In 1974/1975 we began to conceptualize a bioshelter that would point the way towards a solar-based, year-round, employment-creating agriculture for northern climates. Our goal was to devise a food raising ecology which would use little space and would require one-fifth to one-tenth the capital of an orthodox farm. Our original target was for a bioshelter-based microfarm costing $50,000, land included. The experimental prototype known as the Cape Cod Ark cost less.

Our strategy was to avoid mimicking and scaling down single crop commercial farms. Instead we adopted an ecological perspective, incorporating into the design high levels of integration, multiplicity of pathways, a blend of soft technologies and mixed crops (including greens, vegetables, flowers, fish and other aquatic foods) and the mass propagation of trees. The microfarm's structure was to be a solar building with internal climate, disease and pest controls being carried out by ecological, structural and data-processing subcomponents.

In this NEWSLETTER, Colleen Armstrong writes about the agricultural work which has been carried out primarily by her and Kathleen Ryan. There is significant news in their results:

Firstly, they found that vegetable yields in the solar environment of the Cape Cod Ark match those of petroleum dependent commercial greenhouses.

Secondly, it is possible to control diseases and pests with ecological methods exclusively. Biocides are not required. Multifaceted techniques for biological regulation work and open up a wide range of possibilities for bioshelter food production.

Thirdly, varietal trials yielded information on crops best adapted to bioshelter environments.

NOTES ON GREENHOUSE AGRICULTURAL MANAGEMENT

by Colleen Armstrong

Soils

Sterile soils and intensive management through the use of toxic chemicals are common elements of orthodox greenhouse food culture. We opted for deep, biologically diverse soils "seeded" from fields, meadow and forest environments in alluvial, limestone and glacial areas in southern New England. To the soils we added compost, seaweeds (for trace elements and structure) and composted leaf litter. Our intent was to build soils with the following characteristics:

— high fertility

— high organic matter and water holding ability

— multiple nutrient exchange pathways and storage capabilities

— carbon dioxide production optimized through dense bacterial activities

— shelter for diverse animal populations, including earthworms and pest predators

The most practical indicator of soil fertility is the amount of produce a plant yields. We considered two important facts when discussing soil fertility in the Cape Cod Ark: (1) the soil is the basic, essential source for plant nutrient uptake; and (2) unlike seasonal cropping, the soil's nutrients are tapped twelve months of the year. Therefore, we rotate crops to balance nutrient demand. To evaluate our soil conditions, two laboratories — Woods End Laboratory, Temple, Maine and University of Massachusetts Suburban Experimental Station, Waltham, Mass. — have audited Ark soil samples. These reports are vital especially when your selected crops are heavy feeders that may cause nutrient deficiencies.

To maintain soil fertility, each bed is turned with good compost material in September, after the summer season has come to a close. This re-instates many micro-organisms that break down the carbon structures with a steady nutrient and mineral release. In addition, we irrigate with warm nutrient-rich fish-pond water. The solar algae ponds provide a soluble quick source of nitrate-nitrogen, ammonium-nitrogen, and phosphate compounds.

Climate

Vegetable and flowering plants respond quickly to environmental conditions. Light, temperature, humidity and carbon dioxide can be regulated: but, keep in mind, these factors are interrelated. A brighter light quality will raise the temperature range. If a bioshelter has an opaque, insulated north wall, light quality will vary in different areas. Often northern sections will receive partial light while southern sections gain direct light. Select crops that will do best in these conditions.

Unlike conventional oil-heated glasshouses, daytime and nighttime temperatures can fluctuate within a wide range. A fifteen degree (F) difference is optimal, but clear days and cold nights may cause a twenty-five to thirty degree (F) fluctuation. Fall temperatures are similar to late summer — warm days and cool nights. Winter has a feeling of spring. Daytime degrees reach the seventies by midday and nighttime is chilly, 40-50°F. By the vernal equinox, it's warm enough to plant tomatoes, the warmest months will last till the harvest moon.

All greenhouses are humid places, particularly at night, when plants respire carbon dioxide. In winter, cool moist air can encourage harmful fungal growth: botrytis, root-rot and leaf-rot. Warmer air, air recirculation, or fresh air exchange can minimize extreme humid conditions. In addition, select plants that have been bred to resist fungal diseases. Many greenhouse varieties listed below carry this quality.

Carbon dioxide is the trigger for photosynthesis; it also provokes much debate among growers. When vents are closed for long periods of time, where does CO_2 come from? To date CO_2 has not been a problem for winter or summer vegetable production in the Ark. Soil organisms, fish, small animals and people all contribute CO_2 to the atmosphere.

Vegetables For Bioshelters in The Northeast

A wide assortment of foliage and fruiting vegetables are raised during fall, winter and spring seasons. Often light intensity, air and soil temperature will narrow the selection for protected cultivation. In comparing American and European varieties of vegetables, we have found that Dutch lettuce and tomato varieties are superior in production, insect and disease resistance, and taste. (See Seed Resource List). It is possible that Dutch greenhouse crop-breeding conditions more closely approximate conditions in bioshelter environments in the northeastern United States.

Table 1. Vegetable Varieties for Bioshelters in the Northeast

Fall (September -November)

Vegetable	Name of Variety	Seed Co.	Light Condition
Beet	Ruby Queen	Stokes	Direct
	Early Wonder Tall Top	Johnny's	Direct
Broccoli	Cleopatra	Stokes	Direct
Cauliflower	Opaal®	Rijk Zwaan	Direct
Celery	Utah 52-70 Improved	Johnny's	Direct
Chard, Red	Rhubarb	Stokes	Direct, Partial
Chard, Swiss	Fordhood Giant	Stokes	Direct, Partial
Endive	Full Heart Batavian	Johnny's	Direct, Partial
Kale	Harvester LD	Johnny's	Direct, Partial
	Gr. Curled Dwarf Scotch	Stokes	Direct, Partial
Lettuce, Bibb	Ravel®	Rijk Zwaan	Direct, Partial
Lettuce, Head	Reskia®	Rijk Zwaan	Direct
	Zwaareese®	Rijk Zwaan	Direct
Leek	Elephant	Stokes	Direct
Parsley	Champion Moss Curled	Stokes	Direct, Partial
	Plain Dark Green Italian	Stokes	Direct, Partial

Winter (November - February)

Vegetable	Name of Variety	Seed Co.	Light Condition
Beet Greens	Green Top Bunching	Stokes	Direct
Chard, Red	Rhubarb	Stokes	Direct, Partial
Chard, Swiss	Fordhood Giant	Stokes	Direct, Partial
Chinese Cabbage	Matsusitima	Johnny's	Direct, Partial
	Chinese Pacchoi	Johnny's	Direct, Partial
Endive	Full-Heart Batavian	Johnny's	Direct, Partial
	Green Curled	Stokes	Direct, Partial
Lettuce, Bibb	Ravel®	Rijk Zwaan	Direct
Lettuce, Loose-Leaf	Gr. Rapids Tip-Burn Resistent	Stokes	Direct
Parsley	Champion Moss Curled	Stokes	Direct, Partial
Spinach	New Zealand	Stokes	Direct, Partial
Turnip Greens			Full

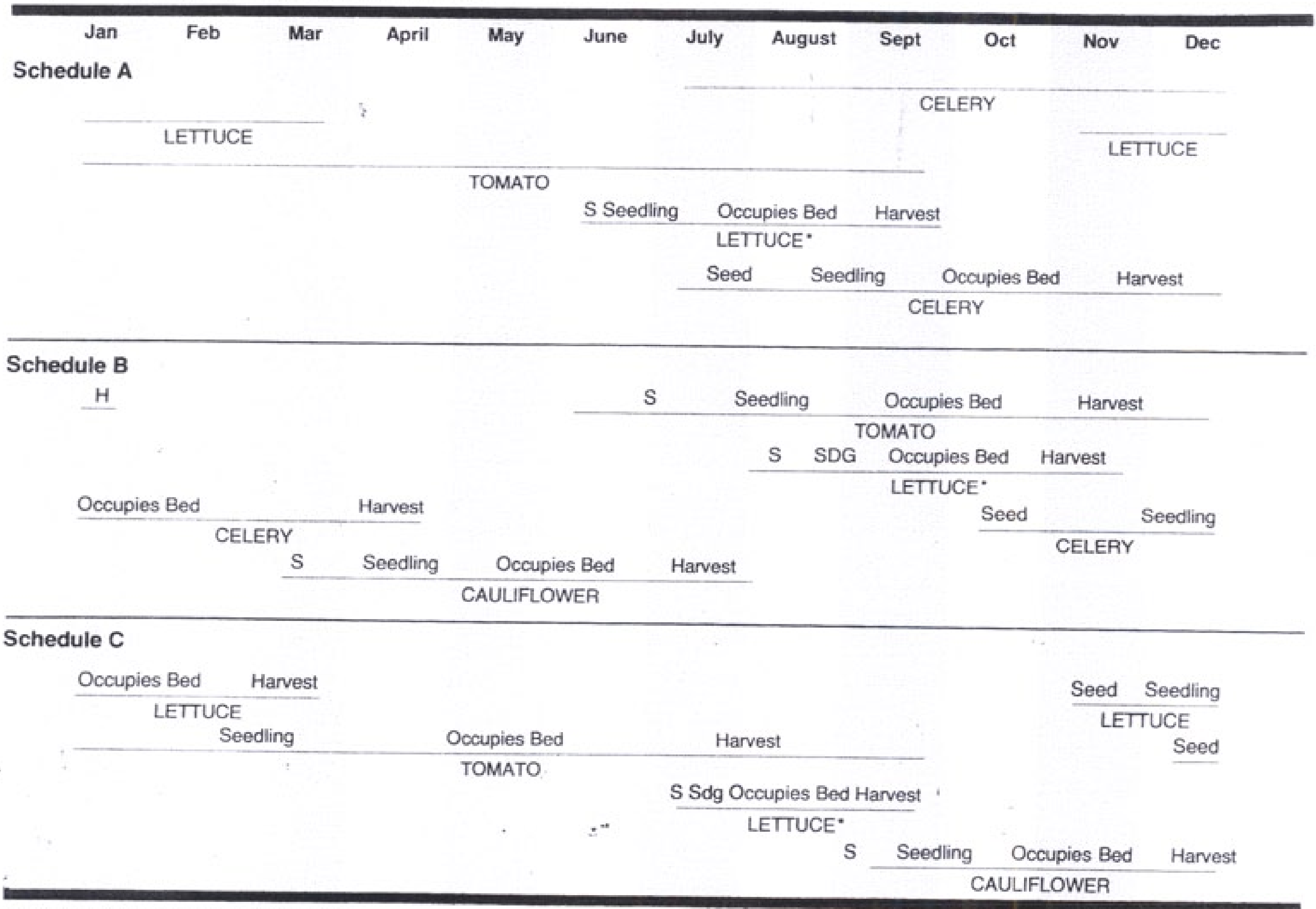
Spring (March - May)

Vegetable	Name of Variety	Seed Co.	Light Condition
Broccoli	De Cicco	Johnny's	Direct
Cauliflower	Opaal®	Rijk Zwaan	Direct
Celery	Utah 52-70 Improved	Johnny's	Direct
Chard, Red	Rhubarb	Stokes	Partial, Shade
Chard, Swiss	Fordhood Giant	Stokes	Partial, Shade
Chinese Cabbage	Springtime	Stokes	Partial
Kale	Harvester LD	Johnny's	Direct, Partial, Shade
	Gr. Curled Dwarf Scotch	Stokes	Direct, Partial, Shade
Lettuce, Bibb	Ravel®	Rijk Zwaan	Direct, Partial
	Ostirata	Stokes	Direct, Partial
Lettuce, Head	Zwaaresse®	Rijk Zwaan	Direct
Lettuce, Loose-Leaf	Grand Rapids Tip-Burn Resistent	Stokes	Direct, Partial
Parsley	Champion Moss Curled	Stokes	Direct, Partial, Shade
	Plain Dark Green Italian	Stokes	Direct, Partial, Shade
Spinach	Malabar	———	Direct
Tomato	Lito®	Rijk Zwaan	Direct
	Sweet 100	Stokes	Direct

Maximizing Food Production

Maximizing food production in any size greenhouse takes planning and consideration for optimal growing seasons. Most of our vegetable and flower seeds are germinated in flats, transplanted into small boxes, then set into the soil beds. Growing seedlings to transplant size will save time and precious space. As one crop is maturing, a second can be started. A yearly planting schedule helps in adjusting timetables for seed orders, seeding and harvesting. Figure 1 shows three alternate planting schemes for one year. Table 2. presents the corresponding retail price revenue per square foot for each schedule.

Figure 1. Alternate Annual Planting Schedules



* Lettuce grown under mature tomatoes

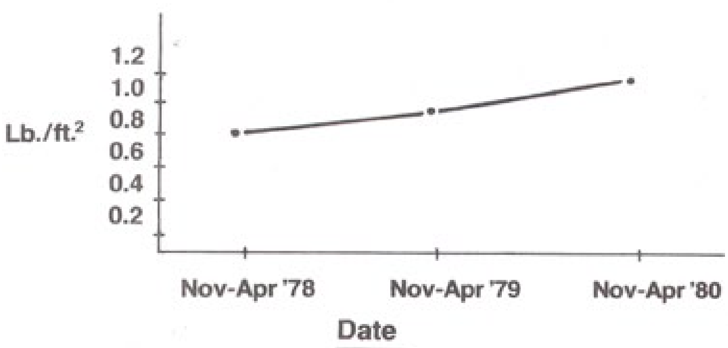
Table 2. Retail Price Revenue for Alternate, Annual Planting Schedules — Early 1980 Prices

		Retail Price		Produce/ft^2		Revenue
SCHEDULE A						
Celery		$ .89/bunch		1 bunch/ft^2		$ .89
Tomato	avg.	$ 69/lb.		4 lb./ft^2		$2.76
Lettuce		$ .69/head	(two)	1.9 head/ft^2		$2.62
					Total	$6.27/ft^2/year
SCHEDULE B						
Celery		$ .89/bunch		1 bunch/ft^2		$ .89
Tomato*		$ .99/lb.		1.2 lb./ft^2		$1.18
Lettuce		$ .69/head		1.9 head/ft^2		$1.31
Cauliflower		$1.89/head		.4 head/ft^2		$ .79
					Total	$4.14/ft^2/year
SCHEDULE C						
Lettuce		$ .69/head	(two)	1.9 head/ft^2		$2.62
Tomato	avg.	$ .69/lb.		4 lb./ft^2		$2.76
Cauliflower		$1.89/head		.4 head/ft^2		$ .76

Winter Crop Varieties

Optimal plant growth occurs when both proper air and soil temperatures are maintained. Average soil temperatures at a 2" depth in the Ark during the coldest months are as follows: November 60°F; December 59.5°F; January 55°F; February 59°F; March 62°F. The soil beds are a portion of the total thermal mass while providing more than sufficient temperatures for a bountiful winter vegetable production. Air temperatures fluctuate between 77°F on clear days and 55° - 60°F on cloudy days. With an average minimum air temperature of 49.2°F and an average maximum air temperature 70.8°F, the Ark's climate is similar to a spring season in a temperate zone. Lettuce, endive, celery, chard, beet, brassicas, spinach, and parsley varieties have been evaluated for their adaptability to these light and temperature conditions. During the dead of winter (Nov. 22 - Jan. 22), endive, parsley, New Zealand spinach, beet greens and both Swiss and Red chard are constant producers.

Figure 2. Winter Vegetable Production in the Cape Cod Ark: Average Pounds per Square Foot (in a 517 sq. ft. area) over a Six Month Period



HIGH VALUE CROPS

Celery

Celery is a relatively high priced, popular vegetable on American markets. Although it is one of the more difficult plants to grow, our first-year results were encouraging.

Celery is a compact, vertical axis crop. It can be spaced at one plant per square foot, weighs one to two pounds per plant and has a retail price of eighty-nine cents per bunch. It is a good storage vegetable and has a flexible harvest period. The actual time that the crop occupies bedding space is seventy-two to seventy-six days, or close to one-half of the total maturation process.

Tomatoes

In New England, many conventional tomato growers have dropped production with the rising cost of fuel. Retail prices for tomatoes approach and often exceed one dollar per pound on Cape Cod during seasons when tomatoes are imported. Greenhouse tomatoes have two seasons, spring and fall. Predictably, the spring season is more profitable with better climatic conditions. During the first year of spring tomato production we harvested an average of two pounds per square foot. This yield figure is probably low; we know part of the crop was snitched by visitors. The following spring, a more sophisticated program evolved, incorporating a valuable pruning technique. Double-pruning is a European method which incorporates a selected axial sucker (vegetative outgrowth) into a second indeterminant stem. This pruning technique can double fruit yields while not affecting fruit size; and it is an excellent method for maximum space utilization. Preliminary trials began with Dutch seeds. Our favorite variety is Lito® from the Rijk Zwaan Co. This variety of tomato is slightly smaller than average garden tomatoes although it tastes as sweet as a garden tomato. Mid-March planting gave mid-May fruit. Production lasted fourteen weeks with a finale of 13 pounds of fruit per plant! If the Ark tomato area was equivalent to 1,000 square feet, Lito® could produce 4,000 pounds of fruit in the spring season.

Fall tomato production also has its merits. Once again, timing is most important. Seeding begins the first of June; healthy plants are set in beds by the first week in August. The first tomatoes begin to ripen in mid-October. Fall fruit production is considerably less than spring, 1.2 lb./ft.^{2} compared to 4 lb./ft.^{2} respectively. However, top price is paid at this time and further on into December. Light-reflection material and thermal curtains would help boost fall tomato production.

PREVENTIVE MEASURES FOR INSECT CONTROL

A diverse community of insects take refuge and livelihood among the assorted vegetable crops in the Ark. While many people claim *all* insects are pests, the usual troublemakers are the little creatures who compete with us for our food. Other insects can act as our aids in a practice called biological control. These agents depend on insects for their nutrition or may place their young in host insects to feed while developing to the mature adult.

A number of steps can be taken to prevent a pest infestation in any greenhouse. Ultimately, good preventive methods will minimize an increase in pest populations. Many insects live on the underside of leaves where they are protected from high temperatures and close to water and succulent tissue. Often a harmful number of plant-feeders have accumulated before any damage is apparent. A periodic check by flipping over the leaves and actively searching for small insects will reveal exactly who and how many are established in the greenhouse. (Don't be squeamish!) Common pests are aphids, whiteflies, spider mites, thrips, mealy-bugs and pill bugs. A magnifying lens or field glass (10 X) can be used to find immature or nymph stages of most pests, but adult spider mites and thrips are small enough to demand such a lens also.

Identifying an insect can be a challenge but, a few close resources will help. There are good books for the amateur which offer keys, pictures and damaged plant symptoms. (See Insect Control references #1, #3, #5, and #9.) Your county's agricultural extension agent should be able to help identify insects too.

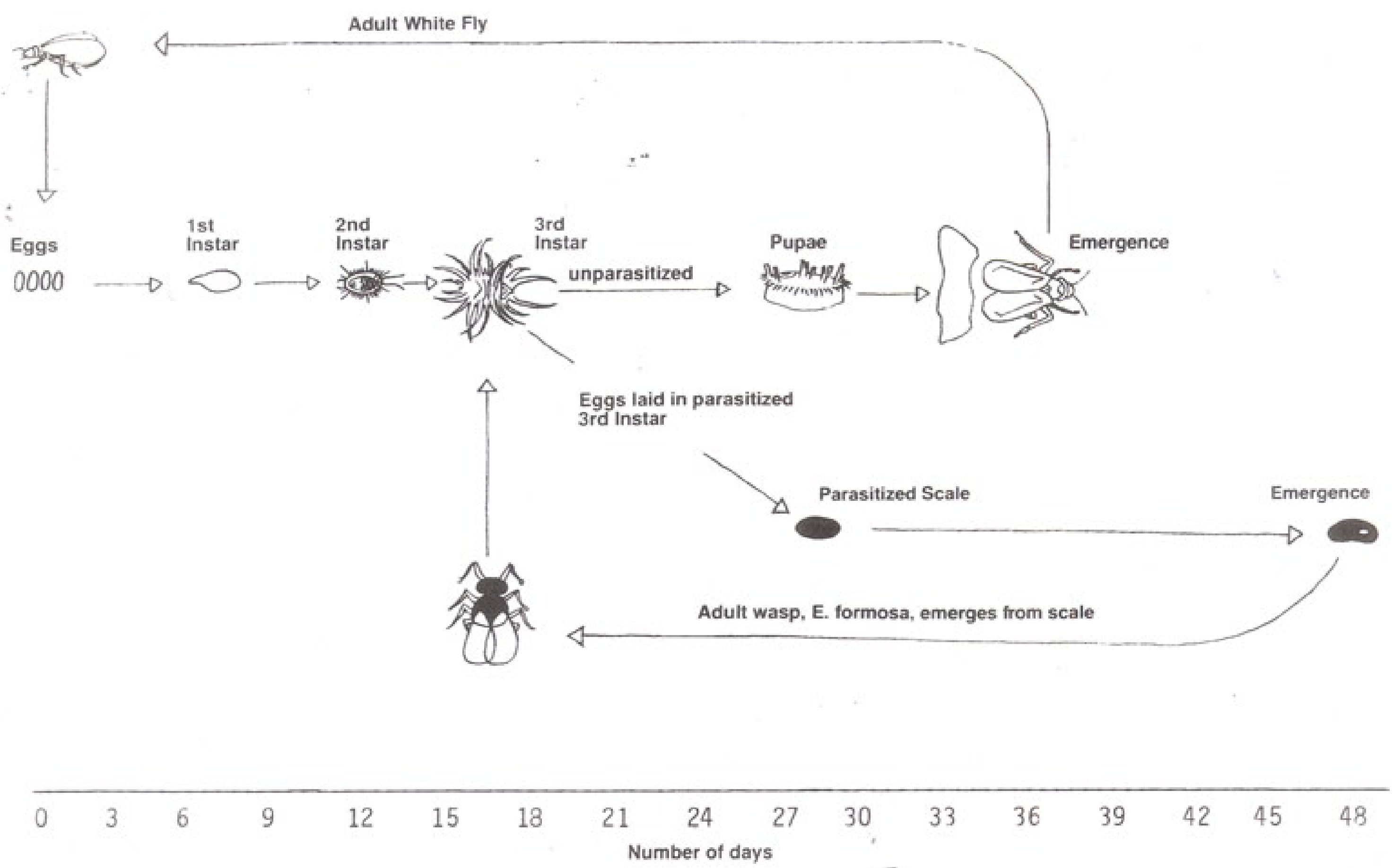
Bug checks should be made once a week or every four days. We pay close attention to young seedlings — their soft tissue is particularly vulnerable to aphid attack. When selecting vegetable varieties, choose disease resistant strains, as the healthier plant has more vigor to ward off the herbivore. Insects are attracted to sick, pale plants. In addition, a well-balanced soil will provide the nutrition for strong plant growth.

Insect Control by Natural Enemies

If pesticides have not been applied to the greenhouse, local beneficial insects will contribute to the control of insect pests. Doors, vents, nooks and crannies become pathways for easy entry. Over the years, many insects have been attracted to the Ark. Numerous components make the bioshelter a reasonable place to stay. Bordering the vegetable beds, flowering plants offer sweet nectar and rich pollen to insects, especially flowers in the carrots, dill, parsnip, mint, basil, pennyroyal family. Ample water, high humidity and warm temperature make it a pleasant place for insects to stay.

Being a soft bodied insect, aphids appeal to both predator and parasite. Generally less than ⅛" (2.5 mm) long, aphids occur in large colonies on young plant growth. *Myzus persicae* (Sulzer), the green peach aphid, is the most common greenhouse pest; fortunately, they have many natural enemies. *Aphidoletes aphidimyza* (Rondoni) is a hungry predator of the green peach aphid adult fly *A. aphidimyza* is an uncolorful predator but the larval stage is bright orange and easily detectable, 1/10" (1-2 mm) long. The orange maggot snags both adults and nymph aphids, preying upon them at a fast rate. *A. aphidimyza* is frequently seen in springtime with their birthrate increasing as daily temperature rises.

Figure 3. The Life Cycle of the White fly *T. Vaporarium* and the parasitic wasp, *E. formosa* (at 75°F)



Syrphid flies are beautiful insects, many resemble bumblebees in appearance and habit. Like the predatory midge, the syrphid larvae feed on aphids, some mealybugs and leafhoppers.
The maggots measure between 1/16 - 1/3″ (1-12 mm) long with a transparent skin over a pointed, eyeless body. Using their mouth "hooks", the syrphid larvae suck out all contents of the aphid and toss off the shell. Often the shell appears like a dust flake on the underside of leaves. At cool temperatures, 65°F and below, the complete life cycle can be two months or more. Summer weather hastens this period to one month. Both syrphid and *A. aphidimyza* larvae can clean up several aphid colonies in a day.

Beside native aphid predators, small parasites will contribute to aphid control. The most familiar are chalcid and braconid wasps, who sting their host and lay one or more eggs in the aphid's body. As the young parasitic wasp develops (only one egg will survive) the aphid shell will remain in perfect tack. These "mummies" may swell a bit and become a metallic yellow, bronze or black, depending on species. The mummy case is the easiest stage to recognize as the adult wasps range between 1/16-1/32″ (0.5 m - 1.5 mm) long. In late spring, summer and fall both *A. matricariae* (Braconid) and *Aphelinus* species (Chalcid) are found throughout the Ark.

In the coolest months, all insects are at their slowest pace. Even though, one aphid parasite thrives in cool, humid conditions and arrives in a very inconspicuous form, a fungus. Aphids attacked by *Entomophthora aphidio* (Hoffman) are a creamy color and velvet texture. After fungi break down the celular structures, the insect dies and the reproductive hyphae push out through the shell. Once the fungus enters the greenhouse environment, the spores of the reproductive conidia will spread to aphids in the dampest areas.

Several other insects and spiders have established themselves in the Ark. Praying manti, ground beetles, and damsel flies are only a few of the insect scavengers. Sporadically, spiders will feed on aphids, whiteflies, and thrips. In combination, these natural enemies lighten the task of pest management and create a healthier growing environment.

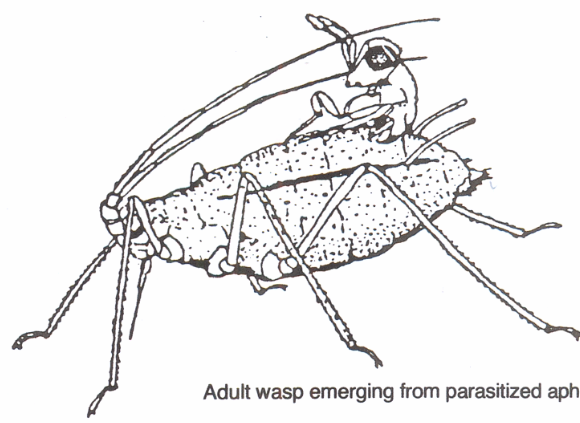
Biological Islands

Most agricultural environments are intrinsically unstable because crops are planted, removed and altered from season to season. This instability can lead to pest outbreaks since biological regulatory mechanisms are usually not well established. An introduction of ladybird beetles (*Hippodamia convergens*) to control aphids is one example. Once the crop is harvested, the predators' nourishment, the aphids, are reduced. Consequently, the ladybird beetle population will drop or become non-existent. We increased the ecological diversity and biological stability in the Ark through the incorporation of aquatic and terrestrial micro-control "islands" throughout the interior. These "islands" include stable perennial plants such as ginger, banana, flowers and herbs, grasses such as bamboo, which are rarely disturbed. They in turn provide continuing habitats for pollinators, predators and parasites of insect pests. They include parasitic wasps, larvae of flies, predatory mites, spiders, frogs and lizards. The small island network, located in the less-than-optimal growing areas, creates a pleasant surrounding and functions as a habitat for organisms which range over crops and protect them.

Specific Beneficial Insects

Several beneficial insects are available from commercial insectaries. (See list of Commercial Insectaries.) Ladybird beetles, praying manti, green lacewings, and Trichogramma are the easiest to attain. A few preliminary steps will optimize the effectiveness of purchased friends. First, order the insects when you foresee a rise in the pest population that may damage crop yield. Use predators and parasites when pest population densities are low. Then before the insects arrive, become acquainted with both friend and foe's life cycles. This will help in recognizing who is in the

first shipment, where the problem areas are to release the insects and how to distinguish immature stages of the second generation. Pay close attention to the time of day and temperature requirements of the new predators and parasites. Since ladybird beetles are diurnal, releasing the adults at dusk will encourage them to rest that night and wake up to their new environment the next morning. The Ark has had successful trials of ladybird beetles, *Hippodania convergens* (Gu'erinmenville), releases in fall and winter months. Since most of the vents are closed at these seasons, the transitory ladybird beetle is forced to stay within the building. By spring, when aphid populations are multiplying, second and third generation ladybird beetles have been established in the bioshelter. *Encarsia formosa* (Gahan) is a specific parasite of the greenhouse whitefly, *Trialeurodes vaporarium* (Westwood). Like many parasitic wasps, *E. formosa* needs warm temperatures for an effective rate of parasitism. For four years, this host-parasite relationship has made a significant contribution to whitefly control. (See *The Journal of The New Alchemists, 6* and *7.)*



Adult wasp emerging from parasitized aphid.

Trapping

Both mechanical and biological traps can be one part of an insect control program. Recently, we began a spring trapping scheme for early emerging whiteflies. Boards painted a yellow-orange and coated with a sticky substance were placed near the growing tips of cucumbers and tomatoes. Whitefly adults were attracted to the boards and snagged by the gooey coating. (See Insect Control reference #11.) Molasses and water in shallow bowls placed at ground level will trap sow bugs, pill bugs, and slugs. Finally, tufts of nasturiums will attract both aphids and whiteflies. The pale green leaves can hold colonies of the pest while surrounding plants are protected.

References for Bioshelter Management

1. *The Complete Book of Greenhouse Gardening.* Ian G. Walls. Quadrangle, New York Times Book Co., 10 East 34th Street, New York, New York 10002. (Commercial orientation.)

2. *Seed-Starters Handbook.* Nancy Bubel. 1978 Rodale Press Inc., Emmaus, Pennsylvania 18049. $10.95.

3. *The Complete Greenhouse Book.* Peter Gregg and Derry Watkins. 1979. Garden Way Publishing. $8.95.

4. *The Greenhouse Environment: The Effect of Environmental Factors on Flower Crops.* John W. Mastalerez. 1977. John Wiley and Sons, New York. (Cut flowers and ornamental production.)

5. *Organic Gardening Under Glass.* George and Katy Abraham. 1978. Rodale Press Inc., Emmaus, Pennsylvania 18049. $9.00.

6. *Greenhouse Grow How.* John H. Pierce. 1977. Plants Alive Books, 5509 1st Avenue, South, Seattle, Washington 98108. $20.00.

7. *Greenhouse Tomatoes - Guidelines for Successful Production.* S.H. Wittwer and S. Honma. 1969. Michigan State University Press, East Lansing, Michigan 48824. $5.75.

8. *Plant Propagation: Principles and Practice.* H.T. Hartman and Dale E. Kester. 1975. Prentice-Hall Inc., New Jersey. $19.95.

9. *Survival Greenhouse - An Eco-System Approach to Home Food Production.* James B. Dekorne. 1975. Walden Foundation, New Mexico. $7.50.

10. *Horticultural Management of Solar Greenhouses in the Northeast.* Miriam Klein. 1980. The Memphremagog Group, P.O. Box 456, Newport, VT 05855. $5.00.

Seed Companies for Greenhouse Culture

1. Johnny's Selected Seeds, Organic Seed and Crop Research, Albion, Maine 04910, USA.

2. Stokes Seeds, Inc., 737 Main Street, Box 548, Buffalo, New York 14240, USA.*

3. Rijk Zwaan, Zaadteelt en Zaadhandel, B.V. De Lier, Holland.*

4. Nichols Garden Nursery, 1190 No. Pacific Hwy., Albany, Oregon 97321, USA.

5. The Graham Center Seed Directory. A gardener's and farmer's guide to sources of traditional, old-timey vegetable, fruit and nut varieties. Cary Fowler. For each copy, send $1.00 to:

   Seed Directory
   Frank Porter Graham Center
   Route 3, Box 95
   Wadesboro, North Carolina 28170, USA

* Indicates good source for greenhouse culture.

Commercial Insectaries

1. Beneficial Biosystems
   1603-A 63rd Street
   Emeryville, California 94608
   Ph.: 415-655-3928

2. Beneficial Insect Co.
   P.O. Box 323
   Brownsville, California 95919

   Ladybird beetles

3. Better Yield Insects
   13310 Riverside Drive E.
   Tecumseh, Ontario
   CANADA N8N 1B2

   Encarsia formosa, parasite of greenhouse whitefly
   Phytoseiulus persimilis, predator of two-spotted red spider mite

   Note: Importation permits are necessary. Ask for Form 526.

   Technical Permit
   Technical Service Staff
   PP&Q APHIS USDA
   Federal Center
   Hyattsville, Maryland 20782

4. Bio Tactics
   22412 Pico Street
   Colton, California 92324

   Predatory mites

5. California Green Lacewings, Inc.
   2521 Webb Avenue
   Alameda, California 94501

   Trichogramma, fly parasites, and green lacewings

6. Fountain Sierra Bug Co.
   P.O. Box 114
   Rough and Ready, California 95975
   Ph.: 916-273-0513

   Ladybird beetles

7. Gothard Inc.
   P.O. Box 320
   Canutrillo, Texas 79835

   Trichogramma

8. King's Natural Pest Control
   P.O. Box 69-G
   Limerick, Pennsylvania 19468

   Ladybird beetles, Trichogramma, and fly parasites

9. Ladybug Sales
   Rt. 1, Box 93A
   Biggs, California 94917

10. Mincemoyer's Nursery
    Rt. 526
    Jackson, New Jersey 08527

11. Norman Evens
    3423 Devin Road
    Grave City, Ohio 43123

    Praying mantis egg cases

12. Pyramid Nursery and Flower Shop
    P.O. Box 7274
    Reno, Nevada 89503

    Green lacewings

13. Rincon-Vitova Insectaries, Inc.
    P.O. Box 95
    Oakview, California 93022
    Ph.: 805-643-5407

    Aphytis melinus, parasite of red scale
    Cryptolaemus montrouzieri, predator of mealybug
    Green lacewings, Trichogramma, predatory mites, fly parasites, and coming soon: *Encarsia formosa*

14. Unique Nursery
    4640 Attawa Avenue
    Sacramento, California 95822
    Ph.: 916-451-9929

    Ladybird beetles, Chinese mantis, green lacewing, Trichogramma and fly parasites

15. Western Bio Control Lab
    P.O. Box 1045
    Tacoma, Washington 98401

16. Bio Control Co.
    10258 Ladybird Drive
    Auburn, California 95603
    Ph.: 916-273-4006

    Ladybird beetles and Chinese mantis

Insect Control in Bioshelter Environments

1. *Windowsill Ecology.* William H. Jordan, Jr. 1977. Rodale Pres Emmaus, Pennsylvania 18049. 229 pp., $8.95.

2. *Theory and Practice of Biological Control.* C.B. Huffaker and B.S. Messenger (Ed.) 1976. Academic Press, Inc., New York, New York. 788 pp., $42.50.

3. *Handbook on Biological Control of Plant Pests,* Vol. 16, No. 3. 1960. Brooklyn Botanical Garden, Brooklyn, New York 97 pp., $2.00.

4. *Organic Plant Protection.* Roger B. Yippsen, Jr. (Ed.) 1976. Rodale Press, Inc., Emmaus, Pennsylvania. 688 pp., $12.95.

5. *Field Guide to the Insects of America North of Mexico.* Donald J. Borror and Richard E. White. 1970. Houghton Mifflin Co., Boston, Massachusetts. 404 pp., $5.95.

6. Alternative methods for control of greenhouse insect pests. R.K. Linquist C. Frost and M.L. Wolgamott. 1979. Ohio Report, 64(1): 12-14 - Jan.-Feb., 1979. Ohio Agricultural Research and Development Center, Wooster, Ohio.

7. *Integrated Pest Management.* Dale R. Bottrell. 1979. Council on Environmental Quality Publication. Stock No. 041-011-00049-1, U.S. Government Printing Office, Washington, D.C. 20402. 120 pp., $4.75.

8. *The Pesticide Book.* George W. Ware. 1978. W.H. Freeman and Co. 197 pp., $10.50.

9. Floriculture insects and related pests — biology and control (Sec. 1). A.S. Gentille and P.T. Scanlon. Floragram, University of Mass., Cooperative Extension Service, USDA, Amherst, Massachusetts.

10. *Biological Control by Natural Enemies.* Paul Debach. 1974. Cambridge University Press, New York, New York 10002. 322 pp., $5.95.

11. Greenhouse whitefly control of an integrated regimen based on adult trapping and nymphal parasitism. R.E. Webb and F.F. Smith. 1979. Published for: 4th Conf. for Biological Control of Glasshouses. 01LB/SROP.