
BEGONIA PESTS AND THEIR CONTROL

SPECIAL BULLETIN NO. 4

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**AMERICAN BEGONIA SOCIETY
LONG BEACH, CALIFORNIA**

● The Editor wishes to express his appreciation to the following members of the Society for their assistance in the preparation of this bulletin:

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M. B. Dunkle, Professor of Biology, Junior College, Long Beach, Calif.

Rudolf Ziesenhenne, Begonia Culturist, Santa Barbara, Calif.

J. Paul Walker, Instructor at Agricultural Center, Long Beach, Calif.

● Much valuable information on plant pests and their control, including methods and formulas for insecticides, has been obtained from Government Bulletins, and particularly from one entitled Greenhouse Pests, Circular No. 12, issued by the Natural History Survey Division, State of Illinois, Urbana, Illinois.

SPECIAL

BEGONIA BULLETINS

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AMERICAN BEGONIA SOCIETY

LONG BEACH, CALIFORNIA

Membership, including Monthly Bulletin,
\$1.00 Per Year.

● THE PURPOSE OF THIS BULLETIN

The information herein on the control of the pests that may attack begonias has been assembled from sources considered authentic. It is presented in compact and accessible form, and is designed for the guidance of the amateur lath-house gardener. Methods applicable to the small greenhouse, and to the culture of house grown pot plants are also suggested.

The commercial grower has perfected methods of pest control that are, perhaps, better adapted to the wholesale production of plants, and are not discussed here.

The methods outlined and the formulas quoted are standard, and are recommended by begonia culturalists of long experience.

The commercial products named are mentioned as examples of types of insecticides, and are not recommended to the exclusion of others of equal merit.

● PESTS AND CONTROLS

The insect pests that attack begonias—including mites, bugs, slugs, etc., which are not strictly insects—are those that are common enemies of other cultivated flowering plants. There are in this country no pests that are peculiar to begonias alone.

These insects may be those that scar or penetrate the skin or bark of the plant and suck its juices; or of the chewing type, which eat portions of the leaves or stems. They must be combated differently. Those that suck and have soft bodies can be killed by contact sprays or by dusts of toxic chemicals. The chewers must be fed poisons. Specific recommendations are made for each pest in the text.

● PREVENTION, THE BEST CONTROL

The problem of the control of these pests varies with the conditions under which the plants are grown: out-of-doors, in lath or cloth houses, under glass or in the living room, the fundamental principles being much the same.

Since it is difficult to eradicate the pests after the plants are infested, and since there is always the possibility of injury to plants by the use of chemical sprays, the importance of preventive measures cannot be over-emphasized.

The practice of garden hygiene as a daily routine will greatly lessen the probability of attacks of insects and other pests.

Regardless of the diligence with which this work is done, there will be times when the pests will invade the garden. The spring of the year will bring with it the major offensive of the attacking enemies, and it may require drastic methods and instant combat to control them. Be prepared. Know the means and provide the defense.

● PREVENTIVE MEASURES

Plants grown in a properly constructed lath-house have a measure of protection from pests not enjoyed by those in the open yard.

Promote vigorous growth by sound cultural methods—proper soil and moisture, adequate plant food, humid atmosphere, perfect drainage and ventilation. A healthy plant can better withstand the attacks of pests and the control methods applied.

So far as possible avoid the transmission of infestation.

Periodic spraying or dusting are simple sanitary and preventive measures.

Cleanly quarters always. Remove dying and decayed plant material. Do not permit rubbish to accumulate in which pests might propagate or find shelter. Glasshouses should be emptied of plants, and thoroughly fumigated, disinfected and re-painted.

Wash all flower pots before using them.

Use care in the selection of potting soil and leaf mold. The presence of nematodes in soil intended for potting may be detected by planting a few young tomato plants in samples of it. If present, the tell-tale knots will soon appear on the roots.

Every new plant acquired should be thoroughly inspected for pests and diseases before it is placed in the garden. Especially should the roots be examined for nematodes. Every precaution should be taken to prevent the intro-

duction of these serious pests into clean soil.

Vaporite or other naphthaline products should be incorporated in the soil when renovating flower beds or mixing potting soil.

● PESTS

The pests that are likely to attack begonias and other lath-house plants are here listed alphabetically and are discussed as to how they may be identified, the injury they do, and proper methods of control.

● ANTS

Ants do not feed upon plant tissues but are indirectly responsible for pest injury. They transport scale, mealy bugs, and aphids from infested plants to clean ones, so that these pests may secure fresh feeding grounds and continue to secrete the honeydew upon which the ants feed. They should be eradicated as a preventive measure.

If the ant nests can be located the ants can be killed by pouring into the hole a tablespoonful of carbon bisulphid. Otherwise, ant baits should be placed in suitable containers along the ant trails.

Many brands of ant poison baits are for sale. A suitable one may be made from Formula No. 8. (See section, Sprays and Formulas.)

● APHIDS, COMMONLY CALLED APHIS, PLANT LICE, GREENFLY OR BLACKFLY

Aphids are small, sluggish, sucking insects, about 1/10 inch long, having large abdomens. They may be green, yellowish-green, red or black in color. The males, usually, and some of the females have wings. This type of female lays eggs. Another kind is wingless and gives birth to living—and hungry—young, all females, who in turn produce similar young. By this process of reproduction a large number of insects may quickly invade a garden, and do irreparable damage.

Watch closely for them—they are more likely to appear on other plants than begonias—and be prepared to combat them.

The young and tender parts of plants are quickly injured when attacked by aphids. The insects pierce the skin of the plant and suck the juices, deforming and dwarfing young leaves, terminal growth and flower buds. If permitted to remain on the plant they secrete a sticky substance called honeydew, which promotes fungus growth and collects dirt. Injury to older growth is not so apparent, but is serious, nevertheless.

Control methods: A fine spray of water from the garden hose under considerable pressure—where the plant is sturdy enough to stand the treatment—will wash off the aphids and kill them. This must be repeated daily.

Since these are sucking insects, in order to kill them with a chemical spray a contact poison must be used. A liquid spray of this kind can be prepared from Formula No. 1 or No. 3. Commercial brands of sprays for this purpose are listed in Groups Nos. 1, 2, and 3. Poison dusts are also recommended for the control of aphids. Several brands made on nicotine or pyrethrum bases are on the market, and are more desirable than home mixed ones.

In greenhouses these pests are usually controlled by fumigating with nicotine. See section on Fumigants.

Also read direction on ant control.

● CANKER WORMS, CATERPILLARS

Worms are some of the chewing pests that must constantly be watched for. The canker, or measuring worms that appear in California about June and persist the remainder of the season are particularly destructive. They come as if by magic, hatching from eggs deposited by moths on the under sides of the leaves, and immediately start eating. They develop rapidly and devour as they grow. When fully developed, they spin a web about themselves, usually within the folds of a leaf, and go into the pupa stage.

Spraying the plants with a solution of arsenate of lead sufficiently often to keep them covered with the poison will provide reasonable protection. The residue of this spray is visible on the

plants as a white deposit, and is, therefore, unsightly.

The solution may be made up from Formula No. 5. The commercial brands of insecticides in Group No. 2 are recommended by the manufacturers for this purpose, but are probably not as effective as the arsenate base sprays. They do not discolor the plants, however. Destruxol (Group 1) contains other effective stomach poisons.

For a contact spray, use Formula No. 4.

Daily inspection and hand picking is sure but tedious. The tiny, newly hatched worms will often be found on the edges of the hole they are eating in the leaf. Disturbed, they suspend themselves on a self-spun web and will be found suspended in the air.

The best preventive is to kill the moths before they lay the eggs. The new lanterns fitted with electrically charged screens are effective, when hung in the garden, in electrocuting moths and beetles. The price of these devices is about \$15.00. A tall candle lighted above a pan of water, will attract moths and burn their wings. Then they will fall into the water and die.

● EARTHWORMS

The common earthworm will not appear in the soil of potted plants, or that used in flats for propagating purposes if it has had Vaporite, naphthaline flakes, or Scotch soot mixed with it. However, they are best removed from a pot by tapping the plant out of the pot and picking the worms out by hand.

● FULLER'S ROSE BEETLE

This beetle is occasionally troublesome but is more likely to attack other lath-house plants than begonias. They are grayish, and have prominent snouts. They crawl—do not fly. In feeding they chew holes in the leaves.

Same control methods as for canker worms. Hand picking is best. The white larva of this pest sometimes will eat the roots of plants. Kill the adults and there will be no larvae.

● MEALY BUGS

Mealy bugs are small, less than $\frac{1}{4}$ in. long, have white, soft bodies, and are sluggish of movement. They collect in clusters on the under sides of leaves or in protected locations. They are of the sucking type of pest, and an ever-present threat. Their secretion of honeydew attracts ants, and induces the growth of fungi.

The damage they do to plants is similar to that done by all sucking insects—stunting the growth and deforming it.

Mealy bugs are hard to eradicate. Vigilance in the use of preventive measures is recommended, ant control being especially helpful. Spraying of infested plants with a fine stream of water under considerable pressure—if the plant is sturdy—will clean them off. Frequent repetitions should suffice. Chemical sprays, when applied with force, will penetrate the cottony protective webs that surround these pests, and kill them. Must be repeated every few days. Tender plants so sprayed should be washed off two hours after applying, to prevent burning the foliage.

For mealy bugs on house plants, use rubbing alcohol applied with a small brush, touching each insect—but not the plant.

Make spray according to Formula No. 1 or No. 4, or use sprays similar to those in Group No. 2 or No. 3.

● MITES

Plant mites are very minute, spider-like pests of the sucking class. They are so small they cannot be seen without a magnifying glass. They are not to be confused with thrips. They hatch from eggs deposited at night on the under sides of leaves, on petals of flowers, and in protected parts of the plants. After a few days in an inactive stage they begin feeding.

This pest is not a serious one on begonias in lath-houses in California, but in glass houses everywhere it may become very destructive, attacking begonias, including the tuberous ones, cyclamen, gloxinias, gesneria, etc.

Their presence on begonias can be detected by the rusty-brown spots on the under parts of leaves. This scarring may be extended to cover considerable areas, and will produce curled

leaves, stunted terminals and deformed flowers.

Repeated spraying with nicotine sulphate (Formula No. 1) or with a brand of spray similar to those in Group No. 2 or No. 3 (which are contact sprays) will control mites on begonias grown in lath-houses or out-of-doors. Where a few are grown as pot plants indoors, moth balls of naphthaline, or better, balls of PDB (paradichloro benzene) placed on the soil is a satisfactory preventive and control measure.

Commercial growers who produce the above class of plants under glass consider mites a major pest and practice strict sanitation, and as a control measure fumigate with nicotine gas. For directions for this procedure, see Fumigants.

There is a root mite—pale yellow in color—which burrows into tubers producing a brown spongy area. The tubers should be soaked in a solution of Formula No. 4 before planting.

● MILLIPEDES, THOUSAND LEGGED WORMS

These are short, light brown worms with shiny bodies and many legs. They are usually found curled up in the soil, or under objects on the ground, scurrying away when disturbed. This variety does not ordinarily attack living plants, but feeds on decayed vegetable matter. A larger, dark brown one, less common, does feed on roots when other preferred food is not available. Millipedes will feed on begonia tubers, even sprouting ones—if they have access to them. Use Formula No. 7 for control.

● MINERS

Grub-like white worms that burrow in leaves between the upper and lower surfaces are called leaf miners. Seldom found on begonias, but often on cinerarias. Spray with nicotine solution, Formula No. 1 or with Destruxol.

● NEMATODES, EEL-WORMS

The nematodes are most formidable foes. They are microscopic worms that attack the roots of many kinds of

plants, including begonias, producing a condition called root-knot. They are prevalent in the sandy soils of the warmer sections of the United States, and are a threat to greenhouse culture everywhere. They thrive in moist, light soils where the temperature ranges from 50 to 75 degrees—the ideal begonia environment.

Their presence is shown by a plant which ceases to grow normally and turns yellow. The roots will show the characteristic tubercles of the size of peas or larger.

Nematodes cannot be eradicated from an infested plant. Such a plant and the soil surrounding it should be discarded and removed from the garden. **Do not throw them on the compost heap.** Burn the plant and bury the soil in a deep hole and cover with quick lime. Disinfect pots before re-using by washing in a 1% solution of formaldehyde.

It is imperative to practice preventive measures to guard against invasion of clean quarters. Inspect all new plants before introducing them into the garden. Test all soils before planting begonias in them. A few young tomato plants potted in samples of the soil will soon develop the knots on their roots if the soil is infested with nematodes.

Infested soils in lath-houses or outside beds may be sterilized by the use of carbon bisulphid. (See Fumigants), or a 1% formaldehyde solution. Vaporite or naphthaline flakes incorporated in the soil of beds or potting mixtures will prevent infestation.

It is the standard practice to regularly sterilize the soil in greenhouses with steam.

● SOW BUGS, PILL OR SHOT BUGS

These are all crawling creatures. The sow bugs are gray in color, oval shaped and less than ½ in. long. The others have harder, darker, and shiny shells. Both curl up into balls when disturbed. They feed at night, and during the daytime can be found hidden under clods or articles on the ground.

It is the common belief that these insects are harmless to plants. Although they do feed on decayed vegetable matter, they also eat fine roots and stems of young plants. They are more destructive to some other lath-house plants—notably pansies and violas—than to begonias.

The poison baits recommended for slugs, with the addition of more molasses, are effective in controlling sow bugs and pill bugs. Formula No. 6 or No. 7. Vaporite or naphthaline flakes worked lightly into the soil are satisfactory repellants.

● SCALES

There are a number of the scale pests. They are seldom found on begonias but may attack other plants associated with them, especially ferns.

Often plants look sickly for no apparent reason. However, close observation will disclose thin, narrow and long scales on the stem and on the veins on the under side of leaves.

Some kinds of scale have soft bodies, others have hard protective shells. They are all more easily killed while very young, therefore contact sprays should be applied just after the young are hatched. Those sprays having an oil base are perhaps more effective. Greenhouse Volck is one brand said to be good. Another sold under the trade name of Lemon Oil is recommended. Do not mistake this compound for oil of lemon.

Hardier plants may be sprayed with nicotine solutions. In both cases it is best to wash off the spray material two hours after it has been applied, and water the plants thoroughly.

The control of ants will lessen the spread of scale pests.

The so-called "dormant sprays" are too strong to be used on any tender garden flowering plants; they are designed only for fruit trees.

● RED SPIDERS

Red spiders are very tiny, eight-legged insects—1/16 in. in diameter, and are not true spiders or true insects. They may be found on the under sides of leaves in fine webs. Their mouths are constructed for sucking the juices of plants. The injury they do is evidenced by the graying or yellowing of the leaves, and defoliation when not controlled. They are rather resistant to control measures; easier to prevent.

They thrive in warm, dry air, hence do not often appear in the begonia house with its humid atmosphere. They attack many kinds of plants, and should be constantly watched for. House

plants grown in the dryer living room air are especially susceptible.

Space the plants far enough apart so they can get plenty of fresh air. This is a good preventive.

Frequent spraying with water under pressure is the cheapest and most effective control. Sprays with derris as a base are recommended by the manufacturers. Group No. 2.

● SNAILS AND SLUGS

These are slimy, repulsive crawling creatures, similar in appearance except that the snail carries a shell. Both leave a tell-tale shiny trail where they have crawled. They are night feeding, chewing animals, hiding during the day in moist soils of the begonia house and greenhouse. The young hatch from translucent eggs and are several weeks developing to adult stage, meanwhile they eat voraciously. Holes are eaten in the leaves of most all kinds of plants, the smaller ones being completely devoured, and the larger leaves being skeletonized if the pests are not combated.

Fortunately, slugs and snails are easily killed with poison sprays and baits. The standard stomach poison spray is one made of arsenate of lead. Formula No. 5. Bait mixed as directed in Formula No. 6 is a satisfactory one. There are many brands of such sprays and baits on the market.

Leaves of lettuce or cabbage, or orange peels make good lures for attracting these pests at night. A few hours after dark the snails and slugs can be collected and destroyed.

● THRIPS

Thrips are very small, narrow, winged insects. They are quite active and can be seen moving about on the under sides of leaves. In color they vary from whitish-green or yellow to dark brown. They may invade a garden quickly, coming in a swarm from the outside, and in a short time can do much damage.

They scar the surface of leaves and tender stems, and suck up the exuding juice. "The marks they make on plants are dark streaks on the under sides of leaves and on stems." (Blackmore and Langdon.) This characteristic

scarring is sometimes ascribed to miners. Terminals, leaves and flower buds become stunted and disfigured. Thrips also deposit a sticky substance which collects dust and fungi.

These pests are difficult to control, but the best practice, perhaps, is to spray weekly with nicotine solution. Formula No. 2. Many of the commercial sprays listed are recommended by the makers for this purpose.

Dusts with a nicotine base are effective, also. Both dust and spray must be applied to the under side of the leaves.

Fuchsias are especially susceptible to attacks of thrips.

● WHITE FLY

The adults are about 1/16 of an inch long, are white and have four small wings. The scale-like larva sucks the juice from the leaves and produces honey-dew, as do the aphids, and this in turn collects black fungus. The following sprays will kill the immature and adult flies.

Red Arrow, 1/3 teaspoonful to 1 gallon water.

Garden Volck, 2 teaspoonfuls to 1 quart of water.

Nursery Volck, 2 teaspoonfuls to 1 quart of water, plus 4 drops Black Leaf 40.

● WHITE WORMS

Minute white or translucent worms about 1/4 to 1/2 inch long, named Enchytræ, may collect about the roots of plants near the stem. Plants do not thrive when they are present. The worms can be collected by hand (they make excellent food for tropical fish or goldfish), or can be controlled by carbon bisulphide, Vaporite or formaldehyde.

● WIREWORMS

These are shiny, brownish-yellow, hard shelled worms, the larvae of the "click beetle." They can be controlled by handpicking. By placing pieces of potato three to five inches in the ground, the worms can be lured and collected. Carbon bisulphide, Vaporite

or formaldehyde may be used as controls.

● HINTS ON SPRAYING

Spray at least once a week in order to get the newly hatched insects. Spray even if pests are not visible.

In spraying as a preventive measure use a weaker solution and apply less often.

Be sure that the insecticide is applied to the tops as well as the under sides of the leaves, wetting the plant thoroughly. Spray when the wind is not blowing.

In using a nicotine spray, tie a dry cloth over the nose to prevent inhaling the poisonous mist.

In using the insecticides, fungicides and fumigants, be sure to follow the directions of the manufacturer, as stronger dosages may defoliate or kill the plants.

● SPRAYING AND DUSTING APPLIANCES

The best of insecticides will be ineffective unless applied to the plants in a proper manner. Well constructed appliances, kept in repair and good working order, are essential.

Hand dusters of the plunger and cylinder type are satisfactory where a small number of plants are to be treated. Hand sprayers of the compressed air type are easily operated, and may be adjusted, by the use of various nozzles, to the work in hand. To prevent unnecessary rusting of the container, the sprayer should be emptied and washed after each using.

● FORMULAS

The amateur and small grower will find it more satisfactory to use the commercial brands of insecticides rather than mix small quantities from the formulas given below. They are effective when used as directed by the manufacturers.

CONTACT SPRAYS

BLACK LEAF 40 is, perhaps, more generally used to control the sucking

pests than any other. Its active ingredient is a 40% solution of nicotine sulphate, a poison injurious to man as well as to plant pests, and should be used with care.

Formula No. 1:

1 fluid oz. Black Leaf 40
5 gallons water
1 oz. (by weight) soap to each gallon.

Formula No. 2:

Same as above, using 4 gallons water.

Formula No. 3:

1 teaspoonful Black Leaf 40
1 gallon water
1 oz. soap
Equals 1-800 dilution.
(For soft bodied insects, aphids, etc.)

Formula No. 4:

2 teaspoonfuls Black Leaf 40
1 gallon water
1 oz. soap
Equals 1-400 dilution
(For scale, mealy bug, etc.)

The soap acts as a spreader, causing the liquid to adhere to the insects. However, soap will burn very tender foliage.

GROUP NO. 1

DESTRUXOL is another commercial insecticide very effective when used as directed by the makers. It contains poisons dangerous to humans, (sodium cyanide, carbolic acid, wood creosote). Recommended for the control of mealy bug, aphids, thrip, scale. This spray leaves a poisonous residue that acts as a stomach poison, also.

ACME ALL AROUND SPRAY contains Black Leaf 40, arsenate of lead, Bordeaux mixture. A contact, stomach poison and fungicide.

GROUP NO. 2

The above type of spray—having poisons injurious to man—is being replaced to some extent by those containing compounds of derris, cube, rotenone and pyrethrum, substances that kill pests by paralysis and suffocation, but are harmless to man. They are good contact sprays and leave a

residue that is effective to a lesser degree as a stomach poison.

Derris and cube are tropical plants, of which rotenone is the active principle. Pyrethrum is made from the dried flowers of a chrysanthemum.

RED ARROW is a brand that contains pyrethrum and rotenone. Use as a contact and stomach poison.

EVER GREEN. Contains pyrethrum. Contact spray, partial stomach poison.

CUBOR. Active principles derived from cube and derris roots.

ARWELL SPRAY. Derris and pyrethrum. Advised not to use with soap.

PESTLESS GREENHOUSE SPRAY is particularly effective. BARFOOT ROTENONE SPRAY, and others are similar.

The brand named PY-SECT is especially recommended for mealy-bugs.

GROUP NO. 3

In this class are the Oil Emulsion sprays which use oils as spreaders. Do not use this class of sprays on ferns.

GREENHOUSE VOLCK, contains nicotine, oils and soap.

WILSON'S O. K. PLANT SPRAY. Nicotine and vegetable oils.

VERDOL, UNION OIL SPRAY. Do not use any of the above with sulphur.

STOMACH POISON SPRAYS

LEAD ARSENATE is the poison generally used in combating the chewing insects. Calicum arsenate and Paris Green are more likely to burn tender plants. Most of the commercial brands of sprays for this purpose have lead arsenate as a base. They should be mixed as directed on the containers. Several of the newer type of sprays, those having rotenone as the active poison, are reasonably effective as stomach poisons, also.

Formula No. 5:

1 oz. lead arsenate
2 gallons of water, or
1 heaping tablespoonful lead arsenate
1 gallon water

POISON BAITS

Some of the chewing pests—slugs, snails, sow bugs,—will eat poison baits scattered on the ground among the plants in the garden. It is best to put out this material late in the evening after thoroughly soaking the soil.

There are many brands of bait offered for sale: Snarol, Garden Bug-go, Acme Bait-M, Snail Foil, Pestless Garden Bait, are examples.

Formula No. 6:

25 lbs. bran
2 qts. molasses
10 qts. water
 $\frac{1}{2}$ lb. sodium arsenate, or
1 lb. Paris Green, or
2 lbs. Lead Arsenate

The addition of 6 oranges or lemons finely ground, increases its attractiveness.

If used for sow bugs, double the amount of molasses.

Formula No. 7:

1 part Paris Green
9 parts sugar

This is a special bait for sow bugs or pill bugs. Do not place the Paris Green on the plants—it will burn them. This bait should not become wet. Place on pieces of wood so it may be removed while sprinkling.

Formula No. 8:

Liquid Ant Bait
1 lb. sugar
1 pt. water
 $\frac{1}{4}$ oz. arsenite of soda
1 tablespoonful honey

Put the sugar and arsenite of soda in the water, boil until dissolved, add honey. Soak small pieces of sponge in this poison, place them in tin boxes in the ant runways; punch small holes in the sides of the cans so the ants can enter.

Of the commercial brands of similar baits, Antrol is an example.

NOANT recommended for both Argentine and grease eating ants.

POISON DUSTS

Various dusts that are toxic to plant pests may be effectively used as contact insecticides. It is not advisable to mix small amounts of these materials. Advise the purchase of ready mixed brands. These may contain nicotine, pyrethrum or derris derivatives.

FUMIGANTS

Where it is practicable to use a poisonous gas, as in a greenhouse, this class of insecticide is especially valuable.

CYANIDE. We will not advise the use of cyanogen gas as it is too dangerous except in the hands of experienced persons. Those interested will find complete directions for using it in the bulletin Greenhouse Pests, Circular No. 12, issued by the Illinois State Natural History Survey, Urbana, Illinois, and other government bulletins.

NICOTINE. This is the poison most generally used in fumigating glasshouses for the control of insect pests. The nicotine may be vaporized by burning nicotine papers, cones or powders. Tobacco stems are not satisfactory, as the proper dosage cannot be estimated, and the smoke from them contains elements injurious to plants. A good preparation for this purpose is Nico-fume, a powder sold in cans designed to burn the nicotine under pressure. Nicotine fumes are harmful to man, and may burn very tender foliage as maiden hair fern.

CARBON BISULPHID, a volatile, inflammable and explosive liquid, is useful in fumigating soils for the destruction of nematodes. In the open ground make one inch holes 12 inches apart, 10 inches deep, and into each pour 1 tablespoonful of carbon bisulphid, closing the hole with damp earth.

Carbon bisulphide emulsion, mixed 1 part to 400 parts of water, is recommended as a soil fumigant for the control of mealy bug, nematodes and root aphids. It should be applied at the rate of $7\frac{1}{2}$ gallons to each square yard of surface. It will penetrate to a depth of 18 inches.

SULPHUR may be burned in empty greenhouses at the rate of 4 lbs. per 1000 cu. ft., for the control of many insects. Will not kill eggs. Very destructive to plant life.

NAPHTHALINE FLAKES, moth balls, Vaporite, or paradichloro-benzine (PDB), are recommended as repellents. Placed in the garden soil and potting mixture they will discourage nematodes, and various other pests. For outside, use 8 oz. per cu. yd. of soil.

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COPOSIL Fungicide

