. *Bignoniaceæ.*

Increased by cuttings from young shoots, which root readily in sand, under a hand-glass, with bottom heat, during the spring months.

Amsonia. *Apocynaceæ.*

Propagated by seeds; by divisions of the roots in spring; or by cuttings during the summer months.

Amygdalus. See Prunus.

Amyris. *Burseraceæ.*

Increased by cuttings, which root readily in sand, under a hand-glass with bottom heat, during the spring months.

Anacampseros. *Portulacaceæ.*

Increased by seeds; by cuttings and leaves, taken off close to the plant. These should be laid to dry a few days before planting.

Anacardium (Cashew). *Anacardiaceæ.*

Ripened cuttings, witb their leaves left on, root freely in sand nnder a hand-glass, in heat.

Anagallis (Pimpernel). *Primulaceæ.*

The annuals, by seeds sown in a warm place in spring; the perennials, by cuttings from young shoots, or by division, at any time, either under a hand-glass or in a closed frame. Keep in the shade, and when thoroughly established harden off gradually.

Anagyris. *Leguminosæ.*

Increased by cuttings, which should be planted in July in a pot of sand, and placed under a hand-glass.

Anamenia. See Knowltonia.

Ananas. See Pine Apple.

Anantherix. *Asclepiadeæ.*

Increased by seeds, which ripen in abundance, or by division of the root.

Anarrhinum. *Scrophularineæ.*

Propagated by seeds sown outside in the spring, or by growing cutting, but they require protection during severe winters.

Anastatica. *Cruciferæ.*

Increased by seeds sown in the spring in heat, and the plants afterwards potted off and plunged again in heat to hasten their growth.

Anchietea, Lucinæa, Noisettia. *Violarieæ.*

Propagated by young cuttings, which root freely in sand, under a bell-glass, in a moderate heat.

Anchomanes. *Aroideæ.*

Propagated by seeds and offsets.

Anchusa. *Boragineæ.*

Propagated by seeds, which should be sown in early spring in pots of sandy soil; they will germinate in three or four weeks. Also by divisions, rarely by cuttings.

Andersonia. *Epacrideæ.*

Propagated by cuttings from tips of young shoots. These should be made in autumn, winter or spring, and planted in sand in a gentle heat, with a bell-glass over them.

Andreusia. See Myoporum.

Androcymbium. *Liliaceæ.*

Increased by seeds and offsets.

Andromeda. *Ericaceæ.*

Propagated by seeds, sown thinly as soon as ripe, in pots or pans, in sandy peat soil. Place in a cool frame or greenhouse giving plenty of air. The young plants should be planted out in spring, if large enough, or pricked into boxes if small. By layers which, if carefully pegged down during September, will take twelve months to make sufficient roots to allow of their being separated; layerage is a common method.

Andropogon. *Gramineæ.*

Increased by seeds or by division of the roots.

Androsace, including Aretia. *Primulaceæ.*

Propagated by seeds, which should be sown as soon as possible, and raised in a frame; also by divisions and cuttings.

Androsæmum. See Hypericum.

Androstephium. *Liliaceæ.*

Propagated by seeds and offsets. The seeds should be sown as soon as ripe in a cold frame.

Andryala. *Compositæ.*

Increased by seeds and divisions in spring.

Aneilema. *Commelinaceæ.*

Propagated by seeds and root divisions.

Anemia. See Ferns.

Anemone (Wind Flower). *Ranunculaceæ.*

Propagated by seeds, root divisions, or root cuttings in autumn or early spring; the seeds are better sown as soon as ripe in pans, in a cold frame.

Anemonopsis. *Ranunculaceæ.*

Increased by seeds, and by divisions of the root stock in spring.

Angelica. *Umbelliferæ.*

Increased by seeds, which should be sown in September or March in ordinary soil.

Angelonia, Schelveria. *Scrophularineæ.*

Propagated by seeds which should be planted in spring in hot-beds, and transplanted in the open in May. By cuttings of the young shoots in spring. These root readily under a hand-glass, or in a propagating bed if given plenty of air daily.

Angophora. *Myrtaceæ.*

Increased by ripened cuttings, which will root in a few weeks in sandy soil under a hand-glass, in a cool house.

Angræcum. See Ærides.

Auguloa. *Orchideæ.*

Propagated by dividing the pseudo-bulbs, just before they commence to grow. (See under Orchids.)

Anigozanthus, Schwægrichenia. *Hæmodoraceæ.*

Propagated by dividing the roots in spring.

Anisanthus. See Antholyza.

Anise. *Umbelliferæ.*

Increased by seeds sown in ordinary soil, on a warm sunny border in May.

Anisochilus. *Labiatæ.*

Increased by seeds sown in February, in heat; or by cuttings, which will root in sandy soil under a bell-glass, in heat

Anisomeles. *Labiatæ.*

Propagated by seeds, which may be sown in spring, in heat. By cuttings made in spring and inserted in heat, under a bell-glass.

Anisopetalum. See Bulbophyllum.

Anœctochilus. *Orchideæ.*

Propagated by cutting off the growing top just below the last new root, dividing the remainder of the stem into lengths of two or three joints. (See under Orchids.)

Anoma. See Moringa.

Anomatheca. *Irideæ.*

Increased sometimes by seeds sown very thinly in seed pans as soon as ripe. Also multiply very rapidly by cutting up the masses once a year. Offsets.

Anona (Custard Apple). *Anonaceæ.*

Increased by seeds, which should be sown in pots, and plunged into a hot-bed. By ripened cuttings, which will root in sand under a hand-glass, in a moist heat.

Anoplophytum. See Tillandsia.

Anopterus. *Saxifrageæ.*

Propagated by half-ripened cuttings, which root freely under a bell-glass in a cool house or frame in summer.

Ansellia. *Orchideæ.*

Increased by divisions of the bulbs just after flowering. (See under Orchids.)

Antennaria. *Compositæ.*

Propagated by seeds, sown in spring in a cold frame, and by divisions of the roots in spring.

Anthemis (Camomile). *Compositæ.*

Propagated by seeds and divisions.

Anthericum, Phalangium. *Liliaceæ.*

Increased by seeds sown as early as possible after they are ripe, in a cold frame; by division of the roots.

Anthocercis. *Solanaceæ.*

Increased by cuttings, which strike freely in sand under a bell-glass, with a mild bottom heat.

Antholoma. *Tiliaceæ.*

Propagated by cuttings of the ripened wood, which will strike root in sand, under a hand-glass.

Antholyza, Petamenes, including Anisanthus. *Irideæ.*

Increased by seeds which should be sown as soon as ripe, in light soil, in a cool house. Here they will germinate the following spring, and will be fit to plant out in the summer of the same year. Also by offsets.

Anthospermum (Amber Tree). *Rubiaceæ.*

Increased by cuttings, inserted in sand under a bell-glass.

Anthurium. *Aroideæ.*

Propagated by seeds sown as soon as ripe in shallow well-drained pans or pots filled with a compost of peat, loam, moss, broken crocks or charcoal and clean sand. Cover lightly and place in a close, moist propagating case, where a temperature of 75° to 85° is maintained; or the pots may be covered with bell-glasses. Keep the soil in a uniformly moist condition. Also increased by divisions, which should be made in January.

Anthyllis (Kidney Vetch). *Leguminosæ.*

Herbaceous perennials increased by seeds or cuttings. The cuttings of most species will root in a pot of sandy soil, with a bell-glass over them, in a cool house or frame. Seed of the annuals should be sown in a warm dry place in the open ground.

Anticlea. See Zygadenus.

Antirrhinum (Snapdragon). *Scrophularineæ.*

Increased by seeds sown in early spring or mid-summer; by cuttings, which should be taken in September when they will readily root in a cold frame, or under a hand-glass.

Aotus. *Leguminosæ.*

Increased by seeds. In April or September by cuttings of half-ripened wood, inserted in sand under a bell-glass.

Apeiba. *Tiliaceæ.*

Propagated by well ripened cuttings planted in sand in heat, under a bell-glass, which should be tilted occasionally to give air.

Aphelandra. *Acanthaceæ.*

Propagated by cuttings from half ripened wood taken off with a heel. Cut the base of each clean across; insert an inch apart in pots of sandy soil, and plunge in a brisk bottom heat.

Aphelexis. *Compositæ.*

Increased by seeds. Also by cuttings made in spring or summer; small half-ripened side shoots are the best; and these will root in sandy soil, under a bell-glass, in a cool greenhouse.

Aphyllanthes. *Liliaceæ.*

Increased by seeds, which should be sown as soon as ripe in pots in a cool greenhouse. Divisions are also made.

Apios. *Leguminosæ.*

Propagated by the tubers or divisions of them.

Aplectrum (Putty-Root). *Orchideæ.*

Increased by the bulb-like subterranean tubers; also by seeds. A difficult plant to grow.

Aplotaxis. See Saussurea.

Apocynum (Dog's Bane). *Apocynaceæ.*

Propagated by seeds, suckers and divisions The best time to divide is just as the plants are starting into growth in spring.

Aponogeton. *Naiadaceæ.*

Increased rapidly by seeds and offsets. The seeds should be sown as soon as ripe, in pots buried in loam, and covered with glass.

Apple (*Pyrus Malus*). *Rosaceæ.*

Standard apple stocks are grown from seeds, and dwarf stocks from layers. Apple seeds are either imported from France or are obtained from pomace. The French seeds give what are technically known as *crab stocks*, the word *crab* being used in the sense of a wild or inferior apple. The yearling stocks themselves are imported from France in great numbers. It has been supposed that French crab stocks are hardier and more vigorous than ours, but this opinion is much less common than formerly, and the foreign stocks are not so popular now as the domestic stocks.

The chief source of apple seeds at the present time is the pomace from cider mills. The "cheese" of pomace is broken up, and if the material is dry enough it may be run through a large sieve to remove the coarser parts. The seeds are then removed by washing. Various devices are in use for washing them out. They all proceed upon the fact that the pomace will rise in water and the seeds sink. Some use a tub or common tank, which is tilted a little to allow the water to flow over the side. Others employ boxes some seven or eight feet long, four feet wide and a foot deep, the lower end of which is only eleven inches deep to allow the escape of the water. This box is set upon benches, and a good stream of water is carried into it at the upper end. A bushel or two of pomace is emptied in at a time, and it is broken and stirred with a fork or shovel. When the seeds are liberated they fall to the bottom and the refuse runs over the lower end. Another box is provided with several cleats, at intervals of about a foot, and the ends are left open. The box is set at an angle, and the seeds are caught behind the cleats. Seeds must not stand long in the pomace pile, or they will be seriously injured. Nurserymen like to secure the pomace as soon as it is taken from the press.

As soon as the seeds are collected, they should be spread upon tables or boards, and should be frequently turned until perfectly dry. They may then be stored in boxes in slightly damp sand or sawdust, or in powdered charcoal and kept in a cool and dry place until spring. Or if they are to be sown immediately they need not be dried, but simply mixed with enough dry sand to absorb the water so as to make them easy to handle Seeds should not be allowed to become hard and dry through long exposure to the air, or they will germinate unevenly. Apple seeds procured at the seed stores are often worthless because of this neglect. Very dry seeds can sometimes be grown, however, by subjecting them to repeated soakings and then sprouting in a gentle hot-bed or mild forcing-house. Change the water on the seeds every day, and at the end of a week or ten days mix with sand and place in a thin layer in the hot-bed. Stir frequently to prevent molding. When the seeds begin to sprout, sow them in the open ground. This operation, which is sometimes called *pipping*, may be performed in a small way by the kitchen stove. Seeds are sometimes "pipped" between moist blankets. (See also page 17.)

When sowing is done in the fall, the seeds may be sown in the pomace. This entails extra labor in sowing, but it saves the labor of washing. This practice gives good results if the pomace is finely broken, and it is now common among nurserymen.

In loose and well-drained soils, sowing is undoubtedly best performed in the fall, just as early as the seeds are ready. But upon land which holds much water, and which heaves with frost or contains much clay, spring sowing is preferable. In spring, the seeds should be sown just as soon as the ground can be worked.

If the stocks are to be cultivated with a horse, the rows should be three or three and a half feet apart. Some growers sow in narrow drills and some in broad ones. The broad drills are usually six to ten inches wide. The earth is removed to the depth of two or three inches, if it is loose and in good condition, the seed is scattered thinly on the surface and the earth hoed back over them. If the ground is likely to bake, the seeds should not be sown so deep; and it is always well, in such cases, to apply some very light and clean mulch. The plants should be well cultivated during the season, and they should attain a height of six to twelve inches or more the first year. If the plants come thickly, they must be thinned out.

In the fall of the first year the seedlings should be large enough to be dug and sold to general nurserymen. Sometimes the poorest plants are allowed to stand another year, but they are usually so scattering that they do not pay for the use of the land, and they should be transplanted the same as the larger stock, or the weakest ones may be thrown away. The stocks are dug with a plow or tree-digger and heeled-in closely, so that the leaves "sweat" and fall off. The plants are then stored in sand, moss or sawdust in a cellar. Before they are shipped the tops are cut off near the crown, usually with a hatchet on a block. The stocks are then graded into budding and grafting sizes. The general nurserymen buy these stocks in fall or early winter. Those which are root-grafted are worked during late winter, but those intended for budding, or which must be grown another season before they attain sufficient size for working, are "dressed" (See Chapter V) and heeled-in; in the spring they are set in nursery rows, from a foot to eighteen inches apart in the row. The nurseryman reckons the age of his tree from the time the seedling is transplanted, rather than from the time the seed was sown.

Seedling raising is usually conducted by men who make it a business and who supply the general nurserymen of the country. It is largely practiced at the west, where the deep and strong soils produce a rapid growth. The yearling trees are graded by the western growers into about four lots: "Extras," or those at least one-fourth inch in diameter at the crown and having twelve inches of both top and root; these are used mostly as budding stocks the next season. "Commons," those between three-sixteenths and one-fourth inch at the crown and having eight inches of root; these are used for immediate root-grafting. "Second-class," those from two to three-sixteenths inch at the crown, and "third-class," or all those under two-sixteenths. The last two classes must be grown in the field for one or two seasons before they can be worked.

Dwarf stocks are mostly obtained from mound-layering. The common stock for dwarfing is the Paradise apple, a dwarf variety of the common apple species (*Pyrus Malus*). This variety rarely attains a height of more than four feet. A larger or freer stock is the Doucin, also a variety of *Pyrus Malus*, which will produce an engrafted tree intermediate in size between that given by the Paradise and free or common stocks. This is little used in this country. To obtain stools for mound-layering, the tree, when well established, is cut off within four or six inches of the ground in spring, and during the summer several shoots or sprouts will arise. The next year the stool is covered by a mound, and by autumn the layers are ready to take off. Sometimes, when stocks are rare, mound-layering is performed during the first summer, before the young shoots have hardened, but good stocks are not obtained by this method. Common green layering is sometimes practiced the first year, but it is not in favor. The dwarf stocks, in common with all apple stocks, may be propagated by root-cuttings and by hard-wood cuttings.

Apple stocks are either grafted or budded. Root-grafting is the most common, especially at the west where long scions are used in order to secure own-rooted trees. (See Chapter V.) Budding is gaining in favor eastward and southward; it is performed during August and early September in the northern states, or it may be begun on strong stocks in July by using buds which have been kept on ice. Stocks should be strong enough to be budded the same year they are transplanted, but the operation is sometimes deferred until the second summer. Stocks which cannot be worked until the second year are unprofitable, especially on valuable land. For root-grafting, strong one-year-old roots are best, but two-year-olds are often used.

In common practice, the root is cut into two or three pieces of two to three inches each, but stronger trees are obtained, at least the first year or two, by using the whole root and grafting upon the crown. The lowest piece is usually small and weak and is generally discarded.

The apple is easily top-grafted and top-budded. (See Chapter V.)

Apple Berry. See Billardiera.

Apricot (*Prunus Armeniaca*). *Rosaceæ.*

The apricot thrives upon a variety of stocks. Apricot stocks are used in apricot-growing regions, especially for deep and rich well-drained soils. The pits grow readily if given the same treatment as that detailed for the peach (which see). The stocks are also handled in the same manner as peach stocks. Apricots upon apricot roots are not largely grown out sideof California, in this country. Apricot stocks can be grown from root cuttings the same as cherries and other stone fruits.

The apricot does well upon the peach, especially on light soils. In the warmer parts of the country peach is much used.

Plum stocks are commonly used at the north, especially if the trees are to be planted in moist or heavy soils. The common plum is generally used, but some of the native plum stocks are now coming into favor, especially in trying climates. The Russian apricots, which are a hardy race of *Prunus Armeniaca*, are grown in colder climates than the common varieties, and they therefore demand hardy stocks. Any of the native plums make good stocks, but the Marianna is now coming into especial prominence. The myrobolan plum can be used for all apricots, but it is not popular, particularly in severe climates.

The almond, both hard and soft-shelled, is sometimes used for the apricot, but the union is likely to be imperfect and it is not recommended. Almond-rooted trees are best adapted to light soils.

Varieties of apricots are usually budded, in the same way as the peach, although they may be side-grafted at the crown in the nursery row.

Aquartia. See Solanum.

Aquilegia (Columbine). *Ranunculaceæ.*

Increased by seeds. They must be sown very thinly, soon after being ripe, in a sandy soil or in pans in a cold frame. Division of the root is the only way to perpetuate any particular variety with certainty.

Arabis (Wall Cress, Rock Cress). *Cruciferæ.*

Increased by seeds sown in the border or in pans, in spring. By divisions of the root, and by cuttings placed in a shady border during summer.

Arachis (Pea-Nut, Ground-Nut). *Leguminosæ.*

Increased by seeds, which should be sown in heat; and, when the plants have grown to a sufficient size, they should be potted off singly. See under Pea-Nut

Arachnimorpha. See Rondeletia.

Aralia. *Araliaceæ.*

Propagated by seeds and by root cuttings; also by stem cuttings, in heat.

Araucaria, Eutacta. *Coniferæ.*

Increased by seeds sown in pans or boxes, with but gentle heat. By cuttings from the leading shoots, placed firmly in a pot of sand; they first require a cool place, but afterwards may be subjected to a slight warmth. When rooted, pot off into fibrous loam, mixed with leaf soil and sand.

Arbor-vitæ. See Thuya.

Arbutus (Strawberry Tree). *Ericaceæ.*

Increased by seeds, which should be sown in sand during early spring, and by grafting, budding, or inarching upon *A. Unedo.*

Arctotheca. *Compositæ.*

Propagated by divisions of the plant, or by cuttings in spring.

Arctotis. *Compositæ.*

Propagated by cuttings, which may be made at any time; they should be pricked in pots of very sandy soil, and placed in very gentle warmth. They must be kept uncovered and moderately dry, or they will rot

Ardisia. *Myrsineæ.*

Propagated by seeds and cuttings.

Areca (Cabbage Palm). *Palmæ.*

Increased by seeds, which should be sown in a compost of loam, peat, and leaf soil, in equal parts, with a liberal addition of sand, and placed in a moist and gentle heat.

Arenaria (Sandwort). *Caryophylleæ.*

Increased by seeds, division or cuttings; the last placed under a hand-glass will root freely Seeds should be sown in spring in a cold frame. The best time to divide the plant is early spring, or during July and August.

Aretia. See Androsace.

Argania. *Sapotaceæ.*

Increased by layers and cuttings. The latter require a propagating frame. Both should be made in autumn and spring, and in a moderately heated greenhouse.

Argemone. *Papaveraceæ.*

Increased by seeds, which may be sown out-doors in Spring; those of the rarer species in a hot-bed.

Argyreia (Silver-weed). *Convolvulaceæ.*

Propagated by cuttings, which will do well in sand, with a hand-glass over them, in a little bottom heat.

Argyrochæta. See Parthenium

Argyroxyphium. *Compositæ*

Propagated by seeds.

Arisarum. *Aroideæ*

Propagated in spring by seeds or divisions of the root.

Aristea. *Irideæ.*

Increased by seeds and divisions.

Aristolochia (Brithwort). *Aristolochiaceæ.*

Propagated by seeds and layers, which are not very satisfactory. Cuttings root freely in sand, under a bell-glass with bottom heat. The seeds must be fresh.

Aristotelia. *Tiliaceæ.*

Propagated by layers, or by ripened cuttings, which root freely if placed under a hand-glass.

Armeria (Thrift, Sea Pink). *Plumbagineæ.*

Increased by seeds sown in spring, in pots of sandy soil, and placed in a cold frame; by division, separate pieces being planted as cuttings under hand-glasses.

Arnatto. See Bixa.

Arnebia. *Boragineæ.*

Increased by seeds. Cuttings of the strong shoots should be inserted in pots of sandy soil, and placed in gentle heat.

Arnica. *Compositæ.*

Propagated by seeds sown in a cold frame in spring, and by divisions, which should be made in spring.

Aronicum. See Doronicum.

Arracacha. *Umbelliferæ.*

Increased by divisions of the roots.

Arrow-root. See Calathea.

Arrhostoxylum. See Ruellia.

Artabotrys. *Anonaceæ.*

Propagated by seeds; and by cuttings of ripened wood, placed in early spring in sand under a frame, with bottom heat.

Artanema. *Scrophulariaceæ.*

Increased readily by seeds and cuttings.

Artanthe. See Piper.

Artemisia (Mugwort, Southernwood, Wormwood). *Compositæ.*

The annuals by seeds; the herbaceous ones, by dividing at the root; the shrubby kinds by cuttings.

Arthropodium. *Liliaceæ.*

Increased freely by seeds and by divisions.

Arthrostemma. *Melastomaceæ.*

Propagated by cuttings of small firm side shoots, which will root, in April or August, under a hand-glass in sandy soil.

Artichoke (*Cynara Scolymus*). *Compositæ.*

Usually grown from seeds. Although the plant is perennial, a new stock should be started about every other year. It may be increased also by suckers or divisions of the stools.

Artichoke, Jerusalem (*Helianthus tuberosus*). *Compositæ.*

Commonly increased by means of the tubers, which may be planted whole or cut into eyes, after the manner of potatoes. Seeds are very rarely used.

Artocarpus (Bread Fruit). *Urticaceæ.*

Propagation is difficult. Suckers may be utilized when procurable. The young and slender lateral growths are used for cuttings.

Arum. *Aroideæ.*

Propagated by seeds, but usually by division of the roots, the best time being just as they begin their new growth, securing as many roots as possible to each division. Any rootless pieces should be placed in heat shortly after removal; this hastens the formation of roots and excites top growth. Arisæmas are treated in the same way.

Arundinaria. *Gramineæ.*

Increased by division of the root.

Arundo (Reed). *Gramineæ.*

Propagated by seeds or divisions, spring being the best time for either method. In early autumn, the canes can be cut into lengths of 18 to 24 inches and partly buried in sand in a gentle bottom heat, laying them horizontally.

Asarum. *Aristolochiaceæ.*

Propagated easily by divisions in spring.

Ascaricida. See Vernonia.

Ascium. See Norantea.

Asclepias (Milk-weed, Swallow-wort). *Asclepiadeæ.*

Increased by seeds sown in pots in spring, pricked out singly when large enough, and treated like cuttings. By cuttings, which should be secured in spring, struck in gentle heat, under a bell-glass, and as soon as they are well-rooted potted into small pots. Seeds of *A. tuberosa* must be sown or stratified at once.

Ascyrum. *Hypericineæ.*

Increased by seeds and by careful divisions of the roots in spring.

Ash. See Fraxinus.

Asimina. *Anonaceæ.*

Propagated by seeds procured from their native country. The seedlings should be raised in pots, and sheltered carefully. By layers made in autumn.

Aspalathus. *Leguminosæ.*

Propagated by young cuttings of half-ripened wood, placed in sand, in spring, under bell-glasses, which must be wiped dry occasionally.

Asparagus. *Liliaceæ.*

The common kitchen garden asparagus is best propagated by means of seeds. These are sown in spring as soon as the ground can be worked, usually in rows a foot or two apart. Thin the young plants to two or three inches apart in the row and give good culture, and the plants can be set in the field the following spring, and they will give a fair crop after growing there two seasons. Small growers nearly always buy plants of nurserymen. Old asparagus crowns can be divided, but seeds give better plants.

The ornamental species of asparagus are propagated by seeds when they are obtainable; otherwise, by division.

Asperula. *Rubiaceæ.*

Increased by seeds and by divisions of the roots during spring and early summer.

Asphodeline. *Liliaceæ.*

Propagated by division.

Asphodelus (Asphodel). *Liliaceæ.*

Propagated by seeds and by division of the root in early spring.

Aspidistra. *Liliaceæ.*

Aspidium. See under Ferns.

Asplenium. See under Ferns.

Propagated by suckers.

Assonia. *Sterculiaceæ.*

Propagated by young cuttings, which will root freely in sand with strong bottom heat, if covered with a bell-glass.

Astartea. *Myrtaceæ.*

Increased by young cuttings, in sand, in gentle heat, under a bell-glass.

Astelma. *Compositæ.*

Propagated by seeds sown in pots of light, open soil, in gentle heat. By half-ripened cuttings, which will root readily in sandy soil with a hand-glass over them.

Astephanus. *Asclepiadeæ.*

Propagated by divisions; and by cuttings, in sandy soil, in moderate heat.

Aster (Aster, Michaelmas Daisy, Star-wort). *Compositæ.*

Propagated by seeds sown in spring, or by root divisions made in autumn; also by cuttings, which root freely in sandy soil under a hand-glass, with little heat.

Asteracantha. *Acanthaceæ.*

Propagated by seeds sown in August; and by divisions in spring.

Asteriscus. See Odontospermum.

Asterocephalus. See Scabiosa.

Asteropterus. See Leyssera.

Asterostigma. See Staurostigma.

Astilbe. *Saxifrageæ.*

Propagated by division in early spring, and by seeds if they are produced.

Astragalus (Milk Vetch). *Leguminosæ.*

Seeds should be sown in pots of sandy soil placed in a cold frame, as soon as ripe, or early in the spring, as they may lie a long time before germinating. The herbaceous perennials also increase by divisions, and the shrubby kinds slowly by means of cuttings placed in a cold frame.

Astrantia. *Umbelliferæ.*

Increased by seeds and root divisions in autumn or spring.

Astrapæa. *Sterculiaceæ.*

Propagated by cuttings of young wood made in spring, placed in a compost of loam and peat, or sand, under a bell-glass, in heat.

Astrocaryum, Phœnicophorum. *Palmæ.*

Increased by seeds sown in spring in a hot-bed; or by suckers, if obtainable.

Astroloma. *Epacrideæ.*

Propagated by young cuttings placed in sandy soil, under a bell-glass, in a cool house.

Asystasia. *Acanthaceæ.*

Increased by cuttings of young shoots, placed in sand, under a bell-glass, with a strong bottom heat, in spring.

Ataccia. See Tacca.

Atalantia. *Rutaceæ.*

Propagated by ripened cuttings, which will root freely in sandy soil under a hand-glass, in heat.

Atamasco Lily. See Amaryllis.

Athamanta. *Umbelliferæ.*

Increased by seeds sown in spring, or by division.

Athanasia. *Compositæ.*

Propagated by means of cuttings taken from half-ripened wood in spring, and placed in sand under a hand-glass.

Atherosperma. *Monimiaceæ.*

Propagated readily by cuttings.

Athlianthus. See Justicia.

Athrixia. *Compositæ.*

Propagated by cuttings of young wood, under a bell-glass in sandy soil.

Athrotaxis. *Coniferæ.*

Increased by cuttings.

Atragene. *Ranunculaceæ.*

Seeds should be stratified, and sown in early spring, in gentle heat. By layering in autumn; the layers should not be separated for about a year, when they will be vigorous plants. By cuttings, which should be set in light soil and placed under a hand-glass.

Atropa (Belladonna). *Solanaceæ.*
Seeds.

Aubletia. See Paliurus.

Aubrietia. *Cruciferæ*

Propagated by seeds, which should be sown in spring In early autumn carefully transplant to a cool shady border. Also by divisions. Where a stock of old plants exists, layer their long slender branches any time after flowering, and cover with a mixture of sand and leaf soil; they will then root freely and establish themselves in time for spring blooming. Cuttings should be "drawn" or grown in a frame until they are soft, before they are removed.

Aucuba. *Cornaceæ.*

Readily increased by seeds, sown as soon as ripe; or by cuttings, inserted in spring or autumn in sandy soil, with or without a covering.

Audouinia. *Bruniaceæ.*

Propagated by cuttings of half-ripened wood, in sand, under a bell-glass, in gentle heat.

Aulax. *Proteaceæ.*

Increased by ripened cuttings, taken off at a joint, and inserted in pots of sandy soil. These will root well under a hand-glass, in a cool house.

Auricula (*Primula Auricula*). *Primulaceæ.*

Propagated by seeds, sown as soon as ripe or in spring, in well-drained pots, filled with sandy soil, well watered previous to sowing. Cover lightly with coarse sand, place a pane of glass over the pot, and place the latter in a hand-glass. By offsets, which should be removed when top-dressed, as they are more likely to root. Arrange about four offsets around the sides of well-drained three-inch pots, filled with sandy soil, place under a bell-glass or in a close hand-light, water very sparingly so as to prevent them damping off. After becoming established, admit air, and pot off singly.

Australian Feather-palm. See Ptychosperma.

Australian Mint-bush. See Prostanthera.

Avens. See Geum.

Averrhoa. *Geraniaceæ.*

Increased in spring by half-ripened cuttings, which will root in sand, under a hand-glass, with bottom heat.

Axillaria. See Polygonatum.

Azalea. *Ericaceæ.*

Increased by seeds, sown as soon as ripe, or early the following spring, in a large shallow frame containing from two to three inches of peat, over which more peat must be spread by means of a fine sieve; do not cover, but water thoroughly. When the seedlings begin to appear they should have air, shade, and a daily sprinkling of water; transplant in autumn in boxes of peat and coarse sand, water, shade and keep close until growth commences. Grafting is largely practiced to increase the stock of named varieties or choice seedlings, the stock most employed being *A. pontica* for hardy sorts, and some strong growing variety of *A. Indica*, like "Phœnicia," for tender ones. Layering in spring, enclosing the part buried with moss, is also practiced; but the layer must be left two years before separating. Cuttings of the last year's wood two or three inches long, taken with a heel, root readily in sand; about the end of summer is the best time. When placed outside they should be covered with a hand-light for about two months, and at the end of that time air should be given freely.

Azara. *Bixineæ.*

Propagated by cuttings.

Bahiana. *Irideæ.*

Propagated quickly by seeds sown in pans, placed in a gentle heat. These will grow at almost any time. The young plants will require to be carefully transplanted each season until they develop into blooming corms. By offsets grown in boxes or planted out in light rich soil until large enough for flowering.

Babingtonia. *Myrtaceæ.*

Increased by cuttings of the young sterile shoots, which may be planted in sand under a bell-glass, and kept in a moderate heat until rooted, when they should be placed singly in small pots, in a compost of equal parts loam and peat, with a little sand.

Baccharis (Ploughman's Spikenard). *Compositæ.*

Propagated by seeds and by cuttings.

Backhousia. *Myrtaceæ.*

Increased by half-ripened cuttings, in sand, under a bell-glass, in a cool house, during spring

Bactris. *Palmeæ.*

Increased by suckers, which are very easily produced.

Badamea. See Terminalia.

Bæa, Dorcoceras. *Gesneraceæ.*

Propagated easily by seeds.

Bæckea. *Myrtaceæ.*

Increased by cuttings of young wood, which will root freely if placed in a pot of sand, with a bell-glass over them, in a cool house.

Bæria. *Compositæ.*

Propagated by seeds sown in spring.

Bahia, Phialis. *Compositæ.*

Increased by seeds, or by divisions.

Balbisia, Ledocarpum. *Geraniaceæ.*

Propagated by seeds, or by cuttings made from the half-ripened wood, placed in sand, under a hand-glass.

Baldingera. See Premna.

Balfouria. See Wrightia.

Balm (*Melissa officinalis*). *Labiatæ.*

Seeds sown out-doors in spring. Division.

Balsam (*Impatiens balsamina*). *Geraniaceæ.*

Increased by seeds sown in early spring, in pans of rich, sandy soil, and placed in a gentle bottom heat of about 65°. Or the seeds may be sown directly in the garden when the weather becomes warm. Varieties increased by layers in late summer, under glass, or by veneer grafting.

Balsamodendron. *Burseraceæ.*

Increased by cuttings taken from the ripe young wood, in spring, and placed under a hand-glass, in bottom heat.

Balsam-tree. See Clusia.

Bambusa (Bamboo). *Gramineæ.*

Propagated by careful division of well-developed plants, in early spring, just as new growth is commencing; establish the divisions in pots. If young shoots are layered, leave only the end exposed.

Banana and Plantain (*Musa sapientum*, *M. paradisiaca* and others). *Scitamineæ.*

Edible bananas rarely produce seeds. The young plants are obtained from suckers, which spring from the main root-stock. These suckers are transplanted when two or three feet high. These plants themselves do not produce so good crops as the suckers which arise from them, and are not transplanted. Two or three suckers are sufficient for a plant at a time; what others arise should be transplanted or destroyed. The suckers should be set deep, as low as two feet for best results. In fifteen or eighteen months the plants will bloom, if they have had good care. The stem bears fruit but once, but new stems arise to take its place.

Baneberry. See Actæa.

Banisteria. *Malpighiaceæ.*

Propagated by cuttings from ripened wood, which will root freely in sandy soil, under a hand-glass, in stove heat.

Banksia. *Proteaceæ.*

Seeds are very unsatisfactory. Propagated by well-ripened cuttings taken off at a joint, and placed in pots of sand without shortening any of the leaves, except on the part that is planted in the sand, where they should be taken off quite close. The less depth the better, so long as they stand firm. Place them under hand-glasses in a propagating house, but do not plunge them in heat.

Baphia (Camwood, Barwood). *Leguminosæ.*

Propagated by cuttings, which should not be deprived of any of their leaves. Place in sand under a hand-glass in heat.

Baptisia. *Leguminosæ.*

Increased by seeds, which should be sown in sand and leaf-mould in the open, or in pots placed in a cold frame. By divisions.

Barbadoes Gooseberry. See Pereskia.

Barbarea (Winter Cress, American Cress, Upland Cress). *Cruciferæ.*

Increased by seeds, divisions, suckers and cuttings.

Barberry (*Berberis vulgaris*). *Berberideæ.*

Propagated by stratified seeds, or by suckers, layers and cuttings of mature wood. Layers are usually allowed to remain two years. Rare sorts are sometimes grafted on common stocks.

Barbieria. *Leguminosæ.*

Propagated by cuttings of the half-ripened wood, which should be placed in sand, under a glass, in strong heat.

Barkeria. *Orchideæ.*

Propagated by divisions made just before new growth commences. See under Orchids.

Barklya. *Leguminosæ.*

Increased by seeds; also by half-ripened cuttings, which should be placed in sandy soil, under a bell-glass, in a cool house.

Barleria. *Acanthaceæ.*

Propagated by cuttings made of the young wood, and placed in a compost of loam and peat with a little rotten dung, under a bell-glass, in stove temperature with bottom heat.

Barnadesia. *Compositæ.*

Increased by seeds, sown in spring in heat. By offsets. By cuttings made of half-ripened wood in spring, and placed in sand, under a bell-glass.

Barnardia. See Scilla.

Barosma, Parapetalifera. *Rutaceæ.*

Increased by cuttings, which root readily if taken from ripened wood and placed in a pot of sand, in a shady place in a cool house, with a bell-glass over them.

Barrenwort. See Epimedium.

Barringtonia. *Myrtaceæ.*

Increased by cuttings taken from the lateral shoots, at a joint, when the wood is ripe; place in sand and cover with a hand-glass. The cuttings should not be stripped of any of their leaves.

Bartonia. *Loaseæ.*

Increased by seeds in spring, in gentle heat. The seedlings should be potted singly into small, well-drained pots. In winter they should be placed on a dry shelf in a greenhouse or frame.

Barwood. See Baphia.

Basil (*Ocymum Basilicum* and *O. minimum*). *Labiatæ.*

Seeds, sown in a hot-bed or out-doors.

Bassia. *Sapotaceæ.*

Increased by cuttings taken from ripened wood; place in sand, under a hand-glass, in a strong, moist heat.

Basswood. See Tilia.

Bastard Balm. See Melittis.

Bastard Cedar See Cedrela.

Bastard Indigo. See Amorpha.

Batatas. See Ipomæa and Sweet Potato.

Batemannia. *Orchideæ.*

Increased by divisions and offsets.

Batschia. See Lithospermum

Bauera. *Saxifrageæ*

Propagated by cuttings placed in sandy soil under a glass

Bauhinia (Mountain Ebony). *Leguminosæ.*

Propagated by cuttings, which should be taken when the wood is neither very ripe nor very young. The leaves must be dressed off, and the cuttings planted in sand under a glass in moist heat. Also by seeds

Bay-berry. See Myrica.

Bean *Leguminosæ.*

Seeds; sow only after the weather is thoroughly settled for out-door culture.

Bean Caper. See Zygophyllum.

Bean, Sacred, or Water. See Nelumbium.

Beard-tongue. See Pentstemon.

Bear's Breech. See Acanthus.

Bear's Grass. See Yucca.

Beaucarnea. *Liliaceæ.*

Increased chiefly by seeds which have been imported from their native country. By cuttings, when obtainable.

Beaufortia, including Schizopleura. *Myrtaceæ.*

Propagated by cuttings of half-ripened shoots; place in a sandy soil under a glass, with very little heat.

Beaumontia. *Apocynaceæ.*

Increased by cuttings placed in sand in bottom heat.

Bedfordia. *Compositæ.*

Increased by cuttings, which should be dried a little before inserting them in a light soil.

Beech. See Fagus.

Beefwood. See Casuarina.

Beet (*Beta vulgaris*). *Chenopodiaceæ.*

Seeds, sown very early.

Befaria, Bejaria. *Ericaceæ.*

Propagated by cuttings of young wood, placed in sandy soil, in gentle heat.

Begonia. *Begoniaceæ.*

Increased by seeds, well ripened before they are gathered, and kept very dry until sown. For the successful raising of begonias, it is necessary to sow the seed in pans or pots of well-drained, light, sandy soil, which should be well watered before the seeds are sown. The seeds should not be covered with soil, or they will fail to germinate. Place a pane of glass over the pans, and set in a warm house or frame, where a temperature of about 65° can be maintained, and shade from the sun. As soon as the plants are large enough they should be pricked off into pans of light leaf-mould soil, in which they may remain until large enough to be placed singly in pots. By divisions of the rhizomes. Also increased by cuttings, which strike freely in pots of sand and leaf-mould, and placed on a bottom heat of about 70° Where large quantities are required, a bed of cocoanut fiber in a stove or propagating-frame may be used, and in this the cuttings may be planted, and remain until well rooted. Leaf cuttings succeed best when laid on sand or cocoanut fiber, and shaded from bright sunlight. Select old, well-matured leaves, and make an incision with a sharp knife across the principal nerves, on the under side They should then be placed on the sand or fiber, and held down by means of a few pieces of crock. Under this treatment bulbils will form on the lower ends of the nerves of each section of the leaf, and these, when large enough, may be removed from the bed and potted. Fan-shaped pieces of leaves are often used. Leaf cuttings of begonia are described and figure in Chapter IV. Species like *B. diversifolia*, etc., may be propagated by the bulblets which form in the axils of the leaves. Tuberous begonias are best propagated by seeds, as described above, but stem cuttings can be used with fair success, if they are cut just below a joint.

Bejaria. See Befaria.

Belenia. See Physochlaina.

Bellardia. See Manettia.

Bellevalia. *Liliaceæ.*

Propagated by seeds, which should be sown as soon as ripe. By offsets.

Bellflower. See Campanula.

Bellidiastrum. *Compositæ.*

Increased by divisions in early spring, or directly after blooming.

Bellis (Daisy). *Compositæ.*

Increased by seeds, which should be sown in early spring. By division after flowering, each crown making a separate plant. The soil must be pressed about them moderately firm.

Bellwort. See Uvularia.

Bellium. *Compositæ.*

Increased by seeds; also by divisions made in spring.

Beloperone, Dianthera. *Acanthaceæ.*

Propagated by young cuttings. They should be taken in spring.

Belvala. See Struthiola.

Belvisia. See Napoleona.

Bengal Quince. See Ægle.

Bennetia. See Saussurea.

Bent Grass. See Agrostis.

Benthamia. *Cornaceæ.*

Propagated by seeds sown when ripe in a cool house, or layering in autumn. By cuttings, and by grafting on the dogwood.

Benzoin (*Lindera Benzoin*). *Laurineæ.*

Seed.

Berardia. *Compositæ.*

Increased by seeds sown in spring.

Berberidopsis. *Berberideæ.*

Propagated by seeds in spring, by layering in autumn, or by young cuttings in spring.

Berberis. See Barberry.

Berchemia. *Rhamneæ.*

Propagated by layering the young shoots. By ripened cuttings, and slips of the root planted under a hand-glass.

Bergera. *Rutaceæ.*

Increased by layers or by ripened cuttings, which should be taken off at a joint and placed in sand under a hand-glass in bottom heat.

Berkheya. *Compositæ.*

The herbaceous perennials usually by divisions of the plant in spring; the other species by cuttings placed under a glass.

Bertolonia. *Melastomaceæ.*

Propagated by seeds and cuttings.

Berzelia. *Bruniaceæ.*

Increased by young cuttings inserted in sand under a bell-glass, in gentle heat.

Besleria, Eriphia. *Gesneraceæ.*

Increased by cuttings placed in heat.

Bessera. *Liliaceæ.*

Propagated by offsets.

Betonica. See Stachys.

Betula (Birch). *Cupuliferæ.*

Increased by seeds, which must be sown as soon as gathered, or else stratified. By grafting or budding upon seedling stocks of the common kinds; the former should be done in spring or late winter, and the latter in summer when the buds are ready.

Bidens (Bur Marigold). *Compositæ.*

Propagated by seeds or by divisions of the plant.

Biebersteinia. *Rutaceæ.*

Increased by seeds sown in April in a slight hot-bed. In early summer by cuttings, placed under a hand-glass.

Bigelovia. *Compositæ.*

Propagated by cuttings.

Bignonia (Trumpet Flower). *Bignoniaceæ.*

Increased by seeds or layering, or, in early spring, by cuttings made from good strong shoots with two or three joints. Place cuttings of tender sorts in a well-drained pot of sandy soil, under a bell-glass, in bottom heat. Also by seeds. *B. radicans* propagates readily from root cuttings.

Billardiera (Apple Berry). *Pittosporeæ.*

Increased by seeds, and by cuttings placed in a pot of sandy soil, under a bell-glass, in gentle heat.

Billbergia. *Bromeliaceæ.*

Propagated by suckers which are taken from the base of the plant after flowering, when they have attained a good size. The best method to adopt is as follows: Take the sucker in the hand and gently twist it off the stem; next, trim the base by the removal of a few of the lower leaves, and then insert each sucker separately in a small pot, in sharp soil. A bottom heat of about 80° will greatly facilitate new root growth; failing this, they will root freely in the temperature of a stove, if placed in a shaded position for two or three weeks, after which they will bear increased light and sunshine during the latter part of the day.

Bilberry. See Vaccinium.

Bindweed. See Convolvulus.

Biophytum. *Geraniaceæ.*

Propagated by seeds sown in spring on a hot-bed.

Biota. See Thuya.

Biotia. See Madia.

Bird of Paradise Flower. See Strelitzia.

Bird's-tongue Flower. See Strelitzia.

Birch. See Betula.

Birthwort. See Aristolochia.

Bitter Sweet. See Celastrus and Solanum.

Bitter Vetch. See Orobus.

Bivonæa. *Cruciferæ.*

Increased by seeds, which should be sown in spring where the plants are intended to remain. They should be thinned out to insure full growth.

Bixa (Arnatto). *Bixineæ.*

Propagated by seeds sown when ripe, in bottom heat, or by cuttings put in sand under a hand-glass, in heat; the latter is the better method.

Blackberry (*Rubus villosus* and vars.). *Rosaceæ.*

New varieties are obtained from seeds, which may be sown as soon as they are cleaned from the ripe fruit, or which may be stratified until the next spring. If the soil is in prime condition, fall sowing is preferable.

Varieties are multiplied by suckers and by root cuttings. The suckers spring up freely about the old plants, especially if the roots are broken by the cultivator; but they have few fibrous roots and are inferior. The best plants are obtained from root cuttings. Roots from one-fourth to three-eighths inch in diameter are selected for this purpose. The roots are dug in the fall, cut into pieces an inch or two long, and stored until early spring. They may be buried in boxes of sand after the manner of stratified seeds, or stored in a cool cellar; callusing proceeds most rapidly in a cellar. The pieces are planted horizontally an inch or two deep, in loose, rich soil. It is best to put them in a frame and give them slight bottom heat, although they will grow if planted in the open in April or May, but the plants will make much less growth the first season. Some varieties do not strike quickly without bottom heat. When the variety is scarce, shorter and slenderer pieces of root may be used, but these demand bottom heat. The heat in the frames is usually supplied by manure, or the heat of the sun under the glass may be sufficient. In these frames the cuttings can be started in the north late in March, or some six or eight weeks before the plants can be set out-doors without protection. When the weather has become somewhat settled, the plants may be planted out, and by fall they will be two to three feet high.

Black Boy. See Xanthorrhœa.

Bladder-nut Tree. See Staphylea.

Bladder-pod or **-seed.** See Vesicaria.

Bladder Senna. See Colutea.

Blakea. *Melastomaceæ.*

Increased by cuttings taken from shoots that are about ripe; plant in a pot of sand, and plunge in a moist heat, under a hand-glass.

Blandfordia. *Liliaceæ.*

Propagated by seeds and offsets, or by division of the old plants, which must be done when repotting.

Blazing Star. See Liatris.

Bleeding Heart. See Dicentra.

Blephilia. *Labiatæ.*

Increased by division of the roots in early spring.

Bletia. *Orchideæ.*

Propagated by divisions, which should be made after the plants have finished flowering, or previous to their starting into growth. These are terrestrial, and their flat, roundish pseudo-bulbs are usually under ground. They bear division well, especially *B. hyacinthina*, which may be cut up into pieces consisting of a single pseudo-bulb. (See under Orchids.)

Blood Flower. See Hæmanthus.

Blood-root. See Sanguinaria and Hæmodorum.

Blueberry. See Vaccinium.

Blue-eyed Grass. See Sisyrinchium.

Blumenbachia. *Loaseæ.*

Propagated by seeds sown in pots in spring, and placed in a gentle heat.

Blumia. See Saurauja.

Bobartia. *Irideæ.*

Propagated by separating the offsets during autumn.

Bocconia. *Papaveraceæ.*

Some species grow well from seed. By young suckers, taken from established plants during summer. Cuttings taken from the axils of the large-leaves during early summer push freely, so that they will have plenty of roots before winter sets in. Root cuttings of *B. cordata* strike freely.

Bœbera. *Compositæ.*

Increased by cuttings made of young, rather firm shoots, and placed in sand, under a glass.

Bœhmeria. *Urticaceæ.*

Increased by divisions.

Boleum. *Cruciferæ.*

Propagated by seeds sown in a pot in spring, placed in a frame or in the open border during summer.

Boltonia. *Compositæ.*

Increased by divisions of the root in March.

Bomarea. *Amaryllideæ.*

Propagated by seeds, which may be sown in a warm house. Also increased by careful division of the underground stem. In making a division it is necessary to observe that the part taken has some roots by which to live till new ones are formed.

Bombax (Silk Cotton Tree). *Malvaceæ.*

Plants raised from seeds brought from their native habitats make the best trees. Increased by cuttings, which will root readily if not too ripe. They should be taken off at a joint, and placed in sand under a bell-glass, in moist heat.

Bonapartea. See Tillandsia.

Bonjeania. See Dorycnium.

Bonnaya. *Scrophularineæ.*

The annual species by seeds, the others by divisions and cuttings.

Bonnetia. *Ternstrœmiaceæ.*

Increased by cuttings of firm, young shoots inserted in sand, under a hand-glass, in a moderate heat.

Borago. *Boragineæ.*

Propagated by seeds sown from spring or autumn in any good garden soil. Also by divisions in spring, or by striking cuttings in a cold-frame.

Borassus. *Palmeæ.*

Increased by seeds sown in a strong bottom heat.

Borbonai. *Leguminosæ*

Propagated by cuttings in spring. They should be half-ripened, and placed in a sandy soil under a bell-glass, in a cool house.

Boronia. *Rutaceæ.*

Increased by seed. By young cuttings, or those made from half-ripened wood. Place these in a thoroughly drained pot of sandy soil, with one inch of sand on the surface, and cover with a bell-glass; remove frequently and wipe dry.

Borreria. *Rubiaceæ.*

Propagated by cuttings. Those of the perennial kinds strike root readily in a light soil, in heat. The annual kinds require a similar treatment to other tender annuals.

Bossiæa. *Leguminosæ.*

Seeds should be sown on a slight hot-bed in March. Also increased by half-ripened cuttings, which should be placed in a pot of sand with a bell-glass over them, in a cool house.

Boswellia (Olibanum Tree). *Burseraceæ.*

Increased easily by cuttings in sand under a glass.

Botrychium. See Fern.

Botryanthus. See Muscari.

Bouchea. *Verbenaceæ.*

Increased during spring by cuttings, placed in sand under a glass and in a gentle heat.

Bougainvillea. *Nyctagineæ.*

Propagated by cuttings from the half-ripened wood. Place in sandy soil, in a brisk heat. Also grown from root cuttings.

Bouncing Bet. See Saponaria.

Bourbon Palm. See Latania.

Boussingaultia. *Chenopodiaceæ.*

Increased by seeds, and easily by means of the tubercles of the stem.

Bouvardia. *Rubiaceæ.*

The old plants should be cut back, placed in heat in a stove or pit, and freely syringed, which will cause them to break freely and produce a good supply of cuttings. They will root from any surface of the stem, and should be about two inches long. The cuttings should be dibbled pretty thickly into pots about five inches across A good watering must be given without wetting and thereby injuring the foliage. Plunge the pots in bottom heat of about 70° or 80°, and cover with a bell-glass. Keep moist and shady during sunshine, till rooted. They are also readily and more easily increased by root cuttings.

Bowiea. *Liliaceæ.*

Propagated by seeds or offsets.

Bowstring Hemp. See Sanseviera.

Box Elder. See Negundo.

Box Thorn. See Lycium.

Box Tree. See Buxus.

Brachychiton. *Sterculiaceæ.*

Increased by young cuttings planted in sandy soil in gentle heat.

Brachycome (Swan River Daisy). *Compositæ.*

Propagated by seeds sown in early spring in a gentle hotbed, or they may be sown thinly out-doors, late in spring.

Brachylæna. *Compositæ.*

Propagated by cuttings from the half-ripened shoots, placed in a well-drained pot of sandy soil, under a bell-glass.

Brachyrhynchos. See Senecio.

Brachysema. *Leguminosæ.*

By seeds sown in spring in heat. By layers. In summer by cuttings from the half-ripened shoots, placed in sandy soil under a bell-glass, in a gentle bottom heat.

Brachystelma. *Asclepiadeæ*

Propagated by divisions of the root, and by cuttings in a sandy soil, in heat.

Bradleia. See Phyllanthus.

Brahea *Palmæ*

Propagated by seeds in heat.

Brassia. *Orchideæ.*

Increased by dividing the plant when growth has commenced. (See under Orchids.)

Bravoa. *Amaryllideæ.*

Propagated by seeds sown as soon as ripe, and by offsets in autumn.

Bread Fruit. See Artocarpus.

Bread Nut. See Brosimum.

Breakstone. See Saxifraga.

Bredia. *Melastomaceæ.*

Increased by seeds, and by cuttings from the ripened shoots placed in sandy loam, under a hand-glass, in heat.

Brexia. *Saxifrageæ.*

Increased by cuttings, the leaves of which should not be shortened. Place in sand under a hand-glass, in heat; or a leaf taken off with a bud attached will grow.

Briza (Quaking Grass). *Gramineæ.*

Propagated by seeds, which may be sown in spring or in autumn.

Broccoli. See Cabbage.

Brodiæa, Hookera. *Liliaceæ.*

Increased by offsets, which should be left undisturbed with the parent bulbs till they reach a flowering state, when they may be divided and planted in autumn.

Bromelia. *Bromeliaceæ.*

Some are propagated by seeds. All by cuttings inserted in sand, in heat.

Bromus. *Gramineæ.*

Increased by seeds sown outside in late summer or in spring, thinning out when necessary.

Brongniartia. *Leguminosæ.*

Increased by cuttings of the young shoots, which, if firm at the base, will root in sand under a bell-glass, in a cool house.

Brosimum (Bread Nut). *Urticaceæ.*

Propagated by cuttings of ripe wood with their leaves on. Place in sand in moist heat.

Broughtonia. *Orchideæ.*

Increased by dividing the plant. (See under Orchids.)

Broussonetia (Paper Mulberry). *Urticaceæ.*

Propagated by seeds, sown when ripe or kept till the following spring; and by suckers and cuttings of ripened wood, inserted in autumn in a cool house.

Browallia. *Scrophularineæ.*

Seeds. To have blooming plants by holidays they are propagated by seeds, sown in spring or summer in pans or pots of light, rich, sandy soil, and kept in a close frame or hand-light, where they can be shaded till germination takes place.

Brownea. *Leguminosæ.*

Increased by cuttings from the ripened wood; place in sand under a hand-glass, in moist heat.

Brownlowia. *Tiliaceæ.*

Propagated by cuttings made from ripe shoots; place in sand, under a hand-glass, in heat.

Brucea. *Simarubeæ.*

Increased by cuttings from ripened wood, which will root freely in a pot of sand under a hand-glass, in moderate heat.

Brugmansia. See Datura.

Brunfelsia, Franciscea. *Scrophularineæ.*

Propagated by cuttings placed in sand under a bell-glass in moderate heat. When rooted, place in pots with a compost of loam, leaf-soil, peat and sand.

Brunia. *Bruniaceæ.*

Increased by cuttings of young shoots, which root freely in sand under a hand-light in summer.

Brunonia. *Goodenovieæ.*

Propagated by divisions in early spring before repotting.

Brussels Sprouts. See Cabbage.

Brunsvigia. *Amaryllideæ.*

Increased by offsets of considerable size. They should be potted carefully in a mixture of sandy loam and peat, with good drainage, and kept tolerably warm and close until established; water sparingly until root action has commenced. The best place for growing the offsets into a flowering size is on a shelf near the glass, in a temperature of from 50° to 55°.

Brya. *Leguminosæ.*

Propagated by seeds or cuttings placed in a hot-bed.

Bryonia. *Cucurbitaceæ.*

Propagated by seeds, or by divisions of the tuber.

Bryophyllum. *Crassulaceæ.*

Propagated by cuttings; or by simply laying the leaf on moist sand, and at each indentation upon the margin a plantlet will appear.

Bucco. See Agathosma.

Buceras. See Terminalia.

Bucida. See Terminalia.

Buckbean. See Menyanthes.

Buckeye. See Æsculus.

Bucklandia. *Hamamelideæ.*

Increased by cuttings of ripened shoots placed in sandy loam under a hand-glass, in moderate heat. Water carefully, for they are liable to rot off.

Buckthorn. See Rhamnus.

Buckwheat (*Fagopyrum esculentum* and *Tartaricum*). *Polygonaceæ.*

Propagated by seeds.

Buffalo erry. See Shepherdia.

Bugle. See Ajuga.

Bugle Lily. See Watsonia.

Bugwort. See Cimicifuga.

Bulbine *Liliaceæ.*

Increased—the bulbous rooted species by offsets, and the herbaceous sorts by suckers and divisions. Also by cuttings.

Bulbocodium. *Liliaceæ.*

Increased by offsets in a rich, sandy loam. Take up the bulbs, divide and replant them every second year, handling in autumn and renewing the soil or planting in new positions.

Bulbophyllum, Anisopetalum, Bolbophyllum, Tribrachium. *Orchideæ.*

Propagated by division of the pseudo-bulbs.

Bulbospermum. See Peliosanthes.

Bullrush. See Typha and Juncus

Bumalda. See Staphylea.

Bunchosia. *Malpighiaceæ.*

Propagated by cuttings of ripened shoots, placed in sand under a bell-glass, in moist bottom heat. Good drainage is essential.

Buphthalmum (Ox-eye). *Compositæ.*

Propagated in spring or autumn by divisions.

Bupleurum (Hare's Ear). *Umbelliferæ.*

The annuals by seeds sown in spring out-doors; the herbaceous perennials may be increased by divisions made in autumn or spring, and the greenhouse species by cuttings made in spring.

Burchardia. *Liliaceæ.*

Propagated by offsets or divisions made just previous to potting in spring. It is best to repot annually. Good drainage should be allowed, and the plant must not be potted too firmly.

Burchellia. *Rubiaceæ.*

Increased by cuttings, not too ripe, planted in sand and placed under a hand-glass, in a gentle heat.

Burgsdorffia. See Sideritis.

Burlingtonia. *Orchideæ.*

Increased by dividing the plant. (See under Orchids.)

Burnet. *Rosaceæ.*

Propagated by seeds and division.

Burning Bush. See Euonymus.

Bursaria. *Pittosporeæ.*

Increased by young cuttings put in sand under a bell-glass, with a little bottom heat.

Bursera. *Burseraceæ.*

Propagated by cuttings placed under a bell-glass, with bottom heat.

Burtonia. *Leguminosæ.*

Some of the species produce seed in abundance, and these form the best means of increase. By young cuttings, which root freely in sandy soil in a cool house, with a bell-glass over them.

Butcher's Broom. See Ruscus.

Butomus (Flowering Rush). *Alismaceæ.*

Increased by seeds, or by divisions of the roots in spring.

Buttercup. See Ranunculus.

Butternut. See Juglans.

Butterwort. See Pinguicula.

Button-wood. See Platanus.

Buxus (Box Tree). *Euphorbiaceæ.*

Propagated by seeds sown as soon as ripe, in any light, well-drained soil. They can be increased by suckers and divisions; by layers of young or old wood, made in autumn or early spring; by cuttings made of the young shoots, from four to six inches in length, in a sandy place in spring or fall. The latter method is the better way in this country, and in the north the cuttings should be handled under glass.

Byrsonima. *Malpighiaceæ.*

Increased by cuttings of half-ripened shoots in sand under a hand-glass, in moist bottom heat.

Cabbage (*Brassica oleracea*, and vars.). *Cruciferæ.*

Seeds. They may be sown in the open ground in spring, or in the fall and the young plants wintered in a cold-frame, or in a hot-bed or forcing house in late winter and spring. Brussels sprouts, broccoli and cauliflower are treated in the same manner.

Cabbage Palm. See Areca.

Cabomba. *Nymphæaceæ.*

Propagated by root divisions.

Cacalia. See Senecio.

Cacao. See Theobroma.

Cactus. *Cacteæ.*

Propagation by seeds is not often adopted, as it is a very slow method. The seeds should be sown in very sandy soil, and placed in a semi-shady position until germination commences, when they may be exposed and very carefully watered. Usually propagated by cuttings or offsets, which should be made with a sharp cut, and laid upon a sunny shelf or on dry sand until the wound is healed and roots emitted, when they should be potted in sandy soil. Place with the others, and keep syringed. Grafting is resorted to with weak kinds, which will not grow freely except upon the stock of a stronger species; and by this means, also, such kinds can be kept from the damp soil, which frequently causes decay. The stocks usually employed are those of *Cereus tortuosus*, *C. peruvianus*, *Pereskia aculeata*, etc., according to the species intended for working; they readily unite with each other. If the scion and stock are both slender, cleft-grafting should be adopted; if both are broad it is best to make horizontal sections, placing them together and securing in proper position by tying with matting, but not too tightly, or the surface may be injured.

Cæsalpinia. *Leguminosæ.*

Increased by cuttings, which are somewhat difficult to root, but may succeed if taken from the plant in a growing state and planted in sand with a hand-glass over them, in heat.

Cajanus. *Leguminosæ.*

Plants are usually raised from seeds obtained from the West Indian Islands and India. Also grown from young cuttings, put in sand with a hand-glass over them, in heat.

Cakile (Sea Rocket). *Cruciferæ.*

Propagated by seeds sown in spring.

Caladium. *Aroideæ.*

Increased by tubers, which have been kept dry or rested for some time. Place in small pots in a stove or pit, where the night temperature is maintained from 60° to 65°, and syringed daily once or twice at least. Large tubers, if sound, may be divided and the pieces potted. Some also by cuttings.

Calamagrostis. *Gramineæ.*

Increased by seeds sown in autumn or spring. *C. arenaria* (now *Ammophila arundinacea*), used for holding sands along sea-shores, is propagated by division and can probably be handled easily by root-cuttings

Calamintha. *Labiatæ.*

Increased by seeds, root divisions, or cuttings in spring.

Calamus. *Palmeæ.*

Increased by seeds.

Calandrinia. *Portulacaceæ.*

Increased by seeds sown in pots where they are intended to flower, as transplantation, unless performed with more than ordinary care, will check their growth or result in loss.

Calanthe. *Orchideæ.*

As a rule, the natural annual increase in the number of pseudo-bulbs meets the requirements of most cultivators. Where a quick propagation is desired, it may be performed by dividing the pseudo-bulbs transversely; after allowing the raw surface to callus, the upper part should be set on moist sand, and several buds will form around the base. The bottom portion may be used in the ordinary way. Another plan is to divide the pseudo-bulbs lengthwise into two or more pieces. (See under Orchids.)

Calathea. *Scitamineæ.*

Increased by division in summer or any time between that and the spring months. When making divisions, see that each crown is well furnished with roots.

Calceolaria (Slipperwort). *Scrophularineæ.*

Herbaceous kinds increased by seeds sown from June to August on pans of light, sandy soil, which should be soaked with water before sowing. Care must be taken to make the surface of the soil level, and also to sow the seed as evenly as possible. It is better not to cover with soil, but a sheet of glass should be laid over the pan, which must be placed in a shady part of the greenhouse or cold-frame until the young plants show the first leaf. The glass can then be gradually removed. The shrubby kinds, by seeds and by cuttings in August. Place in a cold-frame facing the north, in sandy soil, and when rooted, pot off into 3-inch pots. Place in a light, sunny frame, where they may remain until the middle of February.

Caldcluvia. *Saxifrageæ.*

Propagated by cuttings of the half-ripened shoots planted in sand under a hand-glass, and placed in a very gentle bottom heat.

Calectasia. *Juncaceæ.*

Propagated by divisions.

Calendula (Marigold). *Compositæ.*

Increased by seeds and by cuttings, which thrive well in a compost of loam and peat.

Caliphruria. *Amaryllideæ.*

Propagated by bulbels. After flowering, the plants should have a slight heat, and when starting into new growth should be repotted.

Calliandra. *Leguminosæ.*

Increased by cuttings of rather firm young wood, in sand under a hand-glass, in heat.

Calla. See Richardia.

Callicarpa, Porphyra (French Mulberry). *Verbenaceæ.*

Propagated by seeds, divisions or by cuttings of the young shoots, with the same treatment as Fuchsia.

Callichroa. *Compositæ.*

Increased by seeds sown in spring in a slight hot-bed, and placed in the open border later; or if sown out-doors it will still flower in the autumn.

Callicoma. *Saxifrageæ.*

Propagated by half-ripened cuttings, placed in sandy soil under a hand-glass.

Calligonum, Pallasia, Pterococcus. *Polygonaceæ.*

Increased by cuttings, which will root in spring or autumn if placed under a hand-glass.

Calliprora. *Liliaceæ.*

Propagated by offsets, which should not be removed from the parent bulbs until they are of good size.

Callipsyche. *Amaryllideæ.*

Propagated by seeds and bulbels.

Callirhoe (Poppy-Mallow). *Malvaceæ.*

Perennials by seeds, divisions of roots, and cuttings; the annuals by seeds only. Cuttings should be started in sandy soil in a frame.

Calliopsis. See Coreopsis.

Callistachys. See Oxylobium.

Callistemon. *Myrtaceæ.*

Increased by seeds, and by ripened cuttings in sand under a glass.

Callistephus, Callistemma (China Aster). *Compositæ*

Propagated by seeds, which should be sown under cover in spring, or seeds for late plants may be sown in the open.

Callitris, Frenela. *Coniferæ.*

Increased by seeds, or by cuttings inserted under a hand-light in autumn, and wintered in a cold pit.

Calluna (Heather). *Ericaceæ.*

Propagated by cuttings of the tender shoots inserted in pure sand under glass in a cool house in autumn

Calochortus (Mariposa Lily). *Liliaceæ.*

Propagated by seeds, offsets, and by the tiny bulblets on the upper portion of the stem. Sow seeds as soon as ripe, or early in the year, thinly in pans, so that the young plants may pass a second season in the seed pots on pans. Place in a cool house or frame, and keep the plants close to the glass during their early stages, as they are very liable to damp off. Early the third season pot off and plant singly, encouraging them to grow freely. The offsets are best removed when the plants are in a dormant state, placed in pots or pans, or planted out in pits or frames until they reach flowering size.

Calodendron. *Rutaceæ.*

Increased by cuttings of half-ripened wood placed in sand under a glass, in gentle bottom heat.

Calophaca. *Leguminosæ.*

Propagated by seeds. May be grafted on the common laburnum.

Calophanes. *Acanthaceæ.*

Propagated by division of the roots in spring or fall.

Calophyllum. *Guttiferæ.*

Increased by cuttings made from the half-ripened shoots, which root freely in sand, if placed under a glass in bottom heat.

Calopogon. *Orchideæ.*

Increased by offsets taken from the tuberous roots.

Calothamnus. *Myrtaceæ.*

Increased by cuttings of young wood, firm at the base. Place in sand and cover with a hand-glass.

Calotis. *Compositæ.*

Increased by divisions of the root.

Calotropis. *Asclepiadeæ.*

Propagated by young cuttings thinly dibbled in a pot of sand, placed under a hand-glass in heat. They must not receive too much moisture, or they will rot.

Caltha (Marsh Marigold). *Ranunculaceæ.*

Propagated by seeds sown as soon as ripe, or by dividing the roots in early spring, or in summer after flowering.

Calycanthus (Sweet-scented Shrub Allspice). *Calycanthaceæ.*

Increased by seeds sown in a cold-frame ; by divisions or offsets, and by layers put down in summer.

Calycophyllum. *Rubiaceæ.*

Propagated by cuttings of half-ripe shoots, which will root in sand, if placed under a bell-glass, in bottom heat.

Calypso. *Orchideæ.*

Increased by offsets.

Calyptranthes. *Myrtaceæ.*

Propagated by layers, or by cuttings placed in heat.

Calystegia (Hedge Bindweed, Bearbind). *Convolvulaceæ.*

Propagated by seeds sown in spring, or by dividing the plants.

Calythrix. *Myrtaceæ.*

Increased by cuttings of the young shoots placed in sand, under a bell-glass in a cool house, in late spring.

Camassia, Sitocodium. *Liliaceæ.*

Propagated by seeds sown in a warm situation out-doors, or in pots or boxes under glass. The young plants should remain at least two years in the seed beds. Also increased by offsets, which are produced very freely, and should be removed either when in a dormant condition, or just previously to starting into fresh growth, and arranged in clumps or lines, placing a little sand about them.

Cambessedesia. *Melastomaceæ.*

Propagated by half-ripened cuttings, which root freely in a mixture of peat and sand, if placed under a glass, in heat.

Camellia, including Thea (Japanese Rose). *Ternstrœmiaceæ.*

The single red camellia by either seeds, layers or cuttings. Double and variegated camellias by layers, but cuttings will succeed. Seeds give suitable stocks on which to inarch or graft the rarer kinds. The ripened shoots of the preceding summer should be taken off in August. Two or three of the lower leaves should be removed, and the cuttings planted firmly in the soil with a dibble. The pans containing the cuttings should be kept in a plant or cold-frame, without being covered with glass, but shaded during bright sunshine. In the following spring, such as have struck will begin to push, when they need to be placed in a gentle heat. Inarching or grafting is done in early spring, as soon as growth commences.

Camœnsia. *Leguminosæ.*

Increased by cuttings, which will root in sandy loam, if placed under a bell-glass.

Camomile. See Anthemis.

Campanula (Bell-flower, Slipperwort). *Campanulaceæ.*

Increased by seeds. The perennials are also propagated by dividing the roots, or by young cuttings in spring.

Campanumæa. *Companulaceæ.*

Propagated by seeds and divisions.

Camphora (Camphor-tree). *Laurineæ.*

Increased by cuttings and seeds.

Campion. See Silene.

Camptopus. *Rubiaceæ.*

Propagated by cuttings in sandy loam under a glass, in bottom heat.

Canarina, Pernettya. *Campanulaceæ.*

Propagated by divisions when repotted or by young cuttings in a sandy soil, in gentle warmth.

Candollea. *Dilleniaceæ.*

Increased sometimes by seeds, but usually by cuttings, which will root if placed under a hand-glass in a compost of equal parts loam and peat, with enough sand to render the whole porous.

Candytuft. See Iberis

Canella. *Canellaceæ.*

Increased by well-ripened cuttings taken off at the joint. They will root in sand under a hand-glass, with bottom heat, in spring; but care should be taken not to deprive them of any of their leaves.

Canna (Indian Shot). *Scitamineæ.*

Propagated by seeds sown in heat in late winter. The seeds are very hard, and germination will be materially stimulated if they are soaked in tepid water for twenty-four hours. They should be sown thinly in pans (a mixture of sand and leaf-loam is best for them), and a covering of one and one-half or two inches of earth is not excessive. It is a good plan to sow the seed singly in small pots. Also increased by divisions; they form a root-stock, each portion of which, with bud and roots attached, may be converted into an independent plant.

Cannabis (Hemp). *Urticaceæ.*

Propagated by seeds sown in spring.

Cantua, Periphragmos. *Polemoniaceæ.*

Increased by cuttings placed in sand under glass.

Capparis (Caper-tree). *Capparideæ.*

Propagated by cuttings of ripe shoots, which will root in sand under glass, in moist heat.

Caprifolium. See Lonicera.

Caragana (Siberian Pea-tree). *Leguminosæ.*

Propagated by seeds and by root cuttings; the low-growing shrubs by seeds and layers. Caraganas are generally increased by grafting on *C. arborescens*, which is easily raised from seeds, sown when ripe or in spring.

Carapa. *Meliaceæ.*

Increased by ripe cuttings, which will root in sand under glass, in a moist heat.

Cardamine, including Pteroneurum (Lady's Smock). *Cruciferæ.*

Seeds. Propagated easily by division after flowering.

Cardinal-flower. See Lobelia.

Carduncellus. *Compositæ.*

Seeds. Increased by divisions of the roots.

Carex (Sedge). *Cyperaceæ.*

Propagated by seeds, or by divisions. Seeds often lie dormant the first year.

Careya. *Myrtaceæ.*

Propagated by division, or by ripened cuttings, which root freely if planted in sand under a hand-glass, and placed in moist bottom heat.

Carica (Papaw-tree). *Passifloreæ.*

Propagated by cuttings of ripe shoots with their leaves on. They root readily in a sandy soil, and in a gentle bottom heat.

Carissa. *Apocynaceæ.*

Increased by cuttings of ripe wood placed in sand under glass, in bottom heat.

Carlina. *Compositæ.*

Increased by seeds sown in spring. With difficulty by divisions.

Carmichælia. *Leguminosæ.*

Propagated by cuttings of half-ripened side shoots in sand under a glass, in a cool house in late spring.

Carnation. *Caryophylleæ.*

By propagating by seed, new and excellent varieties are raised. Sow the seeds in April or May, and in a slight hot-bed or in a greenhouse. Also propagated by layering, which should be done at the end of July or the beginning of August. The shoots selected should be denuded of a few of their leaves at the base of the young wood, and a slit must be made from this point upwards, extending through a joint of the bare stem, so that a tongue is formed.

Increased also by cuttings. It is necessary to have a slight bottom heat, and on it put four or five inches of light soil, covered with clean sand. The cuttings must be long enough to have a tolerably firm base, and they must either be taken with a heel or cut off at a joint, and firmly inserted in the soil. This is the ordinary method. See Fig. 52, *b*.

Carob, Algaroba, or St. John's Bread (*Ceratonia siliqua*). *Leguminosæ.*

Stocks are obtained by seeds. The seeds are often treated to scalding water before sowing, in the same manner as locust seeds. Varieties are grafted or budded on the seedlings, or they may be multiplied by means of hard-wood cuttings in frames.

Carpinus (Hornbeam). *Cupuliferæ.*

Increased by seeds, which vegetate irregularly. Varieties propagated by budding or grafting.

Carpodinus. *Apocynaceæ.*

Propagated easily from cuttings of half-ripened shoots.

Carrion Flower. See Stapelia.

Carthamus (Safflower). *Compositæ.*

Increased by seeds sown in a gentle heat in spring.

Carya. See Hickoria.

Caryocar, Rhizobolus (Butternut). *Ternstræmiaceæ.*

Increased by ripened cuttings, which will root in sand in heat.

Caryophyllus (Clove-tree). *Myrtaceæ.*

Increased by cuttings of firm shoots with the leaves left on. These will root if planted in sand in a moist heat.

Caryopteris. *Verbenaceæ.*

Propagated by seeds, by divisions, or by cuttings.

Caryota. *Palmeæ.*

Increased easily by seeds or by suckers.

Cashew. See Anacardium.

Casimiroa. *Rutaceæ.*

Increased readily by seeds.

Cassandra (Leather Leaf). *Ericaceæ.*

Propagated by seeds very carefully sown, or by layers.

Cassava (*Manihot Aipe*). *Euphorbiaceæ.*

Propagated by cuttings of the stem and by suckers. Cut the large main stalks into pieces from four to six inches long and set them perpendicularly into the ground in the field. The cuttings can be struck at various times, but spring is usually preferred. The stalks can be kept over winter by covering with sand on a dry knoll, placing the stalks and sand in layers. Cover the whole with boards to shed the water. Suckers which appear during summer can be removed and planted or made into cuttings.

Cassia. *Leguminosæ.*

Annuals and biennials by seeds, which must be sown in spring, in a gentle heat. The shrubby species by cuttings of half-ripened shoots, which will root in heat at about the same time of the year. *C. Marylandica* also by division.

Cassine. *Celastrineæ.*

Increased by ripened cuttings, which will readily strike root if planted in a pot of sand with glass over them.

Cassinia. *Compositæ.*

Annuals by seeds. The herbaceous and shrubby kinds are increased in spring by dividing the roots, or by cuttings of half-ripened shoots placed in sand.

Castalia. See Nymphæa.

Castor Bean. See Ricinus.

Casuarina (Beefwood). *Casuarineæ.*

Propagated by seeds, or by cuttings made of half-ripened shoots, placed in sand under glass.

Catalpa. *Bignoniaceæ.*

Increased by seeds, and by cuttings made of the ripe wood. The named varieties and *C. Bungei* are propagated by soft cuttings in June and July. Grafts are also used.

Catananche. *Compositæ.*

Increased by seeds, which should be sown in spring. Also by division.

Catchfly. See Silene.

Catesbæa (Lily Thorn). *Rubiaceæ.*

Propagated by cuttings planted in sand in spring, and plunged in heat.

Catmint. See Nepeta.

Catnip or **Catmint** (*Nepeta Cataria*). *Labiatæ.*

Seeds. Division.

Cat's Tail. See Typha.

Cattleya. *Orchideæ.*

Increased by the pseudo-bulbs. (See under Orchids.)

Cauliflower. See Cabbage.

Caulophyllum. *Berberideæ.*

Propagated by divisions of the roots, made in early spring or after flowering. Also by seeds.

Ceanothus. *Rhamneæ.*

Increased by layers, which is the readiest way of obtaining strong plants, or by cuttings, which should be inserted in a cold-frame.

Cecropia (Snake Wood). *Urticaceæ.*

Propagated by cuttings of ripened shoots. Place in sandy peat in a moist bottom heat.

Cedar. See Cedrus.

Cedrela (Bastard Cedar). *Miliaceæ.*

Increased by large ripened cuttings, placed in sand, in heat.

Cedronella. *Labiatæ.*

The herbaceous species by division of the roots or by cuttings of young wood. *C. triphylla* by cuttings.

Cedrus (Cedar). *Coniferæ.*

Increased by seeds, which are difficult to extract from the cones. Gather the cones in spring, and sow the seeds immediately in pans. Varieties are propagated by veneer grafts.

Celastrus (Staff-tree, Bitter-sweet). *Celastrineæ.*

Propagated by seeds and suckers, also by layering the hardy species in autumn. Ripened cuttings will root freely in a compost of loam, peat and sand.

Celery. (*Apium graveolens*). *Umbelliferæ.*

By seeds, as described on page 12; or, for the early crop, sow under glass, as in a hot-bed.

Celosia (Cockscomb). *Amarantaceæ.*

Propagated by seed sown in spring, in pans of well-drained, rich, sandy soil or in the open.

Celsia. *Scrophularineæ.*

Increased by seeds, which may be sown in the open border and thinned out for flowering, or raised in nursery beds and transplanted. *C. Arcturus* should be increased by cuttings, the young wood striking freely in a cool house or frame.

Celtis (Nettle-tree). *Urticaceæ.*

Increased by seeds, which should be sown as soon as ripe. By layers, and by cuttings of ripened shoots in autumn.

Centaurea. *Compositæ.*

Annuals by seeds, which may be sown in the open border. To propagate *C. Cineraria*, and some others sow seeds in August in slight heat, or make cuttings about the beginning of September.

Centranthus. *Valerianeæ.*

Increased by seeds sown in spring.

Centronia. *Melastomaceæ.*

Propagated by cuttings of half-ripened shoots, which should be inserted in peat and sand, under glass.

Centropogon. *Campanulaceæ.*

Increased by seeds, by divisions and by cuttings from any young shoots three or four inches long. Take off with a heel and place in sharp sandy soil, close around the edge of the pot, and then keep close under a propagating box, in a temperature ranging between 60° and 70°.

Cephælis. *Rubiaceæ.*

Increased by cuttings of firm young shoots, which will root well in sandy soil under a hand-glass, in moist stove heat.

Cephalanthus (Button-wood). *Rubiaceæ.*

Seeds. Propagated by layers or ripened cuttings in autumn.

Cephalotus. *Saxifrageæ.*

Propagated by seeds, or by divisions before new growth commences. Also by offsets.

Cerastium. *Caryophylleæ.*

Propagated by seeds and divisions, or by cuttings inserted in the open ground in a shady place, after flowering.

Ceratiola. *Empetraceæ.*

Increased by seeds and by cuttings, which should be placed in sandy soil under glass.

Ceratonia (Algaroba Bean, Carob Tree). *Leguminosæ.*

Increased by ripened cuttings, which will root if planted in sand under a frame.

Ceratozamia. *Cycadaceæ.*

Increased by seeds, and sometimes by suckers and divisions; but imported plants give most satisfaction.

Cercidiphyllum. *Leguminosæ.*

Propagated by tender cuttings made during the summer, and slightly wilted before placing in the frames.

Cercis (Judas-tree). *Leguminosæ.*

Propagated by seeds, sown about the end of March on a bed of light soil, in a gentle heat. They may also be increased by layers, but plants raised from seeds thrive best. It is not necessary to stratify the seeds. *C. Japonica* is grown from soft cuttings in early summer.

Cereus. See Cactus.

Ceropegia. *Asclepiadeæ.*

Propagated by cuttings of small side shoots made in spring, which will root in sand, in heat, with or without a glass covering.

Cestrum, including Habrothamnus. *Solanaceæ.*

Propagated by cuttings in August, the same being potted off as frequentiy as the roots reach the sides of the pots.

Chænostoma. *Scrophularineæ.*

Increased by cuttings, which may be made in autumn and placed in a greenhouse or cold pit during the winter.

Chætogastra. *Melastomaceæ.*

Increased by seeds sown in March, or the perennials by cuttings in sandy peat.

Chamæbatia. *Rosaceæ.*

Propagated by cuttings, which should be struck in sand in a cold-frame.

Chamæcyparis. *Coniferæ.*

Propagated by seeds freely, also by layers, but mainly by cuttings put in during October. Select young side shoots with a heel ; insert in well-drained pots of sandy soil, and place in a close cold-frame, keeping fairly moist through the winter. In February they should be calloused, and should be placed in gentle heat, where they will root freely.

Chamæranthemum. *Acanthaceæ.*

Propagated by cuttings of young shoots, which will root in spring if planted in sand and placed in heat.

Chamærops, including Corypha, Taliera. *Palmæ.*

Increased by seeds, or by suckers, which generally appear in considerable quantities.

Chard. See Beet.

Cheilanthes. See Fern.

Chelone (Turtle Head). *Scrophularineæ.*

They may be increased by means of seeds. Also by dividing the plant during fall. Young cuttings inserted in sandy soil in a cold-frame grow well.

Cherry (*Prunus Avium and P. Cerasus*). *Rosaceæ.*

Cherry stocks are commonly grown from seeds. If the ground is in readiness and is in proper condition, the seeds may be planted in fall, or even as soon as they are ripe. If stored until spring, they must be stratified and kept very cool to prevent germination, and they should be sown at the earliest possible moment. They do not need to be cracked by hand. Care must be taken that cherry pits do not become hard and dry. This precaution is more important with cherries than with peaches and plums. At the close of the first season the seedlings will be a foot or foot and a-half high, large enough to transplant into nursery rows after the manner of apples, where they are budded the following season. In warm climates the pits are sometimes cracked as soon as they are gathered, and the "meats" planted immediately. They will then make stocks fit for grafting the following winter, or for transplanting and budding the following summer. Cherry seeds must never be allowed to become so dry that the meat is hard and brittle.

Cherries, in common with other stone fruits, grow readily from root cuttings, in the same manner as blackberries. They do better if started over a gentle heat.

The Mazzard cherry is the stock upon which cherries are nearly always worked. It is simply a hardy and vigorous variety, with inferior fruit, of the common sweet cherry (*Prunus Avium*). Seeds of this are readily procured in this country. All varieties of cherries are worked readily upon it. The Mahaleb cherry is used as a stock for nearly all varieties when dwarf trees are desired. This is a distinct species, *Prunus Mahaleb*. The seeds or stocks are usually imported. This stock is adapted to heavy clay soils, while the Mazzard is not. The Mahaleb is not generally used in this country.

Morello (*Prunus Cerasus*) stocks will no doubt prove to be valuable in the northwest, where great hardiness is demanded. Seedlings do not sprout or sucker badly, but the natural suckers, which are sometimes used for stocks, are likely to be more troublesome in this respect. If strong-growing tops are worked on Morello stocks, however, there is usually little annoyance from suckering.

It is probable that some of the native American cherries can be used as stocks. The common wild red, pin or bird cherry (*Prunus Pennsylvanica*) has already been used to some extent. The sweet and sour cherries unite readily with it, and bear very early. It is yet to be determined how long the trees will persist, but there are trees known which are sixteen or eighteen years old, and which are still healthy and vigorous. The dwarf or sand cherry (*Prunus pumila*), especially the western form of it, gives promise as a dwarf stock.

Cherry stocks are worked both by budding and grafting. Budding is the common method. The stocks should be fit to work the season they are transplanted, or in the second summer from seed. Such as are too small for working then may be allowed to stand until the following year.

In the west, where great hardiness is required, the varieties are crown-grafted upon Mazzard stocks in winter. Yearling stocks are used, and the cions are from six to ten inches long. When planted, only the top bud should be left above ground. The cion strikes roots, and own-rooted trees are obtained.

The ornamental cherries are worked upon the same stocks as the fruit-bearing sorts. Mazzard is commonly used for all species.

Chervil (*Chærophyllum bulbosum* and *Scandix Cerefolium*). *Umbelliferæ.*

Seeds, sown much the same as celery seeds, but the plants are usually allowed to stand where sown. Seed is often sown in autumn.

Chestnut (*Castanea sativa* and var. *Americana*, and *C. Japonica*). *Cupuliferæ.*

Chestnut stocks are grown from seeds. Difficulty is sometimes experienced in keeping the seeds, as they lose their vitality if dried too hard, and are likely to become mouldy if allowed to remain moist. The surest way is to allow the nuts to become well dried off or "seasoned" in the fall, and then stratify them in a box with three or four times as much sand as chestnuts, and bury the box a foot or two deep in a warm soil until spring. They do not always keep well if stored or stratified in a cellar. Fall planting exposes the nuts to squirrels and mice. American stocks are probably better than European.

The stocks are worked by whip-grafting above ground, the wound being well tied and protected by waxed cloth. Care should be taken to have the stock and cion about the same size, in order to secure a good union. Crown-grafting, root-grafting and budding have not been very successful in this country upon the chestnut. The cions should be cut early, before they begin to swell, and kept dormant until the stock begins to push into leaf. Only vigorous stocks should be grafted. The best results are obtained when the stocks have recovered from transplanting, or when they are from three to five years old. The working of chestnut stocks is far from satisfactory in a commercial way. The union is imperfect in many varieties, and usually no more than half the grafts take well.

Chicory (*Cichorium Intybus*). *Compositæ.*

Seeds, sown in spring where the plants are to grow.

Chilopsis (Desert Willow). *Bignoniaceæ.*

Increased by seeds, or by cuttings of half-ripened shoots in sand under a bell-glass, in a gentle bottom heat.

Chimonanthus. *Calycanthaceæ.*

Propagated by layering in the autumn.

China Aster. See Callistephus.

Chiococca (Snowberry). *Rubiaceæ.*

Propagated by cuttings, which strike root freely in sand under a hand-glass, in heat.

Chionanthus (Fringe-tree). *Oleaceæ.*

Increased by seeds, which should be started in a cold-frame. By layers and cuttings. By grafting or budding it on the common ash, it succeeds very well.

Chionodoxa. *Liliaceæ.*

Propagated by seeds, which are produced freely. They should be sown as soon as ripe. By bulbels.

Chironia. *Gentianeæ.*

Increased by seeds, and by cuttings inserted in sandy soil, and placed in a gentle heat in spring.

Chives or **Cives** (*Allium Schœnoprasum*). *Liliaceæ.*

Division of the clumps.

Chloanthes. *Verbenaceæ.*

Propagated by cuttings of young shoots, which root freely in sandy soil under glass.

Choisya. *Rutaceæ.*

Increased by ripened cuttings.

Chrysanthemum. *Compositæ.*

Increased by seeds to obtain new varieties; these should be sown in spring. Division may be made, but this is not often practiced. Usually propagated by cuttings of firm, healthy, short-jointed shoots, about three inches long. They should be made in spring, and placed near the glass of a rather close frame having a temperature of about 45°. No bottom heat should be given. If inserted in pots, only the lower leaf should be removed; if in beds the remaining foliage should also be trimmed to admit air. The soil should be made of equal parts of sand, leaf-mould and loam, spreading a layer of sand over the top. Insert about one-half of the cutting, press the soil firmly, and water. Leaf cuttings have been employed. Inarching and grafting may also be performed.

Chrysobalanus (Coco Plum) *Rosaceæ.*

Increased by seeds when procurable. Large cuttings, however, taken off at a joint without shortening any of their leaves, will root readily if planted thinly in a pot of sand, and placed in moist heat with a bell-glass over them.

Chrysocoma (Goldy-locks). *Compositæ.*

Propagated by seeds, or by cuttings of half-ripened shoots, placed in sand under glass.

Chrysogonum. *Compositæ.*

Seeds. Increased by dividing the roots in spring.

Chrysophyllum (Star Apple). *Sapotăceæ.*

Increased by seeds when procurable. By cuttings of small well-ripened shoots, plunged in strong, moist heat.

Chrysopsis. *Compositæ.*

Seeds. Propagated by division in spring.

Chrysosplenium (Golden Saxifrage). *Saxifrageæ.*

Increased easily by division. Also occasionally by seeds.

Cicca (Otaheite Gooseberry). *Euphorbiaceæ.*

Seeds. By cuttings of ripe shoots, which will root in sand, if placed under a glass and in bottom heat.

Cimicifuga (Bugwort). *Ranunculaceæ.*

Increased by seeds, sown in a cold-frame or border as soon as ripe; or by division of the roots in spring.

Chinchona (Peruvian Bark). *Rubiaceæ.*

Imported seeds, and cuttings taken off when ripe and planted in a pot of sand, under glass, in a moist heat.

Cineraria. *Compositæ.*

Seeds should be sown under glass; those intended for autumn flowering in April and May, those for spring in July and August. Light leaf-mould should be used, and about an equal quantity of fresh sifted loam and sharp sand added, the whole being well mixed. Old cow-manure is a good medium in which to sow (see page 19); then fill up with fine soil. Also by divisions and by cuttings.

Cinquefoil. See Potentilla.

Cipura. *Irideæ*

Propagated by seeds, which should be sown in a slight heat in spring; or by bulbels, which are abundantly produced.

Circæa (Enchanter's Nightshade). *Onagrarieæ.*

Seeds; also by the running roots.

Cissampelos. *Menispermaceæ.*

Propagated by cuttings, which root readily in heat.

Cissus. *Ampelideæ.*

Propagated by cuttings in the spring. Choose the weakly shoots that are pruned just before the plants break into new growth, or allow the young shoots to grow to a length of about two inches. Then cut them off, with a small piece of the base branch adhering to the young wood; or the shoots may be cut off with one or several of these young branchlets on them. Cut the old branch through at the base of each young one, and insert the cutting with this heel of the old wood entire. In this country, usually grown from common green cuttings in summer.

Cistus (Rock Rose). *Cistineæ.*

Propagated by seeds, by layers or cuttings under frames outside, or inside with a gentle bottom heat; but seedlings always make the best plants. The seeds should be sown early in the spring in pans or boxes in a frame, and lightly covered with sifted sandy mould. Cuttings should be made from three to four inches long. They may be struck in spring or autumn, in sandy peat under glass

Citron (*Citrus medica*). *Rutaceæ.*

Seeds, which usually reproduce the kind. Mature cuttings, the same as lemon. Also budded on orange, lemon or lime stocks.

Citrus. *Rutaceæ.*

Increased by seeds, layers, cuttings, inarching, grafting and budding. For particular methods, see Lemon, Lime, Orange and Pomelo.

Cladrastis (Yellow-wood). *Leguminosæ.*

Propagated by seed sown in the open air in spring, or by cuttings of the roots.

Clarkia. *Onagrariæ.*

Increased by seeds, which may be sown in spring or autumn out-doors.

Clavija, Theophraste. *Myrsineæ.*

Propagated by cuttings of half-ripened shoots. These will root in sandy loam, with a surface consisting wholly of sand, if placed in bottom heat.

Clematis (Virgin's Bower). *Ranunculaceæ.*

Clematis may be increased by seeds. The seed vessels should be gathered before autumn, and stored in some dry, cool place till the following spring, when the seeds they contain may be sown in light, sandy soil, and placed in gentle heat till they germinate. By layers outside, put in at any time. All the varieties of clematis may also be readily increased by cuttings made of the young shoots, which may be cut up to every eye and planted in gentle heat. Also by grafting any of the varieties on portions of clematis roots in winter. Good healthy pieces of root obtained from old plants answer the purpose well. See also Atragene.

Cleome. *Capparideæ.*

Increased by seeds sown in a frame in spring, with slight warmth. Ripened cuttings root freely in moderate heat.

Clerodendron, Ovieda, Siphonantha, Volkameria. *Verbenaceæ.*

Increased by seed, which, if sown when ripe or in the spring, and grown on in heat, may be converted into flowering plants the second season. Propagated also by cuttings of both green and mature wood; also of roots. Suckers. The climbing varieties do not root quite so readily from cuttings as the others, but cuttings of the ripened wood do well.

Clethra. *Ericaceæ.*

Propagated by seeds, divisions and layers. Cuttings taken from the half-ripened wood will root in gentle heat.

Clianthus (Glory Pea, Parrot Beak). *Leguminosæ.*

C. Dampieri is best raised from seeds, which should be sown singly in good-sized pots, when the necessity of first shifting will be obviated. *C. puniceus* and others from cuttings, which strike easily in sand in bottom heat.

Clintonia. *Liliaceæ.*

Propagated by seeds and by division of the root in spring.

Clitoria *Leguminosæ.*

The best method of increasing is by seeds. Increased also by cuttings of stubby side shoots, which will root in sandy soil, in heat.

Cliva, Imantophyllum. *Amaryllideæ.*

Propagated by seeds or divisions.

Clove-tree. See Caryophyllus.

Clusia (Balsam-tree). *Guttiferæ.*

Increased by cuttings of half-ripened shoots, which will strike in sand, with bottom heat.

Cobæa. *Palemoniaceæ.*

Readily raised from fresh seed in spring, if a gentle bottom heat is supplied. It is often said that the seeds must be placed on edge, but this is a mistake. From cuttings taken when young, in spring, and inserted in pots of sandy soil, placed in gentle bottom heat.

Coccocypselum. *Rubiaceæ.*

Propagated by dividing the creeping stems.

Coccoloba (Seaside Grape). *Polygonaceæ.*

Propagated by seeds and by cuttings of the ripened wood, with leaves entire, and taken off at a joint. These will root freely in sand under glass.

Cocculus, Wendlandia. *Menispermaceæ.*

Propagated by seeds. By half-ripened cuttings of side shoots; these will root easily in spring or summer, if planted in sand and placed in bottom heat, under glass.

Cockscomb. See Celosia.

Cocoanut (*Cocos nucifera*). *Palmæ.*

The nuts are buried in nursery rows, and the young trees are transplanted. A more common practice is to remove the buried nuts, when they begin to sprout, to the place in which the tree is to stand. A nut is then placed in a hole some two feet deep, which is gradually filled in as the plant grows. In from six to eight years the tree begins to bear.

Codiæum, Croton. *Euphorbiaceæ.*

New varieties are produced by seed. Increased by taking off the tops of any strong leading shoots, and making them into cuttings. They may be struck by placing singly in small pots and covering with bell-glasses, in strong, moist heat, where they will soon emit roots, without losing any of the leaves attached at the time they were inserted. Or they may placed in a bed of sand.

Coffea (Coffee-tree). *Rubiaceæ.*

Propagated by seeds. Also by ripe cuttings, which strike freely in sand under glass, in moist heat; and the young plants so raised produce flowers and fruit more readily than those grown from seed.

Coffee-tree, Kentucky. See Gymnocladus.

Colchicum (Autumn Crocus). *Liliaceæ.*

Seeds, sown as soon as ripe in a protected place. Separa-ration.

Coleus. *Labiatæ.*

Increased by seeds for new varieties. By cuttings with the greatest freedom at almost any time of the year, and, with a good moist heat, they will quickly form fine specimens. (Fig. 53.)

Colletia. *Rhamneæ.*

Increased by cuttings of half-ripened wood, six to eight inches in length, in a cool greenhouse.

Collinsonia. *Labiatæ.*

Increased readily by dividing roots in spring; also seeds.

Colocasia. See Caladium.

Columbine. See Aquilegia.

Colutea (Bladder Senna). *Leguminosæ.*

Propagated by seeds, or by cuttings, placed in sandy soil in the autumn.

Combretum. *Combretaceæ.*

Increased by cuttings of side shoots, taken off with a heel, planted in sand under glass, and placed in heat.

Comesperma. *Polygaleæ.*

Seeds. Propagated by young cuttings, which root freely if planted in sand under glass.

Comfrey. See Symphytum.

Commelina. *Commelinaceæ.*

Increased by seeds. By cuttings, which will root in sand, in a gentle hot-bed.

Comocladia (Maiden Plum). *Anacardiaceæ.*

Seeds. Propagated by ripened cuttings, which will root in sand if placed under glass, in heat.

Comparettia. *Orchideæ.*

Increased by division of the plants. (See under Orchids.)

Comptonia (Sweet Fern). *Myricaceæ.*

Seeds; by dividing the clumps, and by layers, which should be put down in autumn.

Conocarpus (Button-tree). *Combretaceæ.*

Seeds. Increased by cuttings of firm shoots, taken in April, in bottom heat.

Convallaria (Lily of the Valley). *Liliaceæ.*

Increased by "crowns" or "pips" (see Fig. 17), which are the separated growing points of the roots, possessing a strong bud. These crowns can be obtained from any well established bed in the fall, but they are usually imported.

Convolvulus (Bindweed). *Convolvulaceæ.*

Seeds of the hardy annuals should be sown in spring in the open border. The hardy perennials may be increased by seeds sown in spring, by division of the roots, and by young cuttings.

Coprosma. *Rubiaceæ.*

Increased by layers and cuttings.

Coptis. *Ranunculaceæ.*

Propagated by seeds and division of the roots.

Cordia, Varronia. *Boragineæ.*

Seeds. Increased by cuttings, green or ripe, which strike root readily in sand, in heat.

Corema (Portugal Crakeberry, Crowberry). *Empetraceæ.*

Seeds. Propagated by cuttings planted during summer.

Coreopsis, Calliopsis. *Compositæ.*

The hardy annuals, which are largely grown under the name of calliopsis for summer ornamentation, by seed, which should by sown in March in a gentle heat, or outside later. The perennials are propagated also by divisions of the root in autumn or spring, or during the summer by young cuttings, which will strike freely in a cold-frame.

Coriander (*Coriandrum sativum*). *Umbelliferæ.*

Seeds sown in fall or spring.

Corn. See Maize.

Corn Salad (Valerianella, several species). *Valerianeæ.*

Seeds sown in spring, summer or autumn.

Cornus (Dogwood Osier). *Cornaceæ.*

Increased by seed, suckers of soft wood, layers or cuttings. The herbaceous species, *C. Canadensis* and *C. Suecica*, may be increased by division, as also by seeds. The willow-like cornuses grow from cuttings of ripe wood. Named varieties and some species are budded in many cases, especially all the weak-growing sorts. *Cornus Mas*, raised from seed, is the favorite stock. Shield-budding in late summer and veneer-grafting are most successful. (See Fig. 44.)

Coronilla. *Leguminosæ.*

By seeds sown as soon as ripe. The hardy species by division. Cuttings strike freely if placed in cold-frames or a cool house under a hand-glass in spring, and when calloused, introduced to gentle bottom heat.

Correa. *Rutaceæ.*

Seeds. May be propagated by cuttings very readily. Varieties are usually grafted on *C. alba.*

Cortusa (Bear's-ear Sanicle). *Primulaceæ.*

Increased by seed sown as soon as ripe in a cold-frame; also by carefully dividing the roots.

Coryanthes. See Stanhopea.

Corydalis. *Fumarieæ.*

Increased by seeds, or by dividing the plants directly after flowering. The bulbous-rooted species by offsets.

Corylus (Hazel ; Cob-nut). *Cupuliferæ.*

Propagated by seeds, suckers, layers or cuttings. Grafting and budding are each practicable, and are adopted when growing tall standards or scarce varieties. The seed of all should be sown as soon as gathered, or stored in sand till the following spring. All superior varieties should be increased by suckers or layers. Stools kept for layering must be allowed to make more growth than those used for suckers. Free growth must be encouraged for a year or more, and, any suitable time in winter, the shoots should be bent to the ground, pegged firmly, and covered to the depth of three inches with earth. They will be well rooted by the following autumn, and may then be removed and planted out permanently.

Corynostylis, Calyptrion. *Violarieæ.*

Increased by seeds, or by cuttings of the young wood, placed in sand in bottom heat, under glass.

Cosmos. *Compositæ.*

Seeds, usually started under glass. The tuberiferous species, like Dahlia, which see.

Costus. *Scitamineæ.*

Increased by dividing the roots.

Cotoneaster. *Rosaceæ.*

Propagated readily by seed, which should be sown in spring; by layers or cuttings in autumn, or by grafting on *C. vulgaris*, the common quince, or the hawthorn.

Cotton (*Gossypium*). *Malvaceæ.*

Seeds commonly. Grown as a curiosity under glass; it may be increased by soft cuttings.

Cotyledon (Navelwort). *Crassulaceæ.*

Increased by seed, offsets, cuttings of the stem, and by leaves. The leaves should be pulled off in autumn, laid on dry sand in pans on a shelf in a propagating or other warm house, and not watered until small plants appear at the ends of the leaves.

Cowslip. See Primula.

Crambe. *Cruciferæ.*

Increased by seeds, by dividing the roots and by root cuttings. See Sea-kale.

Cranberry (*Vaccinium macrocarpon*). *Ericaceæ.*

The cultivated cranberry is propagated entirely by cuttings. These are made from vigorous young runners, from six to ten inches in length, and they are thrust obliquely into the soil until only an inch or two of the tip projects. Some blunt instrument, as a stick, is commonly used to force them into the sand of cranberry bogs. Planting is done in the spring, and the cuttings are taken just previous to the opertion. If cranberry seedlings are desired, the seeds should be sown in flats of peaty earth, which are stored until spring in some protected place, in the manner of stratification boxes. The seeds should be covered lightly, preferably with fine moss. The plants are allowed to grow the first year in the box.

Crassula. *Crassulaceæ.*

Seeds; also by cuttings, which should be taken off and laid for two or three days in the sun to dry before planting.

Cratægus (Haw, Hawthorn). *Rosaceæ.*

Propagated by stratified seeds. Some growers spread the haws in shallow piles in the fall, and allow them to decay, so that most of the pulp is removed before they are stratified. Haws often come irregularly, even from stratified seeds. The varieties are grafted, rarely budded, on common stocks.

Cress (*Lepidium sativum*). *Cruciferæ.*

Seeds, sown at any time of year. See Water Cress.

Cress, American. See Barbarea.

Cress, Rock. See Arabis.

Crinum. *Amaryllideæ.*

Increased by seed, sown singly as soon as ripe in three or four-inch pots, in sandy loam and leaf-mould. Place in a temperature of from 70° to 80°, and keep rather dry until the plants appear, when more moisture should be applied. Also increased by offsets, which should be removed when rather small and potted separately, and grown as recommended for seedlings.

Crithmum. *Umbelliferæ.*

Propagated by seeds sown as soon as ripe, and by divisions.

Crocosmia. *Irideæ.*

Propagated by seeds sown in pans in a cold house as soon as possible after maturity. Also by offsets.

Crocus. *Irideæ.*

Propagated by seed, sown as soon as ripe or early in spring, the choicer strains in pots or boxes, using a light, sandy soil, and afterwards placing them in a cold pit or frame; the more common varieties may be placed in a warm position outside in a seed bed. Sow thinly, so that the plants may grow two years in the seed pan or bed without lifting. By the corms. These may be lifted and replanted, allowing each in its turn to develop new corms below. The following year new corms, or cormels, are also formed by the side of the old corms. These old corms die away annually. Some species increase much more rapidly than others.

Crossandra, Harrachia. *Acanthaceæ.*

Seeds. Propagated by cuttings, which root freely at almost any time of the year, in bottom heat.

Crotalaria (Rattle-Box). *Leguminosæ.*

Increased by seeds. The shrubby kinds by young cuttings, which root freely in sand, under glass, in a cool house.

Croton. See Codiæum.

Crowea. *Rutaceæ.*

Seeds. Usually by green cuttings in a frame.

Crowfoot. See Ranunculus.

Crucianella (Crosswort). *Rubiaceæ.*

Propagated by seeds, by divisions during spring or autumn, and by cuttings.

Cryptomeria (Japan Cedar). *Coniferæ.*

Increased by seeds, and by cuttings of growing wood planted in sandy soil, under glass.

Cryptostemma. *Compositæ.*

Propagated by seeds, which should be sown on a gentle hot-bed in early spring.

Cubeba. See Piper.

Cucumber (*Cucumis sativus*). *Cucurbitaceæ.*

Seeds. If sown out-doors, the operation should be delayed until the weather is thoroughly settled.

Cucumber-tree. See Magnolia.

Cunninghamia (Broad-leaved China Fir). *Coniferæ.*

Increased by seeds and cuttings of growing wood.

Cuphea. *Lythrarieæ.*

Increased easily by seed; but cuttings of the perennial sorts strike freely in March or April, in brisk bottom heat.

Cupressus (Cypress). *Coniferæ.*

Seeds may be collected in early spring, and should be sown in April in a warm, friable soil. Cuttings of growing or mature wood, much as for Retinospora, which see.

Curculigo. *Amaryllideæ.*

Seeds; also by suckers, which form at the base of the stem.

Curcuma (Tumeric). *Scitamineæ.*

Increased by root division.

Currant (*Ribes rubrum*, *R. nigrum* and *R. aureum*). *Saxifrageæ.*

New varieties are grown from seeds, which may be sown in the fall or stratified until spring. Varieties are nearly always multiplied by hard-wood cuttings (Fig. 49). The cuttings may be taken in spring and placed directly in the ground, but better results are obtained by taking them in the fall or late summer. Many nurserymen prefer to take them in August, strip off the leaves, and bury them in bunches with the butts up. They may remain in this condition or in a cellar all winter, or they may be planted in the fall. Currant cuttings strike readily, however, under any method. Some growers cut out the buds which come below the surface of the ground to prevent suckering, but this is not generally practiced; the suckers are cut off when the cuttings are removed from the cutting-bed, either to be sold or to be transplanted into nursery rows. Green layering is sometimes practiced with rare sorts, or single eyes may be used, as in grapes. Tip-layering, as in the black raspberry, may also be employed. (See page 33.) Weak or low sorts are sometimes grafted upon stronger ones, in order to give them a tree form, but such bushes are grown only as curiosities or as specimen plants.

Cussonia. *Araliaceæ.*

Increased by cuttings, which should be planted in sand, under glass. Give slight bottom heat.

Custard Apple. See Anona.

Cyananthus. *Campanulaceæ.*

Seeds. Strong roots may be carefully divided in spring, but this is not desirable. Usually by cuttings, which should be taken during spring or early summer, and struck in sandy peat, being kept moist.

Cyanophyllum. *Melastomaceæ.*

Increased by seed. By cuttings or eyes, which should be placed in sand where a good bottom heat must be maintained, and they should be shaded from the sun.

Cyanotis. *Commelinaceæ.*

Seeds; usually by young cuttings in sandy soil, in brisk heat.

Cycas. *Cycadaceæ.*

Increased by seed, and oftener by suckers.

Cyathea. See Ferns.

Cyclamen (Sowbread). *Primulaceæ.*

Propagated by seed, sown when freshly gathered; the hardy kinds in pots placed in a cool frame. By divisions and leaf cuttings, taken off with a heel; but these methods are not very satisfactory.

Cynoglossum. *Boragineæ.*

Propagated by seeds, divisions and root cuttings.

Cypella. *Irideæ.*

Propagated by seed, sown as soon as ripe in a cool house, and by offsets.

Cyperus. *Cyperaceæ.*

Propagated either by seed, sown in gentle heat, or by divisions.

Cyphia. *Campanulaceæ.*

When the stems begin to push out from the root, cut off as many of the shoots as are required, and place them in small pots in an equal mixture of loam, peat, and sand in abundance. The young plants should be kept dry until callused, but not covered with glass. They may also be increased by cuttings, under a hand-glass in a cool house.

Cyphomandra (Tree Tomato of Jamaica). *Solanaceæ.*

Use seeds; or cuttings may be placed under glass, in bottom heat.

Cypress. See Cupressus.

Cypripedium (Lady's Slipper). *Orchideæ.*

By seeds sometimes. Usually by division. (See under Orchids.)

Cyrilla. *Ericaceæ.*

Propagated by seeds and cuttings.

Cyrtanthus. *Amaryllideæ.*

Propagated by offsets.

Cytisus (Scotch Broom). *Leguminosæ.*

By seeds and layers. In spring, cuttings of young wood may be taken when about three inches long (with a heel preferred), placed under a bell-glass in heat, or in a close frame, where they will root readily. If gradually hardened, potted and grown on, small flowering specimens may by obtained the following spring. *C. purpurea* is usually grafted on the common laburnum.

Dacrydium (Tear Tree). *Coniferæ.*

Increased by fresh seed and ripened cuttings.

Daffodil. See Narcissus.

Dahlia. *Compositæ.*

Single varieties, and sometimes the doubles, are grown from seeds. The roots may be broken apart after the crowns have started in spring, and each part grown separately. The roots may be started into growth in heat late in winter, and the young sprouts may be removed and handled as ordinary cuttings as fast as they form. Or rare sorts may be increased during summer by cuttings from the growing tips. Cions made of the growing tips may be grafted into the roots by a cleft or side graft. This method is oftenest employed for the purpose of preserving over winter rare sorts which it is feared may be lost. The grafts are kept growing slowly during winter, and cuttings may be taken from them. Cuttings should always have a bud or buds at the base, and in propagation by division there must be a piece of the crown attached to the root.

Daisy. See Bellis.

Dalbergia. *Leguminosæ.*

Place cuttings of firm young shoots in sand under a glass, in spring. Give a little bottom heat.

Dampiera. *Goodenovieæ.*

Divisions. Cuttings should be planted in a mixture of turfy loam, peat and sand, in heat.

Dandelion (*Taraxacum officinale*). *Compositæ.*

Seeds, in early spring.

Daphne. *Thymelaceæ.*

Seeds. For layers, remove the soil in spring to a depth of two or three inches about the plant, and fill with fine compost to within two inches of the tops of the shoots. The next spring, carefully wash away the compost, and plant the small white buds in pots of fine soil. Place in a cool frame.

Cuttings should be made of matured shoots or side growths in autumn; insert thinly in well-drained pots of peaty soil, and cover with a bell-glass. If kept in a cool house in winter they will callus, and may, early in spring, be introduced to gentle heat, to encourage growth and the emission of roots. Pot the young plants singly, and grow on in a close but not high temperature, and afterwards harden and keep quite cool during the following autumn and winter, in order to thoroughly ripen the wood. Grafted specimens may be treated in a similar way. *D. odora* is propagated by ripened cuttings in a cool house, in sand. Sometimes the old wood can be used. The time is determined by the fitness of the wood.

Darlingtonia. *Sarraceniaceæ.*

Increased by seeds and by dividing the plants. Seeds may be sown on the surface of well-prepared fibrous soil, and then covered with dead sphagnum moss, rubbed through a sieve. Give shade.

Darwinia. *Myrtaceæ.*

Increased by cuttings of the young roots. Place in a cold-frame.

Dasylirion. *Liliaceæ.*

Increased by seeds, suckers and cuttings.

Date (*Phœnix dactylifera*). *Palmeæ.*

The seeds from commercial dates grow readily, and without the intervention of stratification. Special varieties are propagated by a sort of cutting, made by removing and rooting the sprouts which appear about the base of the tree. These root readily if taken off green and liberally supplied with water. They often begin to bear in five or six years.

Date Palm. See Phœnix.

Datisca. *Datisceæ.*

May be increased by seeds, and by dividing well established plants.

Datura, including Brugmansia, Ceratocaulis and Stramonium. *Solanaceæ.*

The annual species are propagated by seeds, which are started under cover in the north. The perennials are readily grown from cuttings in mild heat. Heeled shoots are usually preferred.

Daubenya. *Liliaceæ.*

Increased by offsets.

Davallia. *Filices.*

Propagated largely by division. See Ferns.

Daviesia. *Leguminosæ.*

Seed may be sown in slight heat in spring. Cuttings may be made of firm young shoots, and placed in sand under a frame.

Day Lily. See Hemerocallis.

Deciduous Cypress. See Taxodium.

Decumaria. *Saxifrageæ.*

Seeds. Cuttings may be made in summer, and placed under a frame in a shady situation.

Delphinium (Larkspur). *Ranunculaceæ.*

Seeds may be sown out-doors in a warm border in spring, or in pans, to be placed either in frames or outside. The old plants of perennial sorts may be cut down after flowering, when young growths will proceed from the base, and the whole may be lifted and carefully divided. Cuttings of the young shoots, taken in autumn or spring, will root freely if potted singly and placed in a cold-frame. They will flower the following season at the same time as the divisions.

Dendrobium. *Orchideæ.*

The methods of propagating these plants have already been mentioned. Where a rapid increase of a new or special variety is required, the pseudo-bulbs that are more than one year old should be cut into lengths, and fastened on orchid rafts, with a layer of sphagnum beneath them. Suspend them in a hot, moist house, if possible, over a water-tank. The advantage of this method is that the young plants do not need shifting after they commence rooting on their own account. The section to which *D. aggregatum*, *D. Jenkinsii*, *D. densiflorum* and *D. thyrsiflorum* belong, are best propagated by division. (See under Orchids.)

Dentaria (Toothwort). *Cruciferæ.*

Propagated by seeds or divisions.

Deodar. See Cedrus.

Desfontainea. *Loganiaceæ.*

Cuttings, placed in a sandy loam, in a gentle heat.

Desmodium. *Leguminosæ.*

Increased by seeds, or by cuttings placed under a frame, in heat.

Deutzia. *Saxifrageæ.*

Commercially, the species are mostly propagated by green hardened cuttings in summer, under a frame. Hard-wooded cuttings may be taken in autumn, and be treated in about the same manner as currant cuttings (see page 58). The deutzias are also propagated by divisions and layers. Some of the dwarf sorts are sometimes forced, to make cuttings for winter use.

Dewberry (*Rubus Canadensis* and vars., and *Rubus trivialis*. *Rosaceæ.*

Seeds are handled in the same manner as blackberry seeds. Increased by layers and, like the blackberry, by root cuttings. Layers are made by simply covering the decumbent canes at the joints. This is the usual method of multiplication. The tips, too, root freely, as in the black-cap raspberries.

Dianella. *Liliaceæ.*

Increased by seeds, sown in gentle heat during spring. By divisions.

Dianthera. See Justicia.

Dianthus. See Carnation, Pink and Sweet William.

Dicentra, Capnorchis, Diclytra (Bleeding Heart). *Papaveraceæ.*

The crowns may be divided in early spring, or cuttings may be made of the fleshy roots in short lengths, and placed in sand. The roots should be placed in a compost of sandy loam, in well-drained pots, as soon as the foliage dies off, and transferred to a cold-frame.

Dichorisandra. *Commelinaceæ.*

Propagated by seeds, divisions and cuttings.

Dichosma. See Agathosma.

Dicksonia. *Filices.*

Division mostly. See Ferns.

Diclytra. See Dicentra.

Dictamnus (Dittany, or Fraxinella). *Rutaceæ.*

Seeds should be sown as soon as ripe. Division is used.

Dictyosperma. See Areca.

Dicyrta. See Achimenes.

Didymocarpus. *Gesneraceæ.*

Cuttings, which are obtained from young shoots when commencing growth, and placed in sandy soil, in heat. Also by seeds.

Didymosperma. See Areca.

Dieffenbachia. See Caladium.

Diervilla, Weigela. *Caprifoliaceæ.*

Suckers. Cuttings may be made in spring, summer or autumn. Hardened green cuttings, handled under a frame in summer, are extensively used by nurserymen. (See page 58.) They are sometimes grown from cuttings in winter from forced plants. Hard-wood cuttings, made in winter and planted in spring like the grape, succeed well.

Digitalis (Foxglove). *Scrophularineæ.*

Seeds, sown in spring, either in-doors or in the open. The common foxglove (*D. purpurea*) often self-sows itself.

Dill (*Arethum graveolens*). *Umbelliferæ.*

Seeds, in early spring.

Dillenia, including Colbertia. *Dilleniaceæ.*

Seeds, which, however, are grown with much difficulty. Cuttings of half-ripened wood may be placed in sand, under a frame, in bottom heat.

Dimorphotheca. *Compositæ.*

The seeds of the annual sorts should be sown in heat in spring. The perennials are grown from green cuttings.

Dionæa. *Droseraceæ.*

Propagated sometimes by seed; usually by dividing the plants.

Dion, Platyzamia. *Cycadaceæ.*

Propagated by seed.

Dioscorea (Yam). *Dioscoreaceæ.*

The tubers may be divided in autumn or spring, when not growing. Seeds are sometimes used, so are the tubers which form in the axils by the leaves. Stove species can be propagated by cuttings of the half-ripened wood.

Diosma. *Rutaceæ.*

Cuttings in sandy peat, and under a frame placed in very gentle heat, will soon root.

Diospyros (Date Plum, Persimmon). *Ebenaceæ.*

Seeds are used for the hardy species. Also by cuttings of half-ripened shoots. Those requiring stove heat strike best from ripened shoots, placed in sand in a brisk bottom heat during spring. See also Persimmon.

Dipcadi, Uropetalum. *Liliaceæ.*

Increased by offsets in spring.

Diplacus. See Mimulus.

Dipladenia. *Apocynaceæ.*

In spring, when the plants commence new growth, cuttings from the young shoots are made. These, or single eyes, should be placed in a mixture of sand and peat, in good bottom heat.

Diplazium. See Ferns.

Diplothemium. *Palmæ.*

Propagation is affected by seeds.

Dipteracanthus. See Ruellia.

Dirca. *Thymeleæ.*

Increased by seeds or layers.

Disa. *Orchideæ.*

D. grandiflora and others of similar habit are propagated by offsets. These are best taken off about December, and treated like the old plants. (See under Orchids.)

Disocactus. See Phyllocactus.

Disporum, including Prosartes. *Liliaceæ.*

Seeds may be used ; or the plant may be divided in spring before active growth commences.

Dodecatheon, Meadia (American Cowslip). *Primulaceæ.*

Seeds. The crowns may be divided either in spring or autumn. Cuttings of the whole root can be effectively used, the root being torn off the crown, planted upright, and of course covered with the sandy soil commonly used in this form of propagation.

Dog's Bane. See Apocynum.

Dog's-tooth Violet. See Erythronium.

Dogwood. See Cornus.

Dolichos. *Leguminosæ.*

By seeds. Sometimes cuttage or layerage is resorted to.

Dorcoceras. See Bæa.

Doronicum, including Aronicum (Leopard's Bane). *Compositæ.*

Propagated by seeds and divisions.

Dorstenia. *Urticaceæ.*

Seeds may be sown in a hot-bed in early spring. Before active growth commences the plants may be divided.

Doryanthes. *Amaryllideæ.*

Propagated by suckers placed in small pots.

Dorycnium, including Boujeania. *Leguminosæ.*

Increased by seeds.

Downingia, Clintonia. *Campanulaceæ.*

Seeds should be sown in mild heat in spring.

Draba, including Petrocallis (Whitlow Grass). *Cruciferæ.*

The annuals or biennials propagated by seeds sown in spring in the open border. The perennials may be propagated by dividing the crowns.

Dracæna (Dragon-tree). *Liliaceæ.*

Rarely grown from seed. Layers do not succeed very well. The stems of old plants may be cut up in pieces one or two inches long, and placed at any season in cocoanut fiber or light soil, in the bottom heat of a propagating house. The tops of the plants will also strike as cuttings, and the fleshy base of the stem is sometimes removed and used for propagation. Root cuttings do well in a moderate heat. (See Fig. 47.)

Dracocephalum (Dragon's Head). *Labiatæ.*

The annuals are grown from seeds, sown in the open in spring. Perennials are increased by dividing the roots, or by cuttings of the young shoots in spring.

Dracontium. See Amorphophallus.

Dragon's Head. See Dracocephalum.

Dragon-tree. See Dracæna.

Drimys, Wintera. *Magnoliaceæ.*

Cuttings made of half-ripened shoots should be inserted in a frame.

Drosera (Sundew). *Droseraceæ.*

Seeds, sown as soon as possible after gathering. *D. binata* is increased by cutting roots from strong plants into pieces of one-half or one inch in length, and placing them on the surface of shallow earthenware pans, in sandy peat soil, and covering about one-half inch deep with the same material. They are then placed under a bell-glass, and transferred to a damp, warm propagating house.

Drosophyllum. *Droseraceæ.*

Propagated by seed.

Dutchman's Pipe. See Aristolochia.

Duvaua. *Anacardiaceæ.*

Insert cuttings made of the ripe wood under glass, in gentle heat.

Dyckia. *Bromeliaceæ.*

Propagated by seeds, suckers and divisions.

Eccremocarpus (Calampelis). *Bignoniaceæ.*

Seeds, sown in spring, in a gentle heat. Cuttings may be used, of green or ripe wood.

Echeveria. See Cotyledon.

Echinacea. *Compositæ.*

Readily propagated by seeds and division.

Echinocactus. See Cactus.

Echinops, Echinanthus (Globe Thistle). *Compositæ.*

Sow the seeds in spring for the propagation of the biennials, and divide the perennials early. Also by root cuttings.

Echium (Viper's Bugloss). *Boragineæ.*

The herbaceous species are raised from seeds. Also increased by divisions. The shrubby sorts are increased more readily by layers, but also by cuttings, placed in sandy soil under glass.

Edelweiss. See Leontopodium.

Edgeworthia. *Thymelaceæ.*

Cuttings should be inserted in sandy soil, under glass in spring.

Edwandria. *Leguminosæ.*

By seeds or cuttings of the young wood.

Egg-Plant (*Solanum Melongena*). *Solanaceæ.*

Seeds in heat, in late winter or spring. Cuttings rarely.

Eglantine. See Rosa.

Ehretia. *Boragineæ.*

Place cuttings in sandy soil under glass in bottom heat, in spring.

Eichhornia. *Pontederiaceæ.*

Propagation is affected by division in spring ; seeds.

Elæagnus (Oleaster, Wild Olive, Goumi). *Elæagnaceæ.*

Increased by seeds, layers or cuttings. The named varieties are often grafted on the most vigorous varieties obtainable. Imported seeds of some species are apt to be empty. *E. longipes* can readily be propagated by cuttings of the half-ripened wood in June and July, under glass.

Elæis (Oil Palm). *Palmæ.*

Seeds are used for propagation.

Elæocarpus, including Monocera. *Tiliaceæ.*

Seeds may be sown in a hot-bed. Make cuttings of ripened shoots, with leaves on, and place them in sandy soil, in bottom heat.

Elder. See Sambucus.

Elecampane (*Inula Helenium*). *Compositæ.*

Propagated by seeds in open air in early spring.

Elliottia. *Ericaceæ.*

Insert soft-wood cuttings in sand under glass.

Elm. See Ulmus.

Elodea. See Hypericum.

Empetrum (Crowberry or Crakeberry). *Empetraceæ.*

Seeds. In summer, cuttings may be made, and should be placed in sandy soil under glass.

Encephalartos. *Cycadaceæ.*

Increased by seeds.

Endive (*Cichorium Endivia*). *Compositæ.*

Seeds, either in the open where the plants are to stand, or under glass.

Enkianthus. *Ericaceæ.*

Cuttings made of the ripe wood should be placed under glass during the spring months, without heat.

Entelea. *Tiliaceæ.*

Propagated by cuttings, in sandy soil.

Eomecon. *Papaveraceæ.*

Seeds; also by division.

Epacris. *Epacrideæ.*

Grown from tip cuttings in a frame in winter, with bottom heat. The cuttings root very slowly.

Ephedra. *Gnetaceæ.*

Layers may be made from young shoots or branches.

Epidendrum. *Orchideæ.*

The tall-stemmed section of this genus is increased by cuttings, the section with short, thick pseudo-bulbs by division. The former also occasionally produce viviparous flower-scapes, thus affording a ready means of increase. (See under Orchids.)

Epigæa. *Ericaceæ.*

Increased with great difficulty by careful divisions of established plants, and by layers. Seeds, when obtainable, can be used, but are slow to develop.

Epilobium (Willow-herb). *Onagrarieæ.*

Propagated by seeds, divisions or root cuttings.

Epimedium (Barrenwort). *Berberideæ.*

Sometimes increased by seeds. During July or August, divisions of the roots can be made.

Epiphyllum. *Cacteæ.*

Readily grown from cuttings. Pieces of the branches four to six inches long are placed in sandy soil in gentle heat, and kept moderately dry. Epiphyllums are often grafted on strong stocks of pereskia (*Pereskia aculeata* is commonly used, but *P. Bleo* is equally as good), for the purpose of getting high or rafter plants. A young shoot is cleft-grafted into any portion of the pereskia which has become hard, and the cion is held in place by a cactus spine passed through it. Several cions may be inserted along the sides of the stock.

Eranthemum. *Acanthaceæ.*

Seeds. Cuttings root readily in spring in peaty soil, in a close frame where there is a bottom heat of about 70°.

Eranthis (Winter Aconite). *Ranunculaceæ.*

Increased by seeds and division.

Eremostachys. *Labiatæ.*

May be increased by seeds or division.

Eremurus. *Liliaceæ.*

Increased by seeds and divisions.

Erica (Heath). *Ericaceæ.*

Will grow from seeds, but these are used generally to secure new varieties. Commonly propagated by very short cuttings, taken from the tips, or made of the lower young growth. Carefully remove the leaves from the lower parts of the cutting, which should be about one inch long, and then insert rather closely in pots, which should be filled two-thirds with crocks, the remainder being fine sandy peat with a layer of clean, compact sand on the surface. Cover with glass. Water well, and place in a temperature of about 60°.

Erigeron, including Phalacroloma, Polyactidium. *Compositæ.*

Readily increased by seeds or divisions.

Erinus. *Scrophularineæ.*

Seeds and divisions. After becoming established, they propagate themselves by seed.

Eriobotrya. See Photinia.

Eriodendron. *Malvaceæ.*

Raised from seeds sown in sandy soil, in heat.

Eriogonum. *Polygonaceæ.*

May be increased by seed or division.

Eriosema. *Leguminosæ.*

Propagated by seeds or cuttings.

Eriostemon. *Rutaceæ.*

Cuttings, in sandy peat in spring, under glass, and with gentle heat. Nurserymen propagate by grafting on small stocks of correa.

Erodium (Heron's Bill). *Geraniaceæ.*

Propagation is effected by seeds or divisions.

Erpetion (Australian Violet). *Violarieæ.*

Propagated by seeds; also by division and cuttings.

Eryngium (Eryngo). *Umbelliferæ.*

Seeds or carefully made divisions may be used for increasing the species.

Erysimum (Hedge Mustard). *Cruciferæ.*

Increased by seeds; the perennials by seeds and divisions.

Erythræa, Gyrandra, Hippocentaurea (Centaury). *Gentianeæ.*

Propagated by seeds or divisions.

Erythrina (Coral-tree). *Leguminosæ.*

Seeds. Young shoots can be taken in spring or early summer with a heel, and placed in sandy soil, on a slight bottom heat.

Erythronium (Dog's-tooth Violet). *Liliaceæ.*

Seeds. Offsets or bulbels are usually employed, taken as soon as the leaves dry away after flowering, inserting the bulbels about three inches deep.

Erythroxylon, including Sethia. *Lineæ.*

Place cuttings of half-ripened shoots in sand under a glass, in heat.

Escallonia. *Saxifrageæ.*

Suckers, layers. Cuttings of half-ripened wood strike in sand, when covered with glass. Also by seeds.

Escheria. See Gloxinia.

Eschscholtzia, Chryseis (California Poppy). *Papaveraceæ.*

Seeds may be sown in spring or autumn where the plants are to flower.

Eucalyptus (Gum-tree). *Myrtaceæ.*

Increased by seeds, which should be sown thinly in pans or pots of light, sandy soil, and placed in frames. Also by cuttings.

Eucharis. *Amaryllideæ.*

Seeds may be sown as soon as ripe in a warm house. Offsets or bulbels should be removed and potted off singly.

Eucomis. *Liliaceæ.*

Increased by seeds, sown as soon as ripe, or by bulbels.

Eucryphia. *Rosaceæ.*

The cuttings of young shoots are planted in sand under glass.

Eugenia. See Myrtus.

Eulalia. *Gramineæ.*

Freely increased by seed or division.

Euonymous (Burning-bush, Strawberry-tree, Wahoo). *Celastrineæ.*

Grown from seeds, cuttings and layers. Cuttings usually make better plants than layers. The deciduous species are usually grown from hard-wood cuttings, but the evergreen kinds are started under glass, from cuttings of the growing or ripened wood. The small and weak kinds are grafted on the stronger ones. The evergreen species will grow upon the deciduous kinds.

Eupatorium. *Compositæ.*

Cuttings of the growing wood, under glass in early spring, is the common method of propagation. Seeds can also be used for some species.

Euphorbia, including Poinsettia (Spurge). *Euphorbiaceæ.*

By seeds, especially the annual species. The perennial shrubby sorts are increased by cuttings in a strong heat. Some species are propagated by divisions.

Eurya. *Ternstrœmiaceæ.*

Propagated by soft cuttings, inserted in sand under a glass in heat.

Eurycles. *Amaryllideæ.*

Offsets or bulbels, in spring.

Eurybia. See Olearia.

Eustylis. See Nemastylis.

Euterpe. *Palmæ.*

Seeds in heat.

Eutoca. See Phacelia.

Evening Primrose. See Œnothera.

Exacum. *Gentianeæ.*

Seeds should be sown in spring, in bottom heat.

Exochorda. *Rosaceæ.*

Grown from seeds, layers, cuttings and suckers. Seeds are difficult to procure. Layering in June is a common practice. Various kinds of cuttings are employed, but the best results follow short, soft cuttings, taken from forced plants and set deep in shallow flats of sand. They require a very strong bottom heat, a close frame, and the water should be applied in a spray upon the foliage. Cuttings are sometimes grafted upon pieces of roots. It is regarded as a difficult plant to propagate.

Fabiana. *Solanaceæ.*

Readily increased by seeds and cuttings.

Fagus (Beech). *Cupuliferæ.*

Commonly grown from the nuts, which should be stratified and sown very early in spring. They may be sown immediately after they are gathered, if they can be protected from vermin. The named varieties are grafted upon the European or American species.

Fair Maids of France. See Ranunculus.

Fan-palm. See Corypha.

Farfugium. See Senecio.

Fedia. See Patrinia.

Felicia. *Compositæ.*

Propagated by seeds, or by cuttings inserted in sandy soil, under a glass.

Fennel (*Fœniculum*, various species). *Umbelliferæ.*

Seeds, usually in spring.

Fennel Flower. See Nigella.

Fenugreek (*Trigonella Fœnum-Græcum*). *Leguminosæ.*

Propagated by seeds.

Fenzlia. See Gilia.

Ferns. *Filices.*

Where division is possible, it is the easiest and most economical method of propagation, and should be practiced just before the plant starts into growth. The spores can be sown in February and March, or earlier, under glass in a warm propagating pit. Partly fill a suitable sized pot or pan with coarse peat, giving plenty of drainage; make the surface level, and on this place three-quarter inch cubes of well-seasoned peat which is rather dry, watering the whole and scattering on the spores evenly. Cover with a pane of glass, and place in a partial shade. While the process which corresponds to germination is going on, great care must be given to the water supply. This is sometimes done by placing the pots or pans in a saucer, from which they can suck the water up. Overhead watering may be used, and often is, but will sometimes introduce worms and the like.

The young plants should be pricked out when the true leaf appears, and they are large enough to handle. The same careful treatment should be continued until they are established in pots.

There is not much difficulty in getting the young plants, if fresh spores are obtainable, but there is a good deal of trouble in handling the seedlings, and establishing them in their growing quarters.

Most ferns are readily propagated by means of spores, as directed above and on page 24. Some species rarely produce spores in cultivation, however, and in other cases, as in some tree ferns, it is almost impossible to rear the young plants after the spores have germinated. In all such cases, recourse must be had to separation, division or layerage. There are some species, as *Asplenium bulbiferum*, *Cystopteris bulbifera* and others, which bear small bulblets or detachable buds on their fronds. These buds often vegetate while still attached to the frond. They may be removed either before or after showing signs of vegetation, and set in pots in a close propagating frame, or under a bell-glass. Ferns which make broad crowns may be divided, and this is the common mode with many species. Some species produce creeping root-stocks, which emit roots if pegged down into a pot of soil or on a block of peat. Several plants can often be produced from such a layer. All these operations are best performed in late winter, before the new growth begins. The tree ferns are rarely propagated to any extent in cultivation, but young plants are imported from their native countries.

Fern, Sweet. See Comptonia.

Ferraria, Tigridia. *Irideæ.*

Propagated by means of seeds and bulbels.

Feverfew, See Chrysanthemum.

Ficus. *Urticaceæ.*

The greenhouse species are propagated by layers and cuttings. The cuttings are handled in a close frame, and a leaf or two is usually left on them. For *Ficus Carica*, see Fig. Propagation by seeds is sometimes used in the edible figs, but is not easy with the ornamental sorts. *F. elastica, F. Indica*, etc., are increased by cuttings, planted in sand or sandy soil, and placed in good bottom heat, in a frame under glass. The large cuttings should be staked, and care must be taken to remove the milky juice before planting. Any winter month is good, before growth begins. Last season's wood should be used.

Fig (*Ficus Carica*). *Urticaceæ.*

Figs grow readily from the plump seeds in the commercial fruit. Wash out the seeds, and those that sink may be sown in a frame. The young plants will appear in three or four weeks. In from three to five years the plants will begin to bear. New varieties are obtained in this way.

Varieties of the fig are multiplied with ease by layers, suckers and cuttings. Make cuttings of mature wood in autumn, cutting just below a bud. Scarce varieties may be multiplied by single eye cuttings. Fig cuttings are handled in the same way as grape cuttings. Some prefer, however, to place the cuttings where the tree is to stand. A well-grown plant will bear at two or three years of age.

The fig is readily budded and grafted, but these methods are seldom employed, because the plant is so easily multiplied by cuttings. Shield, ring or tubular buddings are employed. Various methods of grafting are adapted to it, and cleft-grafting is usually employed on old plants.

Filbert. See Corylus.

Fir. See Abies, Pinus and Picea.

Fire-pink. See Silene.

Fittonia. *Acanthaceæ.*

Increased by division, and by cuttings of half-ripened shoots, planted in sandy loam, in bottom heat.

Fitzroya. *Coniferæ.*

Seeds. Increased also by cuttings of half-ripened shoots.

Flax. See Linum.

Flower-de-Luce (*Fleur-de-Lis*). See Iris

Fontanesia. *Oleaceæ.*

Layers are used; also cuttings, planted under a hand-glass in autumn. Or it may be grafted on the privet.

Forget-me-not. See Myosotis.

Forsythia (Golden Bell). *Oleaceæ.*

Propagated extensively by green cuttings in summer, in a frame; also grown from ripe cuttings taken in fall and winter, and planted in the open air in early spring.

Fothergilla. *Hamamelideæ.*

Propagated by seeds, sown in spring in a peaty soil; by layers.

Four-o'clock. See Mirabilis.

Foxglove. See Digitalis.

Fragaria. See Strawberry.

Franciscea. See Brunfelsia.

Francoa. *Saxifrageæ.*

Seeds, sown in early spring in a cool frame. Also by division.

Frangula. See Rhamnus.

Frankenia, including Beatsonia, Hypericopsis. *Frankeniaceæ.*

Increased by seeds and divisions.

Fraxinella. See Dictamnus.

Fraxinus (Ash). *Oleaceæ.*

Propagated chiefly by seeds, which should be stratified. The named sorts are budded upon seedling stocks if the sorts are upright growers, or top-grafted if they are weepers. Both the European and American species are used for stocks.

Freesia. *Irideæ.*

Increased readily by seed, sown as soon as ripe in pots of light, sandy soil, and placed in a sunny position, in a cool frame. By bulbels.

Fremontia. *Malvaceæ.*

Seeds may be used; or cuttings, in spring, may be struck under a hand-glass

French Bean (Varieties of *Phaseolus vulgaris* and *P. nanus*). *Leguminosæ.*

Propagated by seeds.

Freycinetia. *Pandaneæ.*

Increased by offsets.

Fringe-tree. See Chionanthus.

Fritillaria. *Liliaceæ.*

Seeds, sown as soon as ripe where the plants are to stand the first year. Bulbels and division.

Fuchsia (Ladies' Ear Drop). *Onagrariæ.*

Fuchsias grow readily from seeds, which should be sown as soon as ripe, and blooming plants ought to be obtained in eight or ten months. Cuttings of the young growth strike quickly and easily. Blooming plants of most sorts can be obtained in four or five months.

Fumaria (Fumitory). *Papaveraceæ.*

Propagated by seeds.

Funkia, Hosta (Plantain Lily, White Day Lily). *Liliaceæ.*

Propagation is effected by dividing the stools during the early autumn, or when they begin to start in spring. Only strong, healthy clumps should be divided, and each portion should contain several crowns.

Furze. See Ulex.

Gaillardia. *Compositæ.*

The annual sorts are propagated by seeds started under glass; the perennial kinds by seeds, cuttings or division. Sometimes root cuttings are used.

Galanthus (Snowdrop). *Amaryllideæ*

Commonly by bulbels. Rarely by seeds.

Galax, Erythrorhiza, Solonandra. *Diapensiaceæ.*

Propagated by divisions of strong clumps in autumn.

Galega (Goat's Rue). *Leguminosæ.*

Seeds, in spring; also by division.

Galtonia. *Liliaceæ.*

Increased by bulbels or seeds.

Garcinia, Cambogia, Mangostana, Oxycarpus. *Guttiferæ.*

Seeds. Cuttings of ripened shoots should be inserted in sand under a glass, in strong bottom heat.

Gardenia, including Rothmannia. *Rubiaceæ.*

Strong, healthy cuttings may be taken with a heel, early in the year being the best time, but any season will do when suitable cuttings can be secured. They should be placed in bottom heat of about 75°, in a frame.

Garlic (*Allium sativum*). *Liliaceæ.*

By "cloves" or divisions of the bulb. In the north these are planted in the spring, but in warm climates they may be planted in the fall.

Garrya, including Fadyenia. *Cornaceæ.*

Propagated by seeds, or by cuttings of half-ripened wood, in sandy loam in August, and shaded until rooted. Also by budding on *Aucuba Japonica* at the crown. Plant sufficiently deep to cover the bud or graft.

Gasteria. See Aloe.

Gaultheria (Boyberry, Wintergreen). *Ericaceæ.*

Increased by seeds, divisions, layers and cuttings under glass.

Gaura. *Onagrarieæ.*

Seeds should be sown in spring or fall in the open ground.

Gaylussacia. See Vaccinium,

Gazania, Mœhnia, Mussinia. *Compositæ.*

Increased by seeds and divisions. Make cuttings in July or August, from the side shoots near the base of the plant; these should be placed in a sandy soil, in a frame.

Gelsemium, Leptopteris, Medicia. *Loganiaceæ.*

Propagated by cuttings under glass.

Genista. See Cytisus.

Gentiana (Gentian). *Gentianeæ.*

Seeds and division. The seeds germinate slowly, and often with difficulty. They often lie dormant a year or more. They should be sown in well-sifted light loam, in pans or flats, and kept cool and shaded. Division must be carefully done, or the plants will suffer.

Geonoma. *Palmæ.*

Increased by seeds and suckers.

Geranium. *Geraniaceæ.*

Mostly by seeds and divisions. For the conservatory plants known as geraniums, see Pelargonium.

Gerardia. *Scrophularineæ.*

Propagated, but often with difficulty, by seeds, sown in the open air or in a frame or cool house.

Gesnera. *Gesneraceæ.*

Seeds, and cuttings of the shoots and leaves. Handled in essentially the same manner as Gloxinia, which see.

Gethyllis. *Amaryllideæ.*

They may be increased by bulbels or seeds.

Geum, including Sieversia (Avens). *Rosaceæ.*

Gherkin. See Cucumber.

Propagation is effected by seeds or division.

Gilia, including Fenzlia. *Polemoniaceæ.*

Seeds should be sown in spring in the open ground or frame, in a rather light soil.

Gilibertia. *Araliaceæ.*

Cuttings, inserted in sand in a gentle heat.

Gillenia. *Rosaceæ.*

Increased readily by dividing the roots in spring; also by seeds.

Gilliesia. *Liliaceæ.*

Propagated by bulbels.

Gilliflower. See Matthiola.

Ginkgo, Salisburia (Maidenhair-tree). *Coniferæ.*

Seeds, which are mostly imported, and which should be stratified. Also by layers, and by cuttings of either green or ripe wood. The cuttings are handled under glass. Named varieties are grafted upon common stocks.

Ginseng. See Aralia.

Gladiolus. *Irideæ.*

Seeds, which are commonly sown in pans in spring, in the house; or they may be sown in the border. Seedlings flower in two or three years. The common method of propagation is by means of cormels (see page 29, and Fig. 16). These are removed from the parent corm and planted in the open, where some of them will flower the same season, although most of them will require a season's independent growth before they flower. If cormels are desired in abundance, the large corms should not be allowed to flower. Some varieties do not produce cormels readily, and these may be made to bear them by cutting or ringing (page 30). A new corm is formed above the old one each year (Fig. 16).

Glastonbury-thorn. See Cratægus.

Gleditschia. *Leguminosæ.*

Seeds should be sown in spring about one inch deep They should be soaked in hot water before being sown. Varieties propagated by grafts upon seedling stock.

Gleichenia. See Ferns.

Globe Flower. See Trollius.

Globularia. *Selagineæ.*

Propagated by seeds, division or cuttings.

Gloriosa, Clynostylis, Methonica. *Liliaceæ.*

Seeds should be inserted singly in small pots, in a light sandy soil, and plunged in bottom heat. Bulbels, which should be carefully removed from the old bulbs when starting them in spring, as the roots are very brittle.

Gloxinia, Escheria, Salisia. *Gesneraceæ.*

Seeds should be sown the latter part of winter, in well-drained pots or small pans of finely sifted soil, of peat, leaf-mould and sand in about equal proportions. The seeds should be sown thinly and covered slightly, then carefully watered, and placed in a temperature of about 70° and kept shaded. Cuttings of the shoots may be taken when the old tubers are starting in spring, and placed in a close propagating frame. Leaf-cuttings, with a small portion of the petiole attached, give excellent results, especially when the leaves are firm and nearly matured. Leaf cuttings are made in the various ways in which begonia leaf-cuttings are made (see pp. 60–72, Figs. 59, 60). Also grafted (see page 88).

Glycine. See Wistaria.

Glycosmis. *Rutaceæ.*

Seeds. Increased by cuttings, which are commonly inserted in sand under glass, often in heat.

Glycyrrhiza, including Liquiritia (Liquorice). *Leguminosæ.*

Propagated by division and by seeds.

Godetia. See Œnothera.

Golden Rod. See Solidago.

Goldfussia. See Strobilanthus.

Gomphia (Button Flower). *Ochnaceæ.*

Cuttings of firm young shoots should be placed in sand under glass, in heat.

Gomphocarpus. *Asclepiadeæ.*

Seeds should be sown under glass in spring; or cuttings may be made of small side shoots when the plant is commencing new growth, and placed in sand under glass.

Gompholobium. *Leguminosæ.*

Cuttings, which should be made of young shoots during spring, and placed under glass.

Gomphrena. See Celosia.

Gonolobus. *Asclepiadeæ.*

Seeds, divisions, and cuttings under glass.

Goodenia. *Goodenovieæ.*

Seed. During spring, cuttings will root freely if placed under glass.

Goodia. *Leguminosæ.*

Seeds may be used. Cuttings of young shoots may be made during spring, and placed in a frame.

Gooseberry (*Ribes Grossularia* and *R. oxyacanthoides*). *Saxifrageæ.*

Seeds, for the raising of new varieties, should be sown as soon as well cured, in loamy or sandy soil, or they may be stratified and sown together with the sand in the spring. Cuttings six to eight inches long of the mature wood, inserted two-thirds their length, usually grow readily, especially if taken in August or September and stored during winter, in the same way as currant cuttings. Single eye cuttings may be used for rare kinds Stronger plants are usually obtained by layers, and the English varieties are nearly always layered in this country. Mound-layering is usually employed, the English varieties being allowed to remain in layerage two years, but the American varieties only one (Fig. 21). Layered plants are usually set in nursery rows for a year after removal from the stools. Green-layering during summer is sometimes practiced for new or rare varieties. Strong plants may also be procured by tip-layering, as in the black raspberry (see p. 33). If it is desired to train the weaker gooseberries in tree form, they may be grafted upon the stronger growing varieties.

Gordonia, including Polyspora. *Ternstrœmiaceæ.*

Propagated by seeds or layers.

Gorse. See Ulex.

Goumi. See Elæagnus.

Gourds (*Cucurbita Pepo, Lagenaria,* etc.). *Cucurbitaceæ.*

Seeds, after the weather is settled and ground is warm.

Grammanthes. *Crassulaceæ.*

Seeds, sown in spring in a warm house.

Granadilla (*Passiflora edulis,* etc.). *Passifloreæ.*

Propagated by seeds, or, less easily, by cuttings.

Grape (*Vitis,* several species). *Vitaceæ.*

Grape seedlings are very easily grown. If the ground is fit and there is no danger from vermin, the seeds may be sown in the fall, but they are usually stratified and sown in spring. They come readily if sown out-doors, but some prefer to force them under glass with a mild bottom heat. Seedlings do not "come true," and they are therefore grown only for the purpose of obtaining new sorts.

The grape is very readily multiplied by layers, either of the ripe or green wood. The ripe wood or canes may be layered either in fall or spring, but spring is usually chosen. The cane is simply covered up two or three inches deep, and nearly every bud will produce a plant. In August or September the layer should be lifted and cut up into plants. Better plants are obtained if only the strongest canes are used and only a part of the buds on each are allowed to grow. The cane is usually cut back to four or five buds, or if very strong plants are desired only one bud is left on each layer. Canes of the previous year, those recently matured, are preferred, although wood two or three years old may be used, but in this case it is usually necessary to cut or otherwise wound the joint in order to induce the formation of roots. Vines or stools grown for the production of layers should be cut back severely in fall or winter, to induce a vigorous growth of canes the following season. These canes are then layered the succeeding fall or spring. Only a part of the canes are layered from any stool, a part being allowed to grow for cutting back the next fall in order to get another crop of canes. In some varieties which do not strike readily from cuttings, layering is considerably practiced by nurserymen. The Delaware is often grown in this way. Extra strong layers can be secured by layering in pots. A large pot, filled with rich soil, is plunged beneath the layer. In this manner a layer may be rooted and separated even while carrying fruit. Layering in pots is employed only in special cases.

Green-layering is sometimes practiced upon new and scarce varieties, but strong plants are not obtained unless they are well handled by forceful culture after they are separated. The growing cane is layered in mid-summer, usually by serpentine layering.

Cuttings are usually employed by nurserymen to propagate the grape. These are made in many fashions. In all ordinary cases hard-wood cuttings are made from the ripened canes in autumn or winter when the vines are pruned. It is advisable to take the cuttings before the canes have been exposed to great cold. Select only those canes which are well matured, solid and rather short-jointed. In common practice, the cuttings are cut into two-bud length, the lower cut being made close to the bud. The cuttings will range from six to ten inches in length. Some prefer three-bud cuttings (Fig. 43), but unless the cane is very short-jointed such cuttings are too long to be planted and handled economically. Three-bud cuttings usually give stronger plants the first season because roots start from both joints as a rule. Very strong plants are obtained from mallet cuttings (Fig. 45), but as only one such cutting can be made from a cane, unless the cane bears very strong branches, they are not much used. Various methods of peeling, slitting and slicing cuttings are recommended, in order to extend the callusing process but they are not used in common or commercial practice. The cuttings are tied in bundles of 50 or 100, and stored in sand, moss, or sawdust in a cellar, until spring, when they are planted in rows in the open. Some varieties, of which the Delaware is an example, do not strike readily from cuttings. Some growers start common cuttings of these under glass in spring. Others bury the bundles of cuttings in a warm exposure in the fall, with the butt ends up and about level with the surface of the ground. This affords bottom heat to the butts and induces callusing. At the approach of cold weather the cuttings are removed to a cellar, or are heavily mulched and allowed to remain where buried. Storing is safer. Some growers obtain the same results by burying upside down in a cellar. These slow-rooting sorts often start well if they are simply kept in a warm cellar—but where the buds will not swell—all winter, as the callusing is then hastened. At the end of the first season the plants may be transplanted. The plants are often sold at this age, but buyers usually prefer two-year-old plants.

Single bud or "eye" cuttings are largely used for the newer and rarer varieties. These are cut from the canes in the fall, the same as long cuttings, and are stored in boxes of sand or moss. A month before the weather become settled, these boxes may be taken into a house or greenhouse, or put in a mild hot-bed, to induce the formation of the callus. They may then be planted out-doors, and a fair proportion of most varieties may be expected to grow. The best and commonest way of handling eyes, however, is to start them under glass. They are planted horizontally or nearly so and about an inch deep in sand or sandy earth in a cool greenhouse in late winter—in February in the northern states—and in about six weeks the plants will be large enough to pot off or to transplant into cold frames or a cool house. If only a few plants are to be grown they may be started in pots. When the weather is thoroughly settled, they are transferred to nursery rows, and by fall they will make fine plants. There are various ways recommended for the cutting of these eyes—as cutting the ends obliquely up or down, shaving off the bark below the bud, and so on—but the advantages of these fashions are imaginary. A good eye-cutting is shown in Fig. 50. The foreign grapes are propagated by eyes in the north.

Soft cuttings are sometimes used to multiply new kinds. These may be taken in summer from the growing canes, but the plants are usually forced during winter for the purpose of giving extra wood. Cuttings are taken off as fast as buds form during the winter, and they are forced in close frames with a good bottom heat. The cuttings may comprise two buds, with the leaf at the upper one allowed to remain, or they may bear but a single eye, in which case the leaf, or the most of it, is left on. This rapid multiplication from small, soft wood usually gives poor plants; but strong plants may be obtained by allowing the wood to become well hardened before it is used. Soft cuttings will root in two or three weeks under good treatment.

In order to secure extra strong plants from single buds, the eyes may be saddle-grafted or whip-grafted upon a root two or three inches long. The root grafts are then treated in the same way as eye cuttings, only that they are usually grown in pots from the start.

The vine may be grafted with ease by any method. Cleft-grafting is commonly employed upon old plants. The cions are inserted on the crown of the plant, three or four inches below the surface of the ground. The cleft is bound with string and then covered with earth, no wax being necessary. Young plants are usually whip-grafted at the crown, either in-doors or out-doors. Grafting the vine is mostly confined to Europe, California, and other countries where the European grape (*Vitis vinifera*) is grown, as that species must be grafted upon some other stock in order to resist the phylloxera. The common wild frost-grape (*Vitis riparia*) is the most popular stock. The union in these cases must be two or three inches above the ground, to prevent the cion from taking root. The union is wound with waxed muslin, and the earth is heaped about it until it has healed. Grafting may be done out-doors in winter or spring. In the north, winter grafts are likely to be heaved by frosts, and late spring grafts, made as the leaves are pushing, are probably best.

The vine is frequently inarched, and early in spring it can be budded by ordinary methods.

Seed-grafting is a curious practice, which may be applied to the grape (see page 90).

Grape Hyacinth. See Muscari.

Graptophyllum, Earlia. *Acanthaceæ.*

Seeds. Increased by cuttings of rather firm young shoots placed in a frame with some heat.

Gratiola, Sophronanthe (Hedge Hyssop). *Scrophularineæ.*

Seeds. Propagated readily by dividing the roots in spring

Grevillea. *Proteaceæ.*

Propagated by seeds, sown under glass iu February; also by cuttings of half-ripened wood.

Grewia, Chadara, Mallococca. *Tiliaceæ.*

Seeds. Cuttings may be struck in sand under glass, with heat.

Grindelia. *Compositæ.*

Seeds, sown in the border or under a frame. Divisions Cuttings.

Ground-Cherry. See Physalis.

Ground-Nut. See Apios; also Peanut.

Groundsel. See Senecio.

Guaiacum. *Zygophylleæ.*

Ripened cuttings in spring, under a hand-glass, in heat.

Guava (*Psidium*, several species). *Myrtaceæ.*

The guavas grow readily from seeds, and plants will often bloom when a year and a-half old. They may also be multiplied by layers, and by cuttings either under glass or in the open.

Guelder Rose. See Viburnum.

Guernsey Lily. See Nerine.

Gumbo. See Hibiscus.

Gum, Sweet. See Liquidambar.

Gum-tree. See Eucalyptus.

Gunnera. *Halorageæ.*

Propagated by division. It is very difficult to raise from seed.

Gustavia, Pirigara. *Myrtaceæ.*

Cuttings, made of ripened shoots and handled in a frame

Gymnema. *Asclepiadeæ.*

Make cuttings of firm side shoots in spring, and place in a frame.

Gymnocladus (Kentucky Coffee-tree). *Leguminosæ.*

Readily increased by seeds, which start better if soaked for a few hours in hot water. Also by root-cuttings.

Gymnogramme. See Ferns.

Gymnyostachys. *Aroideæ.*

Propagation is effected by suckers and divisions.

Gynerium (Pampas Grass). *Gramineæ.*

Seeds, under glass in the north. Also increased by dividing the tufts.

Gynura. *Compositæ.*

Increased by cuttings and seeds.

Gypsophila. *Caryophylleæ.*

Propagated by seeds, division or cuttings.

Habranthus. See Zephranthes.

Habrothamnus. See Cestrum.

Hackberry. See Celtis.

Hæmanthus (Blood Flower). *Amaryllideæ.*

Bulbels, which should be removed and potted when the plants are commencing new growth, and be kept in a close pit or house till established. Seeds are rarely used.

Hæmodorum (Australian Bloodroot). *Hæmodoraceæ.*

Increased by dividing the roots in spring.

Hakea, Conchium. *Proteaceæ.*

Well-ripened cuttings, placed in sandy peat under glass, in a cool house. Seeds, when obtainable, can be used.

Halesia, Pterostyrax (Silver-bell or Snowdrop Tree). *Styraceæ.*

Seeds, which rarely germinate till the second year. They should be kept constantly moist. Propagation is also effected by layers, or by cuttings of the roots in spring and autumn. Layers are commonly employed in this country.

Halimodendron (Salt-tree). *Leguminosæ.*

Freely increased by seeds, layers or cuttings. May also be grafted on common laburnum.

Hamamelis (Witch-hazel). *Hamamelideæ.*

All grow from seeds or layers, and the Japan species succeed if grafted on American species in the greenhouse. *H. Virginica* may be readily propagated by layers.

Hamelia. *Rubiaceæ.*

Seeds. Cuttings which are nearly ripe will root during the early part of summer under glass, with heat.

Hamiltonia, Spermadictyon. *Rubiaceæ.*

Seeds. Half-ripened cuttings, placed in sand under glass.

Hardenbergia. *Leguminosæ.*

Seeds may be used ; also increased by divisions. Cuttings, made of the firm young side shoots in spring, will grow if inserted under a bell-glass, and placed in a warm frame or pit, without bottom heat.

Hardwickia. *Leguminosæ.*

Propagated by ripened cuttings in sand, in a strong heat.

Harebell. See Campanula.

Hatchet Cactus. See Pelecyphora.

Haw, Hawthorn. See Cratægus.

Hazel. See Corylus

Heartsease. See Viola.

Heath. See Erica.

Heather. See Calluna

Hedera (Ivy). *Araliaceæ.*

Seeds. Layers. The rooted portions of the vine may be severed and treated as independent plants. Cuttings may be made in autumn from any firm shoots, and inserted in pots or in the open ground. If they are placed in heat and kept shaded until roots are formed, good plants are obtained much sooner than when placed in a cold-frame or in the open air. Named varieties are grafted on the stock of any common strong climbing form.

Hedychium (Indian Garland Flower). *Scitamineæ.*

Seeds, rarely. Increased by dividing the rhizomes in spring, when the plants are repotted.

Hedysarum. *Leguminosæ.*

Propagation is effected by means of seeds and division.

Helenium. *Compositæ.*

Increased by seeds or divisions.

Helianthemum, including Fumana (Rock-Rose, Sun-Rose). *Cistineæ.*

The annuals are raised from seeds. The perennials may also be raised from seeds, but it is better to trust to layers and to cuttings, which will root freely in a sandy soil, if kept shaded until established.

Helianthus, including Harpalium (Sunflower). *Compositæ.*

By seeds, which may be sown in pots, and the seedlings transferred, or in the open ground in spring. Also divisions.

Helichrysum, Elichrysum (Everlastings). *Compositæ.*

The annual species and the varieties of *H. bracteatum* may be raised from seed, sown in a light heat in early spring, and afterwards transplanted; or sown in the open ground a little later. The perennial species are increased by cuttings in spring, in a close frame without heat.

Heliconia. *Scitamineæ.*

May be increased by seeds, but the best method is by division of the root stock in spring when growth commences. Separate pieces may be placed in pots, and grown in a moist stove temperature, repotting when necessary; or they may be planted out in the stove, if desired.

Heliotropium (Heliotrope). *Boragineæ.*

Seeds. The common practice is to use cuttings. These can be taken at almost any season, if good growing shoots are to be had. They start readily in sand or soil on a cutting bench, or under a frame. Plants for bedding are struck in late winter from stocks which are in a vigorous condition

Helipterum, including Astelma, Rhodanthe. *Compositæ.*

Seeds may be sown in early spring, under cover.

Helleborus (Black Hellebore, Christmas Rose). *Ranunculaceæ*

Seeds may be sown as soon as ripe. Strong and healthy root divisions are also employed.

Helonias. *Liliaceæ.*

Propagation is effected by seeds, and slowly by root divisions.

Hemerocallis (Day Lily). *Liliaceæ.*

Increased by divisions. *H. Middendorfii* and some others by seed.

Hemlock Spruce. See Tsuga.

Hemp. See Cannabis.

Hepatica. *Ranunculaceæ.*

Can be propagated by division ; also by seeds.

Heracleum (Cow Parsley, Cow Parsnip). *Umbelliferæ.*

Readily increased by seeds or divisions.

Herbertia. *Irideæ.*

Propagated by means of seeds or bulbels.

Herb-Robert. See Geranium.

Hesperis (Dame's Violet, Rocket). *Cruciferæ.*

The single sorts are increased by seeds ; the double forms by carefully dividing the roots, or by cuttings.

Heterocentron. *Melastomaceæ.*

Propagated by cuttings.

Heucheria (Alum Root). *Saxifrageæ.*

Seeds. Readily increased by dividing the crowns during spring.

Hevea, Micrandra, Siphonia. *Euphorbiaceæ.*

Cuttings should be made of half-ripened wood, and inserted in sand under glass.

Hibbertia, including Cyclandra, Pleurandra. *Dilleniaceæ.*

Cuttings, in sandy peat under glass.

Hibiscus. *Malvaceæ.*

Seeds sometimes. Also by divisions and layers. Cuttings of green wood are commonly used, made in summer for hardy species or in early spring for tender ones. Cuttings of ripened wood may be taken in fall, and stored until spring in a rather dry place. The variegated sorts do better if grafted upon strong stocks.

Hicoria, Carya (Hickory, Pecan, etc.). *Juglandeæ.*

Increased chiefly by seeds, which should be stratified ; also by root-sprouts. Seeds are sometimes planted at intervals in the field where the trees are to stand ; but this practice is not to be recommended. The hickory can be grafted. Best results are obtained by veneer or splice-grafting in winter, on potted stocks. Cleft-grafting can be employed out-doors. Saddle-grafting upon young twigs is sometimes used. See also Pecan.

Hippeastrum (Equestrian Star). *Amaryllideæ.*

Seeds may be sown as soon as ripe in well-drained pots or pans of sandy loam, slightly covered, and placed in a temperature of about 65°. For increasing by divisions—which is the usual way—the old bulbs should be taken from the pots and carefully separated, with the least possible injury to the roots. This should be done when the plants are at rest, and the offsets should be placed singly in pots. Keep the bulb about two-thirds above the level of the soil, dispose the roots evenly, and plunge in bottom heat, in a position exposed to the light.

Hippomane, Mancinella. *Euphorbiaceæ.*

Propagated by cuttings, placed in sand under glass.

Hippophaë (Sallow Thorn, Sea Buckthorn). *Elæagnaceæ.*

May be increased by seeds, suckers, layers, and cuttings of the roots.

Hoffmannia, Higginsia. *Rubiaceæ.*

Insert cuttings in sandy soil under cover, in bottom heat.

Hog Plum. See Spondias.

Holbœllia. *Berberideæ.*

In spring, cuttings may be made of half-ripened shoots.

Holly. See Ilex.

Hollyhock (Althæa). *Malvaceæ.*

Seeds should be sown as soon as ripe—in summer—in pots or pans, and placed in a slight bottom heat or in the open air. In either case, place the seedlings in 3-inch pots, and winter in a cold-frame. Dividing the roots, after flowering is over, by separating the crown, so as to preserve one or more buds and as many roots as possible to each piece. Cuttings of young shoots three inches long, taken off close to the old root at nearly the same time, should be placed singly in small pots of light, sandy soil and kept close, and shaded in a cold-frame until rooted. If cuttings are made during winter, a gentle bottom heat must be given. Also grafted (see page 88). See also Althæa.

Honesty. See Lunaria.

Honey-Locust. See Gleditschia.

Honeysuckle. See Lonicera.

Hop. See Humulus.

Hop Hornbeam. See Ostrya.

Horehound (*Marrubium vulgare*). *Labiatæ.*

Seeds, in early spring. Division.

Horkelia. See Potentilla.

Hornbeam. See Carpinus.

Horse-Chestnut. See Æsculus.

Horse-Mint. See Monarda.

Horse-Radish (*Nasturtium Armoracia*). *Cruciferæ.*

Root cuttings ("sets"). These are made from the small side roots when the horse-radish is dug. They may be anywhere from one-fourth to one inch in diameter, and three to six inches long, one end being cut slanting, to mark it. These are planted obliquely, two to four inches deep, in spring. They may be buried during winter. (Fig. 48). The old crowns may be planted, but they make poorer roots.

Hottonia. *Primulaceæ.*

Propagation is effected by seeds and divisions in spring.

House-Leek. See Sempervivum.

Houstonia. *Rubiaceæ.*

Seeds. May also be increased by carefully-made divisions in autumn or spring.

Hovea, Poiretia. *Leguminosæ.*

Propagation is best effected by seeds, sown in well-drained pots of sandy peat soil in spring, and placed in a gentle bottom heat. Cuttings are difficult to strike.

Hovenia. *Rhamneæ.*

Increased by seeds. Root cuttings are also used. Ripened cuttings should be placed in sand, under a hand-glass.

Hoya (Honey Plant, Wax Flower). *Asclepiadeæ.*

For layering, good-sized shoots should have a few of their leaves removed, and should then be put in pots of soil until rooted. The plants may afterwards be grown on, and re-potted according to their strength. Cuttings may be taken in spring or later in the year, from shoots of the preceding summer's growth, and placed in a compost of peat and sand, and plunged in bottom heat in a frame. A slight shade and careful watering will be necessary. *H. bella* does best when grafted on a stronger growing sort.

Huckleberry. See Vaccinium.

Humea, Agathomeris, Calomeria. *Compositæ.*

Sow seeds in light, finely-sifted soil, and place in a frame in early summer.

Humulus (Hop). *Urticaceæ.*

It may be propagated by seeds, or by divisions in spring. Ordinarily, however, the species is increased by hard-wood cuttings of two-bud lengths from the best old shoots, and made in spring. Leave the top bud just above the ground.

Hyacinthus (Hyacinth). *Liliaceæ.*

Seeds are employed for the production of new varieties. These are sown the same season they mature, in light, sandy soil, and are covered not more than a half-inch deep. In four or five years, or sometimes even longer, the bulbs will be large enough to flower. Varieties are perpetuated by means of the bulbels which form freely upon some varieties. These are treated in much the same manner as mature bulbs, or they may be handled in pans or flats. They make flower bulbs in two or three years. To increase the numbers of these bulbels, the bulbs are variously cut by the Dutch growers. These practices are described and illustrated on pages 27 and 28, Figs. 12–14. Hyacinths can be propagated by leaf cuttings. Strong leaves should be taken in early spring and cut into two or three portions, each portion being inserted about an inch in good sandy loam, and given a temperature of about 75°. In eight or ten weeks a bulblet will form at the base of the cutting (see page 52). The lower leaves give better results than the upper ones. These bulblets are then treated in the same manner as bulbels.

Hydrangea, Hortensia. *Saxifrageæ.*

The hardy species are usually propagated by green cuttings in summer, under glass (see Fig. 57). The tender species are increased by cuttings taken at any time from vigorous young wood, usually in late winter. Layers are occasionally employed, and suckers can be separated from some species. Sometimes the hardy species are forced for purposes of propagation by cuttage. *H. quercifolia* is propagated by little suckers or "root pips." *H. paniculata, grandiflora* can easily be propagated from the young wood, taken in June and planted under glass.

Hymenocallis. *Amaryllideæ.*

Treated the same as Pancratium, which see.

Hypericum, including Androsæmum. *Hypericineæ.*

Easily increased by seeds, cuttings, or by strong pieces of the roots of creeping-rooted species. Hard-wooded cuttings taken in fall, are commonly used.

Hypoxis. *Amaryllideæ.*

Propagation is effected by seeds and offsets.

Hyssop (*Hyssopus officinalis*). *Labiatæ.*

Seeds. Division.

Iberis (Candytuft). *Cruciferæ.*

The annuals and biennials are increased by seeds sown in light sandy soil, in spring or autumn. The sub-shrubby sorts are also increased by seeds sown in spring, but more often by divisions or by cuttings.

Idesia. *Bixineæ.*

Seeds may be sown in spring in gentle heat. Half-ripened cuttings may be made in spring or autumn, and should be inserted in sandy loam, and placed under a bell-glass, in gentle heat. Also by root-cuttings.

Ilex, including Prinos (Holly). *Ilicineæ.*

Seeds, which should be stratified. They are often cleaned of the pulpy coat by maceration. The seeds rarely germinate until the second year. Varieties are perpetuated by graftage. The veneer graft, upon potted plants, is usually employed, but other methods may be successful. Budding is sometimes performed.

Illicium (Aniseed-tree). *Magnoliaceæ.*

Seeds. Cuttings of young ripened shoots may be made during summer and should be placed in sandy soil, under a glass.

Imantophyllum. *Amaryllideæ.*

Seeds. Usually increased by division or by means of bulbels.

Impatiens, Balsamina (Balsam). *Geraniaceæ.*

The common annuals may be raised from seeds, in spring, in any ordinary light soil. The stove and greenhouse species may be increased by seeds, or from cuttings, which root freely in a close frame. *I. Sultani* does best from seeds.

Indian Fig. See Opuntia.

Indian Shot. See Canna.

Indigofera (Indigo). *Leguminosæ.*

Propagated by seeds. Cuttings of young shoots may be inserted in sandy or peaty soil under glass, in slight heat.

Inga. *Leguminosæ.*

Propagated by seeds. Cuttings root with difficulty.

Inula, Elecampane. *Compositæ.*

Readily increased by seeds or by divisions.

Ionidium, Solea. *Violarieæ.*

The herbaceous species are increased by seeds and by divisions. The shrubby sorts are increased by cuttings which will root in sand, in a frame.

Ipomœa, including Quamoclit (Moonflower, Morning Glory) *Convolvulaceæ.*

All the annual species are grown from seeds. The perennials are also increased by seedage, but they may be raised from cuttings struck in a forcing-house or a frame. The moon-flowers often do better in the north from cuttings than from seeds. *I. Horsfalliæ* is largely propagated by layers, and other species may be treated in the same way. Division is sometimes employed. *I. pandurata* can be propagated by root-cuttings. Also grafted (see page 88).

Ipomopsis. See Gilia.

Iresine, Achyranthes. *Amarantaceæ.*

Seeds rarely. Increased readily by cuttings. For summer bedding in the north, cuttings should be started in February or March. For use as window plants, they should be taken in late summer.

Iriartea, Deckeria. *Palmæ.*

Propagation is effected by seeds.

Iris, including Xiphion. *Irideæ.*

Seeds grow readily and give good results, and they are usually produced freely, especially in the bulbous species. Sow as soon as ripe in light soil in some protected place. The bulbous species produce bulbels, which may be used for multiplication. The rhizomatous species are propagated by dividing the rhizome into short rooted pieces. Or when the rhizomes lie on the surface of the ground and do not root readily, they may be layered.

Isonandra (Gutta-Percha Tree). *Sapotaceæ.*

Insert cuttings in sandy soil, under glass, in heat.

Isoplexis, Callianassa. *Scrophularineæ.*

Cuttings of half-ripened shoots should be made in spring under glass.

Isopyrum. *Ranunculaceæ.*

Propagated by seeds or by divisions, in autumn or spring

Itea. *Saxifrageæ.*

Propagated by seeds or by suckers, in spring; and in autumn by layers.

Ivy. See Hedera and Ampelopsis.

Ixia, including Morphixia. *Irideæ.*

Seeds may be sown in pans of sandy soil in autumn, and placed in a cool frame. Propagation by bulbels is a much quicker, as it is the usual method.

Ixiolirion, Kolpakowskia. *Amaryllideæ.*

Increased by seeds; and by bulbels.

Ixora. *Rubiaceæ.*

Seeds. Usually increased by short-jointed green cuttings placed in a close frame with a strong bottom heat.

Jaborosa. *Solanaceæ.*

Increased by seeds sown in spring, and by divisions, also by cuttings of young shoots, placed under a frame.

Jacaranda. *Bignoniaceæ.*

Cuttings of half-ripened shoots may be made in early summer and placed in sand over sandy peat, in heat, and kept shaded. Also seeds.

Jacobæan Lily. See Amaryllis.

Jacobinia. See Justicia.

Jacquinia. *Myrsineæ.*

Cuttings of ripened shoots, usually made in summer, placed in sand, in a moist bottom heat.

Jalapa. See Mirabilis.

Jambosa. See Myrtus.

Jasione (Sheep's Scabious). *Campanulaceæ.*

Seeds, sown in spring or fall, usually in the open. The perennials may be divided.

Jasminum (Jasmine, Jessamine). *Oleaceæ.*

Sometimes by seeds, but usually by cuttings of the nearly ripened wood, under glass. Cuttings of ripe wood are also employed, and layers are often used.

Jatropha. *Euphorbiaceæ.*

Cuttings made of firm young shoots will strike in sandy soil in a strong bottom heat. The cuttings, if very fleshy, may be dried a few days before setting them.

Jeffersonia. *Berberideæ.*

Seeds should be sown as soon as ripe, or divisions may be made.

Jerusalem Artichoke (Girasole). See Artichoke.

Jessamine, Yellow. See Gelsemium.

Jonquil. See Narcissus.

Jubæa (Coquito Palm of Chili). *Palmæ.*

Propagation is effected by seeds.

Judas-tree. See Cercis.

Juglans (Walnut and Butternut). *Juglandeæ.*

All the species are readily propagated by means of stratified nuts. Do not allow the nuts to become dry. Artificial cracking should not be done. In stiff soils the seedlings are apt to produce a long tap-root which renders transplanting difficult after the first year or two. The tap-root may be cut by a long knife while the tree is growing, or the young seedling may be transplanted. Particular varieties are perpetuated by grafting or budding with any of the common methods. In the north, they are sometimes worked indoors in pots. Common shield-budding works well, if the sap is flowing freely in the stock. Flute-budding is often employed. The improved native sorts are root-grafted in winter. Old trees can be top-grafted like apple-trees (see p. 90).

The "English" walnut (*J. regia*) is mostly grown direct from seed in this country, and the different varieties usually come true. In California, the native walnut (*J. Californica*) is often used as a stock for this species, and flute-budding on branches a half-inch or more in diameter is often practiced "Twig-budding," or the insertion of a short branchlet or bit of branch which is severed from the parent branch in the same manner as a shield bud, is sometimes employed.

Jujube (*Zizyphus Jujube*). *Rhamneæ.*

Seeds and cuttings.

Juncus (Rush, Bulrush). *Junceæ.*

Seeds. The perennials may be increased by division.

Juneberry (*Amelanchier Canadensis*, var. *oblongifolia*). *Rosaceæ*

Increased by using the sprouts which form freely about the old plants; also by seeds.

Juniperus (Juniper, Red Cedar). *Coniferæ.*

Increased readily by seeds, which, however, often lie dormant until the second year. They germinate more readily if the pulp is removed by maceration or by soaking with ashes for a few days. Green cuttings, in sand under glass, root easily; or mature cuttings may be taken in fall and placed in a cold frame, in which they will need little protection during winter. Some varieties require a long time to root. Most of the named varieties may be grafted on imported Irish stocks, which are much used in some parts of the country. They may be veneer-grafted and handled in a cool house.

Jurinea. *Compositæ.*

Increased in spring by seeds or by divisions.

Jussiæa. *Onagrarieæ.*

Seeds and divisions are used for propagating.

Justicia, including Jacobinia and Sericographis. *Acanthaceæ.*

Seeds occasionally. The species strike readily from short green cuttings on a cutting-bench or under a frame.

Kadsura, Sarcocarpon. *Magnoliaceæ.*

Seeds. Cuttings, made of nearly ripened shoots, which should be placed in sand under glass.

Kaki. See Persimmon.

Kalanchoe. *Crassulaceæ.*

Propagated by seeds, but cuttings, when obtainable, are better.

Kale (*Brassica oleracea*, vars.). *Cruciferæ.*

By seeds, sown in the open in spring in the north, or in the fall in the south.

Kalmia (Mountain Laurel, Calico-bush). *Ericaceæ.*

May be increased by seeds, which should be sown in shallow pans of sandy peat, and kept in a cold-frame until the seedlings are large enough to transfer to the open air after being hardened off. By cuttings of young shoots in sandy peat, placed in a shady situation under a hand-glass. Also by layers. Usually obtained from the woods.

Kennedya. *Leguminosæ.*

Seeds may be sown in spring or summer, or cuttings of rather firm side shoots may be made at the same time, and placed in peaty soil, in a close, warm frame.

Kentia. *Palmæ.*

Increased by seeds, placed in light, sandy soil, with heat.

Kentucky Coffee-tree. See Gymnocladus.

Kerria. *Rosaceæ.*

Propagated by divisions, layers, and by cuttings of young shoots, inserted under a hand-light, or by ripened cuttings. In this country, oftener increased by ripe wood in fall.

Kitaibelia. *Malvaceæ.*

Seeds. May be readily propagated by divisions.

Kleinhovia. *Sterculiaceæ.*

Seeds. Make cuttings of the young ripened shoots, and place in sand, in heat, under glass.

Klugia. *Gesneraceæ.*

Seeds. Propagated usually by cuttings.

Knightia, Rymandra. *Proteaceæ.*

Make cuttings of ripened shoots with upper leaves on, and place in sandy soil under glass, in a very gentle bottom heat.

Kniphofia, Tritoma. *Liliaceæ.*

Increased by seeds, or by divisions of the crown in early spring.

Knowltonia, Anamenia. *Ranunculaceæ.*

Increased by seeds and divisions.

Kœllikeria. *Gesneraceæ.*

Seeds, carefully sown. May be propagated by dividing the tubers.

Kœlreuteria. *Sapindaceæ.*

Propagated in spring by seed, by layers in autumn, and by cuttings of the young shoots in spring; also by root-cuttings

Kœniga. *Cruciferæ.*

Seeds, in spring.

Krameria. *Polygaleæ.*

Cuttings, set in sand under glass, in spring.

Kreysigia, Tripladenia. *Liliaceæ.*

Seeds. Propagated generally by divisions in spring.

Kydia. *Malvaceæ.*

Seeds. May be increased by cuttings of firm shoots, which root in sand under glass.

Laburnum. *Leguminosæ.*

The species may be increased by seeds. Layers and suckers are often used. The varieties by grafting or budding on the common sorts.

Lachenalia. *Liliaceæ.*

Seeds. Bulbels.

Lachnæa. *Thymelaceæ.*

Cuttings of short young shoots may be made in spring, and should be placed in sand, under glass.

Lælia. *Orchideæ.*

Increased by pseudo-bulbs, as in cattleya. See also under Orchids.

Lagerstrœmia (Crape Myrtle). *Lythrarieæ.*

Layers. Cuttings of firm, small side shoots may be made in spring, and placed in bottom heat.

Lagetta (Lace Bark). *Thymelaceæ.*

Usually increased by cuttings of firm shoots, placed in sand under glass, in bottom heat.

Lagunaria. *Malvaceæ.*

Seeds. Cuttings of half-ripened shoots, placed under glass, in a gentle heat.

Lambertia. *Proteaceæ.*

Increased by seeds, sown in slight heat. By cuttings, made of young and rather firm shoots.

Lantana. *Verbenaceæ.*

Seeds, which give new varieties. Cuttings, in fall or spring, from good growing wood, in sand in a warm house or frame.

Lapageria, Capia, Phænocodon. *Liliaceæ.*

Sow seeds when ripe in a sandy peat soil, and keep in a moderate heat. Increased by layers of firm, strong shoots.

Laportea. *Urticaceæ.*

Propagated by seeds, or by cuttings placed in sand, in heat.

Lardizibala. *Berberideæ.*

The cuttings, made of half-ripened shoots, should be inserted in sandy soil under glass.

Larix (Larch, Tamarack). *Coniferæ.*

Seeds should be kept dry over winter and planted early in spring. Shade the young plants. Varieties, as the weeping sorts, are worked upon common stocks. The grafting may be done by the whip method, out-doors early in spring. Rare sorts are sometimes veneer-grafted under glass.

Larkspur, See Delphinium.

Lasiandra. *Melastomaceæ.*

Propagated by cuttings of the growing wood under glass.

Lasiopetalum. *Sterculiaceæ.*

Seeds. Make cuttings in spring of the half-ripened wood, and insert in sand, under glass.

Latania. See Livistona.

Lathyrus (Sweet Pea, Vetchling). *Leguminosæ.*

Seeds, sown very early in the open. The perennials also by seeds, sometimes by division.

Lattice-leaf. See Ouvirandra.

Latua. *Solanaceæ.*

Propagated by cuttings, placed in sand under glass.

Laurel, Mountain. See Kalmia.

Laurus (Laurel). *Laurineæ.*

Increased by seeds, layers, and by cuttings, placed under a hand-glass in sandy soil. Also propagated by root-cuttings.

Laurustinus. See Viburnum.

Lavandula (Lavender). *Labiatæ.*

Divisions. When the flowers are fully expanded, cuttings may be made. These should be inserted in sandy soil, under a frame.

Lawsonia, Alcanna. *Lythrarieæ.*

Increased by cuttings of ripened shoots, placed in sand under a glass, in heat.

Laxmannia. *Liliaceæ.*

Seeds. Propagation is usually effected by divisions or bulbels.

Layia. *Compositæ.*

Increased by seeds, sown in a hot-bed, or in the open border in the south.

Leaf-Beet or **Chard.** See Beet.

Ledum (Labrador Tea). *Ericaceæ.*

Propagated by seeds and divisions, but principally by layers, in sandy peat soil.

Leek (*Allium Porrum*). *Liliaceæ.*

Seeds, sown very early in the spring, either out-doors or in a cold-frame.

Leianthus. *Gentianeæ.*

Seeds, under cover; or cuttings of young shoots may be made, and inserted in sandy soil under glass.

Leiophyllum (Sand Myrtle). *Ericaceæ.*

May be freely increased by seeds, sown in pans and placed in a frame. By layers in autumn.

Lemon (*Citrus Limonum*). *Rutaceæ.*

The named sorts are budded upon either orange or lemon stocks. Orange stocks are probably most generally preferred, as they are adapted to a great variety of soils, and vigorous trees nearly always result. The budding is performed in the same manner as upon the orange, which see. Lemons are often grown from cuttings of the mature wood, which are set in the open ground as soon as the spring becomes warm, or in a frame. Stocks for budding upon are sometimes grown from cuttings in this way.

Lentil (*Ervum*, various species). *Leguminosæ.*

Seeds, sown in early spring.

Leonotis (Lion's Ear, Lion's Tail). *Labiatæ.*

Seeds. Increased by cuttings, which root freely in a gentle bottom heat, in early spring.

Leontice. *Berberideæ.*

May be increased by seeds or by suckers.

Leontopodium (Edelweiss, Lion's Foot). *Compositæ.*

May annually be raised from seeds, or the old plants may be divided in spring. The seeds must be kept in a dry place throughout the winter.

Lepachys. See Rudbeckia.

Leptosyne. *Compositæ.*

Propagated by seeds.

Leschenaultia. *Goodenovieæ.*

In spring or summer cuttings may be taken from the points of shoots that are rather firm, and placed in sandy peat, in a shaded frame.

Lessertia. *Leguminosæ.*

Propagation by seeds, or by divisions in spring.

Lettuce (*Lactuca sativa*). *Compositæ.*

Seeds, which may be sown under glass or in the open. In the middle and southern states, the seeds may be sown in the fall, and the plants protected during cold by a mulch; or the plants may grow during winter in the warmer parts.

Leucadendron (Silver Tree). *Proteaceæ.*

Propagated by seeds.

Leucoium (Snowflake). *Amaryllideæ.*

Seeds, for producing new sorts. Propagation is commonly effected by bulbels, which should be secured as soon as possible after the foliage ripens.

Leucothoë. *Ericaceæ.*

Increased by seeds, which should be covered very lightly By divisions of established plants in autumn or winter. Also by layers.

Lewisia. *Portulacaceæ.*

Propagated by seeds, or by divisions in spring.

Leycesteria. *Caprifoliaceæ.*

May be increased by seeds, sown in spring. By cuttings of the short young shoots, made in spring; by older ones made in autumn.

Leyssera. *Compositæ.*

Increased by seeds, and by firm cuttings, placed in sandy soil during summer.

Liatris (Blazing Star, Button Snake-Root). *Compositæ.*

Seeds are usually sown early in autumn. Divisions may be made in spring.

Libonia. *Acanthaceæ.*

Seeds are rarely employed. Usually increased by short green cuttings in a frame.

Licuala, Pericylcla. *Palmæ.*

Seeds may be sown in spring in a sandy soil, and placed in a strong, moist bottom heat.

Lietzia. *Gesneraceæ.*

Increased by seeds sown in early spring, in heat; by cuttings inserted in sand under a glass, in bottom heat; or by tubers, which must be kept dry in winter and potted in early spring.

Lightfootia. *Campanulaceæ.*

The annuals, by seeds sown in a warm frame in spring Perennials also by cuttings made of young shoots placed in sand containing a little peat, under glass.

Ligularia. *Compositæ.*

Increased by seeds, or by divisions in spring and autumn

Ligustrum (Privet, Prim). *Oleaceæ.*

Stratified seeds. Division. The named varieties are grown from cuttings, either of green or ripe wood.

Lilac. See Syringa.

Lilium (Lily). *Liliaceæ.*

Seeds—giving new varieties in the variable species—should be sown as soon as ripe in well-drained pans of sandy peat, slightly covered with similar soil and a layer of moss, and placed in a cool frame. Usually increased by bulbels, which should be planted a few inches apart in prepared beds. Sometimes small bulblets form in the axils of the leaves, and these are used in the same manner as bulbels. Bulb-scales are often employed for the multiplication of scarce kinds. Those which produce large and loose bulbs, as *L. candidum*, may be increased by simple division. These operations are described on pp. 25 to 29.

Lily of the Valley. See Convallaria.

Lime (*Citrus Limetta*). *Rutaceæ.*

Seeds, which usually reproduce the variety. Some varieties are budded upon strong seedlings.

Lime-tree. See Tilia.

Limnanthes. *Geraniaceæ.*

Freely increased by seeds in any ordinary garden soil in spring or autumn.

Limnocharis. *Alismaceæ.*

Increased by seeds, by divisions, and by runners.

Linaria (Toadflax). *Scrophularineæ.*

Increased by seeds sown in light soil, in early spring. Or by divisions made in spring or autumn. The greenhouse species are ordinary grown from seeds, which should be carefully sown in finely pulverized soil. Cuttings may also be used.

Linden. See Tilia.

Lindleya. *Rosaceæ.*

Increased by ripened cuttings under glass in bottom heat; or by grafting on the hawthorn.

Linnæa. *Caprifoliaceæ.*

Naturally increased by layers or runners. Seeds are rarely employed.

Linum (Flax). *Lineæ.*

Propagated by seeds, the hardy species sown out-doors and the tender ones under glass. Cuttings may be taken from firm shoots and inserted in a sandy position under glass. The ordinary flax is sown directly in the field.

Lippia, including Aloysia, Zapania. *Verbenaceæ.*

Seeds. Usually by cuttings of young shoots, which will root freely in sandy soil in a close, warm frame. If it is not possible to secure the necessary heat, cuttings of the hard wood can be used in autumn, under glass.

Liquidambar (Sweet Gum). *Hammelideæ.*

Seeds, which should be stratified or sown as soon as ripe. Many of the seeds may lie dormant until the second year.

Liquorice. See Glycyrrhiza.

Liriodendron (Tulip-tree, Whitewood). *Magnoliaceæ.*

Increased by stratified seeds. Named varieties are grafted on seedlings. The seeds of the tulip-tree are apt to be hollow, especially those grown along the eastern limits of the distribution of the species.

Lisianthus. *Gentianeæ.*

The annuals may be increased by seeds, those of a shrubby habit by cuttings.

Litchi. See Nephelium.

Lithospermum, including Batschia (Gromwell). *Boragineæ.*

May be propagated by seeds, by divisions, or by cuttings.

Livistona, Latania, Saribus (Fan Palm). *Palmæ.*

Seeds, sown in a sandy soil and placed in a gentle bottom heat.

Lloydia. *Liliaceæ.*

Seeds rarely. Increased by bulbels, or by the creeping shoots leaving a bulb at the extremity.

Loasa, including Illairea. *Loaseæ.*

All are easily increased by seeds sown in a light, sandy soil, usually under cover. Cuttings are rarely used.

Lobelia. *Campanulaceæ.*

Ordinarily increased by seeds, which are more certain if handled in pans or flats under glass. Cuttings from vigorous shoots may be employed, and strong plants of some species may be divided. The cardinal flower (*L. cardinalis*) is grown from seeds carefully sown in fine soil, usually under cover.

Locust-tree. See Robinia.

Loddigesia. *Leguminosæ.*

Increased in spring by cuttings placed under glass, in sandy soil.

Lœselia, Hoitzia. *Polemoniaceæ.*

Seeds. Cuttings of half-ripened shoots in sand under glass.

Logania, Euosma. *Loganiaceæ.*

Propagated by cuttings of firm side shoots inserted in sandy soil, under glass.

Loiseleurea. *Ericaceæ.*

Propagation by layers; very rarely by seeds, which are slow and uncertain.

Lomatia, Tricondylus. *Proteaceæ.*

Increased by cuttings of well-ripened shoots placed in a gentle heat under glass.

Lonchocarpus. *Leguminosæ.*

Seeds. Propagated by growing cuttings placed in sand under glass, in mild heat.

Lonicera, including Caprifolium and Xylosteum (Honeysuckle). *Caprifoliaceæ.*

Seeds, for new varieties. Sow as soon as ripe, or stratify, first removing them from the pulp. The upright species are commonly grown from layers and from cuttings of dormant wood. The creepers are mostly grown from dormant cuttings.

Lopezia, Pisaura. *Onagrarieæ.*

Seeds, under cover in spring. Also increased by cuttings.

Lophanthus (Giant Hyssop). *Labiatæ.*

Propagation is effected by seeds and divisions.

Lophospermum. See Maurandia.

Loquat. See Photinia.

Lotus. *Leguminosæ.*

The species may be raised annually from seeds. Increased also by cuttings.

Lotus of the Nile. See Nymphæa.

Lovage (*Levisticum officinale*). *Umbelliferæ.*

Seeds sown in the open ground, and divisicn.

Lucern. See Medicago.

Luculia. *Rubiaceæ.*

Sow seeds in sandy soil and place in a little heat. Cuttings of young shoots may be inserted in spring, under glass, in gentle bottom heat for the first two or three weeks. Insert immediately after cutting and water freely.

Luffa (Dish-cloth Gourd). *Cucurbitaceæ.*

Seeds, sown in the open, or in the north better started in pots in early spring.

Lunaria (Honesty). *Cruciferæ.*

Propagated by seeds or by divisions.

Lupinus (Lupin). *Leguminosæ.*

Seeds of annuals may be sown in the open border during early spring. The perennials may be increased the same way, or by dividing the stronger growing plants during very early spring.

Lycaste. *Orchideæ.*

Division and pseudo-bulbs. (See also under Orchids)

Lychnis, including Agrostemma, Viscaria. *Caryophylleæ.*

Increased readily in spring by seeds, divisions or cuttings.

Lycium (Matrimony Vine, Box Thorn). *Solanaceæ.*

Increased by seeds, suckers, layers; and by cuttings made in autumn or spring.

Lygodium (Hartford Fern, Climbing Fern). *Filices.*

By spores and divisions of the root. See Ferns.

Lyonia. *Ericaceæ.*

Increased by seeds, which should be sown very carefully in sandy peat soil. Also by layers.

Lysimachia (Loosestrife). *Primulaceæ.*

Propagation is easily effected by seeds; by divisions in late autumn or early spring; and by cuttings.

Lythrum (Loosestrife). *Lythrarieæ.*

Seeds and divisions are the usual methods. Cuttings are employed for some species.

Maclura (Osage Orange). *Urticaceæ.*

Sow seed in the spring. Soak in warm water a few days before sowing.

Madia. *Compositæ.*

Seeds.

Magnolia. *Magnoliaceæ.*

Seeds are commonly used. The coverings should be macerated from the very pulpy species. The cucumber-trees and some others are sown directly in autumn. The seeds of any species should not be allowed to become thoroughly dry. Magnolias strike well from green cuttings, cut to a heel and handled under glass. Layers are often used. Named varieties are veneer- or side-grafted upon strong stocks. The cucumber tree (*M. acuminata*) is used as a stock for all species. The umbrella tree (*M. umbrella*) is also a good stock.

Mahernia. *Sterculiaceæ.*

Propagated during summer by cuttings of young shoots, one or two inches long, inserted in sandy soil, under glass.

Mahonia. See Berberis.

Maidenhair-tree. See Ginkgo.

Maize (*Zea Mays*). *Gramineæ.*

Seeds (properly fruits) planted upon the approach of warm weather.

Malcolmia. *Cruciferæ.*

Propagated by seeds.

Mallow. See Malva.

Malope. *Malvaceæ.*

Seeds may be sown either under glass in early spring, or in the open border a month or two later.

Malpighia. *Malpighiaceæ.*

Cuttings of nearly ripened shoots may be made in summer, with leaves or under glass.

Malva (Mallow). *Malvaceæ.*

The annuals by seeds only. The perennials may be increased by seeds, divisions or cuttings.

Malvaviscus, Achania. *Malvaceæ.*

Increased by seeds, and by cuttings of side shoots, placed under glass, in heat.

Mammea (Mammee Apple, St. Domingo Apricot). *Guttiferæ.*

Seeds. Cuttings of half-ripened shoots should be taken with the leaves on and placed in a frame.

Mammillaria. See Cactus.

Mandevilla. *Apocynaceæ.*

Propagated by seeds, layers, or cuttings of half-ripened wood.

Mandiocca. See Manihot.

Mandragora (Mandrake). *Solanaceæ.*

Propagated by seeds or by divisions.

Mandrake. See Mandragora and Podophyllum.

Manettia. *Rubiaceæ.*

Seeds are sometimes employed. Usually increased by cuttings of young shoots. Root-cuttings are sometimes made.

Mangifera. See Mango.

Mango (*Mangifera Indica*). *Anacardiaceæ.*

Stocks are obtained by seeds. The seeds usually have more than one embryo, sometimes as many as ten. Each embryo will produce a distinct plant. The embryos may be separated before planting, but it is preferable to separate the young plantlets soon after germination, before they grow together, as they are apt to do. The seeds germinate better if the hard shell is removed before planting. Seeds retain their vitality but a few days, and if to be shipped for sowing they should be enclosed in wax. Seedlings begin to bear from the third to the sixth years. Varieties are inarched upon other stocks.

Mangostana, Mangosteen. See Garcinia.

Manicaria, Pilophora. *Palmæ.*

Increased by seeds, which should be sown in a strong, moist heat.

Manihot, Janipha, Mandiocca. *Euphorbiaceæ.*

Propagation is effected by cuttings of young and rather firm shoots, placed in sandy peat under glass, in bottom heat. For the propagation of *M. Aipe*, see Cassava

Mantisia. *Scitamineæ.*

Propagated usually by divisions, made just as growth commences.

Maple. See Acer.

Maranta. *Scitamineæ.*

Propagated the same as Calathea, which see.

Marguerite or **Paris Daisy** (*Chrysanthemum frutescens*). *Compositæ.*

Cuttings, as described for Chrysanthemum.

Marica. *Irideæ.*

Propagated by seeds, and by division of the rhizomes, placing each portion in sand, in a high bottom heat.

Marigold. See Tagetes.

Mariposa Lily. See Calochortus.

Marsdenia. *Asclepiadeæ.*

In spring, cuttings may be made and inserted in sand, under glass.

Marsh-Mallow. See Althæa.

Marsh-Marigold. See Caltha.

Martynia (Unicorn Plant). *Pedalineæ.*

Seeds, sown where the plants are to grow, or started under glass in the north.

Masdevallia. *Orchideæ.*

Division. (See also under Orchids.)

Mathiola (Stock, Gilliflower). *Cruciferæ.*

Seeds, sown either under cover or in the garden. Grows readily from cuttings.

Maurandya, including Lophospermum. *Scrophularinæ.*

Seeds, sown in heat. Cuttings of young growth under glass.

Mauritia, including Orophoma. *Palmæ.*

Sow seeds in heat.

Maxillaria. *Orchideæ.*

Division of the plants, and also of the pseudo-bulbs. (See also under Orchids.)

May-Apple. See Podophyllum.

Meadow-Rue. See Thalictrum.

Meadow-Sweet. See Spiræa.

Meconopsis. *Papaveraceæ.*

Seeds, sown in early spring in a gentle heat. Also propagated by division.

Medeola (Indian Cucumber). *Liliaceæ.*

Seeds. May be increased by dividing the plants in spring.

Medicago (Lucerno, Medick). *Leguminosæ.*

Propagated by seeds or divisions.

Medinilla. *Melastomaceæ.*

Cuttings of young wood in strong, close heat.

Medlar (*Pyrus* [or *Mespilus*] *Germanica*). *Rosaceæ.*

Stocks are grown from stratified medlar seeds, and the plant may be worked upon these, the thorn or quince.

Megarrhiza. *Cucurbitaceæ.*

Propagation is effected by seeds, sown in gentle heat in spring.

Melittis (Bastard Balm). *Labiatæ.*

Seeds and division.

Melaleuca. *Myrtaceæ.*

Seeds. In spring, cuttings getting firm at the base may be made about three inches in length. Place in a compost of peat and sandy loam.

Melastoma. *Melastomaceæ.*

Make cuttings during spring, and place in sandy peat under glass in heat.

Melia (Bead-tree). *Meliaceæ.*

Seeds, sown as soon as ripe. Cuttings of growing wood under glass.

Melianthus (Honey Flower). *Sapindaceæ.*

Increased by seeds, by root-sprouts, or by cuttings, which root freely under glass.

Melichrus. *Epacrideæ.*

Cuttings of the shoots should be made, about two inche long, and inserted in sandy soil.

Melicocca (Ginep, Spanish Lime). *Sapindaceæ.*

Seeds. Place ripened cuttings in sand under glass, in heat.

Melocactus. See Cactus.

Melon (*Cucumis Melo*). *Cucurbitaceæ.*

Seeds, sown where the plants are to stand. In the north they are occasionally started under glass in pots or pieces of inverted sods, by amateurs.

Menispermum (Moon-seed). *Menispermaceæ.*

Propagated by seeds, divisions or cuttings in spring.

Menyanthes (Buckbean). *Gentianeæ.*

Increased by seeds; by divisions of the roots.

Menziesia. *Ericaceæ.*

May be increased by dividing established tufts, by layers or by cuttings.

Mertensia, Lungwort. *Boragineæ.*

Propagation is effected by sowing seeds as soon as ripe, or by divisions in autumn.

Mesembryanthemum (Fig Marigold, Ice Plant). *Ficoideæ.*

May be easily propagated by seeds, sown under glass; by pieces, pulled or cut off, and laid in the sun on moist sand.

Mespilus. See Medlar.

Metrosideros. *Myrtaceæ.*

Propagated by seeds; also by cuttings of the hardened wood in late autumn.

Mezereum, Mezereon. See Daphne.

Michælmas Daisy. See Aster.

Michauxia. *Campanulaceæ.*

The seeds may be sown in the border in spring.

Michelia. *Magnoliaceæ.*

Seeds. Make cuttings of growing wood in summer, and place in sand under glass.

Mignonette. See Reseda.

Milfoil. See Achillea.

Milkweed. See Asclepias.

Milla. *Liliaceæ.*

Increased by seeds, bulbels or divisions.

Miltonia. *Orchideæ.*

Dividing the pseudo-bulbs. (See also under Orchids.)

Mimosa (Sensitive Plant). *Leguminosæ.*

Seeds, sown in-doors. Cuttings of rather firm shoots, and inserted in sandy soil, in heat.

Mimulus (Monkey Flower, Musk Plant). *Scrophularineæ.*

Propagated by seeds, which should be thinly sown and lightly covered. Also by divisions and cuttings.

Mint. See Peppermint and Spearmint.

Mirabilis, Jalapa (Marvel of Peru, Four o'clock). *Nyctagineæ.*
Seeds, sown in spring either under cover or out-doors.

Mistletoe. See Viscum.

Mock Orange. See Philadelphus.

Momordica. *Cucurbitaceæ.*
Increased by seeds, which should be sown in heat early in spring.

Monarda (Horse Mint). *Labiatæ.*
Seeds. Propagated also by dividing the roots.

Monk's Hood. See Aconitum.

Monsonia. *Geraniaceæ.*
Propagation is effected by seeds, sown in-doors in spring; by division, or by cuttings placed in sandy soil under a hand-light, in spring or autumn.

Monstera, Serangium, Tornelia. *Aroideæ.*
Easily increased by seeds and by cuttings of the stem.

Montbretia. See Tritonia.

Montezuma. *Malvaceæ.*
Make cuttings of rather firm shoots, and insert in sand under glass.

Moon-seed. See Menispermum.

Moon-flower. See Ipomœa.

Moricandia. *Cruciferæ.*
Propagated by seed, sown in the open ground during spring.

Moringa, Anoma. *Moringeæ.*
Make cuttings of half-ripened shoots in spring, and insert in sand under glass.

Morning-glory. See Ipomœa.

Morus. See Mulberry.

Mountain Ash. See Pyrus.

Mountain Laurel. See Kalmia.

Mourning Bride. See Scabiosa.

Mucuna. *Leguminosæ.*
Propagation may be effected by seeds or by cuttings of half-ripened wood, under glass.

Muehlenbeckia, Sarcogonum. *Polygonaceæ*.

Seeds. Increased usually by cuttings, taken in early summer in a frame.

Mulberry (*Morus alba*, *M. nigra* and *M. rubra*). *Urticaceæ*.

New sorts are grown by seeds, which should be handled in the same manner as small fruit seeds. Named varieties are multiplied by cuttings of the root, or of mature wood, and sometimes by layers. The tree may also be budded or grafted by ordinary methods.

The common white mulberry was formerly used as a stock for named varieties, but Russian mulberry seedlings are now much used. The stocks may be top-worked out-doors, or root-grafted in the house. They are commonly crown-worked, however, in the house in winter, the stocks being grown in pots or boxes for the purpose. They are then kept under glass until the weather permits them out-doors. By this method fine specimen trees are procured, but they are readily handled by cheaper methods. The weeping and other ornamental sorts are now worked upon the Russian mulberry.

Mulberry, Paper. See Broussonetia.

Mullein. See Verbascum.

Musa (Banana, or Plantain-tree). *Scitamineæ*.

Seeds may be sown in heat during spring. Suckers are used for those species which produce them. Many of the species do not produce seeds freely, and suckers must be relied upon. See Banana.

Muscari, including Botryanthus (Grape Hyacinth). *Liliaceæ*.

Increased by seeds, and by bulbels, which are obtained by lifting the old bulbs early in the autumn, about every second year.

Mushroom (*Agaricus campestris*).

Break up the commercial spawn into pieces about as large as a hen's egg, and plant it in drills or holes, using from one-half pound to a pound of spawn to each square yard of bed.

The spawn is the mycelium of the fungus held in a mass or "brick" of earth and manure. Various methods are employed for making the spawn, but the essentials of them all are that the body of the brick shall be composed of a porous and light material, which can be compressed into a compact mass; fresh mycelium must be communicated to this mass, and then a mild heat must be applied, until the whole mass is permeated by the mycelium. The mass should be kept in heat until the whole of it assumes a somewhat cloudy look, but not until the threads of the mycelium can be seen. Ordinarily, fresh horse manure, cow manure and good loam are mixed together in about equal proportions, enough water being added to render the material of the consistency of mortar. It is then spread upon the floor or in large vats, until sufficiently dry to be cut into bricks. When these are tolerably well dried, mycelium from a mushroom bed or from other bricks is inserted in the side of each brick. A bit of spawn about the size of a small walnut is thus inserted, and the hole is plugged up. The bricks are now placed in a mild covered hot-bed, with a bottom heat of 55° to 65°, and left there until the clouded appearance indicates that the mycelium has extended throughout the mass. Soil from a good mushroom bed is sometimes used to sow new beds, in place of commercial spawn. Old clumps of mushrooms may be allowed to become dry, and they may then be mixed into a bed. The spores will then stock the soil and produce a new crop. The full-grown mushroom may be laid upon white paper until the spores are discharged, and these spores may then be mixed into the earth. Propagation by spores is little understood, however. (See page 24.)

Mustard (*Brassica* or *Sinapis* species).

Propagated by seeds.

Mutisia. *Compositæ.*

Seeds. Layers and cuttings of growing wood, those of the tender species in bottom heat.

Mygindia, Rhacoma. *Celastrineæ.*

Seeds. Cuttings of firm shoots under glass.

Myoporum. *Myoporineæ.*

Seeds, when obtainable. Usually by cuttings of young wood in heat.

Myosotis (Forget-me-not). *Boragineæ.*

Propagated by seeds sown in spring in-doors or in the garden. The perennials may also be increased by divisions, in spring, or by cuttings placed under a hand-glass in a shady spot, in summer.

Myrica (Bayberry, Sweet Gale, Wax Myrtle, Candleberry). *Myricaceæ.*

Hardy species mostly by seeds, from which the pulp has been removed. Sow as soon as ripe, or stratify them. Layers and divisions may also be employed. The greenhouse species are increased mostly by green cuttings.

Myristica (Nutmeg). *Myristiceæ.*

May be increased by seeds; or by cuttings of ripened shoots placed in sand under glass, in bottom heat.

Myrobolan. See Prunus.

Myrodia, Lexarsa. *Sterculiaceæ.*

Cuttings of firm shoots, which should be placed in sand under glass, in heat.

Myroxylon (Tolu Balsam-tree). *Leguminosæ.*

Propagation is effected during summer by cuttings of growing shoots placed in sand in a frame.

Myrrhis (Sweet Cicely or Myrrh). *Umbelliferæ.*

May be increased by divisions or by seeds.

Myrsiphyllum. *Liliaceæ.*

Freely increased by seeds, by divisions, or by cuttings. *M. asparagoides*, the "Smilax" or Boston-vine of greenhouses, is increased by seeds, which germinate readily.

Myrtus, including Ugni (Myrtle). *Myrtaceæ.*

Seeds, when they can be obtained. Readily propagated by cuttings of firm or partially ripened shoots, placed in a close frame; those of the stove species require a warmer temperature than the half-hardy ones.

Nægelia. *Gesneraceæ.*

Seeds rarely. Propagation is effected by potting the runners in spring or summer in a compost of peat, leaf soil and a little loam. Cuttings of young shoots, as mature leaves, will also root readily.

Napoleona, Belvisia. *Myrtaceæ.*

Increased by cuttings of half-ripened shoots two to four inches long, in mild bottom heat.

Narcissus (Daffodil, Jonquil, Chinese Sacred Lily). *Amaryllideæ.*

New varieties are grown from seeds, which give flowering bulbs in three or four years. Ordinarily increased by bulbels, which usually flower the second year.

Nasturtium. See Water Cress and Tropæolum.

Nauclea. *Rubiaceæ.*

May be increased by cuttings of growing shoots, in heat.

Nectarine. See Peach.

Negundo (Box Elder). *Sapindaceæ.*

Propagates with readiness by seeds, which should be sown as soon as ripe. Also by cuttings of mature wood, handled like grape cuttings.

Neillia. Handled the same as Spiræa, which see.

Nelumbo, Nelumbium (Water Chinquapin, Lotus, Water Bean). *Nymphæaceæ.*

Seeds, which may be sown in shallow pans of water in the garden, or if sown in ponds they may be incorporated in a ball of clay and dropped into the water. The seeds of some species are very hard, and germination is facilitated if they are very carefully filed or bored (see Fig. 7). Sections of the rhizomes may be used instead. They should always be covered with water, at least a foot or two deep, if outdoors.

Nemastylis, Nemostylis. *Irideæ.*

Propagation is effected by seeds, or by bulbels.

Nematanthus. *Gesneraceæ.*

Seeds rarely. Freely increased by cuttings, inserted in sandy soil and kept rather dry.

Nemopanthes (Mountain Holly). *Ilicineæ.*

Increased by seeds, which should be sown as soon as ripe or else stratified ; also by division of old plants.

Nemophila. *Hydrophyllaceæ.*

Seeds may be sown in late summer or any time during early spring.

Nepenthes (Pitcher Plant). *Nepenthaceæ.*

Propagated by seeds and cuttings. The seeds must have good drainage, uniform conditions and strong heat (80° to 85°). Sow upon a soil made of peat and fine sphagnum, and keep in a moist and close frame. Cuttings are usually struck in moss in a frame having strong bottom heat. A good plan is to fill a small pot with moss, invert it, and insert the cutting through the hole in the bottom. The pot then keeps the moss uniform. The pot is broken when the plant is removed. When potting off, use very coarse material.

Nepeta, Glechoma (Catmint, Catnip). *Labiatæ.*

Propagated by sowing seed in spring, or by divisions.

Nephelium, Dimocarpus, Euphoria (Litchi). *Sapindaceæ.*

May be increased by seeds, or by cuttings made of half-ripened wood.

Nephrodium. See Ferns.

Nephrolepis. See Ferns.

Nerine. *Amaryllideæ.*

Seeds, for new varieties. Commonly increased by means of bulbels.

Nerium (Oleander). *Apocynaceæ.*

Layers. Cuttings should be made of matured leading shoots, inserted in single pots and placed in a close, warm frame; or they may be rooted in bottles of water and afterwards potted in soil. See Fig. 52, *a*.

Nertera, Nerteria. *Rubiaceæ.*

Increased by seeds, divisions, or cuttings. Any small portion will grow freely, especially if placed in a warm frame.

Nesæa, including Heimia. *Lythrarieæ.*

May be increased by means of seeds, divisions, or green cuttings.

Nettle-tree. See Celtis.

New Zealand Flax. See Phormium.

Nicandra, Calydermos. *Solanaceæ.*

Seeds, sown in the open border, or under glass in the north.

Nicotiana (Tobacco). *Solanaceæ.*

Propagated by seeds, started under glass or in a carefully prepared seed-bed. The ornamental species sometimes by cuttings.

Nierembergia. *Solanaceæ.*

Grown from seeds, under glass. Cuttings of firm shoots are also used.

Nigella (Fennel Flower, Love-in-a-Mist). *Ranunculaceæ.*

Propagated by seeds sown in early spring in the open.

Nightshade. See Solanum.

Nine-bark. See Spiræa.

Nolana. *Convolvulaceæ.*

Seeds sown in the open border during spring.

Norantea, Ascium, Schwartzia. *Ternströmiaceæ.*

Ripened cuttings can be rooted in sand, in heat.

Norfolk Island Pine. See Araucaria.

Norway Spruce. See Picea.

Notelæa, Rhysospermum. *Oleaceæ.*

Seeds. Cuttings of firm side-shoots in spring, usually without heat.

Nuphar. Propagated same as Nelumbo and Nymphæa, which see.

Nutmeg. See Myristica.

Nuttallia. *Rosaceæ.*

May be propagated by seeds; by divisions; by means of suckers, which spring from the roots.

Nyctanthes. *Oleaceæ.*

Cuttings of half-ripened shoots should be set in spring, in bottom heat.

Nymphæa, Castalia (Water Lily, Lotus). *Nymphæaceæ.*

Seeds, which are rolled up in a ball of clay and dropped into a pond, or sown in pots which are then submerged in shallow water, either in-doors or out. Usually increased by portions of the root-stocks, which are sunk in the pond and held by stones, or the tender species placed inside, in pans of water. Some species produce tubers on the root-stocks, which are used for propagation.

Nyssa (Pepperidge, Sour Gum, Tupelo-tree). *Cornaceæ.*

Increased by seeds and by layers. The seeds should be sown as soon as ripe or else stratified. They usually lie dormant the first year.

Oak. See Quercus.

Obeliscaria. See Rudbeckia.

Ochna. *Ochnaceæ.*

During summer, cuttings may be made of growing shoots.

Odontoglossum. *Orchideæ.*

Division. (See also under Orchids.)

Œnocarpus. *Palmæ.*

Propagated by seeds or by suckers.

Œnothera, including Godetia (Evening Primrose). *Onagrarieæ.*

Seeds may be sown in spring or summer. Divisions may be made. Cuttings of perennials should be placed in a cool frame in the early part of the season before flowering begins.

Okra, Gumbo (*Hibiscus esculentus*). *Malvaceæ.*

Seeds, sown where the plants are to stand, or started in pots often in the north.

Olax. *Olacineæ.*

Grown from cuttings of firm or mature shoots in heat.

Olea. *Oleaceæ.*

The ornamental species are grown from cuttings of ripened shoots, either under frames or in the border, and also by seeds. For propagation of *O. Europæa*, see Olive.

Oleander. See Nerium.

Olearia, Eurybia. *Compositæ.*

Seeds. Readily increased by cuttings of growing shoots placed in a frame.

Oleaster. See Elæagnus.

Olive (*Olea Europæa*). *Oleaceæ.*

The olive is grown in large quantities from seed, especially in Europe. The pulp is removed by masceration or by treating with potash. The pits should be cracked or else softened by soaking in strong lye, otherwise they will lie dormant for one or two years. Cuttings of any kind will grow. Limbs, either young or old, an inch or two inches in diameter, and from one to two feet long, are often stuck into the ground where the trees are to grow, or they are sometimes used in the nursery. Green cuttings, with the leaves on, are often used, being handled in frames or in boxes of sand. Chips from old trunks, if kept warm and moist, will grow. The olive is often propagated by truncheons of trunks. A trunk two or three inches in diameter is cut into foot or two foot lengths, and each length is split through the middle. Each half is planted horizontally, bark up, four or five inches deep, in warm moist soil. The sprouts which arise may be allowed to grow, or they may be made into green cuttings.

Knaurs (see page 56) are sometimes used. The olive can be budded or grafted in a variety of ways. Twig-budding and plate or flute-budding give admirable results. Twig-budding is the insertion of a small growing twig which is cut from the branch in just the manner in which shield-buds are cut.

Omphalodes, Picotia.. *Borragineæ.*

Freely increased by means of seeds planted in spring, or by divisions.

Oncidium. *Orchideæ.*

Division. In some species detachable buds are produced in the inflorescence, and these give young plants. (See also under Orchids.)

Oncosperma, Keppleria. *Palmæ.*

Propagated by seeds or by suckers.

Onion (*Allium Cepa*). *Liliaceæ.*

Onions are mostly grown from seeds, which must be sown as early as possible in spring; or in the south they may be sown in the fall. They are also grown from "tops," which are bulblets borne in the flower cluster These are planted in the spring, or in the fall in mild climates, and they soon grow into large bulbs. "Sets" are also used. These are very small onions, and when planted they simply complete their growth into large bulbs. Sets are procured by sowing seeds very thickly in poor soil. The bulbs soon crowd each other, and growth is checked, causing them to ripen prematurely. Good sets should not be more than a-half inch in diameter. Very small onions which are selected from the general crop—called "rare-ripes"—are sometimes used as sets, but they are usually too large to give good resnlts. Some onions—the "multiplier" or "potato onions"—increase themselves by division of the bulb. The small bulb, which is planted in the spring, splits up into several distinct portions, each one of which will multiply itself in the same manner when planted the following year.

Onobrychis (Saintfoin). *Leguminosæ.*

Seeds, sown in spring where the plants are to remain.

Onosma (Golden Drop). *Boragineæ.*

Seeds, sown in the open in spring. Perennial species by cuttings in summer.

Opuntia (Prickly Pear, Indian Fig). *Cacteæ.*

Seeds grow readily, sown as soon as ripe in ordinary sandy soil, either in the house or out-doors. The joints grow readily if laid on sand. It is customary to allow these cuttings to dry several days before planting them. See also Cactus.

Orach (*Atriplex hortensis*). *Chenopodiaceæ.*

Seeds, sown where the plants are to stand.

Orange (*Citrus Aurantium*). *Rutaceæ.*

Orange stocks are grown from seeds, which should be cleaned and stratified in sand or other material, until sowing time. The seeds should not be allowed to become hard and dry. Some prefer to let the seeds sprout in the sand and then sow them in the nursery, but they must be carefully handled. The seeds are usually sown in seed beds, after the manner of apple seeds, and the seedlings are transplanted the next fall or spring into nursery rows. Care must always be exercised in handling orange plants, as they are often impatient of transplanting. Oranges grow readily from cuttings, although cuttage is not often practiced. Green cuttings, handled under a frame, give good results. Mature wood, either one or two years old, can be treated after the manner of long grape cuttings. They must have an abundance of moisture. Layers are sometimes made.

The named varieties are shield-budded upon other stocks. Grafting can be practiced, but it is often unsatisfactory. The nursery stocks are commonly budded in the spring, after having grown in the rows one year, which is two years from the sowing of the seed. If thorn-bearing varieties are to be propagated, a thorn with a bud in its axil is often cut with the bud, to serve as a handle in place of the leaf stalk, which is used in summer budding. Many stocks are used for the orange. The leading ones are sweet or common orange, sour orange (*Citrus Aurantium*, var. *Bigaradia*), pomelo (var. *pomelana* or *decumana*), Otaheite orange, trifoliate orange (*Citrus trifoliata*), and various lemons, as the "French" or Florida Rough and the Chinese. For general purposes, the sweet and sour orange stocks are probably the best. The sour stock is obtained from wild seeds, this variety having extensively run wild in Florida from early times. The trifoliate and Otaheite stocks are used for dwarfing or for small growing sorts, as many of the Japanese varieties. The trifoliate orange is also one of the hardiest of the orange stocks, and its use will probably increase upon the northern limit of the orange belt. Old orange trees can be top-budded with ease. It is advisable to cut them back a year before the operation is performed, in order to secure young shoots. In ordinary greenhouse practice, the seedlings of the pomelo make good stocks. They can be established in three-inch pots the first season, and veneer-grafted the next winter.

Orchids. *Orchideæ.*

The method of propagating these plants must in each species be adapted to the habit and mode of growth. The easiest and safest plan for the vast majority is by division, but seeds, cuttings, layers, offsets, and very rarely roots, are also utilized. It is important that artificial means of increase should only be adopted where the individual plants are in robust health. With many orchids the struggle of life under the unnatural conditions we supply, is necessarily severe, and any operation which transforms one weak plant into two or more weaker ones, is to be deprecated. In cases where the only method available necessitates disturbance at the roots, consideration must be paid to the constitution of the species, for some orchids, even when perfectly healthy, strongly resent interference.

Seeds. In no class of cultivated plants is propagation by seeds more difficult and tedious than it is with orchids. In all cases, fertilization must be performed by hand. In England, the length of time required for the capsules to ripen varies from three months to a year. Good seeds form a very small proportion of the whole, and it occasionally happens that the contents of a capsule will not produce a single plant. This, however, as well as the difficulty experienced in England in rearing plants to the flowering stage, is primarily due to the deficiency of sunlight, and in such a bright climate as that of the United States, would not be likely to occur. Various methods of sowing are in vogue, such as sprinkling over pieces of wood and cork or tree-fern stem, and on the top of moss and peat, in which established plants of the same or a nearly related species are growing. The last is probably the best, but it is always advisable to try several methods. Of course, the material on which the seeds are scattered must always be kept moist and shaded. The period between germination and the development of the first root is the most critical in the life of a seedling orchid. After they are of sufficient size to handle they are potted off into tiny pots, and as they gain strength, are given treatment approximating that of adult plants.

Division. Cypripediums may be taken as an example where this is readily done. It is simply necessary to carefully shake off the soil from the roots, and by the aid of a sharp knife, sever the plant into as many pieces as are required. It is always advisable to leave one or more leading growths to each portion. This method may be practiced for the increase of phaius, masdevallia, sobralia, ada, the evergreen section of calanthe, and all of similar habit.

In nearly all those kinds where the pseudo-bulbs are united by a procumbent rhizome, such as occurs in cattleyas, the process is slower. It seems to be natural for these plants to continue year after year, producing a single growth from the old pseudo-bulb. To obtain additional "leads," the rhizomes should be cut through in early spring, two or three pseudo-bulbs being reserved to each piece. A bud will then push from the base of each pseudo-bulb nearest the division, and a new lead is formed. The pieces should not be separated until this is well established, and three years may sometimes be required. Lælia, catasetum, cœlogyne, lycaste, cymbidium, zygopetalum, odontoglossum, oncidium, miltonia, etc., are treated in this manner.

Cuttings.—This method is available for those kinds with long, jointed stems, like dendrobium and epidendrum. Just before the plants commence to grow, say in February, the old pseudo-bulbs are cut up into lengths, and laid on a moist, warm surface, such as on a pan of moss in a propagating frame. Young offshoots will shortly appear at the nodes, and when large enough are potted off with the old piece attached. This plan may be used also for barkeria and microstylis.

It is well to remember that in any method of propagation where the pseudo-bulb is divided, the vigor of the young plant is proportionate to the amount of reserve material supplied it. However suitable the external conditions may be for growth, it is for some time entirely dependent for sustenance on the old piece from which it springs. *Dendrobium Phalænopsis* is a case in point. If a pseudo-bulb is cut into say three pieces, it will take at least two years for the young plants to reach flowering strength, but frequently by using the entire pseudo-bulb, we can get in a single year a growth quite as large as the old one.

The treatment of young orchids should be founded on what suits the parents. As a rule, however, they require more careful nursing, and some of the conditions must be modified. Drought, intense light and cold draughts must be avoided. For many orchids, especially those from equatorial regions, where the atmospheric conditions alternate between saturation and intense heat and dryness, it is necessary, in order to induce flowering, that nature, to some extent at least, should be imitated. With young plants, by whatever method they may be obtained, the supply of water must only be reduced in accordance with the weather and season, and beyond that, no attempt at resting made. In cases, however, where plants have been divided or made into cuttings, a very limited supply of water is needed at first; but to prevent exhaustion, the atmosphere should always be kept laden with moisture.

Oreopanax. *Araliaceæ.*

Seeds, and cuttings of the young shoots, or division of well established plants.

Ornithogalum (Star of Bethlehem). *Liliaceæ.*

Seeds. Commonly by bulbels, and by division of the clumps.

Ornus. See Fraxinus.

Orobus (Bitter Vetch). *Leguminosæ.*

Readily propagated by seeds, or by dividing the tufts.

Orontium. *Aroideæ.*

Commonly increased by division, but seeds may be used.

Orpine. See Sedium.

Osage Orange. See Maclura.

Osier. See Salix and Cornus.

Osmanthus (Japan Holly). *Oleaceæ.*

Propagated by cuttings under glass, or by grafting on osmanthus stock, or on privet.

Osmunda (Flowering Fern). *Filices.*

Mostly by division; sometimes by spores. See Ferns.

Ostrya (Hop Hornbeam, Ironwood). *Cupuliferæ.*

Best grown from seeds. Also increased by layering; or it can be grafted. The European species is often grafted upon the hornbeam (carpinus).

Othonna, Aristotela, including Doria (Ragwort). *Compositæ.*

Very easily propagated by seeds and cuttings. The leaves also take root.

Ouvirandra (Lattice-leaf). *Naiadaceæ.*

The plants are divided, or seeds are used when they can be obtained.

Oxalis. *Geraniaceæ.*

Seeds, divisions and cuttings. The tuberiferous species are increased by the small tubers which form upon the roots.

Oxycoccus. See Cranberry.

Oxydendron (Sorrel-tree). *Ericaceæ.*

Increased by seeds, which must be handled carefully in light soil. Also by layers, which, however, often root with difficulty.

Oxylobium, including Callistachys, Podolobium. *Leguminosæ.*

Increased by seeds and layers. Cuttings of rather firm side young shoots, made during spring.

Oyster Plant. See Salsify.

Oxytropis. *Leguminosæ.*

Seeds should be sown where the plants are to stand; also by dividing the plant in spring.

Pachira, Carolinea *Malvaceæ.*

Seeds. Large cuttings cut at a joint, with the leaves on, in heat.

Pæony (Peony, Piney). *Ranunculaceæ.*

Seeds, giving new varieties, are sown as soon as ripe. The seedlings seldom rise above the surface the first year, all their energies being spent in the formation of roots. The common herbaceous varieties are oftenest propagated by division of the clumps. Each portion should possess at least one bud upon the crown. All woody species may be increased by layers and cuttings. Cuttings are taken late in summer, cut to a heel, and are handled in a frame or cool greenhouse. During winter they should be kept from freezing. The shrubby species and *P. Moutan* are often grafted, and all species can be handled in this way. The operation is performed in late summer or early autumn, and the grafts are stored in sand or moss where they will not freeze. The next spring they are planted out. The cion is made from a strong short shoot, destitute of flower buds, and is set upon a piece of root, as described and figured on a previous page (p. 88, Fig. 85). Some prefer to cut a wedge-shaped portion from the side of the stock, in which to set the cion, rather than to split the stock; but either practice is good. Strong roots of various varieties or species may be used. The Chinese pæony (*P. Moutan*), *P. officinalis* and *P. albiflora* are probably oftenest used.

Painted-cup. See Castilleia.

Palafoxia. *Compositæ.*

Seeds, commonly sown under glass, or in mild climates sown in the open.

Palicourea. *Rubiaceæ.*

Cuttings, made in spring under glass.

Paliurus, Aubletia (Christ's Thorn). *Rhamneæ.*

May be increased by seeds, by layers or by cuttings of the roots.

Palma-Christi. See Ricinus.

Palms. *Palmæ.*

Palms are mostly grown from imported seeds. These should always be sown in a brisk bottom heat, in a mixture of coarse loam and sand. A hot-bed, established upon the greenhouse bench, is an excellent place in which to start palm seeds. Some species are increased by suckers, which arise from the crown or roots. For more explicit directions, see the various genera.

Pampas Grass. See Gynerium.

Panax (Ginseng). *Araliaceæ.*

Cuttings of stems and roots. Stems of old plants may be cut into pieces an inch or two long and inserted in sand in heat. Or young plants can be obtained by cutting down the tops of strong plants and then separating the suckers which arise.

Pancratium and **Hymenocallis.** *Amaryllideæ.*

Seeds, sown in pans in heat, are sometimes employed. Commonly increased by offsets, which usually form freely

Pandanus (Screw Pine). *Pandaneæ.*

Seeds and suckers, as in palms. Also by cuttings of the young growth in heat. The "seeds" are really fruits, and if in good condition several plants, one to ten, are obtainable from each; they should be separated when well furnished with roots.

Pansy. See Viola.

Papaver (Poppy). *Papaveraceæ.*

Seeds—usually sown out-doors—and divisions. *P. orientalis* and allied species are easily propagated by root cuttings in sandy soil under glass in autumn.

Papaw-tree. See Carica; also Asimina.

Papyrus. *Cyperaceæ.*

Propagation is effected by seeds and by divisions, chiefly the latter.

Pardanthus. *Irideæ.*

Seeds, divisions, and cuttings of young growth.

Paris. *Liliaceæ.*

Increased by seeds or by divisions.

Paris Daisy. See Marguerite.

Parkinsonia. *Leguminosæ.*

Seeds mostly. Cuttings.

Parnassia (Grass of Parnassus). *Saxifrageæ.*

May be propagated by seeds or by divisions.

Parrotia. *Hamamelideæ.*

Increased by seeds or by layers.

Parrya. *Cruciferæ.*

Seeds and divisions.

Parsley (*Apium Petroselinum*). *Umbelliferæ.*

Seeds, which are usually sown out-doors. The roots may be taken up in fall to be forced under glass.

Parsnip (*Pastinaca sativa*). *Umbelliferæ.*

Fresh seeds, sown where the plants are to stand.

Parthenium. *Compositæ.*

Seeds, sown under glass, or in the open.

Pasque-flower. See Anemone.

Passiflora (Passion Flower). *Passifloreæ.*

Seeds, sown under glass. Cuttings of the young growth root easily in sand in a frame. Varieties are sometimes veneer-grafted, *e. g.*, *P. coccinea.*

Paulownia. *Scrophularineæ.*

Seeds, sown in carefully prepared soil, either in a seed-bed or in a cold frame. Cuttings of ripe wood or of roots, made in fall or spring.

Pavonia. *Malvaceæ.*

Seeds, and green cuttings in a frame.

Pea (*Pisum sativum*). *Leguminosæ.*

Seeds, sown where the plants are to stand. The plants are hardy and seeds may be sown very early.

Peach *(Prunus Persica)* *Rosaceæ.*

The peach is perhaps the easiest to propagate of all northern fruit trees. Stocks are universally grown from seeds, although root-cuttings will grow. The seeds should be buried out-doors in the fall, and shallow enough so that they will be fully exposed to frost. Some prefer to simply spread them upon the surface of the ground and cover them lightly with straw to prevent them from drying out. The pits should be kept moist, and by spring most of them will be cracked. Those which do not open should be cracked by hand, for if planted they will not germinate until a year later than the others The "meats" or kernels are sorted out and planted early in drills. Or some prefer to sprout the seeds in the house, in order to select the best for planting. Some growers upon a small scale pinch off the tip of the rootlet to make the root branch. Pits should be secured, of course, from strong and healthy trees, but the opinion that "natural seed," or that from unbudded trees, is necessarily best, is unfounded.

The seeds should be planted in rich soil, and the stocks will be large enough to bud the same year. Any which are not large enough to bud may be cut back to the ground the next spring, and one shoot be allowed to grow for budding, but such small stocks are usually destroyed, as it does not pay to bestow the extra labor and use of land upon them When the buds have grown one season, the trees are ready for sale—at one year from the bud and two years from the seed. Peach trees are always shield-budded, and the operation is fully described on pages 68 to 75. Grafting can be done, but as budding is so easily performed, there is no occasion for it. The peach shoots are so pithy that, in making cions, it is well to leave a portion of the old wood upon the lower end—extending part way up the cut—to give the cion strength

Peaches are nearly always worked upon peaches in this country Plums are occasionly employed for damp and strong soils. Myrobolan is sometimes used, but it cannot be recommended. All plums dwarf the peach more or less. The hard-shell almond is a good stock for very light and dry soils The Peen-to and similar peaches are worked upon common peach stocks

The nectarine is propagated in exactly the same manner as the peach. The ornamental peaches are budded upon common peach-stocks in the same manner as the fruit-bearing sorts

For *Prunus Simoni*, see Plum.

Pea-nut (*Arachis hypogæa*). *Leguminosæ*.

As a field crop, the seeds should be planted where the plants are to stand For propagation in greenhouses, see Arachis.

Pear, Alligator or **Avocado.** See Persea

Pear (*Pyrus communis*, *P sinensis*). *Rosaceæ*

Pear seedlings are grown in the same manner as those of the apple, which see Pear stocks are mostly imported from France, however, as the leaf-blight is so destructive to them here as to render their culture unprofitable. This leaf-blight is a fungus (*Entomosporium maculatum*), and recent experiment has shown that it can be readily overcome by four or five thorough sprayings with Bordeaux mixture, so that there is reason to hope that the growing of pear stocks may yet become profitable in this country. Heretofore, the only means of mitigating the ravages of this blight was the uncertain one of inducing a strong growth early in the season Even when pear stocks are raised in this country, they are grown from imported French seed. Aside from its cheapness, however, this foreign seed probably possesses no superiority over domestic seed But pear seed is so difficult to obtain in America that it is practically out of the market.

Pear seedlings should be taken up and removed from the seed-bed the first fall. The foreign stocks are imported when a year old from the seed The seedlings are trimmed or "dressed" (see page 69), and are set into nursery rows the following spring. The next season—that is, the season in which the stocks are transplanted—shield-budding is performed, as upon the apple The budding season usually begins late in July or early in August in the north If the stocks are small, of "second size," they may stand over winter and be budded the second year. Pear trees are sold at two and three years from the bud Pears do not succeed well when root-grafted, except when a long cion is used, for the purpose of securing own-rooted trees (see page 78) Dormant buds of the pear may be used upon large stocks in early spring, the same as upon the apple, and buds may be kept upon ice for use in early summer (see page 74)

Pears are dwarfed by working them upon the quince The Angers quince is the best stock. The ordinary orange quince and its kin make weak and short-lived trees. Quince stocks are obtained from ordinary cuttings or from mound-layering, the latter method giving much the better stocks (see Quince) The layers should stand until late in autumn of the second season, when they will be found to be well rooted, and may then be taken off, trimmed up and fitted to plant as stocks the following spring, and budded in August. It is imperative to set the bud as low as possible in order to secure long-lived trees. Some varieties do not unite well with the quince, and if it is desired to dwarf them, they should be double-worked (see page 91).

The pear can also be grown upon the apple, thorn and mountain ash. Upon the apple it is short-lived, although pear cions, set in the top of an old apple tree, often bear large fruits for a few years. When pear stocks cannot be had, pears are sometimes worked upon apple roots. If the cions are long they will emit roots, and when the apple nurse fails the pear becomes own-rooted Good dwarf trees are often secured upon the thorn, and there is reason to believe that some of the thorns will be found to be preferable to quince stocks for severe climates and for special purposes. The subject is little understood. The mountain ash is sometimes used for the purpose of growing pears upon a sandy soil, but its use appears to be of little consequence.

Pears of the Le Conte and Keiffer type are often grown from cuttings in the south. Cuttings are made of the recent mature growth, about a foot in length, and are planted in the open ground after the manner of long grape cuttings. Le Conte, Garber, Smith, and other very strong growers of the Chinese type, are probably best when grown from cuttings. They soon overgrow French stocks, as also apple stocks, which have been used to some extent; but if long cions are used, own-rooted trees are soon obtained, and the stock will have served a useful purpose in pushing the cion the first two or three years.

Pecan (*Hicoria Pecan*). *Juglandeæ.*

Propagated by seeds. These may be planted as soon as ripe, or stratified until spring. The ground should be well prepared and the nuts planted about 3 inches deep. By grafting on pecan or common hickory stock that is not over 2 years old. Cions about 6 inches long should be cut during the winter and put in a cool place to hold them back until the stocks have fairly started in the spring. The stalks should then be cut off at the crown and the cion inserted. The tongue-graft gives the best result. Bandage securely and bank with earth nearly to the top of the cion, to keep it moist.

Pelargonium (Geranium, Stork's Bill). *Geraniaceæ.*

Seeds, sown in light soil with mild heat, are sometimes employed. Commonly increased by cuttings of firm shoots, which grow readily (Figs. 52, *e*, and 55). The fancy or show geraniums are often grown from root-cuttings, but sometimes will not come true. Geraniums can also be grafted. (See page 89, herbaceous grafting.)

Pelecyphora (Hatchet Cactus). *Cacteæ.*

Propagated most freely by seeds in moderate heat, and by cuttings made of any small shoots that arise from the base See also Cactus.

Peliosanthes. *Hæmodoraceæ.*

Suckers.

Peltandra. *Aroideæ.*

Propagated by seeds when fresh, or b ydivision.

Pennyroyal (*Mentha Pulegium*). *Labiatæ.*

Seeds and divisions.

Pentapetes. *Sterculiaceæ.*

Propagated by seeds ; by cuttings of half-ripened shoots.

Pentas. *Rubiaceæ*

Propagated, with difficulty, by seeds or cuttings of half-ripened wood.

Pentstemon (Beard-tongue). *Scrophularineæ.*

Seeds, sown in pans and placed under a frame ; or they are sometimes sown in the border where the plants are to stand. Also by division, and rarely by cuttings in summer.

Peperomia, including Micropiper. *Piperaceæ.*

Seeds. Cuttings of single joints of firm stems root easily in a peaty soil. Water sparingly.

Pepper, Black. See Piper.

Pepperidge. See Nyssa.

Pepper-grass, Curled Cress (*Lepidium sativum*). *Cruciferæ.*

Grown from seeds, either under glass for early crops or in the open air.

Peppermint (*Mentha piperita*). *Labiatæ.*

Divisions of the creeping and rooting stems are planted to multiply the plant, and plantations are renewed every three or four years.

Pepper, Red or **Cayenne** (Capsicum). *Solanaceæ.*

Seeds, sown out-doors, or in the north oftener started in the house.

Pereskia (Barbadoes Gooseberry) *Cacteæ.*

Seeds Cuttings, as described under Cactus *P aculeata* is much used as a stock for epiphyllums *P. Bleo* is sometimes used for the same purpose, as it is fully as good as the other species Cuttings of *P. aculeata* can be made a foot or more in length, and of sufficient size for immediate use, or, indeed, the graft may be inserted when the cutting is made

Perilla, Dentidia. *Labiatæ.*

Sow the seeds in early spring in pans or boxes, and place in a gentle heat Or southwards, seeds may be sown in the open

Periploca *Asclepiadeæ*

Seeds Increased mostly by layers or cuttings under glass, during summer or autumn. Root cuttings succeed

Periwinkle. See Vinca.

Pernettya. See Canarina

Persea (Alligator or Avocado Pear). *Laurineæ*

Seeds. Layers of ripened shoots may be made in autumn; or cuttings of firm shoots in spring, under glass

Persimmon (*Diospyros Kaki* and *D Virginiana*) *Ebenaceæ*

Stocks are readily grown from seed, and they usually attain sufficient size for budding the first year. The native persimmon (*Dispyros Virginiana*) is largely used as a stock for the Japanese persimmon or kaki. Imported stocks are occasionally employed, but the native is more vigorous, as a rule, and probably better Persimmons are shield-budded the same as peaches, and they may be root-grafted and top-grafted by ordinary methods

Persoonia, Linkia *Proteaceæ*

Propagated by cuttings of the ripened shoots, under glass

Peruvian Bark. See Cinchona.

Petalostemon (Prairie Clover) *Leguminosæ*

Seeds and divisions

Petunia. *Solanaceæ*

Seeds, either in-doors or in the garden. Choice and double varieties are often increased by cuttings, which grow readily

Phacelia, Eutoca, Whitlavia. *Hydrophyllaceæ*

The annuals are increased by seeds, and the perennials by seeds and divisions.

Phædranassa, including Leperiza (Queen Lily). *Amaryllideæ.*

Propagated by seeds and bulbels.

Phaius. *Orchideæ.*

Division of the bulbs. (See also under Orchids.)

Phalænopsis. *Orchideæ.*

These are very slow and difficult to propagate. In the majority of the species it can only be done where a lateral offshoot is made from the main stem. Some species, such as *P. Luddemanniana*, and more rarely *P. amabilis*, *P. Stuartiana* and *P. Schilleriana*, develop plantlets on the old flower scapes. By pegging these down on a basket of moss they may be established and afterwards separated. *P. Stuartiana* and *P. deliciosa* have been known to produce plants on the roots. Other instances of root-proliferation are recorded in *Saccolabium micranthum* and a species of cyrtopodium. (See under Orchids.)

Phalaris. *Gramineæ.*

Propagated by seeds, but the sports by divisions.

Phaleria, Drimyspermum. *Thymeleaceæ.*

Increased by seeds sown in heat in spring; or by cuttings of the young shoots, which should be inserted in bottom heat.

Pharbitis. See Ipomœa.

Phaseolus (Bean, Kidney, Pole, String; French Bean, etc.). *Leguminosæ.*

The ornamental greenhouse kinds are grown from seeds planted in light soil in a warm propagating house. See Bean.

Phebalium. *Rutaceæ.*

May be increased by cuttings of the young wood, under a glass.

Phellodendron (Cork Tree). *Rutaceæ.*

Increased by seeds, layers and by root cuttings.

Philadelphus (Mock Orange, Syringa). *Saxifrageæ.*

Seeds, layers, suckers and cuttings. Layers are most used. Cuttings of mature wood are sometimes employed. Some well-marked varieties, like vars. *nana* and *aurea* of *P. coronarius*, are grown from cuttings of soft wood in summer in frames.

Phillyrea (Jasmine Box, Mock Privet). *Oleaceæ.*

Seeds. May be propagated by cuttings, layers, or by grafting on the privet.

Philodendron. *Aroideæ.*

Increased by seeds; and by dividing the stems, allowing two or three joints to eaeh piece, inserting them in pots in a brisk heat.

Phlomis. *Labiatæ.*

All of the species may be increased by seeds; the herbaceous kinds by divisions, and the shrubby sorts also by cuttings.

Phlox. *Polemoniaceæ.*

The annuals are grown from seeds sown in the open. The perennials are grown from seeds, divisions, cuttings of stems and roots. Cuttings made during summer, and handled in a frame, do well. The roots are cut into short pieces, and are then handled in pans or flats under cover.

Phœnix, Elate (Date Palm). *Palmæ.*

Increased by imported seeds, sown in a sandy soil, in a mild hot-bed. Also by suckers. See also Date.

Phormium (Flax Lily, or New Zealand Flax). *Liliaceæ.*

Seeds. Also by division of the crowns before growth commences in spring.

Photinia, including Eriobotrya. *Rosaceæ.*

Stratified seeds or half-ripened cuttings under glass. The loquat, *P. Japonica*, is grown from layers or cuttings of ripe wood, and it is worked upon seedling stocks or upon thorn or quince, after the manner of pears.

Phylica. *Rhamneæ.*

Seeds. Cuttings of growing shoots may be inserted in sandy soil, in a warm house.

Phyllanthus, including Xylophylla. *Euphorbiaceæ.*

Increased by means of cuttings of hard shoots in heat.

Phyllis. *Rubiaceæ.*

Seeds, or cuttings under glass.

Phyllocactus, including Phyllocereus and Disocactus (Leaf Cactus). *Cacteæ.*

Seeds germinate readily in sandy soil. Usually increased by cuttings of the stems, five or six inches long, placed in sandy soil, which is kept only slightly moist. See also Cactus.

Phyllocladus, Thalamia (Celery-leaved Pine-Tree). *Coniferæ*

Cuttings of the ripened shoots under glass, in spring. When the cuttings begin callusing, give mild bottom heat.

Physalis (Ground or Winter Cherry, Strawberry Tomato, Husk Tomato). *Solanaceæ.*

Seeds, sown out-doors or under cover. Perennials by division and growing cuttings.

Physianthus, Schubertia. *Asclepiadeæ.*

Seeds, usually started in heat. Cuttings of firm shoots usually side shoots, under glass.

Physochlaina. *Solanaceæ.*

Seeds. Cuttings of soft wood.

Phyteuma, Rapunculus (Horned Rampion). *Campanulaceæ*

Easily increased by seeds or by divisions, in spring.

Phytolacca (Spoke, Skoke, Poke). *Phytolaccaceæ.*

May be propagated by means of seeds, or by divisions.

Picea. *Coniferæ.*

Propagated by seeds, sometimes by layers, or grafts. *P. excelsa* (Norway spruce) makes a good stock; the veneer graft, under glass, in winter, succeeds better than any method of out-door work practicable in our climate; if the graft is inserted near the base in young plants, it is quite possible to obtain them on their own roots after a few transplantings. Side-shoots can be used as cions, and if started in time will furnish good leaders; sometimes a leader is developed more rapidly by bending the plant over at nearly a right-angle, when a stout bud may start from the stem See Abies.

Pickerel Weed. See Pontederia.

Picotee. See Dianthus and Carnation.

Pilea (Artillery Plant, Stingless Nettle). *Urticaceæ.*

May be increased by seeds, divisions or cuttings.

Pilocereus. See Cactus.

Pimelea, Banksia. *Thymelaceæ.*

Seeds. Cuttings of growing shoots in moderate heat.

Pimpernel. See Anagallis.

Pinanga. *Palmæ.*

Propagated by seeds.

Pinckneya, Pinknea. *Rubiaceæ.*

Seeds. Cuttings of the ripened shoots under glass.

Pine-apple (*Ananas sativa*). *Bromeliaceæ.*

Pine-apples very rarely produce seeds, but when they are produced they are sown for the purpose of obtaining new varieties. The pine-apple is usually increased by suckers and "crowns." If the root is left in the ground after the pine is removed, suckers will start from it. The root is then taken up and cut into as many pieces as there are suckers, each piece being then permanently planted. The crown of the fruit and the various offsets or "crownlets," which appear on the sides and base of the fruit, may be removed and used as cuttings. These offsets are commonly used in greenhouse propagation. It is the usual practice to allow them to dry several days before they are planted, and in pine-apple regions they are often exposed to the sun for several weeks. This operation is unnecessary, however, although it is not objectionable.. A good way to start the offsets is to pull off the lowest leaves and insert the offsets in damp moss in shade —giving bottom heat for greenhouse work—and as soon as roots begin to form, which will occur in from two to six weeks, plant them out permanently. In the tropics fruit can be obtained in 20 months after the offsets are transplanted; but fruit bearing is often delayed three or four years under poor treatment.

Piney. See Pæonia.

Pinguicula (Butterwort). *Lentibularieæ.*

The hardy and greenhouse species are increased by seeds divisions, or by leaf cuttings.

Pink (Dianthus, various species). *Caryophylleæ.*

Seeds and divisions. Best results are obtained by raising new plants from seed every two or three years. Seeds are usually sown where the plants are to remain; or they may be sown in a cold-frame and transplanted.

Pinus (Pine). *Coniferæ.*

Seeds, which should be kept dry over winter, are commonly employed. These are often started in pots, but for most species they are sown in well prepared beds out-doors. The seedlings must usually be shaded the first season. Varieties, as also species which do not produce seed freely, may be grafted upon stocks of white or Austrian pine or other species. This grafting may be done upon the tips of growing shoots early in the season (page 90), but it is oftener performed upon potted plants by the veneer method.

Piper, Cubeba (Pepper, Cubeb). *Piperaceæ.*

Seeds. All are increased by means of cuttings of the growing shoots, inserted in sandy soil under glass.

Piscidia (Fish Poison-tree, Jamaica Dogwood). *Leguminosæ.*

Seeds. Cuttings of growing shoots under glass.

Pistacia. *Anacardiaceæ.*

Seeds, cuttings and layers. The pistacio-nut or "green almond" (*P. vera*) is usually grown from seeds, which are planted where the trees are to stand. It is sometimes grafted upon *P. terebinthus*, to give it greater vigor.

Pitcairnia. See Billbergia.

Pitcher-plant. See Nepenthes and Sarracenia.

Pittosporum. *Pittosporeæ.*

Seeds, and by cuttings of the growing or ripe wood, under glass.

Planera (Planer-tree). *Urticaceæ.*

Propagated by seeds, which should be handled like elm seeds.

Plane-tree. See Platanus.

Plantago (Plantain). *Plantagineæ.*

Seeds. The perennial species also by division.

Plantain (fruit). See Banana.

Platanus (Plane-tree, Buttonwood; Sycamore, improperly). *Platanaceæ.*

Usually propagated by seeds, but layers and ripe-wood cuttings may be employed.

Platycerium (Stag's-Horn Fern). *Filices.*

Chiefly by division. See Ferns.

Platycodon, Wahlenbergia. *Campanulaceæ.*

Propagated by seeds and, when old plants are obtainable, by division.

Plectocomia. *Palmæ.*

Seeds. May be increased by suckers.

Pleroma, Lasiandra, including Melastoma. *Melastomaceæ.*

Seeds. Propagated mostly by cuttings of growing shoots in a close frame at any season.

Plum (*Prunus*, many species). *Rosaceæ.*

There are so many species of plums in cultivation, and the varieties of the same species are often so different in constitution and habit, that it is difficult to give advice concerning their propagation. All the species grow readily from fresh, well-ripened seeds. The pits should be removed from the pulp and then stratified until spring. If they are allowed to freeze, the germination will be more uniform, as the pits will be more easily opened by the swelling embryo. Plum pits are rarely cracked by hand. The strong-growing species and varieties, especially southwards, will give stocks strong enough to bud the first season; but the weaker ones must stand until the next season after the seeds are planted. In all the northern states, however, plum pits are usually sown in seed-beds, in the same manner as apple and pear seeds. The seedlings are taken up in the fall, and the following spring set out in nursery rows, where they are budded in August.

Plums are extensively grown from suckers, which spring in great numbers from the roots of many species. In France this method of propagation is largely used. So long as graftage does not intervene, the sprouts will reproduce the variety; and even in grafted or budded trees this sometimes occurs, but it is probably because the tree has become own-rooted from the rooting of the cion. It is a common notion that trees grown from suckers sprout or sucker worse than those grown from seeds. Layers are also extensively employed for the propagation of the plum. Strong stools (page 35) are grown, and the long and strong shoots are covered in spring throughout their length—the tips only being exposed—and every bud will produce a plant, Strong shoots of vigorous sorts will give plants strong enough the first fall to be removed into nursery rows. Mound-layering is also employed with good results. Root-cuttings, handled like those of blackberry, grow readily, but some growers suppose that they produce trees which sucker badly. Many plums grow readily from cuttings of the mature recent wood, treated the same as long grape cuttings. This is especially true of the Marianna and its kin (*P. umbellata*), which are grown almost entirely from cuttings. Some sorts of the common garden plum (*P. doméstica*) also grow from cuttings.

Plums are worked in various ways, but ordinary shield-budding is usually employed in late summer or early fall, as for peaches and cherries. Root-grafting by the common whip method is sometimes employed, especially when own-rooted trees are desired (page 78). In the north and east, the common plum (*P. domestica*) is commonly worked upon stocks of the same species. These stocks, if seedlings, are apt to be very variable in size and habit, and sometimes half or more of any batch, even from selected seeds, are practically worthless. Stocks from inferior or constant varieties are therefore essential. Such stocks are largely imported; but there are some varieties which can be relied upon in this country. One of the best of these domestic stocks is the Horse plum, a small and purple-fruited variety of *Prunus domestica*, which gives very uniform seedlings. This is largely used in New York. The French stocks which are in most common use are St. Julien and Black Damas. The Myrobolan (*P. cerasifera*) is much used in California for standards, but in the east it makes dwarf trees. The peach is often used as a plum stock, and it is valuable in the south, especially for light soils. In the north plum stocks are better. Almond stocks, especially for the French prune and for light soils, are considerably used in California. The apricot is sometimes employed, but results appear to be poor or indifferent, on the whole. Prunes thrive upon the above stocks also.

Various stocks dwarf the plum. The chief dwarf stock at present is the Myrobolan. This is usually imported. It is easily grown, either from seeds or cuttings. The Mirabelle, a foreign stock, is sometimes used. The many species of native plums, of the *Prunus Americana* and *P. angustifolia* (Chickasaw) types, are good stocks for dwarf or intermediate trees. In most cases, the bud or graft grows luxuriantly for two or three years, and thereafter grows rather slowly. It is best to bud or graft low upon these stocks. The Marianna is at present the most popular native stock.

The native or American plums are budded upon native seedlings, or rarely upon *Prunus domestica* seedlings; or they are grown from cuttings, as in the case of Marianna.

The Japanese plums are worked upon peach, common plum or upon natives, preferably Marianna.

Prunus Simoni works upon peach, common plum, Myrobolan and Marianna.

The ornamental plums are worked upon the same stocks as the fruit-bearing sorts. See Prunus.

Plum, Coco. See Chrysobalanus.

Plumbago (Leadwort). *Plumbagineæ.*

Seeds, divisions and cuttings. Cuttings are made from firm nearly mature wood, and should be given mild bottom heat.

Plumeria, Himatanthus. *Apocynaceæ.*

Seeds. Make cuttings of ripe shoots, and place under glass.

Podalyria. *Leguminosæ.*

Readily increased by seeds. Divisions do not succeed well. In spring, cuttings may be made of strong side shoots, and planted in sand under glass.

Podocarpus. *Coniferæ.*

Usually grown from cuttings of firm wood under cover.

Podophyllum (May Apple, Mandrake; erroneously Duck's Foot). *Berberideæ.*

Seeds and division.

Poinciana. *Leguminosæ.*

Propagation by seeds.

Poinsettia, Euphorbia. *Euphorbiaceæ.*

Cuttings of growing shoots, of two or three buds each, handled upon a cutting bench or in a frame. Many propagators prefer to let the cuttings lie exposed two or three days before setting them. Cuttings of ripened wood can be used to good advantage where the heat is rather low. See Euphorbia.

Polanisia. *Capparideæ.*

Seeds, in-doors or in the open.

Polemonium. *Polemoniaceæ.*

Propagated by seeds and by division.

Polianthes (Tuberose). *Amaryllideæ.*

Increased by bulbels. Remove these from the parent bulb in the fall, and keep in a warm, dry place until the following spring. The soil should be light, rich and moist throughout the summer. Before frost comes in the fall, take the bulbs up, and when dry, cut off the leaves. The bulbs should be kept as during the preceding winter, and the culture during the following year is the same as during the first. The bulbs usually flower the second or third summer.

Polyanthus. See Primula.

Polycarpæa. *Caryophylleæ.*

The annuals are increased by seeds; perennials by cuttings.

Polygala (Milkwort). *Polygaleæ.*

Seeds; sometimes by division, and by cuttings of young shoots under cover, particularly for tropical species.

Polygonatum (Solomon's Seal). *Liliaceæ.*

Propagated by seed and by divisions.

Polygonum (Knot-Grass or Weed). *Polygonaceæ.*

Seeds. The perennials are also increased by divisions of the root-stocks, and by cuttings.

Polypodium (Polypody). *Filices.*

Divisions usually. See Ferns.

Pomegranate (*Punica granatum*). *Lythrærieæ.*

Largely by seeds, and all varieties are increased by cuttings, suckers, layers, and scarce sorts by grafting on a common sort.

Pomelo, Shaddock (*Citrus Aurantium*, var. *pomelana*). *Rutaceæ*

Usually grown from seeds, but it may be budded upon pomelo or orange stocks, as in the Orange, which see.

Pontederia (Pickerel Weed). *Pontederiaceæ.*

Seeds rarely. Mostly by divisions.

Poppy. See Papaver.

Populus (Poplar, Aspen, Cotton-wood). *Salicineæ.*

Seeds, sown as soon as ripe and raked in in light soil. Suckers are also used. Most often increased by cuttings of ripe wood, taken in fall and spring. The weeping forms are stock-grafted upon upright sorts, as *P. grandidentata.*

Portugal Laurel. See Prunus.

Portulaca (Purslane, Rose Moss). *Portulaceæ.*

The annuals are raised from seed. Varieties are sometimes propagated by cuttings.

Potato (*Solanum tuberosum*). *Solanaceæ.*

Tubers, either whole or variously divided. Also rarely stem cuttings. (See page 52.)

Potentilla, including Horkelia, Sibbaldia (Cinquefoil, Five-Finger). *Rosaceæ.*

Seeds, layers, divisions, green cuttings.

Poterium, including Sanguisorba (Burnet). *Rosaceæ.*

The herbaceous kinds are increased by seeds. The shrubs are raised from soft cuttings, under glass.

Premna, Baldingera. *Verbenaceæ.*

Seeds and soft cuttings.

Prickly Ash. See Zanthoxylum.

Prickly Pear. See Opuntia.

Pride of India. See Melia.

Priestleya, including Achyronia. *Leguminosæ.*

Seeds. Cuttings of very young wood, under cover.

Prim. See Ligustrum.

Primula, Polyanthus (Primrose, Cowslip). *Primulaceæ.*

Seeds, sown carefully in very fine soil, under glass. Some rare sorts are increased by division.

Prinos. See Ilex.

Pritchardia. *Palmæ.*

Increased by seeds.

Privet. See Ligustrum.

Prostanthera (Australian Mint). *Labiatæ.*

Seeds, divisions, and cuttings of growing shoots, usually by the last method..

Protea, Erodendron. *Proteaceæ.*

Seeds. Cuttings of growing wood, under cover.

Prune. See Plum.

Prunus, Amygdalus. *Rosaceæ.*

The dwarf almonds (*Amygdalus*) are increased by seeds, divisions, cuttings, and by budding upon seedling plum or peach stocks; also by root-cuttings. Peach stocks give larger trees at first than plum stocks, but the trees are not so long-lived. Perhaps ten years may be considered the average life of most ornamental almonds upon the peach, while upon the plum they may persist twenty-five years or more. The ornamental cherries, peaches, etc., are propagated in essentially the same manner as the fruit-bearing varieties. See Almond, Apricot, Cherry, Peach, Plum. *P. Lauro-Cerasus* and *P. Lusitanica*, the cherry laurel and Portugal laurel, may be propagated by short cuttings of ripened wood, in a cool greenhouse in autumn. *P. Pissardii* is said to be easily propagated by cuttings of the soft wood. This method succeeds well with many of the double-flowering plums and cherries, if the wood is grown under glass.

Pseudotsuga. *Coniferæ.*

Propagated the same as Abies, which see.

Psidium. See Guava.

Psoralea. *Leguminosæ.*

Seeds, divisions and cuttings of growing shoots, placed under glass. The tubiferous species, as the pomme blanche or Indian potato (*P. esculenta*) are increased by tubers or divisions of them.

Ptelea (Hop-tree). *Rutaceæ.*

Increased by seeds, sown in autumn or stratified, or by layers. The varieties may be grafted on the common forms.

Pteris (Brake, Bracken). *Filices.*

Easily grown from spores. See Ferns.

Pterocarya. *Juglandeæ.*

Increased by seeds, suckers and layers.

Ptychosperma, Seaforthia (Australian Feather-palm). *Palmæ.*

Seeds.

Pulmonaria. See Mertensia.

Pumpkin (*Cucurbita*, three species). *Cucurbitaceæ.*

Seeds, when the weather is settled.

Punica. See Pomegranate.

Puschkinia, Adamsia. *Liliaceæ.*

Increased by dividing the bulbs, which should be done every two or three years.

Pyrethrum. See Chrysanthemum.

Pyrola (Shin-leaf, Wintergreen). *Ericaceæ.*

Propagated by division; very rarely from seeds.

Pyrus. *Rosaceæ.*

The ornamental species and varieties of apples and crabs are budded or grafted upon common apple stocks. The mountain ashes are grown from stratified seeds, which usually lie dormant until the second year, or the varieties are budded or grafted upon stocks of the common species (*P. Aucuparia*). Layers and green cuttings are occasionally employed for various species and varieties of pyrus. See also Apple, Pear, Quince. It is a good plan to obtain stocks as nearly related to the plant which is to be propagated as possible; *e. g.*, Parkman's pyrus does better on *P. floribunda* than on the common apple stock.

Quamoclit. See Ipomœa.

Quassia. *Simarubeæ.*

Cuttings of ripe shoots under glass.

Quercus (Oak). *Cupuliferæ.*

Stocks are grown readily from seeds, which may be sown in the fall without stratification. The evergreen species are sometimes grown from cuttings. Varieties are grafted on stocks grown from wild acorns. The stocks are potted in the fall and the grafting is performed in January and February, or sometimes in August.

Quince (*Pyrus Cydonia*, *P. Japonica*, *P. Cathayensis*). *Rosaceæ.*

All quinces can be grown from seeds, the same as apples and pears; but seeds are not common in the market, and are therefore little used in this country. The fruit-bearing quinces are propagated most cheaply by means of cuttings of mature wood. The cuttings are taken in the fall, and are stored in sand, moss or sawdust until spring, when they are planted out-doors. Long cuttings—10 to 12 inches—are usually most successful, as they reach into uniformly moist earth. Cuttings are usually made of the recent wood, and preferably with a heel, but wood two or three years old will usually grow. With some varieties and upon some soils, there is considerable uncertainty, and layerage is therefore often employed. Mound-layering (see page 35) is practiced where extra strong plants are required. Long root-cuttings, treated like those of the blackberry and raspberry, will also grow. Many nurserymen bud or root-graft the better varieties upon stocks of Angers or other strong sorts. These stocks are imported or grown from seeds or cuttings. The Chinese quince succeeds upon the common quince. In order to secure extra strong plants and a uniform stand, some growers graft quince cuttings upon pieces of apple or pear roots. In such cases the plants should be taken up in the fall, when the quince will be found to have sent out roots of its own; the apple root should be removed, and the quince replanted the following spring in the nursery row, otherwise suckers frequently spring from the stock and interfere with the growth of the quince. The union is sufficient to nurse the cion for two or three years.

The flowering or Japanese quince is best propagated by short root-cuttings, which are usually made in the fall, and scattered in drills in frames or in a well-prepared border in spring. Cuttings of firm, nearly mature wood, handled in frames, will grow, but they are not often used. The double varieties are root-grafted upon common stocks of *P. Japonica* in winter. The plants are then grown on in pots. Common quince (*P. Cydonia*) stocks are occasionally used, but they are not in favor.

Quisqualis. *Combretaceæ.*

Increased by heeled cuttings of young shoots in heat.

Radish (*Raphanus sativus*). *Cruciferæ.*

Seeds, usually sown where the plants are to grow.

Ragged Robin. See Lychnis.

Ramondia, Myconia. *Gesneraceæ.*

Propagated by seeds or division.

Rampion (*Campanula Rapunculus*). *Campanulaceæ.*

Seeds, where the plants are to stand.

Ranunculus (Buttercup, Crowfoot). *Ranunculaceæ.*

Propagated by seeds and by divisions.

Raphia. *Palmæ.*

Seeds.

Raphiolepis. *Rosaceæ.*

Increased by seeds, and by cuttings of the growing shoots inserted under cover.

Raspberry (*Rubus neglectus, strigosus* and *occidentalis*). *Rosaceæ.*

New varieties are obtained from seeds, which are washed from the pulp and sown immediately, or stratified. The black-cap varieties are grown mostly from root-tips (Fig. 18) as described on page 32. If the ground is loose and mellow, the tips will commonly take root themselves, but upon hard ground the tip may have to be held in place by a stone or clod. Some strong-growing varieties, like the Gregg, especially in windy localities, may have to be held down. The red varieties increase rapidly by means of suckers which spring up from the roots. Better plants are obtained by means of root-cuttings, however, as described under Blackberry (see also Fig. 46). Black-caps may be increased by root-cuttings. These cuttings are best handled in warm cold-frames or mild hot-beds, being planted very early in spring.

By the time the weather is settled, they will be large enough to plant in nursery rows.

Red-bud. See Cercis.

Red Cedar. See Juniperus.

Reinwardtia, Linum in part, of gardeners. *Lineæ.*

Seeds. Cuttings of strong shoots in heat.

Renanthera. See Ærides.

Reseda (Mignonette). *Resedaceæ.*

Seeds. For winter flowering, seeds are sown in July Also grown from cuttings.

Retinospora, Chamæcyparis (Japanese Arbor-Vitæ). *Coniferæ*

Grown sometimes from seeds, which should be denuded of pulp. Layers of tender branches are sometimes employed. They are most commonly grown from cuttings. These are made from tips of growing or ripened shoots, and are two or three inches long, with all the leaves left on. They are usually, from necessity, variously branched. The soft cuttings are usually taken from forced plants and are handled in a close frame or under a bell-glass, with bottom heat. In commercial establishments the cuttings of ripe wood are preferred. The following is the practice of one of the largest nurseries in the country: Cuttings of the entire season's growth, cut to a heel, are taken in October and November, and are placed in sand in boxes in gentle heat, as in a propagating house. By February the roots will be formed, and the boxes are then placed in a cool house where the temperature is about 50°. Early in spring (about April 1st) the boxes are placed out-doors in cold frames, where they remain until May, until frost is over. The boxes are then removed from the frames and are set on boards in a shady place, where they are left until fall. In the fall—having been nearly a year in the boxes—the plants are shaken out and are heeled-in in a cellar. The next spring they are planted out in beds, and during the following summer and winter they are given some protection from sun and cold. Yews and arbor-vitæs are handled in the same way.

Retinosporas are often grafted upon retinospora or common arbor-vitæ stocks. This operation is usually performed upon potted plants in winter by the veneer method.

Rhamnus, including Frangula (Buckthorn). *Rhamneæ.*

The hardy kinds may be increased by means of seeds or by layers. The stove and greenhouse species may be multiplied by cuttings of growing parts. Seeds should be stratified.

Rhaphidophora. *Aroideæ.*

Increased by seeds; or by cuttings inserted in peaty soil with bottom heat.

Rhaphiolepis (Indian Hawthorn). *Rosaceæ.*

Seeds. Cuttings of firm shoots in a frame.

Rheum (Rhubarb, Pie-plant, Wine-Plant). *Polygonaceæ.*

Increased by seeds and by divisions. Each division should contain at least one bud on the crown. Seeds may be sown where the plants are to stand, but will not reproduce the varieties.

Rhipsalis, including Lepismium, Pfeiffera. *Cacteæ.*

Cuttings, after having been dried for a few days, should be inserted in coarse gravel or sand. See Cactus.

Rhodanthe. *Compositæ.*

Propagated by seeds.

Rhodochiton. *Scrophularineæ.*

Propagated by seeds; and cuttings of the growing wood

Rhododendron, Azalea (Rose-Bay). *Ericaceæ.*

Seeds are largely employed, but they are small and light and must be carefully handled. They are sown in spring in pans or boxes in a soil of sandy peat, care being taken to cover them very lightly and not to dislodge them when applying water. They are handled in cold-frames or in a cool house, and the young plants must be shaded. The plants are commonly allowed to remain a year in the boxes. Low growing plants are often layered. Cuttings of growing wood, cut to a heel, are sometimes employed, being made in summer and handled in a frame, but the percentage of rooted plants will often be small. Rhododendrons are extensively grafted, the veneer method being most used. The operation is performed upon potted plants in late summer or early fall, or sometimes in a cool house in early spring. Most of the leaves are allowed to remain upon the cion. The plants are then placed in densely shaded cool frames, and are nearly covered with sphagnum. Various stocks are employed, but for severe climates the hardy species like *R. Catawbiense* and *R. maximum* are probably best. *R. Ponticum* is extensively used in Europe, but it is not hardy enough for the north.

Rhodotypos. See Kerria.

Rhubarb. See Rheum.

Rhus (Sumach). *Anacardiaceæ.*

Seeds, layers, suckers, root-cuttings, and cuttings of green or ripe wood. Suckers are oftenest used.

Rhynchosia. *Leguminosæ.*

Propagated by seeds and division.

Rhynchospermum. See Trachelospermum.

Ribes (Currant, Gooseberry). *Saxifrageæ.*

Seeds, which should be sown as soon as ripe, or else stratified for new varieties. Commonly from ripe cuttings. See Currant and Gooseberry.

Richardia (Calla) *Aroideæ.*

Offsets, which should be removed and potted off when the plants are at rest.

Ricinus (Castor Bean). *Euphorbiaceæ.*

Seeds, which in the north are started in-doors.

Rivina, Piercea (Hoop Withy). *Phytolaccaceæ.*

Readily propagated by seeds; also by cuttings, inserted during spring in heat.

Robinia (Locust, Rose Acacia). *Leguminosæ.*

Seeds, sown in fall or spring, and which usually germinate better if soaked in hot water previous to sowing. Also grown from layers and root-cuttings. Named varieties are grafted or budded, the common locust stock (*R. Pseudacacia*) being preferred, even for the rose acacia (*R. hispida*).

Rocambole (*Allium Scorodoprasum*). *Liliaceæ.*

"Cloves," or divisions of the bulb.

Rocket, ornamental sorts. See Hesperis.

Rocket Salad (*Eruca sativa*). *Cruciferæ.*

Seeds, sown where the plants are to grow.

Rock-Rose. See Cistus.

Romneya. *Papaveraceæ.*

Propagated by seeds in spring.

Romulea. *Irideæ.*

Offsets.

Rondeletia, Willdenovia, Rogiera. *Rubiaceæ.*

Seeds. Cuttings of half-ripened wood, inserted in sand under glass, in heat.

Rosa (Rose). *Rosaceæ.*

New varieties and sometimes stocks are grown from seeds, which are sown as soon as ripe, or kept in the hips until spring. The hardy kinds are usually sown in well prepared beds out-doors. Roses are sometimes grown from layers, and often from root-cuttings, after the manner of blackberries. The common way of propagating roses, however, is by means of short cuttings of firm or nearly mature wood, handled under glass, with a mild bottom heat (of 65° or 70°). They are commonly made in February or March from forced plants. The cuttings are made in various fashions, some allowing most of the leaves to remain, and some preferring to cut most of them off, as in Fig. 56. They are commonly cut to one-bud lengths. Long cuttings of ripened wood, handled in a cool greenhouse or in frames, may also be employed for the various perpetual and climbing roses. Most growers feel that the best plants are obtained from cuttings, but most varieties do well when budded upon congenial and strong stocks. Budding by the common shield method is considerably employed, and veneer-grafting is sometimes used. The stocks are grown either from seeds or cuttings. The commonest stock is the manetti (*Rosa canina*), which is a strong and hardy species. The multiflora rose (*R. polyantha*) is also a good stock, especially for early results. A stock somewhat used about Boston for some of the hybrid perpetuals, with excellent results, is *Rosa Watsonia*, a Japanese species. "Worked" roses are in greater favor in Europe than in this country.

Rosemary (*Rosmarinus officinalis*). *Labiatæ.*

Seeds and divisions.

Rubus (Bramble). *Rosaceæ.*

Seeds, which should be stratified or sown as soon as ripe. Root-cuttings and suckers are mostly employed. The seeds of *R. deliciosus* require two years for germination. See Blackberry, Dewberry, Raspberry.

Rudbeckia, including Lepachys, Obeliscaria (Cone Flower). *Compositæ.*

Propagated by seeds or divisions.

Rue. See Ruta.

Ruellia, including Dipteracanthus. *Acanthaceæ.*

Seeds. Cuttings, inserted in a light rich soil, under glass.

Rulingia. *Sterculiaceæ.*

Seeds. Cuttings under glass.

Ruscus (Butcher's, Alexandrian Laurel). *Liliaceæ.*

Root suckers. Also seeds, when obtainable.

Rush. See Juncus.

Russelia. *Scrophularineæ.*

Seeds. Green cuttings under glass.

Ruta. Haplophyllum (Herb of Grace, Rue). *Rutaceæ.*

Propagated by seeds, divisions and cuttings. Meadow Rue, see Thalictrum.

Sabal. *Palmæ.*

Propagated by seeds, and by suckers, which should be taken when about one foot long. If they have no roots they must be carefully handled.

Sabbatia (American Centaury). *Gentianeæ.*

May be raised from seeds, which should be sown thinly in pans, or on a shady border.

Saffron (*Carthamus tinctorius*). *Compositæ.*

Propagated by seeds, in open air in spring. Saffron is also *Crocus sativus.*

Sage (*Salvia officinalis*). *Labiatæ.*

Seeds, sown in spring where the plants are to stand. Also by division, but seeds give better plants. Sage plantations should be renewed every two or three years. Good plants are grown from cuttings.

Sage Palm. See Cycas.

Saintfoin. See Onobrychis.

Saint John's Bread. See Carob.

Salisburia. See Ginkgo.

Salix (Willow, Osier, Sallow). *Salicineæ.*

All the willows grow readily from cuttings of ripe wood of almost any age. The low and weeping varieties are top-worked upon any common upright stocks.

Sallow. See Salix.

Salpiglossis. *Scrophularineæ.*

Propagated by seeds in open air, or they may be started under glass.

Salsify (*Tragopogon porrifolius*). *Compositæ.*

Seeds, sown in spring where the plants are to remain.

Salvia, including Sclarea (Sage). *Labiatæ.*

May be increased by seeds, sown thinly and placed in a little warmth. Also by cuttings; these will root readily in heat, if they are quite soft and in a growing state.

Sambucus (Elder). *Caprifoliaceæ.*

Seeds, handled like those of raspberries and blackberries. Named kinds are grown from cuttings of mature wood, and by layers.

Sandoricum (Sandal-tree). *Meliaceæ.*

Seeds. Cuttings, in sand under glass, in heat.

Sanguinaria (Blood-root, Red Puccoon). *Papaveraceæ.*

Propagation is effected by means of seeds, or by divisions.

Sanguisorba. See Poterium.

Sanseviera, Salmia (Bowstring Hemp). *Hæmodoraceæ.*

Young plants are obtained from suckers.

Sapodilla or **Sapodilla Plum.** See Sapota.

Saponaria, including Vaccaria (Bouncing Bet, Fuller's Herb, Soapwort). *Caryophylleæ.*

Increased by seeds and by divisions. The hardy annual and biennial kinds may be simply sown in the open border,

Sapota, Achras. *Sapotaceæ.*

Seeds and cuttings. In trodical countries the sapodilla (*S. Achras*) is raised entirely from seeds.

Sarracenia (Indian Cup, Pitcher Plant, Side-saddle Flower. Trumpet Leaf). *Sarraceniaceæ.*

Increased by dividing the crowns. Sometimes by seeds, sown in moss in a cool frame.

Sassafras. *Laurineæ.*

Increased by seeds, and by suckers and root-cuttings.

Satyrium. *Orchideæ.*

Division of the plants, as new growth is commencing. (See also under Orchids.)

Saurauja, Palava, Reinwardtia. *Ternstrœmiaceæ.*

Seeds. Ripened cuttings should be inserted in sand, under glass.

Sauromatum. *Aroideæ.*

Increased by offsets.

Saussurea. *Compositæ.*

Seeds; division.

Savin. See Juniperus.

Savoy. See Cabbage.

Savory (*Satureia hortensis, S montana*). *Labiatæ.*

Seeds, sown where the plants are to remain; or the winter savory (*S. montana*), which is a perennial, by division.

Saxifraga (Saxifrage, Rockfoil). *Saxifrageæ.*

Seeds, divisions, and in some species (as *S. sarmentosa*, the "strawberry geranium") by runners.

Scabiosa (Pin-cushion Flower). *Dipsaceæ.*

Seeds, usually sown in the open, and sometimes by division

Scævola. *Goodenovieæ.*

Seeds. Cuttings should be inserted in a compost of peat and sand, under glass.

Scheeria. See Achimenes.

Schelhammera, Parduyna. *Liliaceæ.*

Increased usually by divisions.

Schinus. *Anacardiaceæ.*

Propagated by seeds.

Schismatoglottis. *Aroideæ.*

Increased by divisions.

Schizandra, including Maximowiczia. *Magnoliaceæ.*

Seeds, when procurable. Propagation is effected by layers; by ripened cuttings, which should be inserted in sand under glass.

Schizanthus (Butterfly or Fringe Flower). *Solanaceæ.*

The half-hardy kinds are increased by seeds sown in a little heat in spring. The seed of the hardy sorts may be sown in the open ground in early spring.

Schizophragma. *Saxifrageæ.*

Propagated easily by cuttings of the ripened wood in a cool house in autumn.

Schizostylis. *Irideæ.*

Propagated by seeds and by division.

Sciadophyllum, Actinophyllum. *Araliaceæ.*

Seeds. Cuttings, in sand under glass, in moderate heat.

Sciadopitys (Umbrella Pine). *Coniferæ.*

Slowly propagated by imported seeds. But cuttings of the half-ripened shoots, taken off in summer and inserted in sand, in heat, root readily.

Scilla (Squill, Wild Hyacinth). *Liliaceæ.*

Slowly increased by seeds, usually by bulbels.

Scolopendrium. See Ferns.

Scorzonera (Black Salsify). *Compositæ.*

Seeds, sown where the plants are to stand.

Scotch Broom. See Cytisus.

Screw Pine. See Pandanus.

Scutellaria (Skull-cap, Helmet Flower). *Labiatæ.*

Seeds, divisions and cuttings of growing shoots under cover.

Seaforthia. See Ptychosperma.

Sea-kale (*Crambe maritima*). *Cruciferæ.*

Seeds, sown without being shelled, usually in a seed-bed. When the young plants have made three or four leaves, they should be removed to permanent quarters. Seedlings should furnish crops in three years. By root-cuttings, four or five inches long, taken from well established plants. These should give plants strong enough for cutting in two years.

Seaside Grape. See Coccoloba.

Sechium (Choko). *Cucurbitaceæ.*

Seeds. Tubers.

Sedge. See Carex.

Sedum, including Rhodiola (Orpine, Stonecrop). *Crassulaceæ.*

Propagation may be effected by seeds, by divisions of the tufts, by cuttings of stems or leaves in spring.

Selaginella. *Lycopodiaceæ.*

Spores. Short cuttings, inserted in very early spring, in pots or pans.

Sempervivum (House Leek). *Crassulaceæ.*

Readily increased by seeds, or by the young plants which appear around the old ones at the base.

Senecio, including Cacalia, Cineraria, Farfugium, Jacobea Kleina, Ligularia (Groundsel, Ragweed). *Compositæ.*

The annuals are propagated by seeds. Others may be increased by seeds, by divisions, or by cuttings both of the roots and shoots.

Sensitive Plant. See Mimosa.

Sequoia, Wellingtonia (Redwood). *Coniferæ.*

Seeds, which must be handled in a frame or half-shady place. Layers, and cuttings handled like those of retinospora and yew.

Sericographis. See Justicia.

Sesamum (Bene). *Pedaliaceæ.*

Seeds, sown under glass, or in the south in the open border.

Sesbania, including Agati (Pea-tree). *Leguminosæ.*

Seeds for annual species; the shrubby kinds by cuttings of the half-ripened shoots under glass, in heat.

Shad-bush. See Amelanchier.

Shaddock. See Pomelo.

Shallot (*Allium Ascalonicum*). *Liliaceæ.*

Grown from "cloves," which are formed by the breaking up of the main bulb.

Shell-bark Hickory (Shag-bak). See Hicoria.

Shepherdia (Buffalo Berry). *Elæagnaceæ.*

Increased by seeds sown in the fall or stratified unti spring.

Sibbaldia. See Potentilla.

Siberian Pea-tree. See Caragana.

Sideritis. *Labiatæ.*

Seeds, divisions, cuttings.

Side-saddle Flower. See Sarracenia.

Silene (Campion, Catchfly). *Caryophylleæ.*

Propagation is effected by seeds, by divisions, and by cuttings.

Silk-Cotton Tree. See Bombax.

Silphium (Rosin-plant, Compass-plant). *Compositæ.*

Propagated by seed and by divisions.

Silver Bell. See Halesia.

Sisyrinchium (Blue-eyed Grass, Pig Root, Rush Lily, Satin Flower). *Irideæ.*

It may be increased in spring by seeds or by divisions.

Skimmia. *Rutaceæ.*

Seeds, in a frame. Also by layers and by firm cuttings in gentle heat.

Skirret (*Sium Sisarum*). *Umbelliferæ.*

Seeds, offsets, or divisions.

Slipperwort. See Campanula and Calceolaria.

Smilacina (False Soloman's Seal). *Liliaceæ.*

Seeds. Division of roots.

Smilax (Green-Briar, American China Root). *Liliaceæ.*

Young plants are obtained by seeds and by layers and divisions of the root. For the "Smilax" or Boston-vine of conservatories, see Myrsiphyllum.

Snapdragon. See Antirrhinum.

Snowball-tree. See Viburnum.

Snowberry-tree. See Symphoricarpus.

Snowdrop. See Galanthus.

Snowflake. See Leucoium.

Soapwort. See Saponaria.

Solandra. *Solanaceæ.*

Increased by seeds sown in spring; by cuttings, inserted in mould or tan. If small flowering plants are desired, the cuttings should be taken from flowering shoots.

Solanum, including Aquartia, Nycterium (Nightshade). *Solanaceæ.*

The annuals, and most of the other species, are raised from seeds. The tuberous kinds may be increased by tubers or divisions of them. The stove and greenhouse shrubby plants may be propagated by cuttings, inserted when young in a warm frame.

Soldanella. *Primulaceæ.*

Increased by seeds and by division.

Solea. See Ionidium.

Solidago (Golden Rod). *Compositæ.*

Seeds, sown in fall or spring, and by divisions.

Solomon's Seal. See Polygonatum.

Sonerila. *Melastomaceæ.*

Propagated by seeds; or by cuttings which should be inserted singly in small pots during spring and placed in a frame in a propagating house.

Sophora, including Edwardsia. *Leguminosæ.*

Seeds, layers and cuttings of either ripened or growing wood. The named varieties are grafted upon common stocks.

Sorghum. *Gramineæ.*

Usually by seeds. Sometimes by cuttings as in Sugar Cane.

Sorrel (*Rumex*, several species). *Polygonaceæ.*

Seeds and divisions.

Sorrel-tree. See Oxydendron.

Sour Gum. See Nyssa.

Sowbread. See Cyclamen.

Spanish Bayonet. See Yucca.

Sparaxis. *Irideæ.*

Seeds. Usually by offsets.

Sparmannia. *Tiliaceæ.*

Propagated by cuttings of half-ripened wood in spring.

Spathiphyllum, including Amomophyllum. *Aroideæ.*

Propagated sometimes by seeds sown in heat, or by divisions of the root-stocks.

Spearmint (*Mentha viridis*). *Labiatæ.*

Commonly grown from cuttings of the creeping root-stocks

Speedwell. See Veronica.

Sphæralcea, Sphæroma (Globe Mallow). *Malvaceæ.*

Seeds; by cuttings of the young growth under glass, and kept shaded until rooted.

Spiderwort. See Tradescantia.

Spinage (*Spinacia oleracea*). *Chenopodiaceæ.*

Seeds, sown usually where the crop is to stand, either in fall or spring.

Spiræa (Spirea, Meadow-Sweet). *Rosaceæ.*

Seeds, sown as soon as ripe or stratified until spring. Commonly increased by cuttings, either of mature or green wood. Green cuttings usually make the best plants. These are made in summer and handled in frames. Some sorts, as *S. ariæfolia*, *S. opulifolia* and varieties (Nine-bark, now known as *Neillia* or *Physocarpus opulifolia*) and *S. prunifolia*, are usually grown from layers put down in spring. The herbaceous kinds are often increased by division.

Spondias (Hog Plum, Otaheite Apple or Plum). *Anacardiaceæ.*

Seeds; by large cuttings of growing wood, which should be inserted in sand or mould, in heat.

Spruce. See Picea and Abies.

Squash (*Cucurbita*, three species). *Cucurbitaceæ.*

Seeds, when the weather becomes warm.

Squill. See Scilla.

Stachys, Betonica, Galeopsis (Hedge Nettle, Woundwort) *Labiatæ.*

Seeds, divisions, or cuttings. Some species (as the Crosnes or *S. tuberifera* of recent introduction) are increased by subterranean tubers.

Staff-tree. See Celastrus.

Stanhopea. *Orchideæ.*

Division of the old roots. (See also under Orchids.)

Stapelia (Carrion Flower). *Asclepiadeæ.*

Seeds; commonly by cuttings in heat.

Staphylea (Bladder-nut). *Sapindaceæ.*

Seeds sown as sown as ripe or stratified until spring. By suckers, layers, and cuttings of roots or of mature wood.

Star Apple. See Chrysophyllum.

Star of Bethlehem. See Ornithogalum.

Statice (Sea Lavender, See Pink). *Plumbagineæ.*

The annuals and biennials may be increased by seeds sown in early spring, in a frame. The perennials by seeds, or by carefully made divisions. Greenhouse species should be propagated by cuttings inserted in small single pots during early spring, and placed under glass.

Staurostigma. *Aroideæ.*

Seeds sown in bottom heat; or by division of the tubers.

Stephanotis, Jasminanthes. *Asclepiadeæ.*

Propagated by seeds; also by cuttings of the previous year's growth inserted singly in pots, in spring, and placed in a close frame with a temperature of 60°.

Sterculia. *Sterculiaceæ.*

Seeds. Increased by ripened cuttings, which should be taken with the leaves on, and placed under glass. Those of the stove species should be placed in moist heat.

Stevia. *Compositæ.*

May be increased by seeds, by divisions and by cuttings.

Stigmaphyllon. *Malpighiaceæ.*

Seeds. Cuttings of ripened wood, inserted in sandy soil under glass, in heat.

Stillingia. *Euphorbiaceæ.*

Easily propagated by imported seeds.

Stock. See Mathiola.

Stokesia. *Compositæ.*

Propagation by seeds and by division.

Stonecrop. See Sedum.

Strawberry (*Fragaria*). *Rosaceæ.*

New sorts are grown from seeds, which are usually sown as soon as ripe; or they may be kept until the following spring either dry or in stratification. Varieties are commonly increased by offsets, or plants formed at the joints of runners. These runners appear after the fruit is off. If strong plants are desired, the runner should be headed-in, and only one plant allowed to form on each runner. The ground should be soft and somewhat moist, to enable the young plants to obtain a foothold. Plants strong enough for setting are obtained in August and September of the same year in which they start. Ordinarily, the runners will take root without artificial aid; but in hard soils, or with new or scarce varieties, the joints are sometimes held down with a pebble or bit of earth. New varieties are often propagated throughout the season from plants which are highly fertilized, and which are not allowed to fruit. Very strong plants are obtained by growing them in pots. A 3-inch pot is sunk below the runner, and the joint is held upon it by a stone or clod. The runner is then pinched off, to prevent further growth, and to throw all its energy into the one plant. The pot should be filled with soft, rich earth. Shouldered pots are best, because they can be raised more easily than others, by catching the spade or trowel under the shoulder. The plants will fill the pots in three or four weeks, if the weather is favorable. Old tin fruit cans, which have been heated to remove the bottoms, can also be used.

Cuttings of the tips of runners are sometimes made and handled in a frame, as an additional means of rapidly increasing new kinds. These cuttings are really the cast-away tips left from the heading-in or checking of the runners.

Strawberry Geranium. See Saxifraga.

Strawberry Tree. See Arbutus.

Strelitzia (Bird of Paradise Flower, Bird's-tongue Flower). *Scitamineæ.*

Increased by seeds, which should be sown in light soil, and the pots plunged in moist bottom heat. Also increased by suckers and by division of the old plants.

Streptocarpus (Cape Primrose). *Gesneraceæ.*

Readily propagated by seeds or by divisions.

Strobilanthes, including Goldfussia (Cone Head). *Acanthaceæ*

Seeds. Cuttings, in any light soil under glass, in heat.

Struthiola. *Thymelæaceæ.*

Seeds, when obtainable. Cuttings in sand under a frame.

Stuartia. *Ternstrœmiaceæ.*

May be increased by seeds and layers, or by means of ripened cuttings, inserted in sand under a hand-glass. Seeds are oftenest used, where obtainable.

Stylidium, Candollea. *Stylidieæ.*

Grown from seeds, or in a few cases, from divisions of the roots. The shrubby kinds may be increased by cuttings.

Stypandra. *Liliaceæ.*

Propagated by divisions.

Styrax (Storax). *Styraceæ.*

Seeds, which must be stratified, or else sown as soon as ripe. They usually lie dormant the first year. Also by layers and cuttings of green wood. Can be grafted upon other storaxes, or upon *Halesia tetraptera.*

Sugar Cane (*Saccharum officinarum*). *Gramineæ.*

Cuttings of the stems. The cuttings should possess a node or joint which bears one or more good buds. These cuttings are planted directly in the field, and the plants will reach maturity in two or three months. Propagation by seeds has been supposed to be impossible, but recent experiments at Kew indicate that it can be done.

Sumach. See Rhus.

Sundew. See Drosera.

Sunflower. See Helianthus.

Sun Rose. See Helianthemum.

Swainsona. *Leguminosæ.*

Seeds. Green cuttings under cover

Swan River Daisy. See Brachycome.

Sweet Brier. See Rosa.

Sweet Cicely. See Myrrhis.

Sweet Pea. See Lathyrus.

Sweet Potato (*Convolvulus Batatas*). *Convolvulaceæ.*

Sweet potato plants are grown in hot-beds, cold-frames or forcing-houses, from sound tubers of medium size. The tuber is laid upon a sandy or other loose bed, and is then covered with sand or sandy loam to a depth of one or two inches. Sometimes, to guard against rot, the tubers are not covered until the sprouts begin to appear. The tubers may be laid thickly upon the bed, but they are less apt to rot if they do not touch each other. Sometimes the tubers are cut in two lengthwise, the cut surface being placed down, in order to place all the plant-giving surface uppermost. In four or five weeks the young plants—three to five inches high—are pulled off and planted, and others soon arise to take their places. One hand should be held firmly upon the soil over the tuber, while the sprout is pulled off to keep it in place. Three or four crops of sprouts may be obtained from each tuber.

Sweet William (*Dianthus barbatus*). *Caryophylleæ.*

Seeds, sown in-doors or in the border. Division of the plants. Best results are obtained by starting new seedlings every other year.

Swertia. *Gertianeæ.*

Seeds, usually started in heat.

Sycamore. See Platanus.

Symphoricarpus (Waxberry, St. Peter's Wort, Snowberry-tree Indian Currant). *Caprifoliaceæ.*

Seeds, handled like those of blackberries. Also by suckers and cuttings.

Symphytum (Comfrey). *Boragineæ.*

May be increased by seeds and by division. Also by root-cuttings.

Symplocos, including Hopea. *Styraceæ.*

Seeds. Cuttings, in sand under glass.

Syngonium. *Aroideæ.*

Increased by dividing the stems into lengths of about three joints, and inserting them in pots in a brisk heat. The tops of plants may be cut off and inserted as large cuttings.

Syringa (Lilac). *Oleaceæ.*

New varieties and stocks are grown from seeds, which are usually stratified until spring. Green cuttings, handled in frames in summer, are largely used. Cuttings of mature wood will grow; also cuttings of the roots. Layers and suckers are often employed. Varieties are extensively grafted upon privet (*Ligustrum*), and common lilacs. Flute-budding is occasionally employed. Lilacs will grow for a time when worked upon the ash. Grafting succeeds well when performed in the open air.

Tabernæmontana. *Apocynaceæ.*

Increased by green cuttings, under glass, in moist beat

Tacca, Ataccia. *Taccaceæ.*

Seeds and division of the roots.

Tacsonia. See Passiflora.

Tagetes (Marigold). *Compositæ.*

Seeds, sown either in-doors or out.

Tamarack. See Larch.

Tamarindus (Tamarind). *Leguminosæ.*

Young plants may be obtained from seeds sown on a hotbed or out-doors in tropical countries. Cuttings, in sand under glass in heat.

Tamarix, Tamarisk. *Tamariscineæ.*

Increased by ripe cuttings under glass, the greenhouse kinds in heat.

Tansy (*Tanacetum vulgare*). *Compositæ.*

Seeds and divisions.

Taxodium, Glyptostrobus (Bald Cypress). *Coniferæ.*

Seeds are usually employed. Layers. Cuttings of young wood in wet sand, or even water, under cover. The varieties of glyptostrobus may be veneer-grafted in August or September on *T. distichum.*

Taxus (Yew). *Coniferæ.*

Seeds, sown when gathered or else stratified. Layers. Cuttings of green wood under glass in summer, or of mature wood as recommended for retinospora. The named varieties are veneer-grafted in August or early fall upon the upright kinds.

Tecoma (Trumpet-Creeper). *Bignoniaceæ.*

Seeds, layers, cuttings of firm shoots, but most commonly by root-cuttings.

Terminalia (Tropical Almond). *Combretaceæ.*

Seeds; also by cuttings of green wood under glass.

Ternstrœmia. *Ternstrœmiaceæ.*

Seeds. Cuttings of the half-ripened shoots under glass, in bottom heat.

Testudinaria (Elephant's Foot). *Dioscoreaceæ.*

Grown from imported roots or seeds.

Teucrium (Germander). *Labiatæ.*

Seeds, divisions, and the shrubby kinds by cuttings under cover.

Thalictrum (Meadow Rue). *Ranunculaceæ.*

Propagated by seeds, and divisions. The varieties by cuttings.

Thea. See Camellia.

Theobroma (Cacao, Chocolate-tree). *Sterculiaceæ.*

Propagated by ripened cuttings, which should be placed in sand, under glass, in heat.

Thermopsis. *Leguminosæ.*

By seeds and divisions.

Thrift. See Armeria.

Thrinax. *Palmæ.*

Seeds.

Thunbergia. *Acanthaceæ.*

Seeds. Cuttings of firm wood in a frame.

Thunia. *Orchideæ.*

As the form of the pseudo-bulbs suggests, this genus is easily propagated by cuttings. These are made about six inches long and inserted in pots of sand. After standing in an ordinary propagating frame or moist stove for a short time young growths will appear at the nodes. When large enough they are taken up and potted in ordinary compost. Two years at least are needed for them to attain to flowering size, but this is the best method where a large number of plants are wanted. (See also under Orchids.)

Thuya, including Biota (Arbor-Vitæ, White Cedar erroneously). *Coniferæ.*

Seeds. Layers. Cuttings of green shoots in summer in a cool frame. Cuttings of ripe wood, as recommended for retinospora. The named varieties are often grafted on potted common stocks in winter or early fall.

Thyme (*Thymus vulgaris*). *Labiatæ.*

Seeds and divisions.

Thyrsacanthus, Odontonema (Thyrse Flower). *Acanthaceæ.*

Seeds; cuttings made in spring, and placed in a close, warm frame.

Tiarella. *Saxifrageæ.*

Seeds and divisions.

Tigridia (Tiger Flower). *Irideæ.*

May be increased by seeds, or generally by offsets.

Tilia (Basswood, Linden, Lime-tree). *Tiliaceæ.*

Stocks are grown from stratified seeds. Layers may be made, and cuttings may be employed, but the named sorts are usually grafted on strong common stocks. Mound-layering is sometimes practiced.

Tillandsia. *Bromeliaceæ.*

May be increased by seeds, and by suckers which should be allowed to grow large before being detached from the parent and should then be inserted singly in pots, in a compost of loam, peat, and leaf mould. Keep moderately molst and well shaded. *T. usneoides* is the "Spanish Moss" of the south; rarely propagated, but may be grown from seeds or divisions of the moss.

Tobacco. See Nicotiana.

Tolu Balsam-tree. See Myroxylon.

Tomato *(Lycopersicum esculentum).* *Solanaceæ.*

Seeds, usually started under glass. Cuttings of growing shoots.

Torenia. *Scrophularineæ.*

Seeds. Cuttings, in a warm frame.

Torreya. *Coniferæ.*

Increased the same as Thuya and Retinospora.

Trachelium (Throatwort). *Campanulaceæ.*

Seeds and cuttings.

Trachelospermum, Rhynchospermum. *Apocynaceæ.*

Seeds. Firm cuttings, in a frame.

Trachycarpus. *Palmæ.*

Seeds and suckers.

Tradescantia. *Commelinaceæ.*

Usually by cuttings; also by seeds and divisions.

Trapa (Water Caltrops). *Onagrarieæ.*

Seeds.

Tree of Heaven. See Ailanthus.

Trichilia. *Meliaceæ.*

Seeds. Cuttings of the ripened wood, with leaves, or under glass in heat.

Trichopilia. *Orchideæ.*

Divisions of the plants. (See also under Orchids.)

Trichosanthes (Snake Gourd). *Cucurbitaceæ.*

Seeds, either in-doors or out.

Tricyrtis. *Liliaceæ.*

Seeds rarely. Offsets and divisions.

Trillium (American Wood-Lily, Indian Shamrock, Wake-Robin). *Liliaceæ.*

Propagated by seeds and by divisions.

Triteleia (Triplet Lily). *Liliaceæ.*

Propagated by seeds and by offsets.

Tritoma. See Kniphofia.

Tritonia, Aletris, including Montbretia. *Irideæ.*

Young plants are raised from seeds; but generally increased by divisions.

Trollius (Globe Flower, Globe Ranunculus). *Ranunculaceæ.*

Seeds. Divisions in early autumn or spring. The seeds should be sown fresh or a long time will be required for germination.

Tropæolum (Nasturtium, Canary-bird Flower, Indian Cress). *Geraniaceæ.*

Seeds, started in-doors or in the garden. Tuberiferous species by tubers or divisions of roots. Perennials sometimes by cuttings in a frame.

Trumpet Creeper. See Tecoma.

Tuberose. See Polianthes.

Tulipa (Tulip). *Liliaceæ.*

Seeds may be sown in boxes of light sandy soil, in late winter, and placed in a cold frame. The next season the young bulbs should be planted in a prepared bed outside. Bulbels may be detached from established bulbs when they are lifted, and grown by themselves. This is the usual method.

Tulip-tree. See Liriodendron.

Tupelo-tree. See Nyssa.

Turnĕra. *Turneraceæ.*

Seeds, divisions and cuttings.

Turnip (*Brassica*). *Cruciferæ.*

Seeds, where the plants are to remain.

Tydæa. See Gesnera.

Typha (Bullrush, Cat's Tail, Reed Mace). *Typhaceæ.*

Propagation may be effected by seeds sown in a pot plunged in water nearly to the level of the soil; or by divisions.

Ulex (Furze, Gorse, Whin). *Leguminosæ.*

Propagated by seeds or by cuttings.

Ulmus (Elm). *Urticaceæ.*

Usually propagated by stratified seeds. Layers are sometimes made, and suckers may be taken. The varieties are grafted on common stocks.

Unicorn Plant. See Martynia.

Uvularia, including Oakesia (Bellwort). *Liliaceæ.*

Seeds; usually by divisions.

Vaccinium (Swamp Huckleberry, Whortleberry, Blueberry, Bilberry, Cranberry). *Vacciniaceæ.*

Seeds, layers, root cuttings, and divisions of the old plants, Some species by hard-wood cuttings, for which see Cranberry. Huckleberry seeds are small and somewhat difficult to grow. The seeds should be washed from the fruits and stored in sand in a cool place until late in winter. They are then sown in pans or flats on the surface of a soil made of equal parts sand and loam. Cover with fine sphagnum and keep in a cool house or frame, always keeping the seeds moist. Seeds treated in this way may be expected to germinate in a month or two, although they may lie dormant a year. Transplant frequently and keep shaded until large enough to shift for themselves. Layers should be tongued. Cuttings, two or three inches long, of the best roots, made in fall and placed in mild bottom heat in early spring, often give fair satisfaction. Native plants can be obtained from the woods and fields which will give good satisfaction if small specimens are taken.

Valeriana (Valerian). *Valerianeæ.*

Seeds and divisions.

Vallota. *Amaryllideæ.*

Bulbels, which usually appear above the surface of the pot. Division of the bulbs.

Vanda. *Orchideæ.*

The majority are propagated in the same way as described for aërides, but two species—*V. teres* and *V. Hookeri*—both tall and quick growing, may be cut into lengths of a few inches. The practice of the most successful cultivators is to start them every year as cuttings about a foot long. (See also under Orchids.)

Vanilla. *Orchideæ.*

Division and cuttings. The vanilla of commerce (*V. planifolia*) is propagated from cuttings which are planted at the base of trees, upon which the plant climbs. (See also under Orchids)

Vegetable Oyster. See Salsify.

Veitchia. *Palmæ.*

Seeds.

Veltheimia. *Liliaceæ.*

By fresh seeds or separation of the bulbs.

Veratrum (False or White Hellebore). *Liliaceæ.*

Young plants are obtained by seeds or by divisions.

Verbascum (Mullein). *Scrophularineæ.*

All are raised from seeds sown in any ordinary soil, except *V. nigrum* and *V. pinnatifidum*, which should be increased by divisions and cuttings respectively.

Verbena (Vervain). *Verbenaceæ.*

Seeds ; also by cuttings of vigorous shoots. Some species by divisions.

Vernonia, including Ascaricida (Ironweed). *Compositæ.*

May be raised from seeds, divisions, or cuttings, depending on the character of the plant.

Veronica (Speedwell). *Scrophularineæ.*

Seeds and divisions. Shrubby sorts often by cuttings.

Vesicaria (Bladder-pod). *Cruciferæ.*

Annuals by seeds ; perennials by division

Vetch (*Vicia sativa*). *Leguminosæ.*

By seeds in open air.

Viburnum. *Caprifoliaceæ.*

Seeds, which should be stratified. They usually remain dormant the first year. Layers usually make the best plants. Green cuttings made in summer and handled in frames give excellent results. *V. plicatum* is propagated by cuttings.

Ripe cuttings are sometimes used for the soft-wooded species. The snowball or guelder-rose (*V. Opulus*) is rapidly increased by layers. It is also a good stock for closely-related species. *V. Lantana* and *V. dentata* are good stocks on which varieties difficult to handle can be worked by the veneer-graft during winter.

Victoria (Royal Water Lily, Water Platter). *Nymphæaceæ.*

The seeds should be kept in vessels of water until ready for sowing, when they may be placed in loamy soil, and the pot submerged a couple of inches in water, the temperature of which should not be allowed to fall below 85°. The tank should be in a light position near the glass. Annual.

Vinca (Periwinkle). *Apocynaceæ.*

Increased by seeds and by divisions.

Viola (Violet, Heartsease, Pansy). *Violarieæ.*

The named violets are increased by cuttings made in a cool house from vigorous shoots. Common species by seeds, runners and divisions of the plants. Pansies are usually grown from seeds, but named varieties may be multiplied from cuttings taken late in the season, or from layers.

Virgilia. See Cladrastis.

Virginia Creeper. See Ampelopsis.

Virgin's Bower. See Clematis.

Viscum (Mistletoe). *Loranthaceæ.*

Raised from seed, which should be inserted in a notch cut in the bark or under side of a branch of the host. Avoid crushing the seed, and have the embryo directed towards the trunk. To prevent birds from disturbing the seeds after being placed in position, cover with light-colored cloth. The seed may also be fastened to a smooth part of the tree by the sticky substance surrounding it, but more seed is lost Our native phoradendron can be handled in the same way.

Vitex (Chaste-tree). *Verbenaceæ.*

Seeds. Suckers. Layers. Cuttings of green or ripened wood.

Vitis. See Grape.

Vochysia, Curcullaria. *Vochysiaceæ.*

Seeds ; by ripened cuttings in sand under glass, in heat.

Waahoo. See Euonymus.

Waldsteinia. *Rosaceæ.*

May be multiplied by seeds or divisions.

Wall-flower (*Cheiranthus Cheiri*). *Cruciferæ.*

Propagated by seeds; the plants, however, will not flower at the north until the second season; protection of a frame is required.

Wallichia, Wrightia. *Palmæ.*

May be increased by seeds; or by suckers, which should be gradually separated so as to allow them to make sufficient roots before they are quite detached.

Walnut. See Juglans.

Water-Cress (*Nasturtium officinale*). *Cruciferæ.*

Cuttings of the young stems, which root in mud with great readiness. Seeds scattered in the water or mud.

Water-Lily. See Nymphæa, Nelumbo and Victoria.

Water-Melon (*Citrullus vulgaris*). *Cucurbitaceæ.*

Seeds, usually sown where the plants are to remain, after the weather is warm and settled.

Watsaonia (Bugle Lily). *Irideæ.*

The plants are multiplied by seeds or by offsets.

Wax Flower. See Hoya.

Weigela. See Diervilla.

Wellingtonia. See Sequoia.

Whin. See Ulex and Genista.

White Cedars. See Chamæcyparis and Thuya.

White-wood. See Liriodendron and Tilia.

Whitlava. See Phacelia.

Whortleberry, Huckleberry (*Gaylussacia resinosa*). *Ericaceæ.*

Propagated by seeds, which should be stratified and otherwise carefully handled. (See also Vaccinium.)

Willow. See Salix.

Wind Flower. See Anemone.

Windsor, Broad or Horn Bean (*Vicia Faba.*) *Leguminosæ.*

Propagation by seeds in open air after the soil is fairly warm.

Winter Aconite. See Eranthis.

Winter Cress. See Barbarea.

Wistaria. *Leguminosæ.*

Readily grown from seeds. Sometimes by division. Layers. Cuttings of ripened wood, usually handled under glass. The common purple and white kinds are largely grown from root-cuttings, an inch or two long, placed in bottom heat, when they will start in four or five weeks. Many of the fancy kinds, especially when wood is scarce, are root-or crown-grafted upon *W. Sinensis.*

Witch-hazel. See Hamamelis.

Woad-Waxen. See Genista.

Woodbine. A name properly belonging to climbing Loniceras, but often applied to Ampelopsis, both of which see.

Wormwood, Southern wood (*Artemisia Absinthium*). *Compositæ.*

Seeds and division.

Wrightia, Balfouria (Palay or Ivory-tree). *Apocynaceæ.*

Seeds; usually by cuttings, which root readily in sand in heat.

Xanthoceras. *Sapindaceæ.*

Usually multiplied by seeds; root-cuttings are sometimes used.

Xanthorhiza, Zanthorhiza. *Ranunculaceæ.*

Seeds and suckers.

Xanthorrhœa (Black Boy, Grass-tree). *Juncaceæ.*

Seeds; but usually by offsets.

Xanthosoma, including Acontias. *Aroideæ.*

May be increased by cutting up the stem or root-stock into small pieces and planting these in light soil, or cocoa fibre, in bottom heat. After a stem has been cut off, a number of shoots are developed, which can be treated as cuttings.

Xerophyllum. *Liliaceæ.*

May be propagated by seeds and by divisions.

Xiphion. See Iris.

Xylophylla. See Phyllanthus.

Yam. See Discorea.

Yellow-wood. See Cladrastis.

Yew. See Taxus.

Yucca (Adam's Needle, Bear's Grass, Spanish Bayonet). *Liliaceæ.*

Increased by seeds; and by divisions, which may be planted in the open ground, or by pieces of thick, fleshy roots, cut into lengths, and inserted in sandy soil, in heat.

Yulan. See Magnolia.

Zamia. *Cycadaceæ.*

Division of the crowns when possible; or by seeds and suckers. The plants are oftenest imported directly from the tropics.

Zanthoriza. See Xanthoriza.

Zanthoxylum (Prickly Ash). *Rutaceæ.*

Seeds, suckers, but more often by root-cuttings.

Zea. See Maize.

Zephyranthes, including Habranthus (Flower of the West Wind, Zephyr Flower). *Amaryllideæ.*

May be multiplied by seeds; or by separating the bulbels.

Zingiber, including Zerumbet (Ginger). *Scitamineæ.*

Propagated by division.

Zinnia (Youth-and-old-Age). *Compositæ.*

Seeds, sown either in-doors or out.

Zizania (Wild or Indian Rice). *Graminæ.*

Seeds, sown along water courses or in bogs in fall or spring.

Zizyphus. See Jujube.

Zygadenus, including Amianthemum, Anticloa. *Liliaceæ.*

Readily multiplied by seeds or by divisions.

Zygopetalum. *Orchideæ.*

Division. (See also under Orchids.)

Zygophyllum (Bean Caper). *Zygophylleæ,*

Seeds, when they can be had; otherwise by cuttings in a frame.

CHAPTER VII.

POLLINATION

Pollination.—The act of conveying the pollen from the anther to the stigma.

Close-pollination—Self-pollination.—The transfer of pollen to a stigma of the same flower.

Cross-pollination.—The conveyance of pollen to the stigma of another flower.

Crossing.—The operation or practice of cross-pollinating.

Fertilization—Fecundation—Impregnation.—The action of the pollen upon the ovules.

Close-fertilization—Self-fertilization.—The action of pollen upon the ovules of the same flower.

Cross-fertilization.—The action of pollen upon the ovules of another flower of the same species.

Individual-fertilization.—Fertilization between flowers upon the same plant.

Hybridizing.—The operation or practice of crossing between species.

Hybridism—Hybridity.—The state, quality or condition of being a hybrid.

Hybridization.—The state or condition of being hybridized, or the process or act of hybridizing.

Cross.—An offspring of any two flowers which have been cross-fertilized.

Individual-Cross.—An offspring of two flowers on the same plant.

Cross-breed—Half-breed—Mongrel—Variety-hybrid.—A cross between varieties of the same species.

Hybrid.—An offspring of plants of different species.

Half-hybrid.—A product of a cross between a species and a variety of another species.

Derivative or Derivation-hybrid—Secondary-hybrid.—A hybrid between hybrids, or between a hybrid and one of its parents.

Bigener—Bigeneric-hybrid.—A hybrid between species of different genera.

Bigeneric half-breed.—A product of a cross between varieties of species of different genera.

Mule.—A sterile (seedless) hybrid.

GENERAL REQUIREMENTS.—In order to understand the methods of pollination, the reader must be able to recognize the parts of the flower. The fuchsia, Fig. 90, shows the parts distinctly. The open flower, on the right, contains four well-marked series of organs. The first series is composed of four narrow and leaf-like parts or sepals, collectively called the calyx. Borne upon these is the corolla, made up of four blunt and variously colored petals. The next series comprises eight slender stamens or male organs (*S*). The thread-like portions or stalks of these are the filaments and upon them are borne the anthers. The anthers contain the pollen. The last and innermost series is a pistil or female organ (*P*). The pistil is made up of three parts: the ovary, which develops into the seed-pod, the style or slender portion, and the stigma, or enlargement at the end. The ovary in this case is the oblong body borne at the base of the flower and upon which the other parts stand. The style runs through the flower to the ovary.

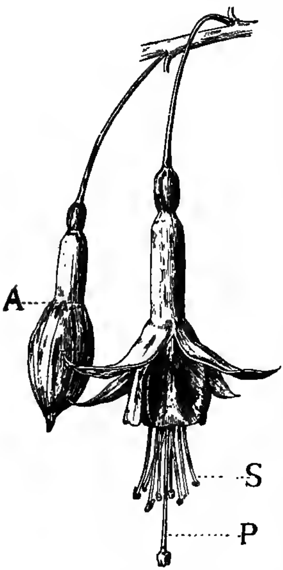

Fig. 90. Parts of the Flower.

The modifications of the flower are numberless, both in form and number of parts, but these four series of organs—the calyx, corolla, stamens and pistils—always comprise a complete flower and they are arranged in the order named. A perfect flower is one which contains both stamens and pistils without any reference to the surrounding or leaf-like organs. Many flowers are imperfect or contain only one sex. When the sexes are borne in different flowers upon the same plant, the species is said to be monœcious; and when they are borne upon different plants the species is diœcious. Sometimes the inflorescence is mixed, some flowers being perfect, some staminate and some pistillate, all upon the same plant; such species are polygamous. Most garden plants have perfect flowers. Many nut-bearing trees are monœcious, as walnuts, butternut, hickories, chestnuts, hazels and filbert and oaks. Some of the composite plants are also monœcious, the large head bearing staminate flowers in one part and pistillate in another. Pumpkins and squashes are monœcious and so are most varieties of melons. Fig. 91 shows a pistillate pumpkin flower with the ovary or young pumpkin below, and Fig. 92 a staminate flower which lacks the enlargement below. Among diœcious species may be mentioned the willows and poplars.

Fig. 91. Pistillate Squash flower.

The ovary contains the ovules. When these are acted upon or fertilized by the pollen they develop into seeds. The pollen falls upon the stigma or upper extremity of the pistil, and each grain germinates and sends a tube down through the style to an ovule. The stigma is a slightly roughened soft surface, and when it is "ripe," or ready to receive the pollen, it becomes slightly moist or sticky. In most plants the stigma is merely a circular expansion of tissue (Fig. 97), but sometimes it is divided into lobes and the lobes remain closed until it is ready for the pollen. The fuchsia stigma is composed of four lobes, which are closed in Fig. 90. Fig. 93 shows the two-lobed stigma of the trumpet-creeper or tecoma before the flower is ready for pollination. Fig. 94 shows the stigma open, in condition to receive the pollen. In these flowers the stamens are hidden in the tube of the corolla.


Fig. 92. Staminate Squash flower.

The pollen is nearly always in the form of very small grains, which become dry when ripe. In some plants, notably in orchids, the pollen is borne in large masses known as pollinia. When the anther is "ripe" it assumes a yellow, orange or brownish cast and the pollen is discharged through a split in the side, a chink at the apex or other aperture. The pollen may fall upon and fertilize the stigma of the same flower, in which case the flower is said to be self-fertilized, or oftener it is carried to another flower by insects, winds or other agencies. Most plants possess some contrivance which renders self-fertilization difficult and cross-fertilization easy.

There are many degrees of cross-fertilization. The cross may take place between two flowers in the same cluster or between two clusters upon the same plant; or it may take place between distinct plants, either of the same or of another species. Fertilization between flowers on the same plant is known as individual-fertilization. The limits within which crossing is possible are not known, but the closer the species are related the more readily, as a rule, will they cross. One of the barriers which nature erects to prevent self or close-fertilization is a difference in time of maturing of the two sexes. In any flower the two parts are rarely ready at the same time. Flowers in which the stamens mature first are said to be proterandrous, and those in which the pistils mature first are proterogynous. In crossing such species, flowers of different ages can usually be found so that the parts can be brought together with-

Fig. 93. Closed stigma of tecoma.

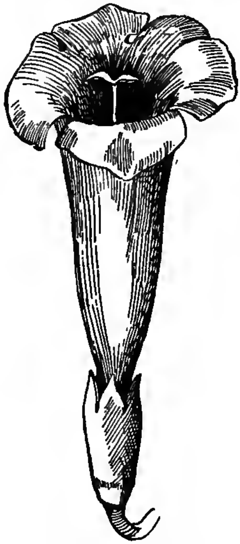

Fig. 94. Open stigma of tecoma.

out-difficulty. But when one series of organs in all the flowers of any species perish before the other series is mature, the pollen must be kept until the pistils are ready, or one sex must be forced or retarded artificially to accommodate the other. If the pollen matures first, it is only necessary to keep it a few days until the pistil is ready; but if the pistil matures first, and the plants cannot be handled artificially, the pollen must be kept over until the following season in order to effect any crosses.

The longevity of pollen is little understood. That of some species will keep much longer than others. It is supposed that, as a rule, it will not keep beyond a few days or weeks. If the pollen is to be kept, the anthers should be picked just before ready to burst and laid upon paper in a warm, dry and shady place until they dry up and the pollen is all discharged. The anthers must then be removed, and the pollen is securely wrapped in dry paper. If it is to be kept long it will probably be better to place it in small, closely cork-stoppered vials. It should be kept in a uniform temperature.

Methods.—All perfect flowers—those which contain both stamens and pistils—must be deprived of their anthers before the pollen is discharged, to prevent self-fertilization. This removal of the anthers is called *emasculation*. It is performed before the flower opens, and therefore before any foreign pollen could have reached the stigma. In some flowers, as in the tomato, Fig. 95, the stigma protrudes even before the petals are fully grown and emasculation must be performed very early. Even if the stigma is not mature, there is a chance that pollen will adhere to it and persist until conditions are fit for its growth.

The flower is generally emasculated by pulling out the anthers with pincers, but some large anthers can be hooked out easily by a very small crochet hook or by a pin bent to a minute hook upon the point.

Fig. 95. Tomato-flower.

It is many times a tedious operation, however, to pull out the anthers without crushing them, and thus distribute some of the pollen. A surer and better plan with most flowers is to cut off the floral envelopes and the stamens near the base with a pair of small and sharp-pointed scissors which cut well at the point. *A* in Fig. 90 shows the point at which this cut should be made in the fuchsia. With a little practice, one can cut off the parts quickly. Fig. 96 shows a tomato-flower after it has been emasculated in this fashion. Fig. 97 represents two flowers of *Nicotiana affinis*, one of which has been cut. One

Fig. 96 Emasculated tomato-flower.

of the most important features of this method is the marking of the fruits which results in all species in which the calyx persists. The calyx, of course, does not develop and the crossed fruit can be distinguished at once, even though the label is lost. The tomato fruit in Fig. 98 lacks entirely the long leaf-like calyx lobes at the base. Fig. 99 shows upon the right a gooseberry fruit, of which the flower was cut, while that on the left illustrates an untreated fruit with the long persistent calyx. This marking of the calyx is useful in all the pomaceous fruits, like apples and pears, and even in capsular fruits, like phloxes and petunias, in which the calyx lobes remain green.

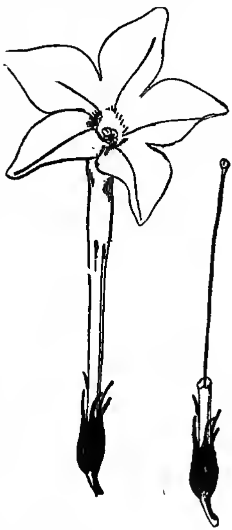

Fig. 97. Nicotiana affinis.

As soon as the flower is emasculated it must be securely tied up with a bag, to exclude pollen, as seen in Fig. 100. Netting of any kind is not safe in ordinary practice, for the pollen grains are small enough to pass through it. It often happens that the flower-stem is not strong enough to hold the bag, nor large enough to allow the bag to be puckered tightly about it. In such cases, all the remaining flowers in the cluster should be removed and the bag should be tied over a portion of the branch. The branch will often need to be cut off to accommodate the bag. If there are many large leaves about the flowers, part of them will need to be cut off. It is always a good practice to emasculate two or three flowers in the cluster—or all those of the same age—in order to multiply the chances of success. If flowers of different ages are emasculated, however, the bag will have to be removed several times to apply the pollen as the stigmas mature, and the chances of success will be lessened, for the flowers should be handled as little as possible.

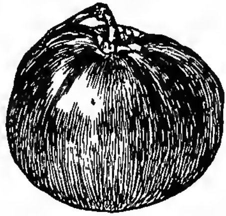

Fig. 98. Crossed tomato.

Various bags have been devised and recommended for covering the flowers, but none of them yet introduced are equal to the ordinary grocers' manilla bags. The only difficulty is that the smallest size—the fourth-pound—is too large for many small subjects, but for these the bag can be cut off. A soft string, five or six inches long, is passed through one of the folds of the bag about an inch from the open end, as seen in Fig. 101, and is tied to hold it in place. To make the bag pucker tightly about the stem, it should be moistened just before it is used.

In some flowers which have long and thick tube-like corollas, and in which the stigma matures quickly, the end of the corolla itself may be tied up. The flowers of squashes and pumpkins are particularly adapted to this treatment, and one is shown in Fig. 102. The flower is tied before it opens. In squash-like plants the flowers usually open early in the morning and the flowers are tied up the preceding evening. The corollas soon wilt and bags must be used after the pollen is applied; and even if the corolla does not wilt and shrivel, insects sometimes eat through it and interfere with the experiment.

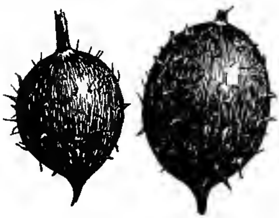

Fig. 99. Crossed and uncrossed gooseberries.

All imperfect flowers of course need no emasculation, but they must be tied up while yet in the bud to protect them from pollen.

As soon as the stigma matures—which will vary from one to six or seven days, according to the species—the pollen must be applied. The novice will be obliged to remove the bags occasionally, to see if the stigmas are ready. As soon as the shiny or glutinous appearance of the stigma is seen, pollination should be performed. The pollen is most easily secured by removing an anther when it is about to burst and breaking it open. If the anther is allowed to break open naturally, the pollen will be lost, or at least difficult to secure. There are various instruments recommended to aid in the transfer of the pollen. A camel's hair brush is often advised, but it is probably the poorest instrument which can be used. It wastes the pollen and also mixes it by holding it among the hairs, and it is often a difficult matter to apply pollen to the stigma evenly and in sufficient amount. The point of a small knife-blade is a better instrument. A still handier and better tool is made by flattening the point of a pin and then inserting the little scalpel in a handle, as shown in Fig. 103. With the point of this implement the pollen can be removed from the groove or opening in the side of the anther. It is commonly better, however, to place the unopened anther upon the thumb nail and crush it with the scalpel, when the pollen can be gathered up on the point and transferred to the stigma. In some species the pollen can be removed only by opening the anther-valves dexterously. Such is the case with the tomato ; the point of the scalpel is inserted in a longitudinal groove or fold in the side of the anther, and as it is carried upwards the pollen is secured.

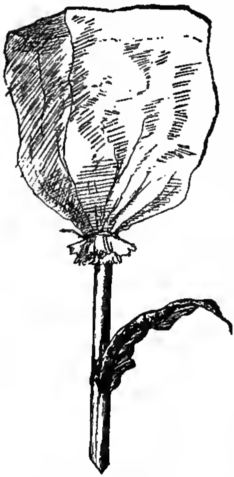
Fig. 100. Flower tied up.

The stigma should receive an abundant supply of pollen. No harm can come from supplying too much while if too little is applied, some of the seeds will not mature or even the fruit may not set. It is well known that in many plants, at least, the pollen stimulates the development of the fruit-walls, as well as fertilizes the ovules, and a greater amount of pollen than is sufficient to produce the seeds themselves may therefore exert an important influence. Sometimes it is not necessary to use an instrument to transfer the pollen. If the pollen is copious and adheres to the anther after it is discharged, the anther may be simply rubbed over the stigma. An anther will ordinarily contain sufficient pollen to fertilize several stigmas. The whole surface of the stigma should be covered until it is colored with the pollen. Sometimes it will be found advisable to cut off the corolla from large flowers, if it was not done when the flower was emasculated, to facilitate the labor of applying pollen. The short stigmas of squashes, for instance, can be reached more easily if the corolla is removed, as in Fig. 104.

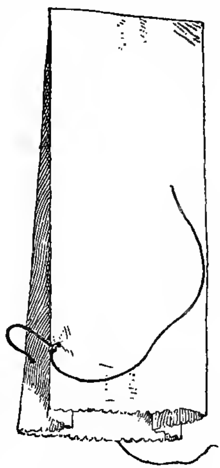

Fig. 101. Bag.

In order to prevent the mixing of pollen, the flowers from which it is to be derived should be covered while in the bud, the same as the flowers designed as the pistillate parents. Otherwise foreign pollen may be deposited upon the anthers by insects or winds.

Fig. 102. Squash flower tied up.

As soon as the pollen is applied to the stigma, the flower should be tied up again the same as before. The bag should remain three or four days or a week, until the stigma has died and all danger of another pollination is removed. If the fruit is likely to be destroyed by birds or insects, it should be covered with netting bags as soon as the paper-bags are removed.

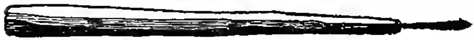

Fig. 103. Pin-scalpel.

These bags also serve to mark the crossed fruits, and to catch them if they should drop before the operator is aware. Of course all crosses should be labelled with the names of both parents and the date of the operation.

For ordinary operations, no especial outfit is necessary for the crossing of plants, but those who experiment largely will find that the work will be greatly facilitated by the use of a portable box in which the various requisites can be carried. If this box has a compartment for every article, the operator will see at a glance if anything is lacking before he goes to the field. Figs. 105 and 106 illustrate a convenient pollinating kit. This is made about 12 inches long, 9 inches wide and 3 inches deep. In the central portion is a compartment for bags and one for labels. At the right end, running crosswise, is a narrow compartment for string, and at its upper end is a small bottle of alcohol. Into this alcohol the scalpel and other tools are dipped whenever another kind of pollen is to be used, in order to destroy whatever pollen grains may adhere to them. In front is a compartment for a magnifying glass, and a long one to hold scalpel, brushes, crochet-hook and pencil. The note-book is held in the cover by a wire clasp.

Fig 104. Treated squash flower.

It is rare that all the flowers which one pollinates will mature fruit. If one-half are successful on the average, the operator may be satisfied. External conditions have much to do with the success of the operation. Some species do not set well during very dry weather and some are impatient of confinement. But probably all plants which thrive under glass are more sure to give good results if pollinated under confinement, because conditions are under control.

Crossing of Flowerless Plants.—Ferns, lycopodiums, and their allies, pass through two stages of development, and fertilization takes place only in the first stage. When spores germinate, a small, thin, green tissue spreads over the soil. This tissue is the prothallus (or prothallium). Upon the prothallus, or somewhat sunken in it, the sexual organs appear. They are minute aggregations of cells. Some of these aggregations develop into sperm or male organs and some into germ or female organs. The sperm organ is known as an antheridium and the germ organ as an archegonium. Spermatozoids are formed in the antheridium, and these enter the archegonium and fertilize the germ cell. This fertilized germ cell then develops into the second stage of the species, or into that part which we know as the fern or the lycopod. During this second stage, the plant bears leaf-like organs and it also produces numerous spores. These spores will produce the prothallus again when sown. Ferns, therefore, are fertilized but once during their lifetime, and the spores are not the direct result of fertilization as are the seeds of flowering plants.

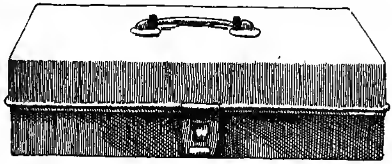

Fig. 105. Pollinating Kit, closed.

If ferns and other flowerless plants are to be crossed, therefore, the operation must be performed in the prothallic stage. It was long a matter of doubt among botanists as to whether crossing is possible among these plants, but it is now known that it does occur. It has been brought about repeatedly in cultivation. The sperm bodies are not transferred by hand, but the spores of the species between which crosses are desired are sown together and the transfer is allowed to take place naturally. The prothallia of ferns are nearly always diœcious (sexes borne on different plants), so that crossing in such cases is not improbable. Many spores should be sown to increase the chances of success, and care should be taken that the different kinds germinate simultaneously. Some species germinate quicker than others, and the operator must determine by previous trial what these differences are. (For methods of sowing spores, see page 24.) Only a small part of the plants will be likely to be crosses. In one of Lowe's experiments, only five plants out of 1,000 were undoubted crosses

Fig. 106. Pollinating Kit, open.

ORDINAL INDEX.

An Index to the natural orders or families mentioned in the Nursery List. A number in parentheses indicates the number of references to the family upon a page, if more than one occurs.

GENERAL INDEX.

BY EDGAR SANDERS.

HORTICULTURAL WORD COINAGE.

The new nursery book just published by L. H. Bailey contains several terms not found anywhere else, not even in the wonderful word collection of the Century Dictionary, unless the next number (No. 19) should strike on the word "seedage." The book starts out with a necessary new use for the word "nursery," which the author defines as "An establishment for the rearing of plants. In America the word is commonly used in connection with the propagation of woody plants only, as fruit trees and ornamental trees and shrubs. This is erroneous. The word properly includes the propagation of all plants by whatever means, and in this sense it is used in this book."

We venture to say that heretofore in any country in which the English language is spoken, it has never been received or used to mean a place for the propagation of plants other than out of doors—in other words, in the nursery.

The other words that sounded new are, one can easily see, perfectly legitimate and quite common with the suffix "age," as applied to fruitage, leafage, pottage, etc., as in the words below, for example:

"Chapter I. *Seedage.*—The process or operation of propagating by seeds or by spores, or the state or condition of being propagated by seeds or spores.

"*Layerage.*—The operation or practice of making a layer, or the state or condition of being layered.

"*Cuttage.*—The practice or process of multiplying by means of cuttings, or the state or condition of being thus propagated.

"*Graftage.*—The process or operation of grafting or budding, or the state or condition of being grafted or budded."

These we believe to be new, and are a happy thought, causing a single word to do duty where heretofore a combination of words has been necessary. It only shows, however, that a dictionary of the English language like a directory should be ann[illegible]o note all changes.