vices, gives excellent plant and root growth, and makes watering necessary only once a week, or less. We have been using the method with success for ten years.

Growing Medium

About 2/3 volume vermiculite (exploded mica)

About 1/3 volume chopped styrafoam plastic (polystyrene foam plastic), about pea size.

Vermiculite is sold under various trade names (Terralite, etc.) and is available from most garden shops.

Chopped or shredded styrafoam plastic in small pieces about the size of a pea is used. It is available from some garden shops, florists, or florists suppliers (United Wholesale Florists, 939 Linden Ave., Memphis, Tenn.; Tufflite Plastics, Ballston Spa, N. Y. sells shredded at \$9/case of 10 ft^3 or fine (about rice size) at \$6/case of 10 ft^3 or \$3/bag of about 6½ ft^3). Or, for small amounts you can chop your own from the styrafoam materials used for insulation and boat flotation.

Mix vermiculite and styrafoam thoroughly, dump into the growing vessel (which may be a porcelain crock, floral pot, paper milk carton, etc.) with a drain hole or holes in the bottom and a screen if necessary (plastic window screen works well). Wet well with nutrient solution—see below— then plant the plant or cutting. Thereafter, watering once per week or even every other week is sufficient, allowing excess solution to drain off (it may be reused), as the vermiculite holds large volumes of liquid.

Vermiculite by itself is not good, as it very soon packs solidly and waterlogs, causing root death and rot. The chopped styrafoam prevents this, keeping the medium light and airy for good root growth ,yet at the same time the vermiculite in the mixture holds the liquid.

The product perlite, also available at many garden shops, may be substituted for the styrafoam. It serves the same function as the styrafoam—preventing packing and waterlogging of the vermiculite—but in our experience works not nearly so well.

The great ease and simplicity of setting up and weekly watering has made this vermiculite-styrafoam medium extremely useful to us, both for short-time, one-shot experiments, and for long-term growth for a year and a half or more.

Nutrient Solutions

For quick or temporary setups, a nutrient solution made up with plant "pills" (Plantabs, etc.) or prepared solution concentrates (Hyponex, Hydrogrow, etc.) available from most garden shops works very well.

For longer times, we use Hoagland's Solution No. 2.

Growing

Using the vermiculite-styrafoam mixture, we have found plants grow well and with ease in hot, dry rooms with lighting by a desk or fluorescent lamp, as well as in controlled environment plant-growing chambers.

CLOSE-UP PHOTOGRAPHY OF HORTICULTURAL SUBJECTS

Lewis Samuel Maxwell

Publisher, Florida Garden Guide

6230 Travis Blvd.

Tampa

For about thirty years I have been photographing small subjects. Most of my subjects have been insects, plant diseases, and plants. I would like to pass on to you some of the things that I have found out about photography during this time.

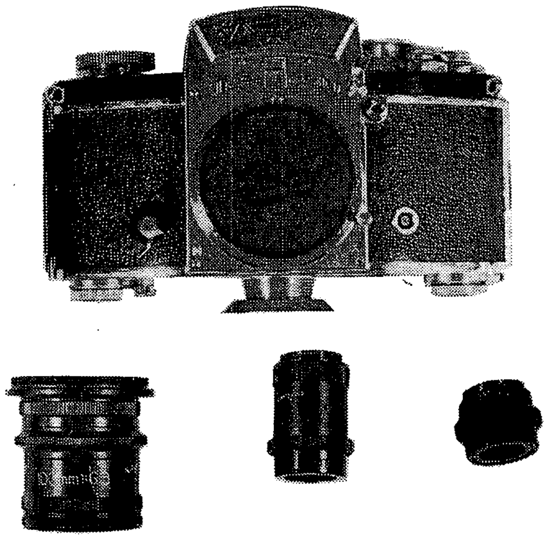
All things in this world are the result of compromise, and in photography we have to make many compromises.

Some of the factors we have to consider in close-up photography are:

1. How much money do we have to spend?
2. How much time do we have for photography?
3. Will we settle for less than the best?

For those of you who do not have to worry about money, have plenty of time and will settle for only the best in picture quality, the large camera is the camera for you. A 4 x 5 cut film Speed Graphic or View camera would be good.

There is nothing as wonderful as working with a 4 x 5 negative. Sometimes I feel that I would rather have a 4 x 5 negative shot

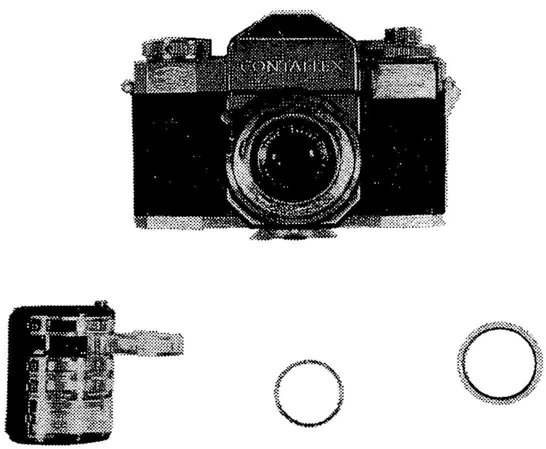


through the bottom of a beer bottle than a 35 mm negative made through the finest lens.

Print quality is directly related to negative size. The resolving power of the best film is far less than that of the poorest lens.

However, in my case I have had only my own money to spend and only the time that could be borrowed from a busy life. Being a realist, I have been able to accept something less than the best and so have settled for the small negative or the 35 mm camera.

Most of my photography has been at the end of a long workday. The subjects were often brought in from the field and had to be photographed while they were still alive and fresh.



As this was the case, I had to develop techniques that would produce results with a minimum of manipulation and time.

For these reasons I settled on 35 mm cameras, for they are precision instruments of great adaptability and when properly used can do adequate work.

New films and developers have improved results with these cameras. I use Panatomic-X for black and white and Kodachrome II for color.

In order to save time and get a complete series of both black and white and color pictures, I have two sets of cameras and accessories.

A pair of Contaflex I cameras, one loaded with Panatomic-X and one with Kodachrome II, is my answer for photos of outdoor pictures of objects covering a field of about five inches or more.

For objects of less than 5 inches in length, I use a pair of Exaktas. One is loaded with Panatomic-X, and the other is loaded with Kodachrome II.

The Contaflex I is a neat, easy to use camera. The fact that it has a between the lens shutter (compour) allows me to easily synchronize it with strobe for fill-in lighting outdoors.

Close-up work with the Contaflex I is accomplished by putting a simple magnifying lens in a filter holder in front of the camera lens. These lenses are from +1, which covers an area about 17 inches long, to +10 which covers an area about 2½ inches long.

Although the Contaflex I can be attached to a microscope, it is not as good for this purpose as is the Exakta.

My second set of cameras, the Exaktas, are especially good for small objects. The Exaktas have a focal-plane shutter and will synchronize with strobe only at speeds of 1/50th of a second or slower. However, the focal-plane shutter makes the use of special lenses easy.

For normal picture taking, lenses are ground to be nearer the film than to the subject. In photographing very small objects this is usually not the case, and some lenses are specially made for this kind of photography.

With my Exaktas I use Zeiss Luminar lenses. My lenses are 100 mm, 40 mm and 16 mm focal lengths. These are made for close-up work.

As an example the Luminar 16 mm lens attached flat against my camera fills the negative with a field length of only 7 mm or about ¼ inch. This lens is excellent for photographing very small insects.

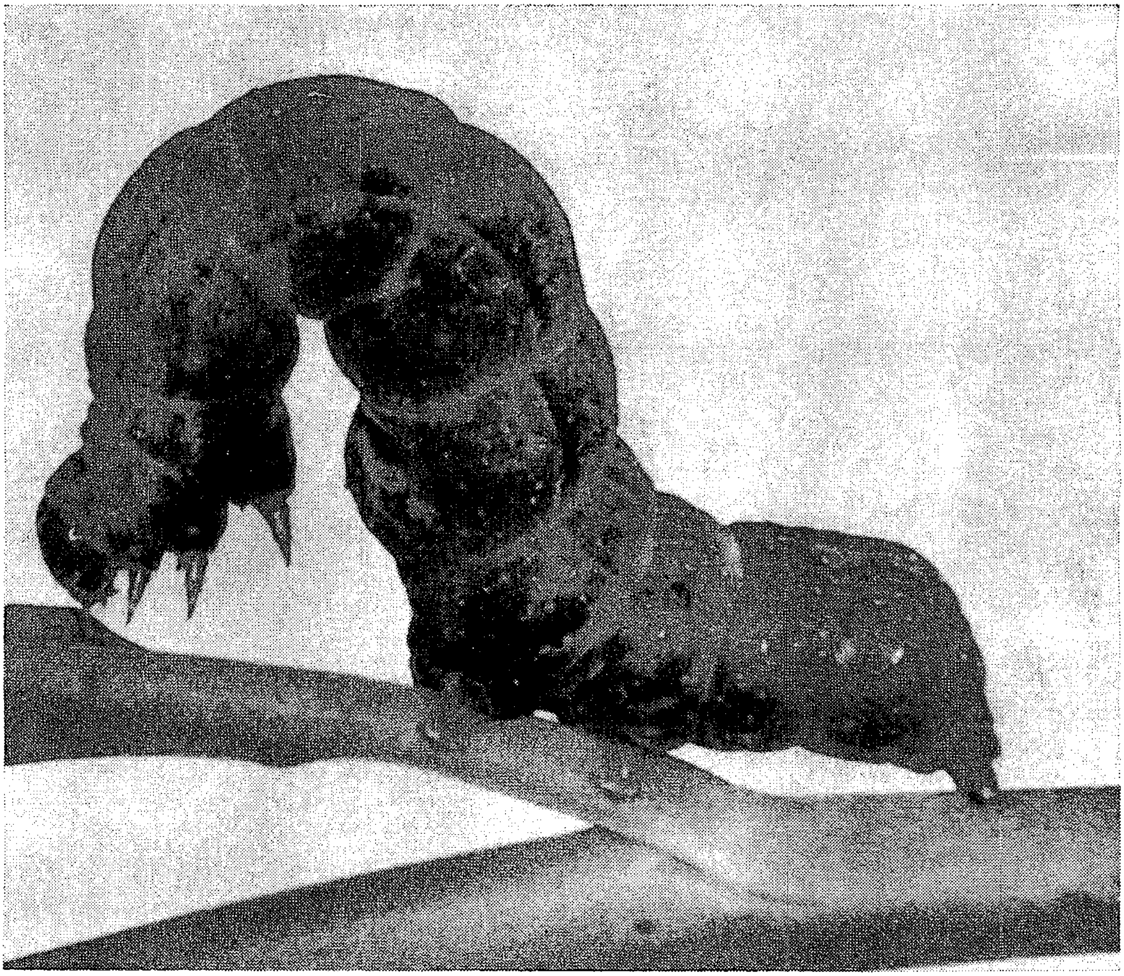


Figure 1.—The Cabbage Looper. This picture was taken with the Exakta and the 100 mm Luminar lens. These Caterpillars are "hams" and with a little coaxing will pose for you.

It is hard to tell which lens to use with the Exakta. The same size image on the negative can be obtained by using a short focal length Luminar lens and no extention tubes or by using a longer focal length lens and several tubes.

With the longer focal length lens you will be working farther from your subject, and at times this is helpful.

Although you do not actually get any greater depth of field with a longer focal length lens, you do get a compacting effect that gives you less distortion than with a short focal length lens.

When photographing small insects the depth of field is very shallow. One must, therefore, do everything possible to have sufficient light in order that the smallest lens opening can be used. (The smaller the lens opening, the greater the depth of field.)

Your depth of field is roughly 1/3 above your critical focus and 2/3 below it. This means that in photographing a thick subject like a beetle you should focus roughly 1/3 of the distance down the insect to get the whole beetle in focus.

In photographing insects you will find that while some will pose for you, others will need to be stunned with CO_2 and photographed as they recover.

These are some of the pictures taken with the cameras and techniques that we have been discussing:

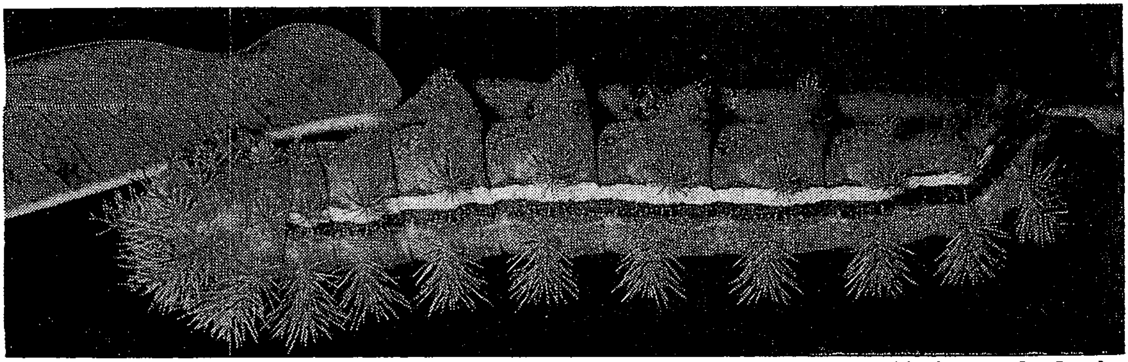


Figure 2.—The Io Caterpillar. This is all an "easy to pose" subject. This picture was taken with the Contaflex I and a +10 supplementary lens.

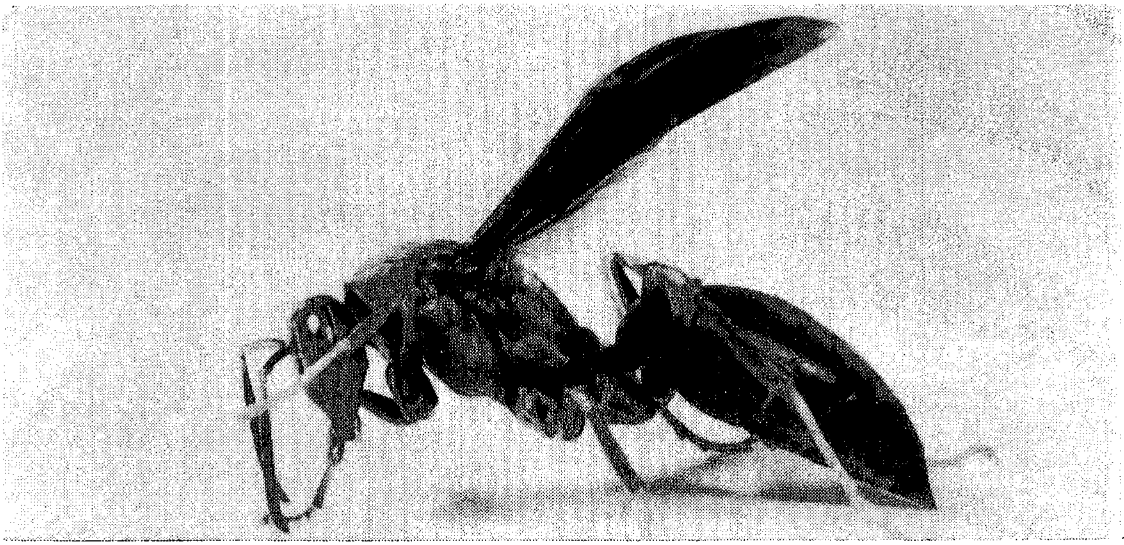


Figure 3.—The Wasp. This wasp was knocked out with CO_2, was photographed just as she recovered, and before she could fly away. My Exakta and 100 mm Luminar lens was used for this picture.

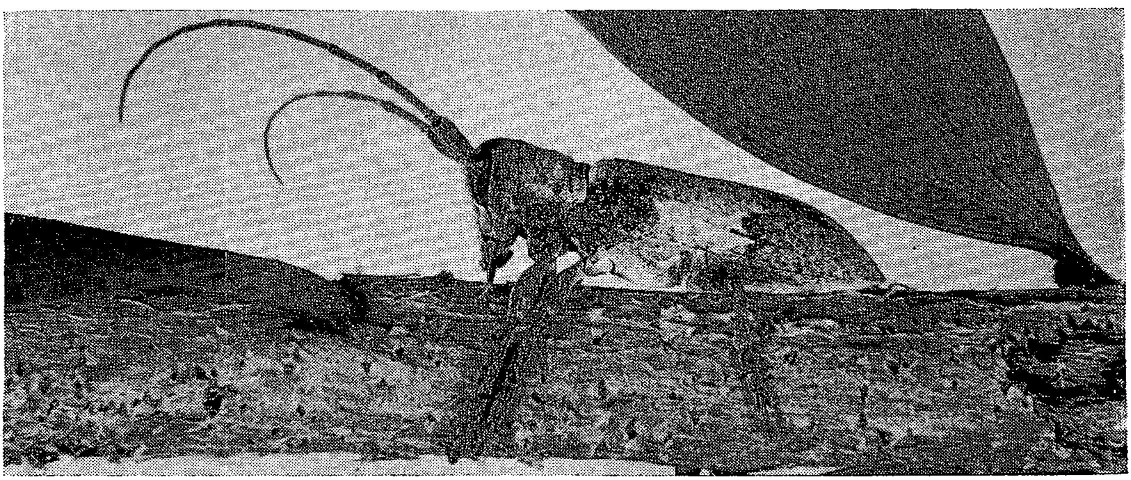


Figure 4.—The Twig Girdler. This insect was photographed by the Contaflex I and a +5 supplementary lens.

Figure 5.—The Whitefly and Pupa Cases. This picture was made with an Exakta and the 16 mm Luminar lens.

Figure 6.—The Jumping Spider. This picture was made with the Exakta and a 100 mm Triotar lens.

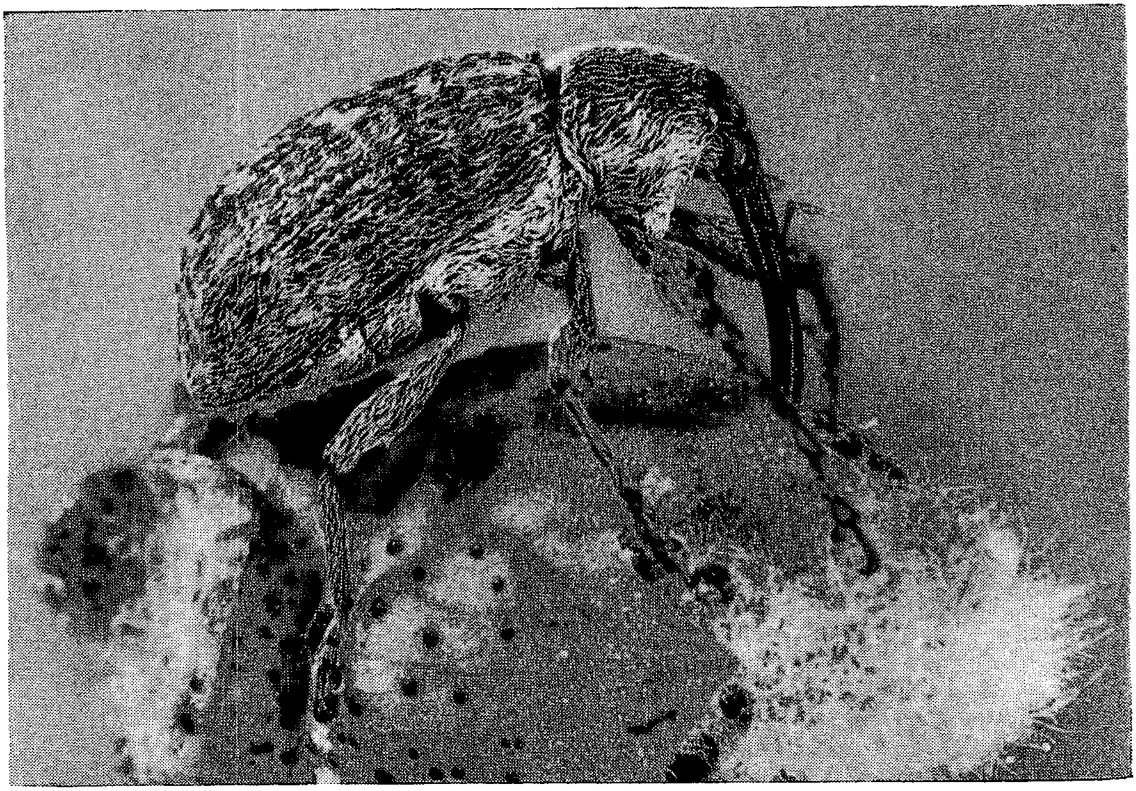


Figure 7.—The Boll Weevil. This picture was made with the Exakta and the 40 mm Luminar lens.

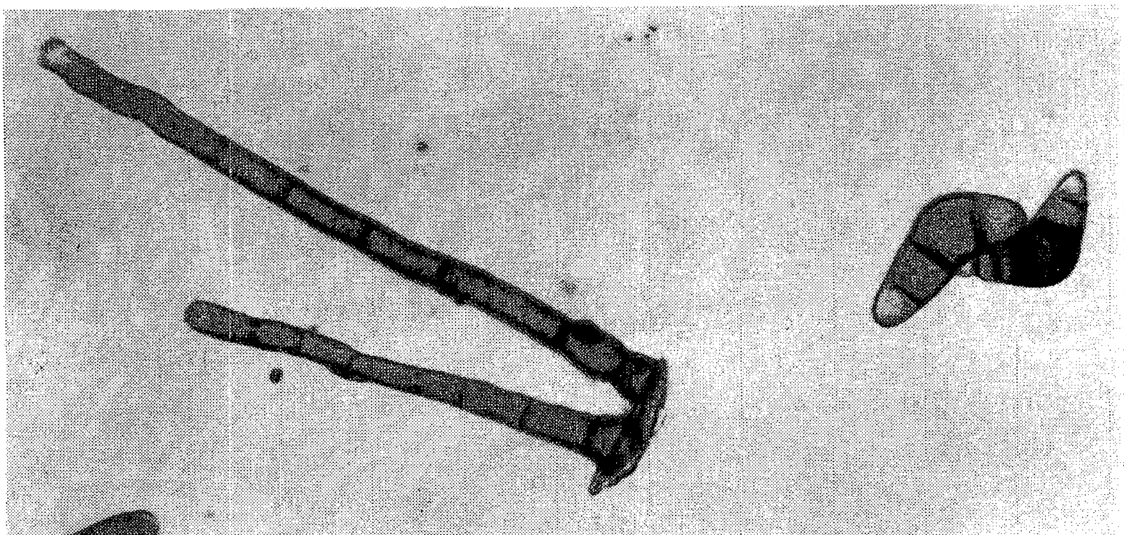


Figure 8.—The Curvularia Conidia and Conidiophores. This picture was made with an Exakta attached to a microscope. It shows the fungus spores and spore stalks.

Fig. 1—The Cabbage Looper. This picture was taken with the Exakta and the 100 mm Luminar lens. These caterpillars are "hams" and with a little coaxing will pose for you.

Fig. 2.—The Io Caterpillar. This is also an "easy to pose" subject . This picture was taken with the Contaflex I and a +10 supplementary lens.

Fig. 3.—The Wasp. This wasp was knocked out with CO_2, was photographed just as she recovered, and before she could fly away. My Exakta and 100 mm Luminar lens was used for this picture.

Fig. 4.—The Twig Girdler. This insect was photographed by the Contaflex I and a +5 supplementary lens.

Fig. 5.—The Whitefly and Pupa Cases. This picture was made with an Exakta and the 16 mm Luminar lens.

Fig. 6.—The Jumping Spider. This picture was made with the Exakta and a 100 mm Triotar lens.

Fig. 7.—The Boll Weevil. This picture was made with the Exakta and the 40 mm Luminar lens.

Fig. 8.—The Curvularia Conidia and Conidiophores. This picture was made with an Exakta attached to a microscope. It shows the fungus spores and spore stalks.

I hope that these ideas will be of some help to those of you who are interested in close-up photography.

THE EFFECT OF PHOSFON AND GIBBERELLIC ACID ON THE GROWTH AND CHEMICAL COMPOSITION OF CHRYSANTHEMUM MORIFOLIUM 'BLUE CHIP'

John F. Cabler

University of Florida

Gainesville

2,4-Dichlorobenzyltributylphosphonium chloride (Phosfon) is a chemical "growth retardant," a compound that retards cell division and/or cell elongation without causing drastic formative changes in the growth habit of the plant. Chrysanthemum growers use Phosfon to produce compact pot-grown plants.

Certain growth characteristics are noticeable when a chemical growth retardant works successfully on a plant. The most striking effect caused by growth retardants is to decrease internode length, and therefore, total height of plants. Leaves of treated plants are usually darker green than those of untreated plants. The stem also thickens and the plant tends to become compact and sturdy (1, 2, 3, 10, 11).

Most experimental work on growth retarding chemicals has studied their effect on anatomical and morphological changes in the plant as reflected in plant size, form, color, rates of cell division and cell elongation, and the time of appearance of plant organs, particularly flowers. Relatively little is known about the mode of action of these compounds. This experiment was initiated to study effects of Phosfon and gibberellic acid (GA) on the growth and chemical composition of the chrysanthemum plant. There have been reports that the growth retarding effect of Phosfon could be nullified by application of suitable concentrations of gibberellic acid. A study of both Phosfon and gibberellic acid might give some additional insight into their possible mode of action in regulating plant growth.

Materials and Methods

A 3 x 2 factorial experiment was established to test the effects of 3 levels of Phosfon and 2 levels of gibberellic acid on the growth and chemical composition of *Chrysanthemum morifolium* 'Blue Chip,' a short-day 9-week variety. A randomized block design was utilized with 3 replications and 3 plants to an experimental unit. Three rooted cuttings of this clone were planted February 18, 1964 in 6-inch plastic pots using a mixture of two-thirds sterilized sandy soil and one-third imported peat.

Plants were pinched February 23, and 60 watt incandescent lights placed 6 feet above the plants were turned on from 11:00 P.M. to 2:00 A.M. to keep the plants in a vegetative condition. Plants were pruned again to maintain a maximum of three laterals per stem.

Treatments were applied on March 19, 1964. Levels of Phosfon were 0, 0.3 ml and 0.6 ml per