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Management Practices for Veteran Trees

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Title: **A Revision of the Integrated Pest Management Techniques at the Greenhouse**

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Abstract:

The purpose of this project is to review the pest control methods currently in use in the Morris Arboretum Greenhouse. It entails checking on new advancements within the Integrated Pest Management industry and, where possible, improving the efficiency of our methods including scouting, pest identification and best practice for control. It is not a complete overhaul of the practices currently in use, but is meant as a supplement to the Arboretum's existing IPM schedule.

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INTRODUCTION

In the horticulture industry the role of pest management has evolved significantly in recent years. The research done by chemical manufacturers, government agencies and universities has greatly increased the knowledge of the biology and habits of pests. In addition, growers have become more environmentally aware and have sought to restrict their use of chemicals, enabling us to lessen our impact on the environment and reduce any risk to the operators in the field.

The intention of pest management is no longer to eradicate every insect and weed that may be living in our collection; but to maintain a balance that enables us to prevent pests and diseases from causing too much damage. We utilize all of the methods at our disposal including cultural, biological, mechanical and chemical controls. By doing this, we can establish a sense of equilibrium, allowing the plants to grow with maximum vigor and cultivating them to attain their optimal landscape value while minimizing our use of pesticides.

BACKGROUND

The initial steps of the project involved looking at the previous five years of Integrated Pest Management (IPM) records, logging the pests that have infested our collection, and noting the frequency and the severity of attacks. The log was then used to help indicate which potential pests may occur. It allowed us to differentiate between chronic pests and more opportunistic or host-specific organisms. The log also helped us to develop an understanding about when the plants in our care would be more susceptible to attack.

From this research we were able to compile a timetable that indicated pest infestations by what month of the year they occurred. This helped us to monitor the potential for a pest occurring and to anticipate any problems allowing us to deal with them in an efficient and timely manner. (See Appendix 1)

The control of pests and diseases is very difficult in the Greenhouse because of the large variety of woody and herbaceous plants that are grown. At any given time we will have over 5,000 individual plants in a small area. At busy times of the year we have a quick turnover of plants in a relatively short space of time. The plants differ wildly in value, habit, hardiness and the susceptibility for pest infestation.

Pests attack the plants throughout the year; but are most prevalent during the growing season, when the plants are producing soft, succulent growth and environmental factors are favorable to their spreading. This is also true under glass where seasonal differences in temperature and light are less pronounced.

SCOUTING

Scouting is probably the most important step in the pest control process. Nearly all infestations start off as one or two insects and unless there is a tight regimen of scouting it can quickly become a major infestation leading to subsequent losses in the plants' vigor and value. During my tenure at the Morris Arboretum the majority of the scouting was done by the Plant Protection Intern, Joe Ibrahim. However, he would only be in the greenhouse twice a week, so it was essential that everybody who came into contact with the plants knew the telltale signs of infestation and that the channels of communication were open and efficient. Our scouting results would be recorded on weekly report sheets that would be read by Greenhouse Manager, Shelley

Dillard, Joe Ibrahim and myself and would be discussed when deciding a course of action for the pests. (See Appendix 2)

The process of scouting should be a methodical, intensive process. It is an integral part of the day, checking the plants for signs of pests and diseases. Only by looking at the plants every day were we able to notice differences.

To help in the scouting and identification process, I compiled fact sheets listing the pests that have been encountered since our IPM records began. These sheets explain the pest descriptions, lifecycles, damage caused, ways of monitoring, and control methods. The fact sheets will also allow for quick and easy access to information from one source.

The sheets were not meant as an exhaustive, comprehensive list of all the pests that might strike, but more as a brief description of our most common pests and were intended as a quick reference. (See Appendix 3)

The records have been filed into one folder alphabetically and can be updated as the needed.

INSECT PESTS

Throughout the year we experienced a number of insect infestations to the plants in the collection. These varied greatly in their seriousness; from fungus gnats, an insect that was more of an annoyance than seriously threatening, although they can act as vectors for viruses and fungal infections, to mealybug, a chronic pest in the fernery that has never been controlled completely and causes growth distortion and unsightliness to affected specimens.

Many of the pests were fleeting and very host specific, so there was only the likelihood of infestation as long as the host plant was present. One example of this was sycamore lace-bug, an insect that feeds on the leaf veins and causes blotching on the leaves, but with a narrow range of potential hosts, and only deemed a threat to a small percentage of the plants in the greenhouse

However, other pests were a constant struggle to keep in check. One example was greenhouse whitefly. They feed on a wide variety of plants and will re-occur more frequently than most other pests. Scale was another that was in constant evidence. There are thousands of species feeding on a wide range of plant genera and were usually mentioned somewhere in our weekly scouting reports.

Ideally it would be advisable to have an area where we could quarantine any incoming and infested plants. This would allow us to keep any outbreaks extremely localized and deal with any situations before it becomes a serious problem; unfortunately because of space restrictions this is not possible.

DISEASES

Disease control is another significant part of the IPM schedule at the Greenhouse. Although outbreaks are relatively uncommon when they do occur they can significantly weaken the plants leaving them prone to insect attacks. The diseases commonly found include mildews, bacterial leaf scorch and damping off. Most of the diseases can be eliminated by good cultural practices. Damping off will only occur when young seedlings are left too wet and rot. By reducing the amount and frequency of watering, the disease can easily be eradicated. The prime conditions for mildews to attack plants are cool, damp conditions with poor air circulation. To prevent mildews from occurring, it may be necessary to open the vents, have the heating on and have the fans running to circulate the air within the Greenhouse. With bacterial leaf scorch there is little that can be done, but it is advisable to try to bolster the vigor of the tree pruning out any

affected areas if the disease is not too serious. Reducing any possible water stress will also help the tree to combat the disease.

WEEDS

Weeds also contribute to the pest problems found in the Greenhouse. They are quite often used as alternative hosts by pests, making our efforts to control them much more difficult. Although there are not a large number of weed species in the Greenhouse area, we do have the same weeds growing in different conditions and this has to be taken into consideration when treating them.

Weed treatment outside is the easiest problem to solve. The weeds only emerge during the growing season, a time of the year that the majority of my working week is spent outside watering. If there is a concentration of weeds at any one spot, they can easily be pulled out by hand. Alternatively, if the area is too large then they can be sprayed with a glyphosate/pre-emergent (Round-Up/Confront) mixture to kill the present weeds and put down a barrier to help prevent the germination of any seeds that may be present in the soil.

Indoors this becomes more of a problem as the use of Round-Up may become volatile and end up damaging some of the plants in the collection. Our options then include hand pulling or a herbicide such as fatty acids or concentrated vinegar and lemon juice. These chemicals are not as effective as the Glyphosate, because they only burn the part of the plant that they come into contact with, leaving the root system intact and allowing the weed to re-emerge, although with repeated sprayings it is possible to exhaust their photosynthetic reserves. When using Burn Off (the vinegar/lemon juice herbicide) the main drawback is the effect that it has on the operator. Although harmless it should be applied with the operator using suitable engineering controls, to prevent irritation to eyes and throat.

Weeds do not just exist in the ground around pots of course, but are also present in many of the pots themselves. Their proximity to the specimen plants makes the use of an herbicide extremely risky, especially if applying to a large number of pots. We therefore had to find more creative ways to deal with these weeds.

To this end we found a company that produces fabric weave barriers that will help prevent the emergence of weeds around our plants. Studies conducted by Cornell University showed that Geodisc® prevented the emergence of over 98% of weeds on the ornamental hardy nursery stock they tested. However because we do not deal in the numbers that commercial producers do, there might be a problem with the numbers involved. If we wanted to follow this idea up we might want to combine with other local arboreta.

MSDS AND SAMPLE LABELS

Although there are a number of pesticides kept in the pesticide room, we had no Material Safety Data Sheets (MSDS) readily available for them. The MSDSs were kept downstairs and referred to the chemicals stored there, which are almost exclusively herbicides. These sheets list the active ingredients of the chemicals, their toxicity levels, advice on how to store them and instructions in case of emergencies.

We listed all the chemicals used in the Greenhouse, including herbicides, insecticides, fungicides, and insect growth regulators and compiled the MSDS alphabetically for ease of reference. We also included the product labels for all the chemicals. These list the ingredients, the engineering controls required to apply the chemicals and the dosage that is required when spraying. Additionally we have also kept all other relevant documents and articles that were in the Pest Control Binders, putting them into some sort of order, listing them either by chemical or by the pest that they are effective against. The sheets will help to ensure that all chemicals used are done so in a safe and effective manner.

CONCLUSION

The importance of Integrated Pest Management will increase at the Morris Arboretum as we continue to explore other methods of control rather than relying on the use of chemicals. The working methods should be constantly re-evaluated with new skills and attitudes that increase the efficiency of our efforts while minimizing the detrimental effects that chemicals have on the environment.

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INTERNET RESOURCES

http://www.attra.ncat.org/

http://www.agnr.umd.edu

http://www.hort.uconn.edu/ipm/

http://www.nysipm.cornell.edu/

http://www.ippc.orst.edu/cicp/

Appendix 1

January

Bagworm cases (containing over-wintering eggs) can be removed

February

Spray dormant oil

March

Aphids will become more active in the spring
Sycamore lacebug activity

April

Watch for emergence of **rust mites** throughout spring

May

Leafminers lay their eggs starting in Late May
Treat **spider mites**
Spray **Euonymous scale crawlers** in Late May
Spray affected Box Elders if they have shown signs of **box elder bug** infestation.
Check for **lace bug** infestation, esp. on *Platanus*, *Ribes*, *Forsythia*, *Rhus*, and *Viburnum*

June

Leafminers lay their eggs
Japanese beetles are active in late June
Spray **caterpillars** when they are small early in the month
Treat **spider mites**
Spray **Euonymous scale crawlers**
Cottony maple scale crawlers emerge mid June

July

Leafminers lay their eggs
Japanese Beetles are active
Spider Mites

August

Check for **Spider mite** damage

September

Treat **spider mites**
Look for all stages of **box elder bug** clustered on the bark.
Rust Mites may re-emerge

October

Spray Enstar II in the fernery for **mealybug**

November

December

Look into getting bio-controls

Appendix 2

Morris Arboretum Greenhouse Pest Scouting Form

Scout: Joseph Ibrahim Date: January 5, 2004

Areas Checked: Room A x B x C x D Hoophouse 1 2 3

Pit House x Fernery x Medicinal House x Cold Frame

Area	Comments (Including Sticky card and indicator plant count)
A	- *Actinopteris* – dying, dead.
B	- Scale on *Gladiolus tristis* - *Coloacasia* margin leaf scorch spot. - Mottling and ants on *Albizia*, unknown cause. - Whitefly on sticky card.
C	- White fly sighted around hollyhock seedlings – *Order *Encarsia* - White fly casings on *Setaria palmifolia* - Mealybug on *Ficus* seedlings
D	- Mealybug on several coleus and *guynura* - Scale on *Schefflera*
Medicinal	- *Skimmia japonica* 2000-201-scale (white peach or prunicola scale) - Few soft bodied scale on *Camellia* Plants. - Scale on *Cephalotaxus sinensis* and *Taxus* - Scale on *Neolitsea sericea* – 2002x147, 2002-084

Pit House - Clean.

Fernery - Scale and mealybug on *Phymatosorus scolopendria* on right of upper walk.

- Scale on *Polystichum polyblepharum* at base of upper walk.
- Mealybug on *Pteris cretica* – all appear to have hotspots of mealybug especially around pond.
- Scale !! on *Adiantum raddianum* on top of outer cave under the roof crank wheel.
- Mealy bug on *Cyathea cooperi* next to bridge.
- Hotspots of scale in the grotto on *Cryptomium falcatum*
- Scale on *Sadleria cyntheodies* 'Ama U'

Appendix 3

Sample Page from Pest Description

Fungus Gnats

They were originally thought of to be just a nuisance in the greenhouse, but have since been shown to cause direct feeding damage to crops and are increasingly thought of as serious pests.

Description

Adults are small mosquito like insects with long legs and antennae. The two wings are clear with a Y-shaped vein in the wing pattern. They are attracted to fungi and are often seen in dying plants that have *Botrytis* sporulation. The females lay the larvae close to the fungal food source. The larvae are translucent, milky white with an obvious black head capsule.

Feeding damage

They are most damaging to seedlings, cuttings and young plants, as a result of the larvae feeding on the tender young roots they can provide an entrance for other pathogens, they can also feed on the developing callus of direct-stuck cuttings thereby delaying rooting. They have also been shown to carry *Pythium, Botrytis, Verticillium* and *Fusarium*, although it has not been noted how effective they are as vectors for these fungal diseases.

Life Cycle

The life cycle may be completed in as little as 3-4 weeks, depending on the temperature. Eggs are laid on the surface of the growing media in cracks and crevices, maturing in 4-6 days, the larvae feed and develop for around 2 weeks, before pupation occurs, after 4-5 days the adults emerge, overlapping and continuous generations make control difficult.

Biological Controls

Bacillus thuringiensis var. *israelensis* sold under the name of Gnatrol is most effective while the young larvae are actively feeding as they must ingest the bacteria for it to be effective.

A small, soil-dwelling predatory mite, *Hyoaspis miles*, feeds on the fungus gnat larvae. They perform best when gnat populations are low. We used them in late January as they also are effective against spider mites.

Using a combination of yellow sticky cards to trap the adults and inserting potatoes into the growing media to attract the soil dwelling maggots was reasonably successful on the *Amaryllis* that we gave out for Christmas 2003.

Chemical controls

Insect Growth Regulators are most effective against the young developing larvae, the one we use being Enstar II.