

B.S. FOX: Not a lot but it is always present. One factor which is of interest is that we find fasciation occurring in certain definite areas where a number of plants show the effect; for example, *Forsythia*, *Olearia nummularifolia* and *Cotoneaster microphyllus* are all affected in one small area of the garden.

D. KNUCKLEY: We find this fasciation a feature of *C. microphyllus* where it has naturalised on the tin mine country in Cornwall.

J KELLY: Is there any advantage of laying cuttings of *C. congestus* flat on the propagating bed?

B.S. FOX: We have not had any difficulty in rooting cotoneasters, but in propagation generally one finds some plants that give better response when the cuttings are inserted at an angle of 45° .

SOME PLANT PROPAGATION TECHNIQUES CURRENTLY BEING USED IN JAPAN

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Because Japan extends over many degrees of latitude (the four major islands stretch for 31° to 46° N) and experiences a great range of climate, tree and shrub production methods vary in different regions. As in western Europe, plant nurseries occur in many parts of the country but three very concentrated areas of production are: Angyo, Saitama Prefecture, 15 km north of Tokyo, Yamamoto near Kawanishi City, Hyogo Prefecture and Kurume, Fukuoka Prefecture in Kyushu. All three areas are composed of a large number of small nurseries providing trees and shrubs, firstly for the local markets (Tokyo and Osaka respectively in the case of the first two areas) but more recently for all of Japan. Farm size is very small. In 1965, 69% of holdings had less than 1 ha of cultivated land. Most of the nurseries visited were less than 1 ha in size and were intensively cultivated.

In some important respects Japanese nurseries differ from those in the West. A smaller number of plant species are propagated but many plants are sold as mature specimens. This difference is due to the contrasting concepts of the function of a garden in the two areas. The object of a garden in Japan is to represent quiet natural beauty in a small area around the home to counteract the noise and tension of urban life. The main aim appears to be to create in a few square yards the impression of being high up in the mountains. For this purpose, rocks, shrubs and trees are arranged with great skill to leave no trace of artificiality.

Because of the emphasis on established natural beauty, the Japanese favour native plants: they do not usually plant small shrubs and trees and watch them grow but prefer to plant mature

specimens. In the small shady areas between high density housing, tall mature plants have the additional advantage of being able to make better use of available light.

In many nursery areas in Japan the dominant feature is the large number of mature trees and shrubs that are recuperating and being trained after having been lifted from mountain or coastal areas. Although most Japanese prefer native species many appear to prize variations in colour or form of these native plants. However, there are many indications that Japanese tastes are changing. There is an increasing interest in trees and shrubs from overseas and also in foreign cultivars.

Among the important shrubs and trees in Japanese gardens at present are: *Pinus thunbergiana*, *P. densiflora*, *Podocarpus macrophylla*, *P. m.* var. *maki* (*P. chinensis*), *Rhododendron obtusum*, *R. indicum*, *Camellia sasanqua*, *C. japonica*, *Pieris japonica*, *Fatsia japonica*, *Acer palmatum*, *A. palmatum* var. *dissectum*, *Ilex integra* and *Nandina domestica*.

The Japanese use the same basic methods of plant propagation as in Britain — seed, cuttings, layering and grafting, but these methods are often modified to suit the different conditions prevailing, viz. philosophy of gardening, climate and availability of materials and labour.

Cuttings. Many different methods are used for raising plants by cuttings in a wide range of rooting composts. Natural conditions for rooting cuttings are generally good and many nurserymen claim that they have no need to use bottom heat or auxins. Cuttings of many species, e.g. *Rhododendron obtusum*, are inserted outside under plastic or muslin shading shortly before or at the start of the rainy season, which extends from about early June to mid-July. Rainfall is much higher in Japan than in Britain and the relative humidity is also greater because of the higher temperatures during the growing season and the maritime nature of the country. Mist propagation units were seen in many nurseries, all operated by means of a time-switch and not by an artificial leaf. Few nurserymen considered that this refinement was justified.

Peat is scarce in Japan, the deposits in the north island of Hokkaido being of poor quality. Peat is imported largely from Siberia but also from Canada and some high quality peat is brought in from Finland and Sweden. Because much of the soil is volcanic and rather porous, the cuttings are rooted directly in the local soil in some areas. In other districts Kanuma soil, a highly porous volcanic soil is used, either alone or mixed with the local soil.

The use of a plastic sheet through which cuttings are inserted in pre-formed holes appears to be becoming popular. This method is used for cuttings of many plants, including *Thujopsis dolabrata*, *Acer negundo*, *Camellia* spp and *Malus prunifolia* (Fig. 1). The

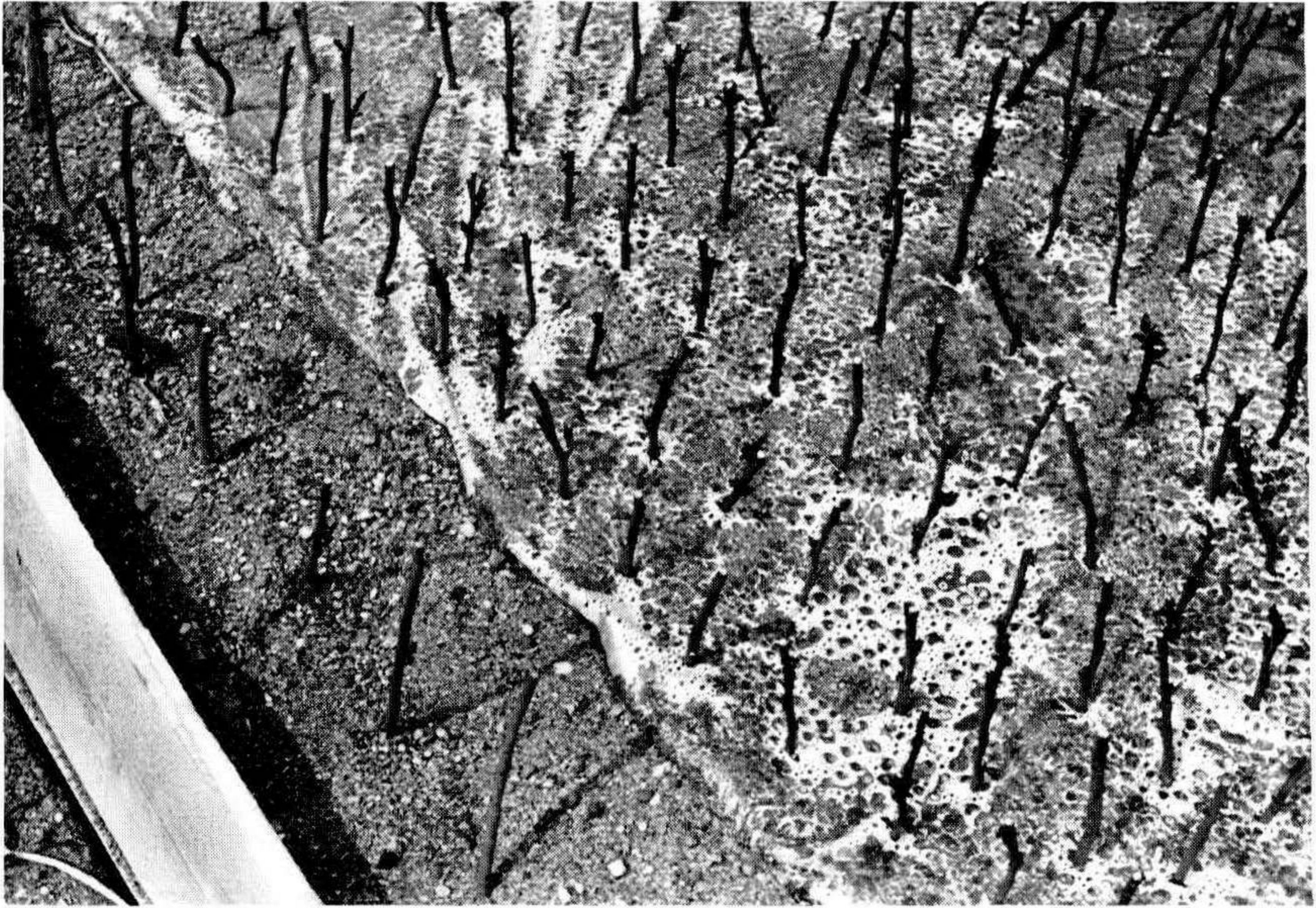


Fig. 1. Hardwood cuttings of *Malus prunifolia* inserted through 0.05 mm polythene sheet at Aomori Apple Experiment Station.

plastic is usually clear and about 0.05 mm in thickness but sometimes black plastic sheeting is used to reduce the weed problem. The compost is usually a coarse sand or volcanic soil and the plastic helps to maintain satisfactory moisture conditions. For example, large cuttings of *Thujaopsis dolabrata* 'Hondai', 15 to 18 in long, inserted in outside beds in April at the Aomori Prefectural Forestry Experiment Station had rooted by early June.

Grafting. Grafting methods in general are similar to those in the West but some of the techniques used are different. Fairly extensive use is made of plastic covering over beds or individual plants, presumably to help prevent drying of the graft union and to promote rapid callusing by raising temperatures. During the last five years much use has been made of small bags approximately 3 in x 1 in (0.03 to 0.05 mm polythene) in the grafting of apple, citrus, chestnuts and other plants. After the dormant scion has been inserted in the rootstock in early spring, the bag is placed over the scion and fixed to the stock by means of a small elastic band (Fig. 2). When the graft is growing strongly, the plastic is perforated to allow the young shoot to emerge.

The use of plastic bags for covering grafts is also extensively used for top working fruit trees to other cultivars. At the Aomori Prefectural Apple Research Station, the use of plastic bags has resulted in a significantly increased "take" (Fig. 3).



Fig. 2. Citrus scions grafted on *Poncirus trifoliata* rootstocks and covered with 3 in x 1 in plastic bags near Kurume City, Kyushu.



Fig. 3. Top working of apple 'Mutsu' on 'Red Jonathan'. Scions covered with plastic bags to improve "take".

In addition to the use of polythene bags over dormant grafts, their use with actively growing scions is also becoming popular (Fig. 4). This method, known as "Green Stem Grafting" is used during the growing season but particularly in August for the propagation of apples, pears, peaches and *Cornus* spp. It is also used in glasshouses during the winter. The scion up to 3 in long is made with a razor blade from an actively growing shoot with its basal end in the form of a wedge (Fig. 4). The stock must be a young actively growing shoot so that the grafting position is relatively high on the plant. The graft is tied with thread and covered with plastic and shading. The bag keeps the soft graft turgid. Grafts of *Malus* spp made in August unite within one week and produce about 18 in of growth during the following three months. This method is popular in the Angyo region for two reasons. It is reputed to be an easy technique and a saleable plant is produced earlier, in just over one year instead of two years from a dormant scion.

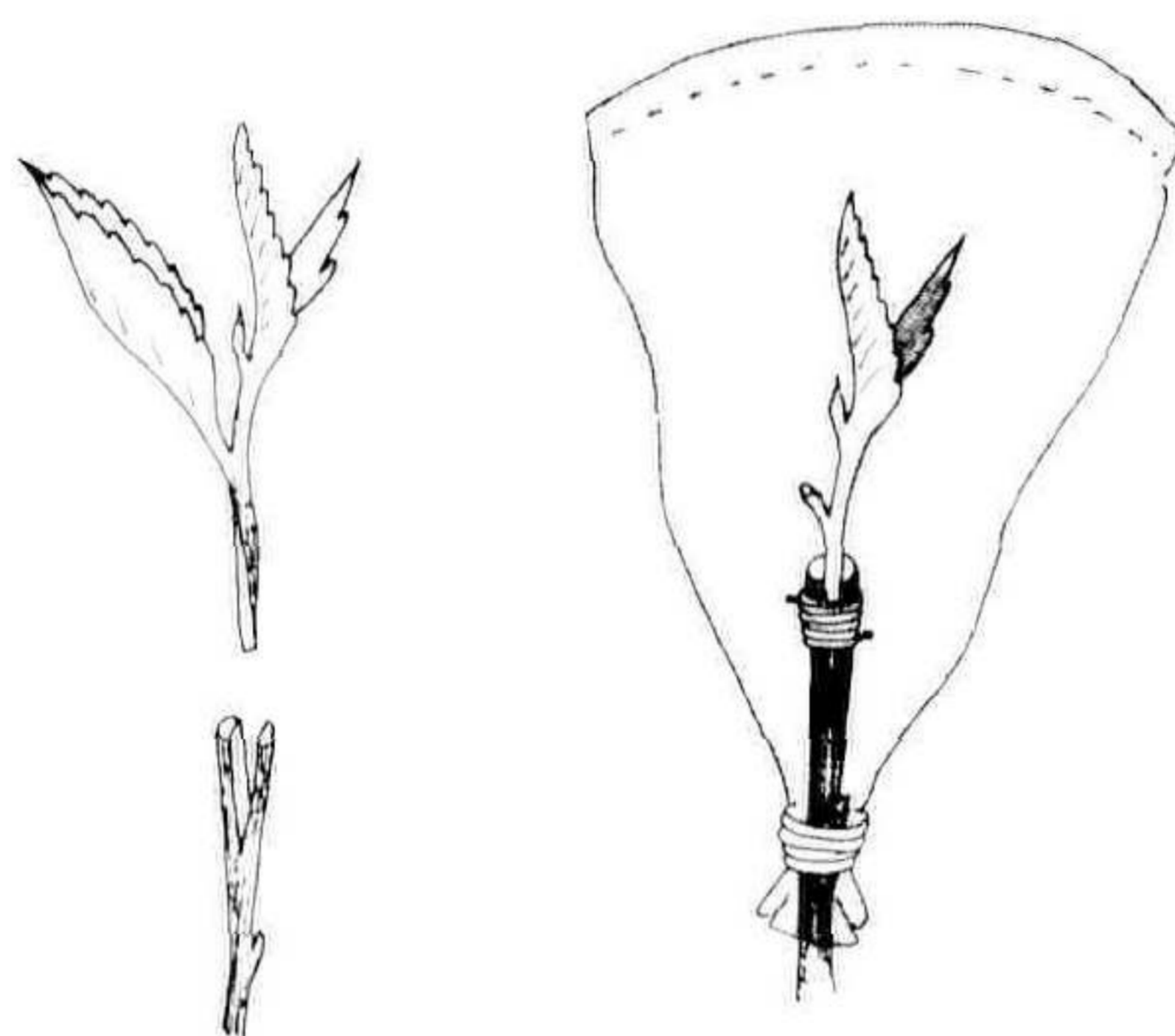


Fig. 4. Green stem grafting. Plastic bag used to keep scion turgid after grafting.

Budding. Traditional shield budding for *Malus* spp is used widely in Japan (Fig. 5a). In the Angyo district, rapidly rising labour costs and the decline in labour availability near Tokyo have popularised a simpler form of budding. Instead of making a T shaped cut on the rootstock a downward incision is made in the rind as far as the cambium. Two-thirds of the flap of rind is then cut off transversely and the bud is held temporarily by the rind at the lower end of the cut surface (Fig. 5b). A plastic tie is used to cover the bud and petiole entirely and is removed when the bud is well united. If budding is done in September, the plastic is normally cut in February. This method of budding is reputed to be less successful than conventional shield budding in the Angyo area (about 80% and 90% "take" respectively) but enables a skilled budder to insert about 3,000 buds per day instead of the usual 2,000.

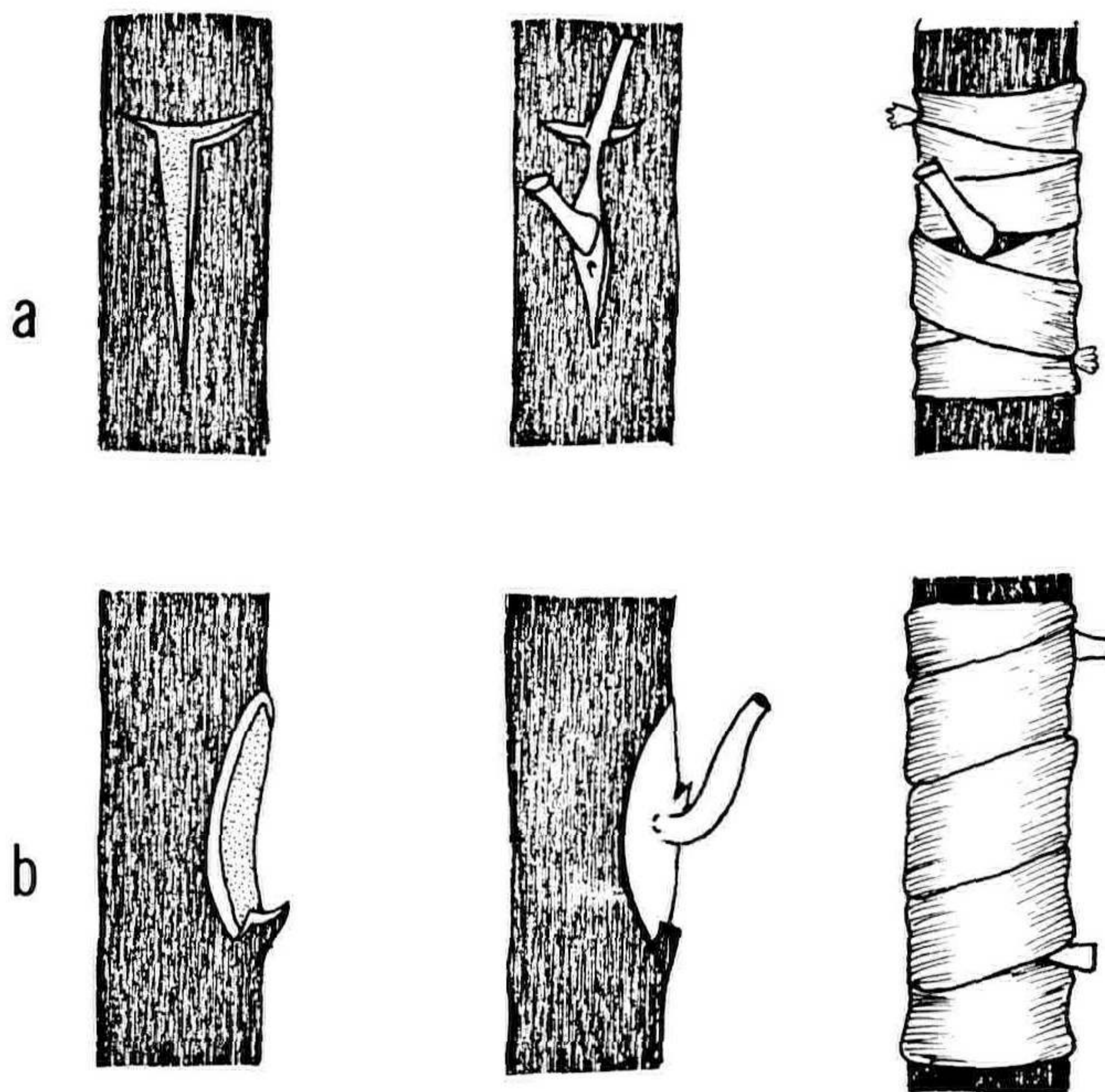


Fig. 5. Budding methods in Japan
 (a) Kyoto and Osaka districts
 (b) A more rapid method of budding, popular in the Angyo district
 (Nr. Tokyo)

Propagation of Bonsai trees. Although many Bonsai trees are raised from seed, this requires much time and many methods are used to enable "old" trees to be produced ready for sale in a short time. Many of the most highly prized Bonsai trees are natural dwarfs, collected from high elevations or from the seashore where the poor soil and strong winds produce stunted plants with naturally distorted trunks. It is not uncommon for nurserymen to plant azaleas in plots high up the mountains for their sons or grandsons to lift 50 years later to turn them into Bonsai azaleas for sale two or three years later. Many well-tended azaleas in gardens are purchased at high prices by nurserymen. These are then skillfully, but severely, root and top pruned with well over nine-tenths of the plants discarded to leave a potential Bonsai with thick distorted trunk and one or two main branches only. A plant treated in this way will be inserted in a small container and tended for two or three years in the nursery before being sold.

Air layering and division are also commonly used to produce in a short time, "old" trees with restricted roots that will fit conveniently into a small pot or container. Nurserymen are continually

on the lookout for branches of trees that have a particularly suitable "wind pruned" shape or that have unusually small leaves. Suitable branches of plants such as maples, junipers, willows, camellias and *Cryptomeria japonica* are air layered by tightly twisting copper wire around the branch in the spring and covering the stem where roots are required with moist sphagnum moss and plastic which is usually tied at both ends. Frequently, pines which form roots slowly, or very old branches (over 10 years old) are air layered. In these cases, where a satisfactory root system may not be produced for over three years, fresh moss is applied each year in early spring.

Many pines raised in Japanese nurseries are for Bonsai trees. Grafting is not normally a popular method of propagation for high quality Bonsai because of the unsightly scar between stock and scion. A five needle pine *Pinus parviflora* (*P. pentaphylla*) is, however, often grafted onto *Pinus thunbergiana* because the latter quickly produces an attractive trunk. The method used is shown in (Fig. 6). A wedge graft is prepared (Fig. 6 a), the stock (Fig. 6 b) is cut horizontally but instead of then cutting downwards, the stock is split down the middle with finger and thumb. This results in a better "take" presumably on account of the production of less resin. No wax is used but after insertion (Fig. 6 c) the needles are gathered tightly together and tied (Fig. 6 d).

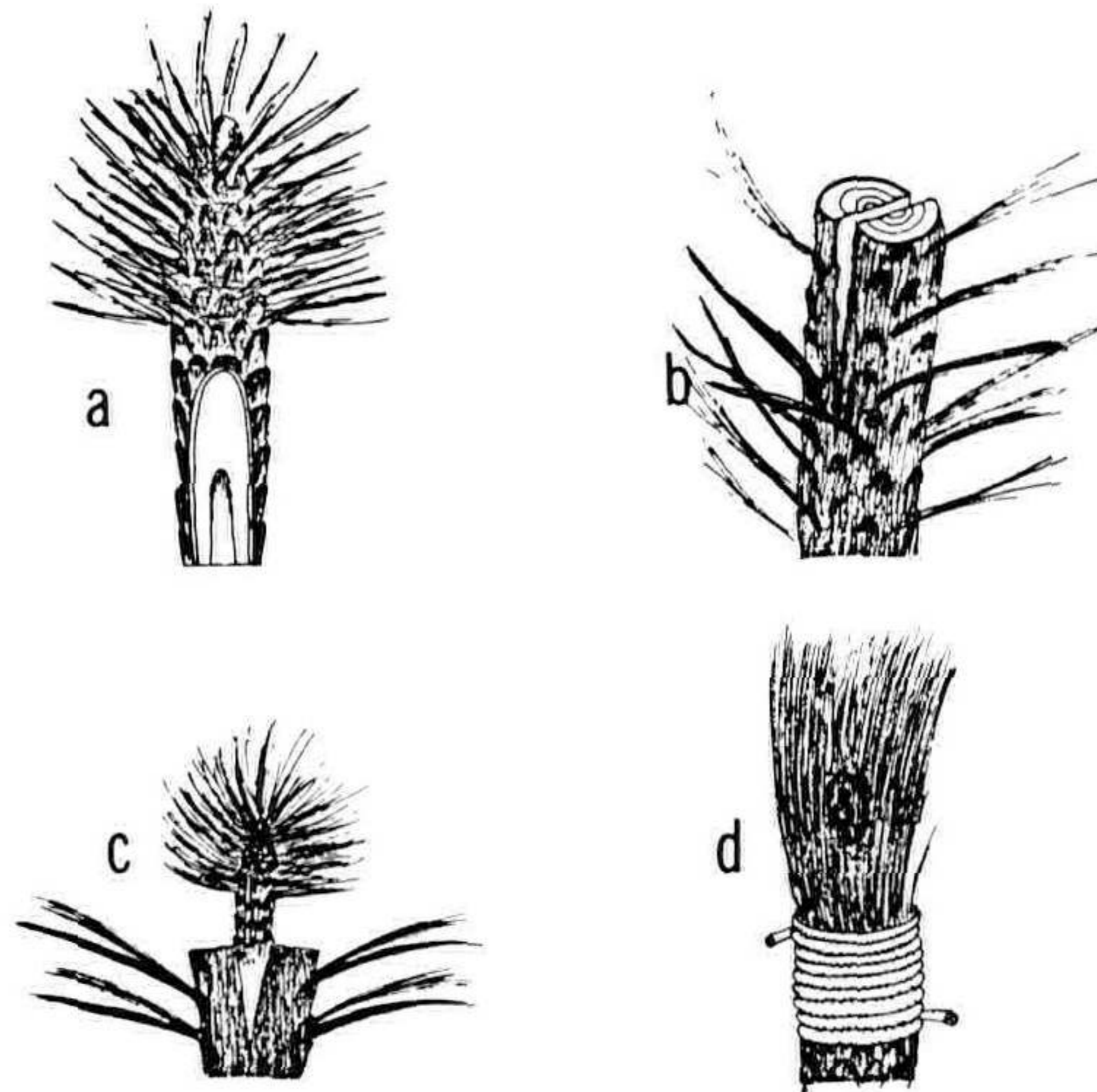


Fig. 6. Top grafting of bonsai pine

- (a) Prepared scion of *Pinus parviflora*
- (b) *Pinus thunbergiana* rootstock cut horizontally and split vertically by finger and thumb
- (c) Scion inserted in stock
- (d) Needles of stock gathered up and tied around scion

Side grafting (Fig. 7) is frequently used particularly for uniting a young scion with an old stock, a method used for the rapid production of a plant with an old trunk to simulate age. The wood of the stock is often so hard that a chisel is required to make a suitable slanting cut (Fig. 7 a). Where the trunk of a Bonsai tree is required to grow at a wide angle to its base to suggest age and wind pruning, a wedge type graft is made (Fig. 7 b). Where the scion is required to grow in the same direction as the stock, the graft is prepared by means of a long oblique cut (Fig. 7 c).

Normally at grafting time the scion should be dormant while the sap is rising in the stock. In addition to removing and heeling in shoots for scion material in the autumn prior to early spring grafting of pines, earlier growth in the stock than in the scion is often achieved by covering the stocks with a plastic tunnel during the winter for grafting in February.

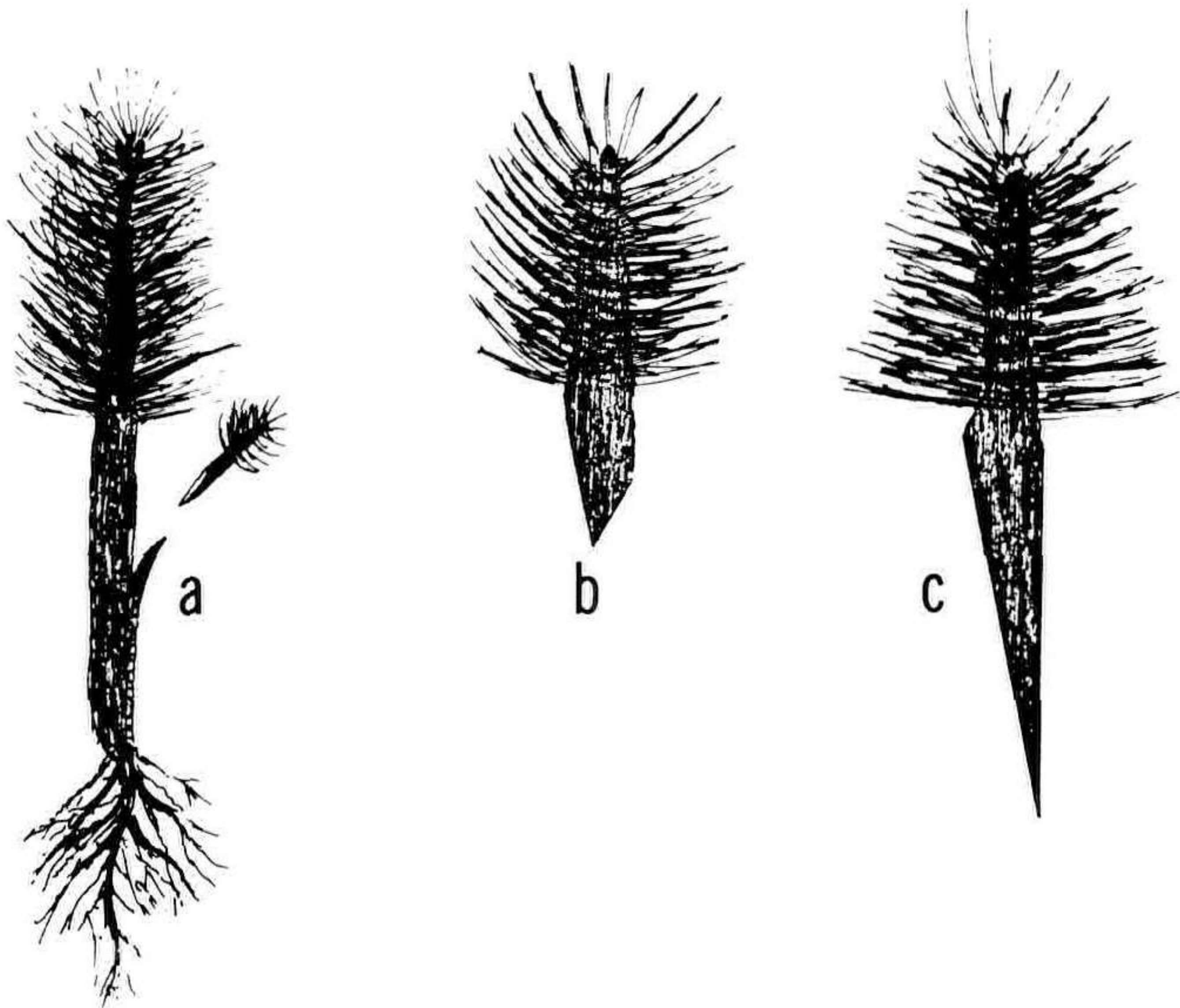


Fig. 7. (a) Side grafting
(b) Scion prepared for inducing spreading growth
(c) Scion prepared for inducing upright growth

Preparation of specimen trees. Mention has already been made of the trade in naturally wind pruned trees lifted from the wild. Some nurserymen also prepare specimen or artificially trained plants from large fairly symmetrical trees. These trees are prepared for transplanting to the nursery one year in advance by

cutting a trench around the tree and by severing the tap root as low down as possible (Fig. 8 a). The trench may be refilled for the year with friable soil or compost to encourage the development of a fibrous root system. When moved to the nursery, the trees are planted shallowly so that the top of the main roots is exposed to increase the semblance of age. The tree is often planted at an angle (Fig. 8 b) and if necessary the leader shortened; unwanted branches are removed and the remainder trained into position as necessary with stakes and wire (Fig. 8 c). Strongly growing upright trees can be trained into garden specimens in about four years. To keep the tree small in relation to trunk diameter, most young shoots are nipped out in May or June according to geographical location. Needles on the lower parts of twigs and branches are often removed to give a flat appearance and, where necessary, branches are trimmed back if they are shading those below. If the tree is required to spread in a particular direction, the young shoot is not pinched out but is wired down as necessary.

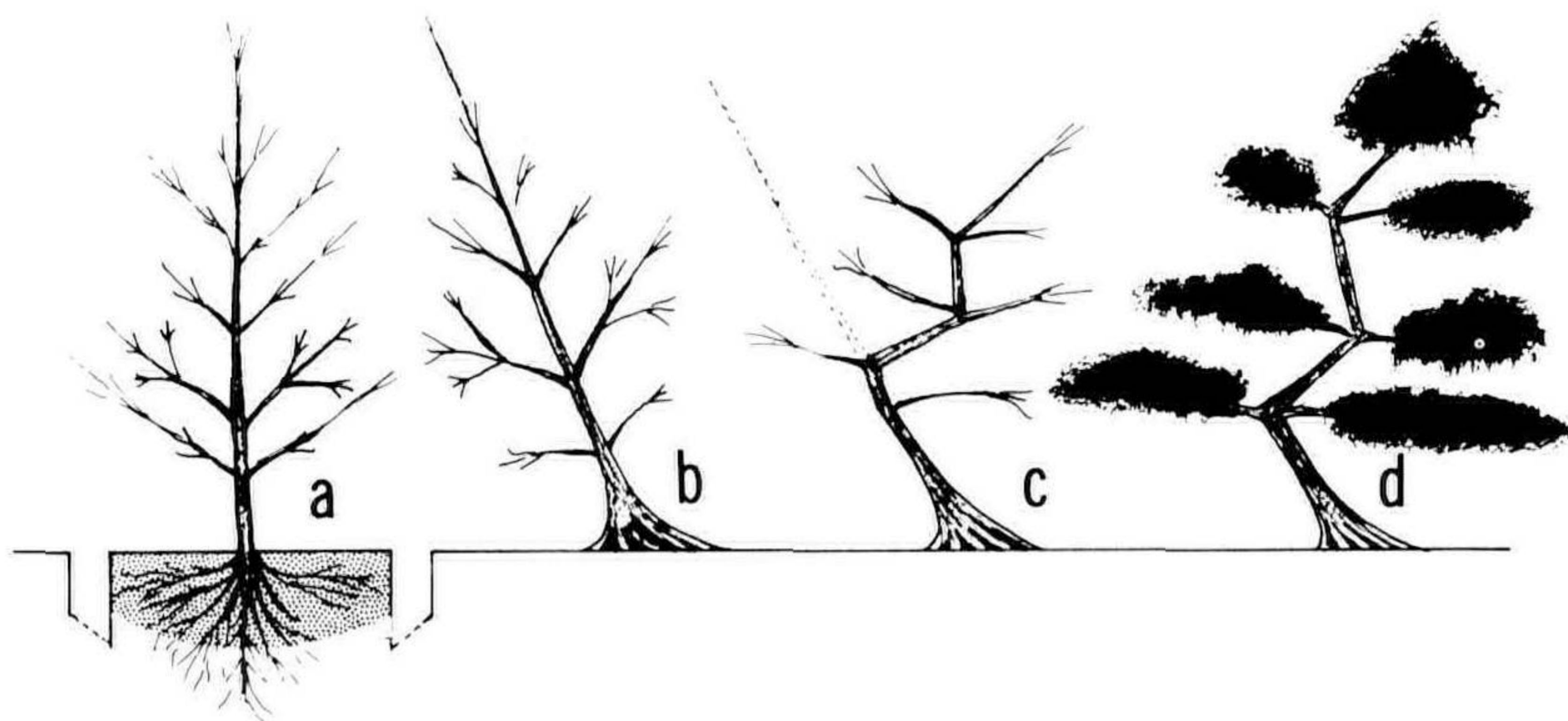


Fig. 8. Steps in the propagation of a specimen pine tree

- (a) Tap root cut one year before moving to nursery
- (b) Planted in nursery in sloping position; upper surface of roots exposed
- (c) Leader removed and new branch structure formed
- (d) Finished tree 3 or 4 years later

Very high prices are obtained in Japan for specimen trees. For example, a six foot high trained tree of *Pinus thunbergiana* on a Kurume nursery was priced at £750.00. On the same nursery a 150 year old tree about 12 feet high was valued at £3120.00.

Wherever I went in Japan I was made to feel welcome. Scientists and nurserymen alike were very willing to impart information and keen to learn about Western methods. Language

difficulties impeded progress on occasions. English is as difficult for the Japanese to learn as it is for British and North Americans to learn their language. Although many Japanese can read and write English they find it difficult to relate the written word to the sound of the language.

Japanese nurserymen are very skillful propagators and much of the scientific research that I saw was of a high standard, but few Japanese horticulturists know the botanical names of the plants they are dealing with. In general, only Japanese names are used and a visitor is well advised to carry with him a Japanese / English flora, such as T. Makino's "A Concise Pictorial Flora of Japan".

Because of the different climatic and economic conditions, many of the propagation practices I saw or heard about could not be transferred directly to Western Europe. Nevertheless, there is much to be learned from Japanese horticulture, particularly as gardens in the West are tending to become smaller at a time when individual householders are prepared to spend more money on their gardens. It seems likely, for example, that the demand for specimen or character trees will increase and that much more could be done to beautify shady corners and narrow passageways between houses with plants, mosses and rocks. It is also clear that some Japanese propagation techniques, e.g. the use of plastic coverings for grafting with actively growing scion material, are worthy of testing and adaptation for use in this country.