# TREE NOTES

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

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# Managing Elm Leaf Beetle


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## *Introduction*

The elm leaf beetle (ELB), *Xanthogaleruca luteola* (Muller) is one of the most serious pests of elms throughout California and the United States. The larvae and adults feed on leaves, often defoliating entire trees. Repeated defoliation leads to reduced growth or dieback. ELB was accidentally introduced into this country from Europe in the 1830s and now exists wherever elms are native or have been planted. All species of elms and the closely related *Zelkova serrata* are susceptible. In California, ELB prefers the Siberian elm (*Ulmus pumila)*, and varieties of the European elm: English elm (*U. procera*), and Scots elm (*U. glabra*).

## *Symptoms Of ELB Infestation*

Irregularly shaped holes in the expanding leaves early in the spring confirm the presence of ELB. Numerous holes indicate a large and potentially damaging population. Later, brown patches appear on the undersides of leaves as the developing larvae begin to feed. Damage may be restricted to only a few scattered leaves or spread uniformly throughout the canopy. Elm leaf beetle injury varies by location and from year to year. Heavy feeding injury results in serious defoliation and leaf drop. A second flush of leaves commonly produced by defoliated elms is often destroyed as well.

Repeated defoliation depletes the tree's energy reserves, reducing growth and predisposing it to other insect and disease pests. Elms and zelkovas that have withstood severe, consecutive annual defoliation sustain reduced growth and dieback.

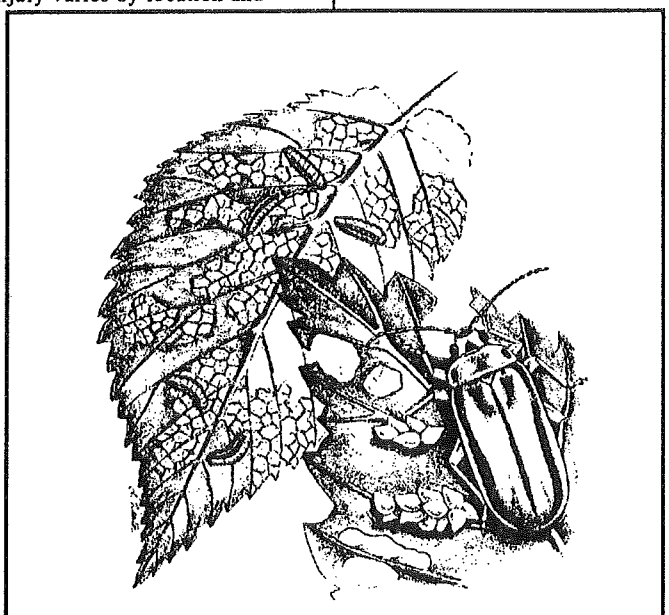
## *Description Of Life Stages*

Adult beetles are five to eight mm long, and lime to olive-green. Each wing cover (elytra)has a black line along the outside margin and a narrow black line along the inside edge where the two elytra meet.

The eggs are laid on end in clusters of 5 to 25 on the undersides of elm leaves. They are yellow-orange, spindle shaped and about one mm long.

The larvae (grubs) are black and worm-like shortly after hatching. When full grown, the grubs are 10 to 12 mm long, yellow-green with a black stripe along each side.

The dull yellow pupae are about five mm long and crescent shaped with many minute, black, spine-bearing tubercles (bumps).



**Elm leaf beetle adult, larvae, and eggs**

## *ELB Life Cycle*

Adult beetles overwinter in protected places, often invading homes and outbuildings in great numbers. They can become a nuisance indoors as they seek shelter for the winter and again as they exit the following year. Overwintering adults emerge in the spring and fly to elm trees to feed and mate. Their feeding produces irregularly shaped holes in the leaves. After mating, the females lay up to 300 eggs in small clusters on the undersides of the leaves. The adults die shortly thereafter. Within a few days the eggs hatch and small, black grub-like larvae emerge and begin feeding on the undersides of the leaves. They chew part way through the leaves leaving the upper surfaces and leaf veins intact, giving the leaves a characteristic lacy, skeletonized appearance. Badly damaged leaves turn brown and drop prematurely.

The larvae feed and grow for three to five weeks, passing through three larval instars (stages) before migrating down the tree to pupate (become adults) in lower branch crotches, in bark crevices along the lower trunk and on the ground near the trunk. Some larvae, however, drop from the tree, avoiding contact with the trunk. Adults emerge seven to fourteen days later, and crawl or fly back to the same tree or to neighboring trees to repeat the life cycle. Beetles emerging in the late summer or fall seek out overwintering sites. In coastal Northern California, ELB typically produces two generations a year. In the warm, inland areas three to five generations may develop.

## *Control Strategies*

BANDING - A relatively safe and economical method to reduce ELB damage when the pest population is low to moderate, is to apply a two to three foot band of insecticide (one percent solution of sprayable carbaryl) around the trunk of the tree, eight to ten feet above the ground. Spray all branch crotches within reach as well. Apply the spray solution before the larvae migrate down the tree to pupate (mid to late June, earlier in warmer areas). In this manner, the larvae that contact the insecticidal band are killed. Although this method does not prevent leaf damage from the spring generation, it can reduce further injury. Several low toxicity pesticides (see below) are available to supplement banding to minimize damage. Bark banding alone will not provide satisfactory control in all situations. Little or no control should be expected during the first year of banding of European elms. However, treatment over several consecutive years can provide control after the first application. By comparison, banding of Siberian elms appears to provide good control during the first season of treatment (Dreistadt, et. al. 1991). The magnitude of injury reduction appears to be related to the proximity of untreated elms and yearly fluctuations in ELB populations. (Costello, et. al., 1990). Unless adjacent elms are treated, banding is generally ineffective due to reinfestation. Success is largely dependent on neighborhood or community-wide participation.

FOLIAR SPRAYS - The foliar application of Carbaryl is an effective means of controlling ELB, but it is also environmentally hazardous and disruptive to natural control. To be effective, it is important to spray after the eggs have been laid (early to late May, later in cooler areas) so that this short-lived pesticide can act on the emerging larvae. It is particularly important to spray the undersides of the foliage because ELB larvae and adults feed predominantly there. Other pesticides are also registered for ELB control, e.g., Chlorpyrifos and certain synthetic pyrethroids, e.g., Fluvalinate, Cyfluthrin. Successful treatment of large

elms requires professional training and equipment. Contact a pest control advisor for assistance.

The eggs and developing larvae can also be killed by using a relatively non-toxic horticultural oil or insecticidal soap. Coverage, however, is important, because these pesticides do not leave a residual. As a result, several applications may be necessary.

A non toxic biological insecticide is now available for the control of ELB. It is safe for mammals, birds, fish and beneficial insects. The active ingredient, *Bacillus thuringiensis var. tenebrionus*, has shown promise in the control of ELB. However, manufacturers' products vary in their effectiveness, and BT products registered for moth and butterfly larvae and mosquitoes are useless against ELB. To be effective, foliage must be thoroughly sprayed with BT during dry weather when the larvae are first seen. Timing of application is especially critical when using BT because the early larval instars are most susceptible and the active ingredient lacks persistence. Several applications may be necessary because BT breaks down in several days and because only a portion of the beetle population is in the susceptible early larval stage at any one time.

TIMING OF SPRAY APPLICATION (BANDING AND FOLIAR) - ELB control efforts in Northern California can be more effectively timed using temperature monitoring (Dreistadt, et. al., 1991), because insect development is dependent on temperature. The threshold temperature for feeding and development of ELB is 52º F (Dreistadt, et. al., 1991) Temperatures above this figure are recorded in degree days. Degree days are estimated for each day by subtracting 52º F from the average daily temperature (maximum minus minimum divided by two). When the number of degree days approaches 700, peak development of the first and second instar larvae is occurring (Dreistadt, et. al., 1991). This is the optimal time to apply foliar sprays as well as to band. Inspect the foliage regularly to confirm the need for and exact timing of treatment. Temperature data is available through the statewide University of California IPM Computer System (IMPACT). Contact the IPM Implementation Group at U. C. Davis.

INJECTION - Systemic insecticides injected into elms have been used with some success to control ELB infestations. There are, however, several drawbacks with this technique, 1) protection is short-lived and treated trees are quickly reinfected, 2) holes made for injection damage the tree, making repeated treatments impractical. Dicrotophos (Bidrin), once used for injection, is no longer registered for this use.

NATURAL CONTROL - Natural control is a more promising pest management option because once established, it is usually permanent, effective, economical and environmentally safe. University of California researchers have released several natural enemies of ELB in selected locations throughout California. Although effective, these parasites (parasitoids) have not been able to overwinter in most areas. Annual inundative spring releases might be effective means to overcome this obstacle. Other species, strains or biotypes may also prove more successful. While natural control alone does not provide satisfactory control, pest management is more effective if the natural enemies are conserved by using safer pesticides and less disruptive application methods.

## *Integrated Pest Management*

Pests such as ELB play a secondary role in the dieback and decline of trees. Environmental stress, site disturbance, increasing age and mechanical injury are the primary inciting factors which reduce vigor, predisposing trees to the impacts of insects and pathogens. While it is important to reduce ELB damage, pest management alone will not improve tree health, alleviate environmental stress or improve growing conditions. A more comprehensive (integrated) pest management approach is needed. By definition, integrated pest management (IPM) implies the use of all control options: biological (natural enemies); cultural (improved tree care); physical (hand picking, hosing off, pruning out, etc.) and chemical (pesticides, oils, soaps, biological pesticides). The key to IPM is to monitor pest populations regularly and to act when pests threaten to cause unacceptable damage. The most effective, long term and least toxic methods are emphasized.

Normal tree growth and health are best ensured by creating/restoring and maintaining favorable growing conditions throughout the life of the tree. A comprehensive tree health program should include:

- PRUNING: minimal thinning, shaping, structural improvement, and removal of dead, diseased and hazardous branches. To minimize the spread of Dutch elm disease, avoid pruning from April through October and dispose of all prunings and cut elm wood.
- IRRIGATION: watering to avoid drought stress. Water deeply, two to three times during the summer. Trees whose roots have been cut during construction are at particular risk of drought stress.
- MULCHING: add two to four inches of organic mulch to the soil surface below the tree's canopy.
- FERTILIZATION: Nitrogen and potassium deficiency may occur around trees where the leaves are regularly removed, disrupting mineral recycling. Fertilize mature trees every two to three years with organic or slow release formulations.
- MAINTENANCE OF FAVORABLE GROWING CONDITIONS: avoid soil compaction, over-fertilization, excess moisture (soggy soil), turf and extensive landscaping under the canopy.
- PROTECTION FROM INJURIES: sub-standard pruning (flush cuts and stubbed branches), excavation within the drip line (periphery of foliage), grade change, girdling wires, bark injuries, root pruning, trunk injections, etc.
- REDUCTION OF HAZARD POTENTIAL: have a Certified Arborist (Western Chapter of the International Society of America) evaluate the tree(s) for potential structural failure. Structural pruning, cabling, bolting, propping and/or removal may be warranted.

Consult a Certified Arborist to help develop and implement a tree health program. The above pesticide recommendations are current; however, future Federal and State regulations may prevent the use of certain pesticides. Call your county Agricultural Commissioner to verify that the recommended pesticide use is permitted and/or to obtain more detailed information. Always read and follow all precautions and safety recommendations on pesticide container labels.

## *Dutch Elm Disease*

Dutch elm disease is perhaps the greatest threat to the health of your elms. You can minimize its spread through improved tree care and sanitation, e. g., prompt detection and removal of diseased elms and proper disposal of all elm wood including prunings (tarping or landfill). Call your County Agricultural Commissioner or your local University of California Cooperative Extension Office for information on Dutch elm disease.

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