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THE CYCLAMEN MITE AND THE BROAD MITE AND THEIR CONTROL

By Floyd F. Smith, *entomologist, Division of Truck Crop and Garden Insects Bureau of Entomology* [1]

CONTENTS

INTRODUCTION

The cyclamen mite (*Tarsonemus pallidus* Banks) has occasioned annual losses to producers of greenhouse crops for more than 20 years, and the damage has increased in severity in recent years. Its depredations are a limiting factor in the production of cyclamens, one of its favorite food plants, and many florists have given up the growing of this crop because of their inability to control the pest. It is very insidious in its destructive habits on the cyclamen. This plant, which requires 17 months of care between the time of planting the seed and the time of flowering, may very early in its growth become infested by the cyclamen mite but show no symptoms that warn the grower of the impending losses until the distorted, partially opened flowers appear at maturity. Then it is too late to save the crop by any of the previously known methods of spraying, dusting, or fumigation. The concealed position of the mites on the plant offers such protection that insecticides do not reach them.

Perhaps not all of the injury is chargeable to the cyclamen mite; a closely related form, the broad mite (*Tarsonemus latus* Banks),[2] has been found to occur simultaneously with the cyclamen mite. The broad mite was considered a tropical species until 1928, when Philip Garman found this mite on tobacco and tomato plants in greenhouses.[3] In the present studies both mites were found on the same plants and on different plants in widely separated parts of the

[1] The writer was assigned to the study of the cyclamen-mite problem in 1931 and, with some interruptions, for 2 years has devoted a large portion of his time to this pest. He is greatly indebted to C. A. Weigel for general supervision of the work, to A. T. Grimes, who cooperated by growing plant material and aiding in the experimental work, and to H. E. Ewing, for advice in the identification of the mites.

[2] Although this scientific name is used here, it is possible that it may be synonymous with *Tarsonemus translucens* Green.

[3] Garman, P. A new greenhouse pest. Conn. Agr. Expt. Sta. Bul. 305: 765–766, illus. 1928.

country. The widespread occurrence of the broad mite indicates that it has probably been present in greenhouses for several years but has been confused with the cyclamen mite.

This circular gives a brief general account of these two mites, presents information concerning a control method that may be applied to certain crops, and suggests cultural and other practices that may be of value in reducing or preventing mite damage. Much more remains to be done on this problem, and it is hoped that additional information will become available later.

COMPARISON OF CYCLAMEN MITE AND BROAD MITE

The broad mite can be distinguished from the cyclamen mite in its different stages by observing (with the aid of a good hand lens magnifying 10 to 14 diameters) the features listed below and by noting the typical injury of each to the host plant.

	Cyclamen mite	Broad mite
Egg	Transparent, oblong oval, with smooth unmarked surface; usually tucked into crevices.	Pearl colored, nearly round, with rows of white spots on the surface; usually flattened against exposed leaf surfaces.
Larva	White, rather long and narrow, slowly moving.	White, smaller, short, broad, more rapidly moving.
Adult female	Milky white to brownish, larger, long, oval, slowly moving; in crevices mostly.	Milky white to brownish, smaller, short, broad, rapidly moving; usually on exposed under surfaces of leaves.
Host injury	Leaves on terminals badly distorted and curled upward; flowers and buds distorted or killed in heavy infestations.	Injured leaves appear shining, glazed, and puckered downward rather than curled; terminal buds killed and drop off, flower buds and flowers not distorted.

HOST PLANTS ATTACKED

Table 1 gives a list of 58 plants which have been found to be attacked by one or both of the mites. In this group 49 are attacked by the broad mite and 25 by the cyclamen mite. Sixteen are injured by both species, 9 are attacked by the cyclamen mite that have not been recorded as attacked by the broad mite, while 33 are attacked by the broad mite that are not known to be injured by the cyclamen mite. This list of plants is far from being a complete host list for the two mites, but it does indicate the extensive range of plants attacked and the large proportion of the hosts that are attacked by both species.

TABLE 1.—*Host plants that have been found to be attacked by the cyclamen mite and the broad mite*

Host plant	Attacked [1] by—	
	Cyclamen mite	Broad mite
Acalypha wilkesiana musaica (banana copperleaf)	−	+
Amaranthus retroflexus (pigweed)	+	+
Amaranthus sp., varieties Sunrise and *tricolor splendens*	−	+

[1] Minus sign (−) indicates that the plant, so far as at present known, is not attacked; plus sign (+), that it is attacked.

TABLE 1.—*Host plants that have been found to be attacked by the cyclamen mite and broad mite*—Continued

Host plant	Attacked by—	
	Cyclamen mite	Broad mite
**Antirrhinum majus* (snapdragon)	+	−
**Begonia semperflorens* (perpetual or wax begonia)	+	+
Beta vulgaris (sugar beet)	−	+
Boussingaultia baselloides (Madeira-vine)	−	+
Bouvardia sp. (Bouvardia)	−	+
Callistemma chinense (China-aster)	−	+
**Capsicum annuum* (common redpepper)	+	+
**Chrysanthemum frutescens* (marguerite)	+	−
**Chrysanthemum hortorum* (common chrysanthemum)	+	+
Citrus sinensis (orange)	−	+
Cosmos bipinnatus (common cosmos)	−	+
Cosmos sulphureus (yellow or Klondyke cosmos)	−	+
**Crassula rubicunda*	+	−
**Cuphea ignea* (fiery cuphea or cigar plant)	−	+
**Cyclamen indicum* (cyclamen)	+	+
**Dahlia rosea* (old garden dahlia)	+	+
**Delphinium ajacis* (rocket larkspur)	+	+
**Delphinium* sp., a hybrid of Belladonna larkspur	+	+
**Fragaria* sp. (strawberry)	+	−
**Fuchsia speciosa* (common fuchsia)	+	−
Galinsoga parviflora	+	+
**Gerbera jamesonii*, (flame-ray gerbera) horticultural variety	+	+
**Geum* sp.	−	+
Gossypium spp. (cotton)	−	+
Hevea spruceana	−	+
Hibiscus rosa-sinensis (Chinese hibiscus)	−	+
**Impatiens sultani* (sultan snapweed)	+	+
Ipomoea batatas (sweetpotato)	−	+
Ipomoea sp. (morning-glory)	−	+
**Iresene lindenii* (*Achyranthes*) Linden bloodleaf	−	+
Lantana camara (common lantana)	+	+
Lycium chinense (Chinese matrimony-vine)	−	+
Lycopersicon esculentum (tomato)	−	+
Mangifera indica (mango)	−	+
Nicotiana tabacum (common tobacco)	−	+
Oxalis sp. (woodsorrel)	+	−
Parthenocissus tricuspidata (Japanese creeper or Boston ivy)	+	+
**Pelargonium peltatum* (ivyleaf geranium)	+	+
Pelargonium hortorum (white horticultural variety of fish geranium)	+	+
Persea americana (avocado)	−	+
Petunia hybrida (common petunia)	+	+
Phaseolus vulgaris (common bean)	−	+
Piqueria trinervia (stevia)	−	+
Polygonum hydropiper (waterpepper)	−	+
Rubus sp. (blackberry)	+	−
Rumex crispus (curly dock)	−	+
**Senecio mikanioides* (ivy groundsel or German ivy)	−	+
Solanum tuberosum (potato)	−	+
Tagetes erecta (Aztec or African marigold)	−	+
Tagetes patula (French marigold)	−	+
Torenia fournieri (blue torenia)	−	+
Verbena spp. (common verbenas)	+	−
**Veronica peregrina* (purslane speedwell)	+	−
Vigna sinensis (common cowpea)	−	+
Zinnia elegans (common zinnia)	−	+

NOTE.—Plants marked with an asterisk (*) have been tested for effects of treatment by hot water or vapor heat, as discussed later.

LIFE HISTORY AND HABITS

In a study of the life history of the two mites it was found that the broad mite could pass through a complete generation in 4 or 5 days at 70° to 80° F., which is less time than is required for the eggs of the cyclamen mite to hatch and less than one half of the time required for a complete generation to develop. The broad mite also reproduces much more rapidly at these temperatures than does the cyclamen mite, the former laying as many as 7 eggs per day and the latter from 1 to 3. The broad mite is, therefore, apparently favored

by the higher temperatures, and this is shown by its greater abundance and damage during the spring, summer, and early fall months. The cyclamen mite is evidently checked by the higher temperatures and lower relative humidities of summer, but becomes more abundant and causes greater damage in the cooler conditions of fall, winter, and early spring. However, studies for 2 years have shown that both mites continue to breed on the plants the year round, and no evidence has been found that they hibernate in the soil or in benches during part of the year. It appears that access to living plant tissue as food is necessary for existence of the mites and that they die when confined to soil or to dry or moist decaying plant tissue. These points have an important bearing on the control of the mites by proper greenhouse practices.

SPREAD OF MITES FROM PLANT TO PLANT

Both mites spread readily from plant to plant when adjacent plants are in contact, but the natural spread of the cyclamen mite is reduced by separating the plants so that the foliage does not touch, as noted by Garman in 1917.[4] In the present studies several lots of uninfested plants were grown for 4 to 6 months, separated from infested plants by spaces of 12 to 18 inches, with no evidence of crossing over by the cyclamen mite. However, the 18-inch space did not prevent spread by the broad mite.

In working with the plants, the florist disseminates the mites from place to place when he carries a tray of infested plants along the aisle and brushes the foliage against uninfested plants and the mites are dislodged. He may also distribute the mites on the hands when potting the plants or disbudding or picking off undesirable leaves. This was demonstrated by the writer when, after working with infested plants, he examined his hands under the microscope and found the mites crawling around, ready to be passed on to another plant. These points emphasize the desirability of isolating older infested crops from the younger stock and of using care in potting and other practices in handling the plants. The fact that these mites are not seen with the unaided eye makes it very difficult for the grower to appreciate fully the importance of these precautions in his daily work with the crops.

PLANT INJURY BY THE CYCLAMEN MITE AND THE BROAD MITE

The cyclamen mite develops slowly and does not quickly kill the new growth, but, by feeding on the young tissue, causes characteristic curling and distortion. The crevices in which this mite usually hides are found in the young upward-folded leaves in the bud. Feeding in this fold injures the upper leaf surface and prevents its growth, while the lower surface expands and causes the leaf to curl upward (figs. 1 and 2, *B*). On cyclamens the mites are found at the crown within the young folded leaves (which are only one eighth inch long) and crawl beneath sepals of the flower buds when still very small. As the mites increase in numbers they severely injure the buds, causing them to die (figs. 3 and 7, *D*). The cyclamen mite enters through breaks in the surface or epidermal layer on injured leaves of

[4] GARMAN, P. TARSONEMUS PALLIDUS BANKS, A PEST OF GERANIUMS. ORDER ACARINA. FAMILY TARSONEMIDAE. Md. Agr. Expt. Sta. Bul. 208, p. [327]–342, illus. 1917.

Delphinium and breeds within the leaf tissue. It also penetrates the crown of *Delphinium* to the base of the leaves and is often found one half inch or more below the soil surface. Feeding areas on *Delphinium* often become blackened. The cyclamen mite may also feed in small numbers on the lower surface of leaves, particularly of *Delphinium*, chrysanthemum, and geranium.

The broad mite feeds on the lower surface of the more fully expanded leaves; this injury interferes with the normal expansion of the lower surface and results in a puckering downward of the leaf. The mite

FIGURE 1.—Pepper plants showing distortion and curling of young leaves following feeding by the cyclamen mite.

multiplies rapidly and extends its feeding to the surfaces of tender petioles, stems, and buds. The rapid feeding over the bud surface stops further development and the buds abscise and drop off, or the leaves are prevented from developing and appear as small scales. Further growth is thus prevented and the plants become stunted (figs. 2, *A*, 4, and 5).

It is thus evident that the two mites cause injury of equal severity but of slightly different types. When both species occur on the same plant, the two types are combined, but the injury by the broad mite

becomes more pronounced. The broad mite affects the plant suddenly and spreads rapidly to other plants, because of its great activity, while the cyclamen mite is more subtle in its procedure and spreads slowly.

CONTROL

As has been indicated, the broad mite causes little curling of the plant parts which would afford protection and does not enter plant crevices as frequently as does the cyclamen mite. The exposed condition of the broad mite offers greater possibilities for control by dusts, sprays, or fumigation. In addition, comparative tests have shown that this mite is killed by treatments that do not affect cyclamen mites placed on the same leaf. Therefore it seems possible that some of the previous workers who reported successful control of the cyclamen mite were really dealing with the broad mite.

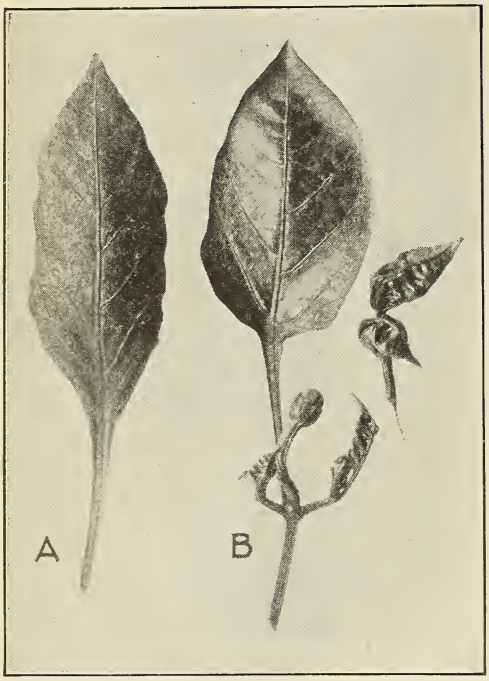

FIGURE 2.—Leaves of pepper injured by mites: *A*, Leaf injured by the broad mite; *B*, leaves injured by the cyclamen mite. Note the absence of injury on the older leaf exposed to the cyclamen mite.

DUSTS AND SPRAYS

In laboratory tests in which different types of dusts were compared, finely powdered sulphur was the most effective against the broad mite. The particles adhere to the bodies of the larvae and adults and kill them within a few hours. The eggs hatch, but the larvae are killed by contact with sulphur still on the leaves. Diatomaceous earth, which adheres well to the bodies of the mites, also killed the mites dusted with it, but was less effective against the hatching larvae. Diatomaceous earth containing either pyrethrum extract or rotenone gave no better kills than did the carrier when used alone. Commercial dusts, consisting of either ground pyrethrum flowers or ground derris root, gave low kills of mites, apparently because of the coarseness of the dust particles, which did not adhere to mites. Hydrated lime as a dust was not completely effective. In tests with a white oil emulsion, one application of a spray containing 1 percent of oil gave 90 percent kill and three applications at weekly intervals gave complete control. Lower dilutions of the spray gave incomplete kills.

Among the insecticides tested, sulphur dust seems to be the most convenient to use, although good results should be obtained with diatomaceous earth. Since some of the mites may not be reached

by one application, several dustings should be made to insure satisfactory control. The dust should be directed toward the lower leaf surfaces and should not be washed off in watering. If the plants are watered early in the day, the dust can be applied after the foliage has dried, and allowed to remain as long as possible the next day.

FUMIGATION WITH CALCIUM CYANIDE

The broad mite can be controlled by fumigation with calcium cyanide at dosages that will kill the greenhouse thrips (*Heliothrips haemorrhoidalis* Bouché). These dosages range from three eighths to 1 ounce per 1,000 cubic feet of space, according to the tightness of the house. Since this dosage is higher than that required to kill aphids in the same house, the use of this fumigant may not be practical on mixed crops, some of which may be harmed by excessive quantities

FIGURE 3.—Cyclamen plant showing advanced stage of injury by the cyclamen mite. The two flower buds are severely injured and the younger growths are killed at the crown.

of the gas. The pupa or resting stage of the broad mite is resistant to the gas, so the fumigation must be repeated three times at 4-day intervals. In the experiments cyclamen mites were not controlled on the same plants with the broad mites which were killed.

FUMIGATION WITH NAPHTHALENE

Naphthalene, when used at dosages ranging between 2 and 7 ounces per 1,000 cubic feet of space, according to the tightness of the greenhouse or fumigation unit, killed the broad mite in all stages except the egg. Since the eggs are not all killed by naphthalene at dosages much higher than the dosage effective against the other stages, the fumigation must be repeated, preferably three times, at 4-day intervals. The adults of the red spider (*Tetranychus telarius* L.) are killed at approximately the same dosage as is required to kill

the broad mite. The effect on the red spider may therefore be used to determine the proper dosage to kill the broad mite, since the former is more easily observed. A 16-hour fumigation under the same conditions of temperature (75° to 80° F.) and high humidity as used for red-spider control should be used.

The larvae and young adults of the cyclamen mite, however, are not killed by the same dosages of naphthalene as is the broad mite, although the exposed older adults are killed. Infestations of cyclamen mites on cyclamen and *Delphinium* have not been eliminated by seven repeated fumigations with naphthalene, but in one test with begonias they were destroyed. The mites are more exposed on begonia, and probably this may be correlated with the greater kill, as compared with those in curled leaves on cyclamen and *Delphinium* or within the leaf tissue and deep in the crown of the latter.

FIGURE 4.—Pepper plant injured by the broad mite. The leaves are puckered and curved downward at the edges and the buds are killed. Compare with figure 1.

FAILURE OF TREATMENTS AGAINST THE CYCLAMEN MITE

None of the foregoing fumigants, dusts, and sprays which were effective against the broad mite were completely effective against the cyclamen mite on cyclamen and *Delphinium*. The latter is not only concealed in the distorted plant parts, within the leaf tissue, or in the crown, where it is protected from dusts and sprays, but even when exposed it is also more resistant to the two fumigants than is the broad mite. The successful control of the cyclamen mite is not precluded in the present study, since proper repetition of applications through the growing period of the plant may so reduce the infestation and retard spread that a commercial crop can be marketed. However, spraying, dusting, and fumigations with various materials have failed in the hands of experienced greenhousemen, and the losses of crops have continued high each year. Because of the failure of these methods the mites have become established on plants and a complete or partial crop loss has resulted.

CONTROL BY HEAT TREATMENTS [5]

When the cyclamen mite has become established on the plants the florist has lacked methods to kill the mites and save his crop or to clean up infested stock plants that can be used later for propagating purposes. The writer has devoted much time during the past 2 years in an effort to develop methods that would meet these conditions. Of these methods some form of heat treatment seems most promising, since the mites are killed at temperatures that are tolerated by the plants. Tests have shown that both species of mites are killed on plants when immersed for 15 minutes in water at 110° F. or exposed for 30 minutes at the same temperature in a vapor-heat treating machine.

The treatment by vapor heat requires a specially constructed apparatus that heats the air to the desired temperature by means of

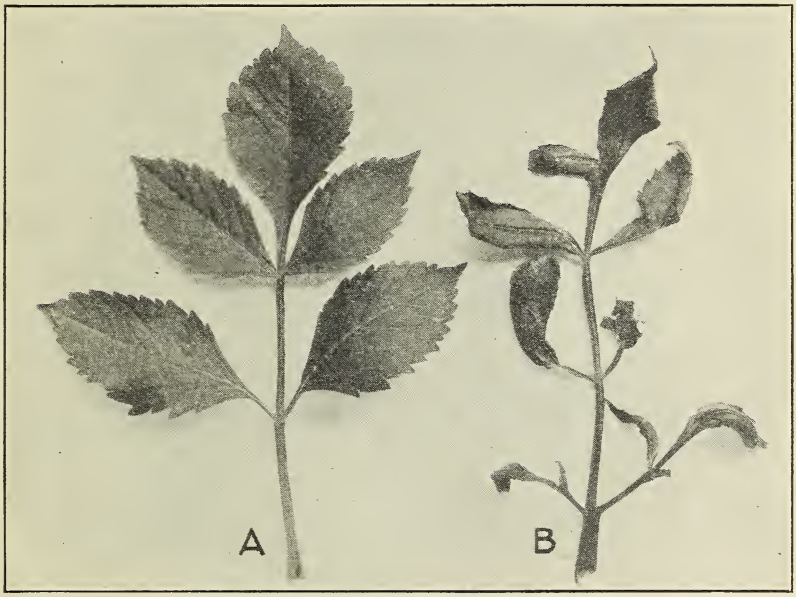

FIGURE 5.—Dahlia foliage: *A*, Uninjured leaves; *B*, leaves injured by the broad mite.

electricity or steam and at the same time completely saturates it with moisture. This type of equipment, which is being installed by narcissus growers for treating the bulbs, may be available to florists who desire to treat stocks for the cyclamen mite.

EQUIPMENT FOR HOT-WATER TREATMENT

In case a hot-water treating outfit (fig. 6) with temperature control is not available, the treatment with hot water can usually be carried out by employing equipment already on hand. The tank should be large enough to permit setting one or more trays in it, and deep

[5] Subsequent to the preparation of this manuscript the writer was advised that Francis Munger, at the University of Minnesota, had conducted similar studies of the hot-water treatment for ornamental plants. His results are being prepared for publication by the University.

enough to allow the water to cover the plants to be treated. The water can be heated before the tank is filled or can be heated by steam run into the tank and controlled with a hand valve. The water should be kept agitated either with a motor-driven pump or propeller or with a paddle in order to keep the bath at an even temperature throughout. A good thermometer should be kept in the bath and the rate of steam flow regulated to maintain a temperature of 110° F. With a little experience the temperature fluctuations can be held within 1°. The tank should be provided with a cover or covered with burlap to reduce the loss of heat during treatment. Trays for holding the plants should have slat or mesh bottoms and suitable wire or

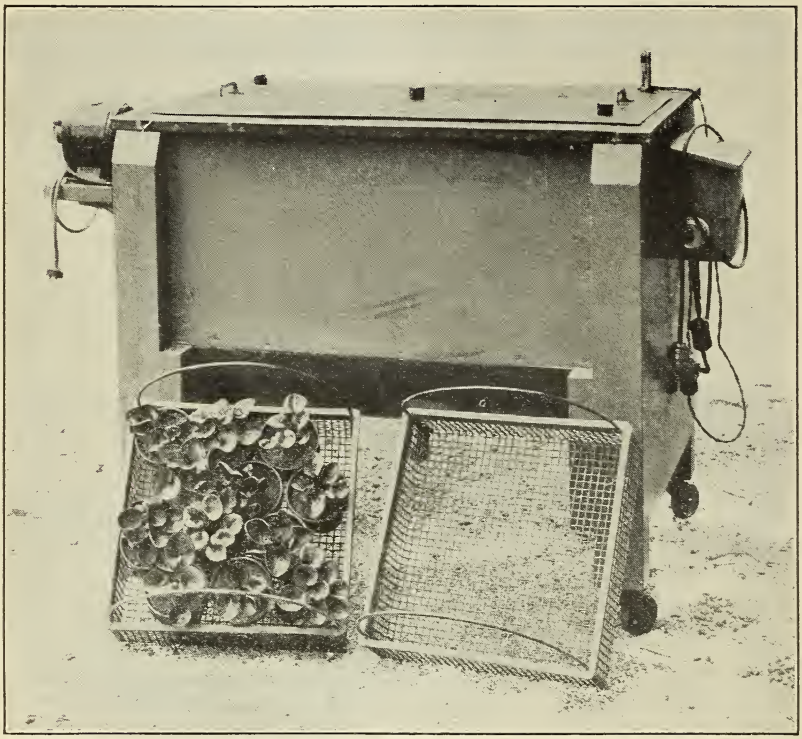

FIGURE 6.—Hot-water treating outfit equipped with a self-regulating electrical heater and an agitator; also wire baskets which were used in the experimental work.

strap handles at the ends that nearly reach the surface of the water. The hot-water treating equipment here described is recommended only for the small-scale grower. The large-scale grower would do well to invest in special equipment, which has more accurate temperature control and does not require constant attention.

METHOD OF TREATMENT WITH HOT WATER

Lower the trays of plants, including the pots, into the water, and at the end of 15 minutes lift them out and tilt them to drain water out of the tops of the pots. Place the plants on a clean bench some distance from other plants which are likely to harbor the mites.

Shade the plants with sheets of newspaper for 24 to 48 hours; after this the shading may be removed and the plants handled as usual. Shading following either of the heat treatments is necessary to prevent foliage injury on otherwise tolerant plants. Soil particles on the foliage may be rinsed off immediately after treatment or after the shade is removed.

After the plants have been removed from a section of bench during treatment, the same area may be used for treated plants, provided the bench is thoroughly cleaned by drenching it with hot water or steam or with an oil-emulsion spray, or it may be permitted to dry off for some time to allow the mites to die. Any foliage or plant parts on or beneath the bench that might harbor the mites should be cleaned up to remove this source of infestation.

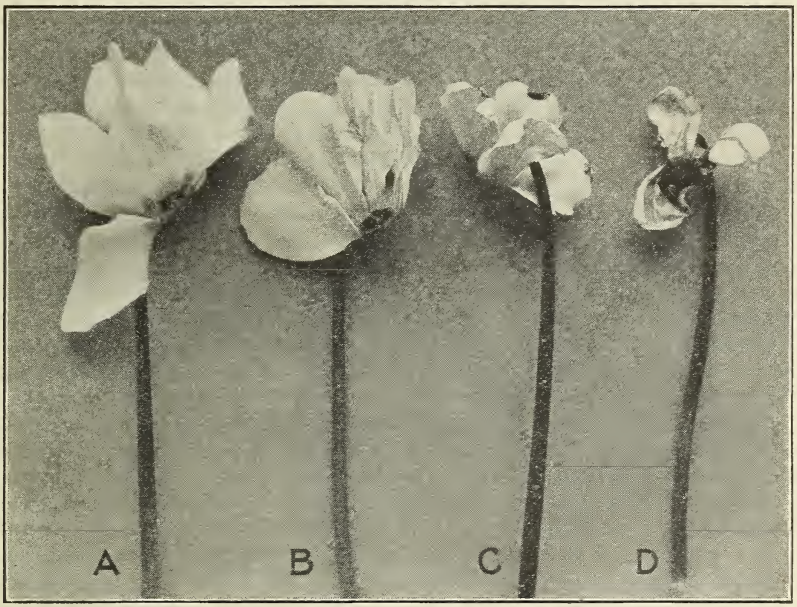

FIGURE 7.—Cyclamen flowers of the same age from different plants: *A*, Flower from uninfested plant treated with hot water while the flower buds were small; *B*, flower from uninfested and untreated plant; *C*, flower from infested plant treated with hot water while the flower buds were small; the mite injury on tips of petals did not continue after treatment; *D*, flower from infested untreated plant.

The 15-minute immersion kills both species of mites on or in the plant parts that are above the soil, provided the plants are not so closely set together that the dense foliage prevents the circulation of the hot water. However, a 25-minute immersion is required to kill the mites that occur between the leaf bases in the crown of *Delphinium*, strawberry, or *Gerbera* plants below the soil surface in pots of 4-inch or larger size. These plants in pots have withstood the 25-minute treatment. In tests where the roots of the plants had been freed of soil and the plants placed loosely in trays, a 15-minute immersion killed the mites in the crowns and did not harm the plants. Such treatment might be useful on *Delphinium* plants when they are transplanted from the field to the greenhouse for forcing, on infested *Gerbera* plants when these are taken up for division and transplanting,

and on infested strawberry plants that are being used for planting stock. Preliminary tests have shown that plants tied in bundles may not be so successfully treated as those placed loosely in trays or bags because of the varying time required for heat penetration.

Since reinfestation may take place following treatment, all precautions should be taken to prevent it. In addition to the proper isolation of treated stock, the process of treating should be so arranged that the men handling the plants and placing them in the tray do not remove the plants at the end of the immersion period and place them on the bench. This will reduce chance reinfestation by handling.

EFFECT OF TREATMENT ON THE PLANTS

The plants marked with an asterisk in table 1 were treated with hot water. These include practically all crop plants that have been found attacked by the cyclamen mite. The effect of heat treatment varies with the kind of plant, as is shown by the following examples. Potted plants of *Gerbera*, *Delphinium belladonna* hybrids, *Lantana*, cyclamen, and strawberry are stimulated to increased growth. Flowers of cyclamen are not injured (fig. 7), but flowers and flower buds of treated *Impatiens sultani* usually drop off. Older leaves of pepper and ivyleaf geranium sometimes drop off, particularly if injured by mites. Older leaves of geranium sometimes develop yellowed areas between the veins, while on chrysanthemum one or two tip leaves just below the leaf bud, but not the bud itself, are injured. Where roots extend to the outside of the soil ball in the pots, there is a slight killing back of the root tips. However, new ones begin to develop in a few days, and there is no marked setback owing to root injury on any of the plants treated, whether they are small plants in 2-inch pots or larger ones in pots up to 6 inches in size.

Of the plants which have been treated, the most tender ones seem to be wax begonia, snapdragon, and dahlia. The petioles and young stems near the terminals are killed on begonia, and the parts beyond them die. The young tips on snapdragon and dahlia are killed back. However, new growth develops from below, and the plants recover.

The remaining plants, including the important crops that are attacked by the mites, have been successfully treated. On cyclamen plants, ranging from 3 to 15 months in age and in pots from 2 to 6 inches in size, the only injury that has been noted is a slight reduction in the waxy appearance of the foliage. However, if the roots are heavily infested with nematodes, the plants are severely injured by the treatment. On small chrysanthemum plants in 2- to 4-inch pots, comprising 53 varieties, the only injury has been the killing of tips or margins of young leaves, and later growth was normal. On other plants, as *Gerbera* and *Delphinium* (which are difficult to spray), there was no injury.

The treatment of potted plants, or of plants that are being transplanted, in hot water may therefore be considered as practical and reliable where other methods have failed and where the plants are not too badly injured to be saved for maturing or for propagation.

TREATMENT OF CUTTINGS

The hot-water treatment of cuttings before they are placed in the propagation bench, if successful, will have application in many instances. Cuttings of *Achyranthes*, wandering-jew, and Boston ivy, the only plants tested, were successfully rooted after such treatment.

SUMMARY AND CONCLUSIONS

The cyclamen mite has damaged greenhouse and other crops for many years and is a limiting factor in the production of certain crops.

The broad mite occurs simultaneously with the cyclamen mite on many crops, and the two species may have been confused in the past.

Both mites live the entire year on the living plants and spread naturally to adjacent plants where foliage touches. They are also distributed when infested foliage is brushed against uninfested plants and even by the hands of those working with the plants. Sanitary measures are therefore important in control.

Both mites severely injure the plants but in different ways; the cyclamen mite distorts leaves and flowers, while the broad mite causes crinkling of leaves and stunting of growth.

The broad mite may be most readily controlled by carefully dusting plants with finely divided sulphur or diatomaceous earth, or by repeated fumigations with naphthalene or calcium cyanide.

The cyclamen mite is less readily controlled by the same dusts or fumigants that are effective against the broad mite, not only because the former is protected in crevices or distorted leaves, but because it is more resistent to some of the treatments.

Experiments have shown that both mites are killed when the infested plants are immersed for 15 minutes in water heated to 110° F., except that for those in the crowns below the soil surface a 25-minute treatment is required. Vapor-heat treatment for 30 minutes at 110° kills the mites as effectively as the 15-minute dip. The major crops attacked by the cyclamen mite are not injured or are very slightly injured by the heat treatments. The treatment will therefore be of value to florists where other methods have failed, but particularly on cyclamens and other potted plants.

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