In contrast, growers reported several instances in which the fruit of 'Nova' on rough lemon dried out and became unsalable before it colored sufficiently. It is possible that 'Nova' will not dry out as rapidly when the trees get older but there seems little reason to use stocks like rough lemon when an excellent one like 'Cleopatra' mandarin is available.

**Miscellaneous**. Some general characteristics of 'Nova' groves and production practices are presented as general information that may have utility in making decisions regarding the development of 'Nova' plantings and the production practices used:
1. Plantings ranged in size from 3 to 117 acres (1.2 to 47.4 ha) and 90% were under 30 acres (12.2 ha) or less.
2. Average yield was about 2.5 boxes per tree with individual plantings ranging from 0 to 5 boxes per tree.
3. Dates of harvest ranged from September 15 to December 20 with most in October and November.
4. About 42% of the growers used ethephon to color fruit on the tree with good, moderate and poor results.
5. No GA was reported used in 1975 but it had been used in previous years with good to poor results.
6. Approximately 68% of all 'Nova' plantings were irrigated during 1975 with systems that included sprinklers and traveling guns.

**Literature Cited**


**THE CASE FOR BIOLOGICAL CONTROL OF LANTANA IN FLORIDA CITRUS GROVES**

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**Abstract.** Lantana (Lantana camara L.) is a serious pest in Florida citrus groves, especially in the Indian River area. Research in Hawaii and Australia and recent work in Brazil shows that a number of host-specific insects are available for use in biological control of lantana. Efforts to introduce some of these insects into Florida are opposed by nurserymen who consider lantana a valuable ornamental. Unless this conflict of interest is resolved, further efforts for biological control of lantana in Florida will have to be abandoned.

Lantana camara L. is a native plant which occurs from southern United States southward through Central and South America to northern Chile and Argentina. It has been introduced into other parts of the world as an ornamental and it is now a serious problem in Hawaii, Fiji, Australia, Kenya, Zanzibar, South Africa and India (1). Typical of pests which are introduced without their natural enemies, lantana spread rapidly into all suitable areas. It is especially troublesome on range land where it forms im-

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in 1902. To date, more than 25 insects have been introduced into Hawaii and control of lantana has been complete in some areas, partial in others, and unsatisfactory in others (1). This is due in large part to the wide range of habitats that lantana occupies in Hawaii. Currently, Australia is very active in pursuing insects as biological control agents against lantana and other weeds. The CSIRO operates a research station in Curitiba, Brazil specifically to survey for and evaluate potential of lantana enemies for possible introduction into areas of Australia where lantana is still a problem.

Introduction of an insect into the United States for biological control of weeds is normally a long and involved process. The initial step is foreign exploration in the native home of the pest plant. The insects are studied and evaluated for their potential as control agents. The host specificity of each insect must be determined (9). An insect must have a limited range of hosts to be considered for introduction and an insect which will feed only on the target species is usually the most desirable. Host preferences are determined by confining insects either on the test plant alone (starvation tests) or in multiple choice tests where there are a number of plant species available for feeding and/or oviposition. Under conditions of the starvation test, some insects will feed on and sometimes oviposit on plants that they would never attack in nature. It takes about one scientific man-year and $40,000 to clear one insect for introduction (5). Since most scientists have several projects underway at any one time and each may involve one to many insects, the results of this type research are usually slow to reach fruition. Even after an insect is tested, it must be approved for release, first by a state committee and then by the Federal Committee on Biological Control of Weeds (6). This procedure may take months before a decision is obtained. Once the insect is released, the time required for the insect to become established and build up sufficient populations to effectively control the weed may take 5-10 years. This is extremely discouraging considering the need for an immediate solution to the problem. However, once an effective biological control agent is established, it will continue to exert pressure on the weed and provide reasonable control continuously without further investment of time or money.

Fortunately, since so much work has been done in Australia and Hawaii, Florida can take advantage of this information and proceed at a much more rapid pace. Not only have the most promising insects been evaluated and tested for host specificity, but since many were released, their effectiveness can be measured and we can profit from their many years of research and experience. Personnel in both Hawaii (Harry Hakao, personal communication) and Australia (K. L. S. Harley, personal communication) have recommended the same 2 insects as being highly effective and suitable for use in Florida. Both insects *Uroplata girardi* Pic and *Octotoma scabripennis* Guerin are chrysomelid beetles which are leaf-miners in the larval stage. Both insects have been thoroughly tested and found to be host specific (3). These insects have had a serious impact on lantana in Australia and are eliminating lantana in some areas (4). Dr. Harley has offered to send beetles in quantity to Florida either for direct release or further propagation in the quarantine facilities.

Application for a permit to introduce these 2 insects into Florida was submitted by me to the Florida Department of Agriculture and Consumer Services in February, 1976. It was denied because of opposition by a group of concerned nurserymen who consider lantana to be a valuable ornamental plant. How can this conflict of interest be resolved? One approach is to compare the economics of the situation. The cost of lantana to citrus growers can be roughly estimated by multiplying the number of infested acres, 105,000, by $25, a conservative estimate of the cost of chemically or physically removing the lantana from the groves. This gives us a figure of $2,625,000 cost to the citrus growers. On the other hand, a gallon container of lantana sells for about $2.50 retail. If we could estimate the number of containers sold, we would then have a rough value of lantana as a nursery item in the trade. Some value must also be added for the numerous plants used in landscaping in yards, parks, etc. We probably should also add the cost of treating lantana to keep it healthy if the beetles are ever introduced. However, this may not be legitimate since lantana is already attacked by numerous insects and should be treated periodically to keep it looking healthy. If we obtain approval to introduce these insects, we should also run tests to determine how the beetles can be controlled so that anyone who wishes to continue growing lantana as an ornamental can effectively treat his plants.

In summary, there are promising insects which can be obtained quickly and utilized in Florida for control of lantana in citrus groves. The cost would be minimal and there is sufficient evidence to indicate that it could at least provide partial control on a continuing basis. However, the nursery growers consider lantana to be a valuable ornamental despite its poisonous properties and the other equally or more desirable plants available as substitutes. If the conflict of interest between the nursery industry and citrus growers cannot be resolved, then permission will never be granted to introduce the insects and we should look elsewhere for ways to control lantana.

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