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ORNAMENTAL HIBISCUS
PROPAGATION AND CULTURE

Hawaii Agricultural Experiment Station
College of Tropical Agriculture and Human Resources
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Page 8, Figure 6, Caption:

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“Figure 6. Hibiscus air layer, using vinyl plastic film. Left, plastic film in place. Right, plastic film removed, showing the root formation. This layer was taken from the variety ‘Glorious.’ ”

It should read:

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ORNAMENTAL HIBISCUS— PROPAGATION AND CULTURE

HENRY Y. NAKASONE AND FRED D. RAUCH

The ornamental hibiscus has long been popular in Hawaii and is the State flower. The first hibiscus society was organized in 1911. Since then, other societies in Hawaii and on the Mainland have helped in developing the multitude of varieties that now exist.

Hibiscus breeding dates back to the 1870's when the Hon. Archibald Cleg-horn, then governor of Hawaii, developed 12 new varieties. Early breeders used a few native species and several introduced forms. The white-flowered *Hibiscus arnottianus* Gray was used extensively. 'Waianaes White,' a botanical variety of *H. arnottianus* Gray, *H. brackenridgei* Gray, a native species with sulfur-yellow flowers, and *H. youngianus* Gaud, a native pink, were found to be sterile after repeated attempts to hybridize them. The latter two, however, were prolific self-seeders. *H. kokio* Hillebrand was a fore-runner of the red varieties.

Among the introduced species used extensively in hybridization are the common single red, *H. rosa-sinensis* L.; coral hibiscus, *H. schizopetalus* Hooker; narrow-petaled white, *Hibiscus* sp. from Fiji, and the common pink hedge hibiscus, possibly a hybrid of *H. cameroni*.

The few parents used in early breeding may account for the appearance of similar varieties from different crosses. Since records were not kept by many breeders or were lost, it is now im-

possible to trace the parentage of existing complex hybrids.

Commercial propagation and sale of hibiscus were restricted to the local trade on September 12, 1947, when an embargo was placed upon Mainland export of plants by the U.S. Bureau of Entomology and Plant Quarantine because of the occurrence of a virus disease affecting the plant. Later, however, Dr. J. Walter Hendrix* demonstrated conclusively that the disease could not be transmitted to other Malvaceae of economic importance, and the restriction was lifted.

GENERAL CHARACTERISTICS

The ornamental hibiscus belongs to the Malvaceae or mallow family. Single hibiscus have five petals, five stigmatic lobes, a five-celled ovary, five teeth on the calyx, and five to ten bracts. Double hibiscus, such as the variety 'Kalakaua' and the cup and saucer forms, follow the same pattern of fives except for the column, which differentiates into an indefinite number of petals. In most of the double flowers, petalody of the staminal column extends to the ovary, thus making them useless as female parents in hybridizing.

In many types of plants the numerical arrangement of floral parts is fairly

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constant and uniform within the species or variety. The hibiscus, however, may have flowers with six, seven, or even eight stigmatic lobes, six or seven teeth on the calyx, and anywhere from five to ten bracts within the same variety or even upon flowers of the same plant. More than five petals on single varieties have been observed occasionally. The length of the style is also a variable characteristic but appears to be uniform within a variety. Some varieties have extremely short styles; others have styles half an inch long, thus making them a conspicuous part of the flower.

Hibiscus flowers last for a day, usually folding an hour or so after sundown. A few varieties last for 2 or 3 days. During cool months many of the 1-day varieties may last 2 or 3 days, but the quality of the flowers deteriorates by the second day. For this reason, their use in decorative work is usually limited to the daylight hours and early evening. If the blossoms are to be used in the evening, they can be picked in the morning before they open and stored under refrigeration until late afternoon. After removal from refrigeration, the flowers open in a few hours and remain in good condition during the evening.

The hibiscus blooms throughout the year but blooms best from fall to spring. This is probably due to the cooler weather and greater rainfall, for prolific bursts of blossoms often occur during the summer months following a period of heavy rainfall and relatively cool weather.

The form of the leaf varies widely between varieties, ranging from deeply lobed leaves to round and heart-shaped

ones, with the two latter forms predominant among the complex hybrids.

Growth habits of different varieties of hibiscus vary greatly if left to develop normally. Plants range from low, drooping shrubs to treelike plants 15 to 20 feet high. In form they differ from sparsely leaved, open-branched types to densely foliated, many-branched types (Figure 1).

PROPAGATION

New plants may be propagated from cuttings or by grafting, layering, or top-working. These methods produce new plants at a rapid rate and the plants are genetically identical to the parent plants. Plants also may be produced from seed.

Cuttings

For many types of plants, cuttings are a rapid and simple means of propagation. The ornamental hibiscus used as a hedge plant in Hawaii is no exception. However, there appears to be considerable variation in the rooting abilities of the more complex hybrid varieties. Some will root with ease, but many root with considerable difficulty or not at all.

Cutting trials were conducted to determine the rooting abilities of a number of complex hybrids from the John A. Johnson collection, using a 2:1 soil-cinder mixture and peat moss as the rooting medium. Ten weeks after planting, no root formation was evident. The varieties 'Fluffy Ruffles' and 'Glorious' showed a greater development of callusing than other varieties tested, indicating that they probably would have developed some roots if

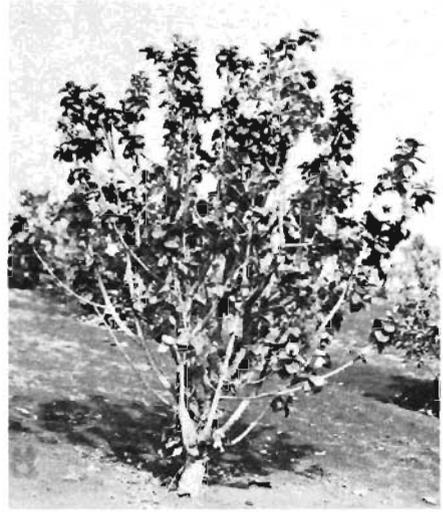


Figure 1. Different growth forms of hibiscus when left to develop without pruning. Top left, low, drooping type with dense foliage. Top right, open-branched upright type with light foliage. Bottom left, upright and spreading type with dense crown of foliage. Bottom right, tall upright type with sparse foliage.

given more time. It may be possible that more specific temperature, humidity, and environmental factors are required in the rooting of these complex hybrids. Root-inducing substances, such as indoleacetic acid (IAA), indolebutyric acid (IBA), and naphthal-

eneacetic acid (NAA), may produce some beneficial results. An 80 ppm indolebutyric acid used on cuttings of *H. rosa-sinensis* var. 'Single Scarlet' showed 100 percent rooting as compared to 10 percent rooting of the non-treated cuttings in a 2-month period.

Rootstocks

A rootstock is a rooted cutting or seedling upon which a scion of a desirable variety is grafted. Common varieties that are easy to root and available in large quantities are usually used as rootstocks. The common pink hedge hibiscus; Peachblow, a double pink with smooth, glossy leaves; and single red, *H. rosa-sinensis* L., are excellent materials for this purpose (Figure 2). Coral hibiscus, *H. schizopetalus* Hooker, and its hybrids are not

recommended because of their whip-like growth (Figure 3). They show poor growth in girth, and scions grafted on them will eventually grow much larger in diameter than the stock, forming huge swellings near the graft union that tend to produce weak bases (Figure 4).

Cuttings for rootstocks are rooted in the usual manner. Tip and hardwood cuttings 6 to 8 inches long are inserted in a well-prepared rooting medium and kept constantly moist in the greenhouse

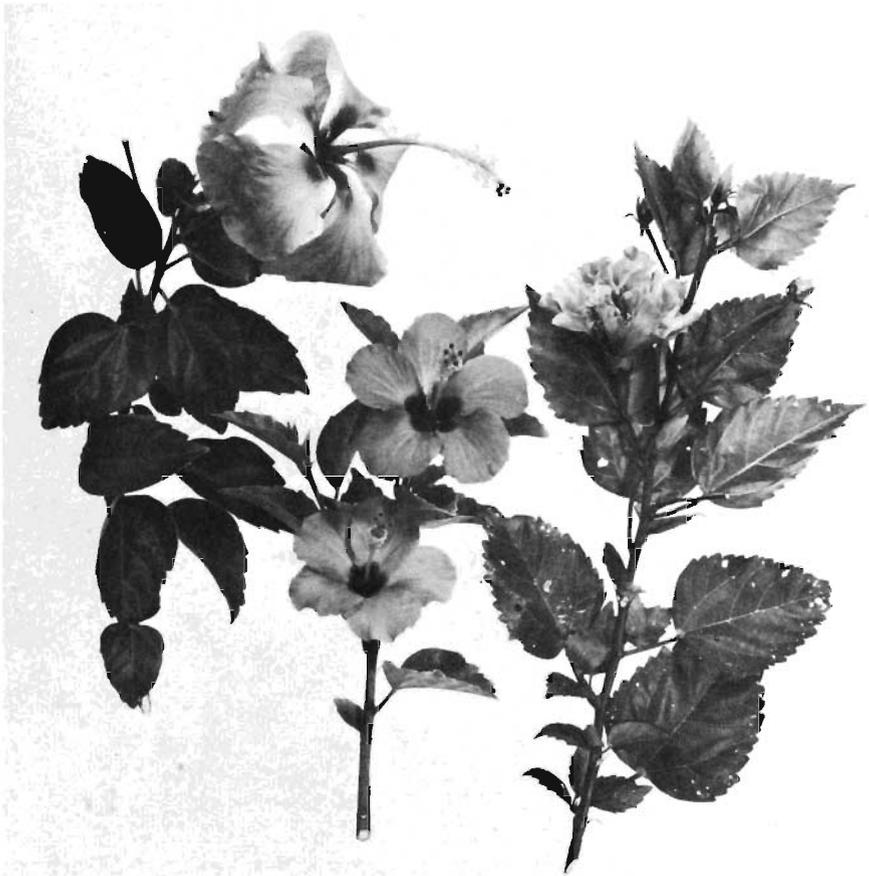


Figure 2. Three common hedge varieties possessing good qualities for rootstocks. Left, common pink. Center, single red, *H. rosa-sinensis*. Right, Peachblow, a double pink variety.

or in some shaded area. The rooting medium may be a mixture of soil and sand, peat moss, vermiculite, seed soil, perlite, or various mixtures of these materials. Vermiculite and perlite are becoming increasingly popular with plant propagators because of the excellent results obtained in the rooting of a variety of plants. In addition to its good

moisture-retaining capacity, good drainage, and lightness, vermiculite enables rooted cuttings to resist root damage during transplanting. Hibiscus cuttings placed in this type of rooting medium will root within 2 or 3 months. They are then transplanted individually into containers. After a few weeks they can be used for grafting.





Figure 4. Swelling at the graft union resulting from the use of undesirable rootstock.

Grafting

Grafting is done by bringing together the cambium tissues of the rootstock and the scion in close alignment so that they may unite to form a continuous conducting system. This is the best method of propagating the more complex hybrids that root with difficulty.

Hibiscus can be grafted at any time of the year. Any part of the twig or stem can be used but, in general, the matured sections are preferred to succulent green twigs which are more susceptible to wilting or injury by the heated wax.

The grafting operation is simple. The important part is the careful cutting of the stock and the scion so that there will be a good fit to allow close contact of the two cambium layers. The art of cutting will come only with constant practice.

Many grafting methods can be used, depending more or less upon the personal preference of the propagator. Side-wedge and side-paste types are most commonly used, although the cleft-graft method is used by some propagators. The cleft method consists of cutting off the stock completely just a few inches above the soil surface, leaving a stub upon which a slit is made. The scion, with its base cut onto a wedge, is inserted into the slit. The barks of scion and stock are fitted, tied with a piece of raffia, and the entire area sealed with paraffin or commercial grafting wax. This method, when employed on a seedling stock with a heavy root system, has a decided disadvantage. The thick root system absorbs a tremendous quantity of water, and the sap continues to exude at the cut end and accumulate within the waxed area, frequently resulting in a rot of both scion and stock. The sealed area may become wet and slimy from the continuous exudation of the sap.

The side-wedge graft is a simple and convenient method (Figure 5). Make an oblique cut a few inches above the base. This cut should not extend beyond the center of the stock as this weakens it considerably. Sharpen the scionwood into a wedge at the basal end. Bend the stock slightly away from the cut and insert the wedge of the scion into the cut. As the pressure is released from the stock, it bends back

and tightens the scion in position. Match the barks of scion and stock and bind the union tightly with a piece of raffia. Coat the graft union, including the scionwood, with melted paraffin or grafting wax and cut back the terminal of the stock slightly, leaving some leaves. This retards the growth of the stock, reduces the evaporation rate, and makes the reserve food and moisture more available to the scion.

The side-paste method resembles the side wedge except that the outer portion of the oblique cut is removed by notching the lower end, leaving the longitudinal surface of the wood, cambium, and bark entirely exposed. The scion is cut to fit this exposed surface. Since there is nothing to hold the scionwood in place, the tying operation is more difficult than the side-wedge method.

The temperature of the melted paraffin should be watched with great care, as hot wax can easily damage the plant tissues. Test the temperature by putting a drop of it on the arm or finger. If the wax solidifies immediately without running, it can be used safely. Household wax, sold in grocery stores, is satisfactory and very inexpensive.

After the buds on the scionwood have sprouted and grown a few inches, remove the entire top of the stock just above the graft union. Leave the grafted plant to grow for later transplanting in the desired location. Remove vegetative buds appearing on the stock of the grafted plants, as these buds will hinder the growth of the scion. The plant at the extreme right in Figure 5 is ready to be transplanted into the ground. Grafted hibiscus will come into flowering in about 4 months.

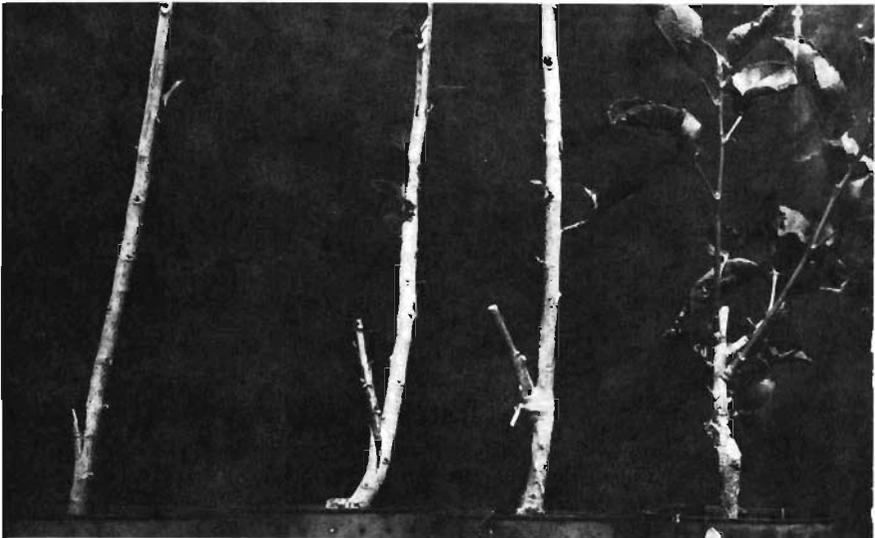


Figure 5. Steps in making the side-wedge graft. Left to right: 1) An oblique cut on the stock; 2) scionwood sharpened into a wedge and inserted into the cut; 3) graft union tied with a piece of raffia and waxed; 4) a grafted plant with the scionwood growing and the stock cut off completely just above the graft union.

The first blooms will be small, but, as the plant establishes itself, the flowers will improve in size and quality.

Layering

Air-layering is a popular and a labor-saving method of propagation. Girdle a branch $\frac{1}{2}$ inch or larger by removing a strip of bark $\frac{1}{2}$ to 1 inch wide. Cover this girdled area with a ball of moist sphagnum moss 3 to 4 inches in diameter, and a sheet of plastic film wrapped tightly over it with the two edges folded together or one edge overlapping the other. Tie the two ends securely to the stem with pieces of string (Figure 6). The plastic film prevents the sphagnum moss from drying out during the period of root formation. Polyethylene film is sold in most hardware and garden shops and can be

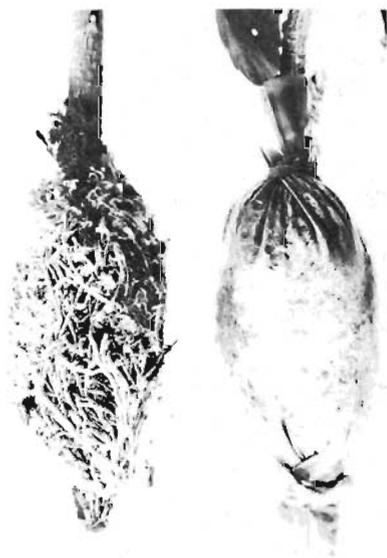


Figure 6. Hibiscus air layer, using vinyl plastic film. Left, plastic film in place. Right, plastic film removed, showing the root formation. This layer was taken from the variety 'Glorious.'

purchased in any length. One square yard will give 16 sheets of 9-inch squares.

Roots will form on the hibiscus layers in 1 to 3 months, depending on the variety. 'Betty Yellow,' 'Mrs. John Walker,' 'Fluffy Ruffles,' 'Perfection,' 'Glorious,' and 'Apple Blossom,' which are difficult to root by cuttings, were air-layered, but none of them showed any root formation after a 5-month period except 'Glorious' and 'Perfection,' which are vigorous growers.

Topworking

To topwork a hibiscus shrub, cut back the tops of the plant and graft the scions of some desirable varieties on the stubs of the main branches. The stubs to be used for grafting should be well distributed on the trunk to produce a well-balanced shrub. Remove all other branches and twigs.

Bark grafting is the usual method used. Slit the bark about 1 inch at the end of the stub and pry it loose from the wood on both sides of the slit. Cut the base of the scion diagonally and insert it between the bark and wood (Figure 7) and wax all cut surfaces. Remove weaker scions later, leaving one vigorous scion to grow on each stub. Remove latent buds that sprout on the trunk of the stock, to reduce competition with the scions.

Seed Propagation

Seed propagation is used primarily to produce new varieties. This process involves pollination and fertilization to produce seeds, and germination and care of the seedlings until flowering time.

Pollination consists of transferring the pollen to the stigmatic surface of the same flower for self-pollination, or

to the stigma of another variety for cross-pollination. There are precautions to follow in some cases. If a plant to be used as a female parent is a good self-seeder, remove the anthers early in the morning before the flower opens, or they may be removed the evening before the flower opens. Cut away the folded petals with a pair of scissors, remove the anthers and bag the entire bud with a cellophane or paper sack. The following morning, remove the bag just long enough to deposit the pollen on the stigma and replace the sack for a day or two until the stigmas have withered.

Pollination is done during the morning hours because of the short-lived nature of the flowers. The time required for the pollen tube to travel through the style and into the ovary has not been determined in the hibiscus, but it is assumed that the pollen tube reaches the ovary by the time the flower wilts in the evening. Fertilization may take place immediately or a few days later. If pollinated during the morning hours, allow sufficient time for this process to be completed. The period between 8 a.m. and 11 a.m. is the most effective time for pollination. A number of early afternoon pollinations have been tried, but few takes have been obtained.

The success or failure in seed set is also influenced by the time of year pollinations are made. Flowers pollinated during the summer months give extremely poor results; those pollinated from October through April have given as high as 80 percent seed set. This period of favorable seed production coincides with that of maximum flower production.

Seed Pods

Seed pods ripen in about 5 to 7 weeks after pollination. At maturity, the pods become dry and break open. If pods are left on the plant, a good percentage of the seeds will be lost. This can be prevented by harvesting the pods just before they break open. Bagging the seed pods is a good method to prevent loss of seeds. The number of seeds per pod varies from 1 to 20.

Seed Germination

Seeds may be germinated immediately after picking or stored under refrigeration at about 45 to 50 F. After a time, however, seeds in cold storage show considerable loss of viability. Seeds may be scarified by nicking the seed coat with a knife blade to force early and uniform germination.

Sow the seeds in cans or clay pots, the size of the containers depending

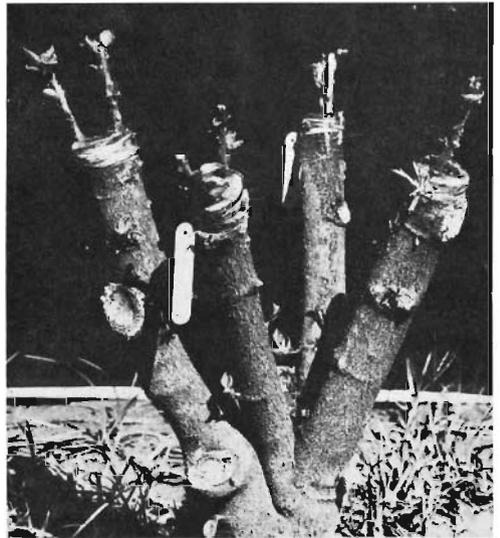


Figure 7. Topworked hibiscus shrub, showing two scions per stub to insure one good growth on each stub.

upon the quantity of seeds. The usual method is to plant the seeds from a single pod in one container and label it with the number or name of the cross. The seeds may be sown on the surface of the soil medium and covered with a layer of white beach sand or fine vermiculite. Place the seeded pots in a shady spot to germinate.

Seeding Culture

When the seedlings are 2 or 3 inches high, pot them individually in No. 2 cans or other suitable containers. Potting soil should be a good soil mixture containing relatively high amounts of organic matter such as well-rotted barnyard manure. Leave the potted seedlings in partial shade or on a greenhouse bench for several weeks and then gradually move into direct sunlight. When the plants are about 10 to 12 inches high, transplant into open ground or into larger containers for flowering.

CULTURE

Irrigation

The amount of water given a plant and the intervals between such watering must be determined by experience rather than by arbitrary rules. Irrigation practices suitable to one locality may be entirely unsuited to another because of differences in amount of rainfall, physical nature of the soil, humidity, and other environmental factors. Plants grown in areas of high rainfall obviously will require less frequent watering than plants grown in areas of light rainfall or along beach areas predominated by sandy soils of low water-holding capacity.

The hibiscus shrub requires a great quantity of moisture, but will not tolerate waterlogged conditions. Where drainage is poor due to poor soil types, irrigate less frequently or provide drainage of excess water. For such conditions an irrigation schedule of twice a week may be more than sufficient. In areas with good drainage and relatively dry conditions, irrigating 3 to 4 times a week may be necessary. Apply water in shallow basins around the shrubs or in furrows where a number of plants are grown in a row.

Fertilization

Application of fertilizer brings rapid response in hibiscus. Plants grown in pots or cans should receive more frequent applications than those set out in the open ground. A handful of organic fertilizer, such as chicken or cow manure, and one teaspoon of a complete chemical fertilizer, such as 16-16-16, per 1-gallon can every 6 to 8 weeks, should be adequate. Less frequent fertilizer application is required when a controlled released fertilizer, such as Osmocote, is used. Seedlings, rooted cuttings, and grafted plants benefit from light applications of chemical fertilizer or some form of organic fertilizer at every stage of transplanting. Plants set out in the ground should be given about $\frac{1}{4}$ pound of a complete fertilizer, such as 16-16-16 or 10-30-10, every 4 or 5 months to insure continuous good growth. Liberal use of organic fertilizer, especially cow manure, is beneficial to the plants and will also

improve the physical nature of the soil.

Pruning

Pruning practice in hibiscus cannot be specifically determined nor a definite schedule set. Although cultural practice and flower production influence plant growth, the plant usually begins to weaken after 2 years. Sporadic flowering and decrease in size of the leaves and flowers are typical symptoms of declining growth. Under local conditions, pruning may be done during the months of May and June. Loss of flowering by pruning will be negligible during the dry summer months, and the plants will have sufficient time to grow and be in condition to flower in the fall and winter months.

The degree of pruning depends upon the condition of the shrub. Old shrubs with numerous bare branches require a rather severe pruning. As much as half of the top may be removed together with all dead twigs and small branches usually growing in the interior of the shrub. Light pruning may be done in some cases where young plants have grown very rapidly without much lateral shoot growth, thus presenting a leggy appearance. Head back the tall branches to any desired point to force lateral buds to develop. This will help to produce a denser and a better balanced shrub.

After pruning, add a complete fertilizer or manure, work it into the soil around the trunk, and irrigate thoroughly. Within a few weeks new vegetative shoots will appear and form a new plant.

Disease and Insect Pests

The hibiscus plant is attacked by relatively few disease, insect, and mite pests.

Among the sap-sucking insects and mites commonly found feeding on the stems and twigs are the hibiscus snow scale, *Pinnaspis strachani* (Cooley); the nigra scale, *Saissetia nigra* (Nietner). the hibiscus mealy-bug, *Nipaecoccus vastator* (Maskell); and the red and black flat mite, *Brevipalpus phoenicis* (Geijskes). Those that feed on foliage are the cotton aphid, *Aphis gossypii* (Glover); the hibiscus whitefly, *Pealius hibiscus* (Kotinsky); the hibiscus rust mite, *Tegonotus hibiscella* (Keifer); the broad mite, *Polyphagotarsonemus latus* (Banks); and the carmine mite, *Tetranychus cinnabarinus* (Boisduval). Flower and leaf buds are often fed on by the southern green stink bug, *Nezara viridula* (L.). Insect pests can be controlled with a spray containing either malathion (2 teaspoons of 57% EC per gallon water) or diazinon (2 teaspoons of 25% EC per gallon of water). Mite pests are controlled with a spray of sulfur (2 tablespoons of 90% WP per gallon of water).

Among the chewing insects that occasionally eat the foliage and flowers are the Chinese rose beetle, *Adoretus sinicus* Burmeister, and the hibiscus caterpillar, *Anomis flava* (Fabricius). These insects can be controlled with a spray containing either endosulfan (4 teaspoons

of 3 EC per gallon of water) or carbaryl (2 level tablespoons of 50% WP per gallon of water).

A leafspot disease may occasionally be found on hibiscus foliage caused by *Cercospora malayensis*. Symptoms include circular to irregular spots, tan to dingy gray, usually with a reddish-purple border. This disease can be controlled with tribasic copper sulfate.

Among the disorders commonly found affecting the root system of hibiscus are root knot nematodes, *Meloidogyne* spp.; root rot *Pythium* spp.; and root and crown rot, *Rhizoctonia solani*. Root knot nematodes produce distinctly swollen roots and plants with sparse foliage and chlorotic or yellow leaves. There

is currently no control for this problem. Infection by *Pythium* root rot results in extensive destruction of the roots which become soft, mushy, and generally brown in color. Poor soil drainage increases the incidence of this disease which can be controlled with a soil drench of Truban, Banrot, or Captan fungicides. The initial symptoms of the *Rhizoctonia* disease is defoliation or leaf drop and dieback of the shoots. Later, distinct brown, slightly sunken cankers may be observed on the stem at the soil line. A soil drench with the fungicide Terrachor will help to correct this problem.

Some varieties of hibiscus are very susceptible to chemical injury, so test the pesticides on a few stems before spraying all of the plants.

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