Pheromone traps to suppress populations of the smaller European elm bark beetle

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Dutch elm disease (DED) has devastated elm populations throughout large portions of the eastern and midwestern United States. This disease has gradually spread westward since its accidental introduction from Europe into North America in 1930. First discovered in California in Sonoma County in August, 1975, DED is a threat to elm populations throughout the state. The California Department of Food and Agriculture is committed to exploring the feasibility of eradicating the disease before it spreads from its initial infection sites.

The principal vector for the DED pathogen, *Ceratocystis ulmi*, is the smaller European elm bark beetle (SEEBB), *Scolytus multistriatus*. The beetles, known since 1951 to occur in California, reproduce in dead or dying elm wood. If the DED fungus is sporulating beneath the bark of this brood material, emerging beetles are capable of transmitting the disease to healthy trees. The fungus spores gain entry into these trees via feeding wounds created when beetles feed in the twig crotches.

Feeding that occurs in the spring or early summer results in general infections because the spores can be quickly carried to all parts of a tree by the long xylem vessels of the springwood. Feeding that takes place in twig crotches one year and older does not result in general infections because the spring vessels do not extend into older wood. Consequently, trees that become infected in the spring or early summer usually die quickly, whereas those infected in late summer are much less affected.

The American elm, *Ulmus americana*, is particularly susceptible to the disease. First symptoms of the disease appear as wilted leaves on one or more branches. Wilted leaves then turn yellow or brown and fall prematurely.

Using the aggregation pheromone *(multilure)* of SEEBB as a bait, sticky card traps can be used to kill large numbers of this beetle. With the support of the California Department of Food and Agriculture, we have been conducting a study to determine the efficacy of a pheromone based trap-out strategy to reduce the size of isolated populations of SEEBB in eastern California. If successful, this strategy would provide an environmentally acceptable method for suppressing beetle populations and could, therefore, conceivably become an integral part of DED control programs.

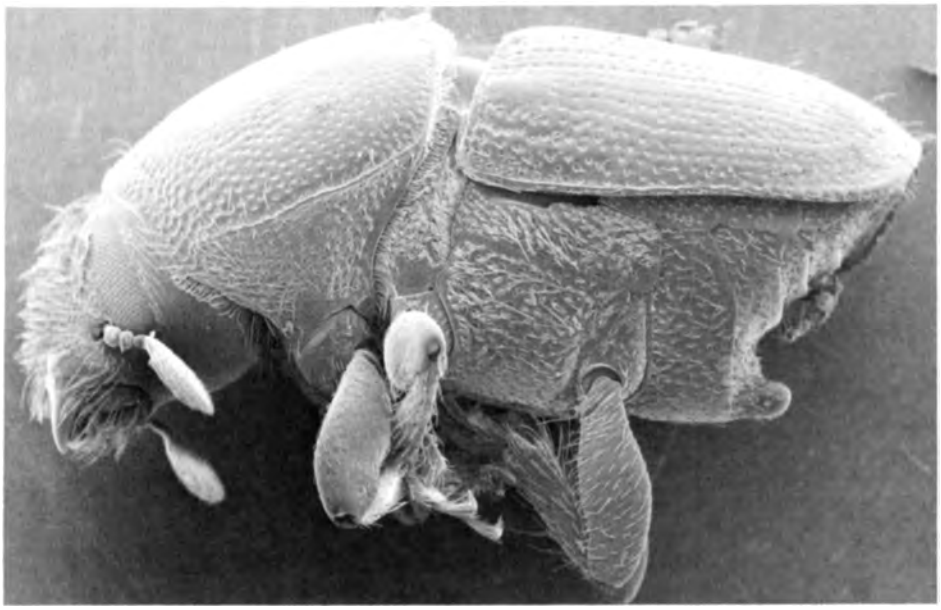

Fig. 1. Smaller European elm bark beetle, 2 to 4 mm long. (Scanning electron microscope picture)

Procedure

The Owens Valley of eastern California was selected as a study area because it is isolated and not known to harbor DED. We chose to work in the towns of Lone Pine, Independence, and Big Pine, each separated from one another by at least 15 miles of open, high elevation desert, and each containing a SEEBB population and a moderate number of elms (300 to 500).

The trap consists of an 18 x 26 inch piece of white cardboard coated on each side with a thin plastic film. Each trap is securely stapled to a utility pole about 10 feet above ground. Stickem Special is applied to the glossy surface of the paper with a paint roller and a pheromone bait is stapled onto the center of the trap. Flying beetles attracted by the pheromone are entangled as soon as they contact the Stickem.

In 1976, field studies were conducted from May 26 to October 27 to evaluate three different patterns of trap deployment; two different bait delivery systems (Conrel and Hercon); directionality of trap placement; and the effectiveness of using alternate single and double area traps to collect beetles. Alternated single and double traps were deployed around the perimeter of Lone Pine (all facing toward the center of town).

A grid pattern throughout Independence compared the two bait formulations, and in Big Pine directionality of single trap placement was compared in four lines (each with six single traps facing a different cardinal direction). Traps were also placed between the towns and in outlying areas to monitor beetle dispersal. Although both bait types release pheromone for 80+ days, traps and baits were replaced at about 50-day intervals, giving three main trapping periods during the summer. After removal from the poles, traps were placed

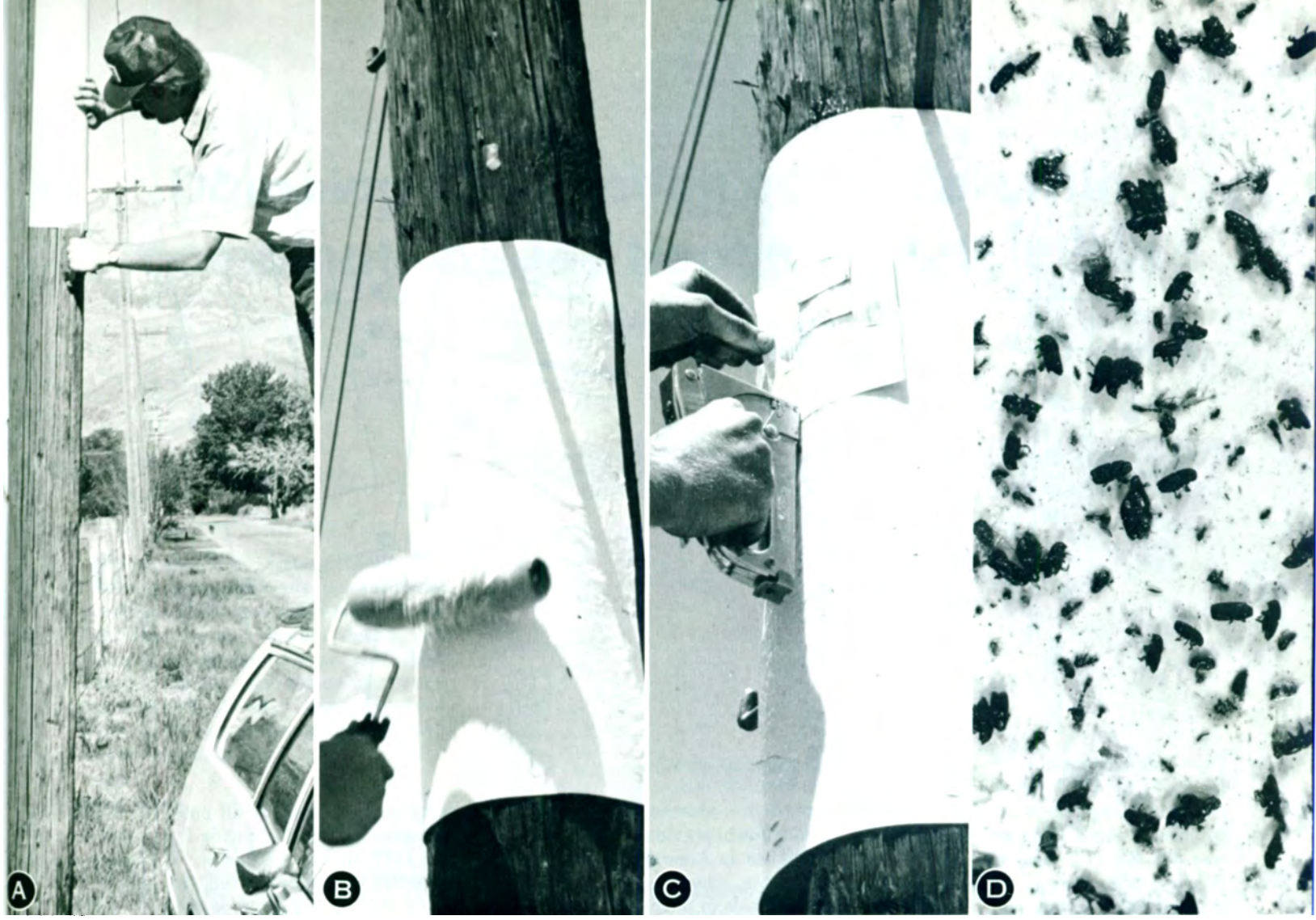

Fig. 2. *A.* Fastening trap to utility pole; *B.* Coating with Stickem; *C.* Stapling multilure bait to center of trap; *D.* SEEB on trap after 50 days.

Catches of Smaller European Elm Bark Beetle Adults Compared by Town and Trapping Period, Owens Valley, 1976

Town	No. of traps	Av. no. caught/trap	Total catch	Av. no. caught/ trap/day	% of total catch
Lone Pine					
May 26—Jul 13 (48)*	34	4,195	142,631	87	44.2
Jul 13—Aug 31 (49)	34	3,568	121,313	73	37.5
Aug 31—Oct 26 (56)	34	1,739	59,115	31	18.3
		total	323,059		
Independence					
May 27—Jul 14 (48)	52	1,503	78,170	31	34.9
Jul 14—Sep 1 (49)	52	1,927	100,179	39	44.8
Sep 1—Oct 27 (56)	52	872	45,357	16	20.3
		total	223,706		
Big Pine					
May 27—Jul 15 (49)	24	944	23,859	20	48.5
Jul 15—Sep 1 (48)	24	819	19,655	17	39.9
Sep 1—Oct 27 (56)	24	238	5,715	4	11.6
		total	49,229		
Trapping period					
First period (48)	110	2,224	244,660	46	41.0
Second period (49)	110	2,192	241,147	45	40.5
Third period (56)	110	1,002	110,187	18	18.5
May 26—Oct 27 (153)†	110	5,418	595,994	35	—

*Number of days in interval
†Entire trapping period

in plastic bags and transported to the laboratory where beetle counts were made.

Results and discussion

The table presents the total trap catch by trapping interval for each of the three towns. About 600,000 beetles were caught by the town traps during the 153-day trapping period with an overall average of about 35 beetles per trap per day. In all towns, the catch during the first two trapping periods (late May to early September) accounted for 80 percent or more of the total catch. The Lone Pine traps caught more beetles per trap than those in the other towns.

Double traps and the Conrel baits appeared to be slightly more attractive to SEEBB than single traps and the Hercon baits, respectively. Beetle counts on traps between towns and in outlying areas ranged from 0 to 333 during the

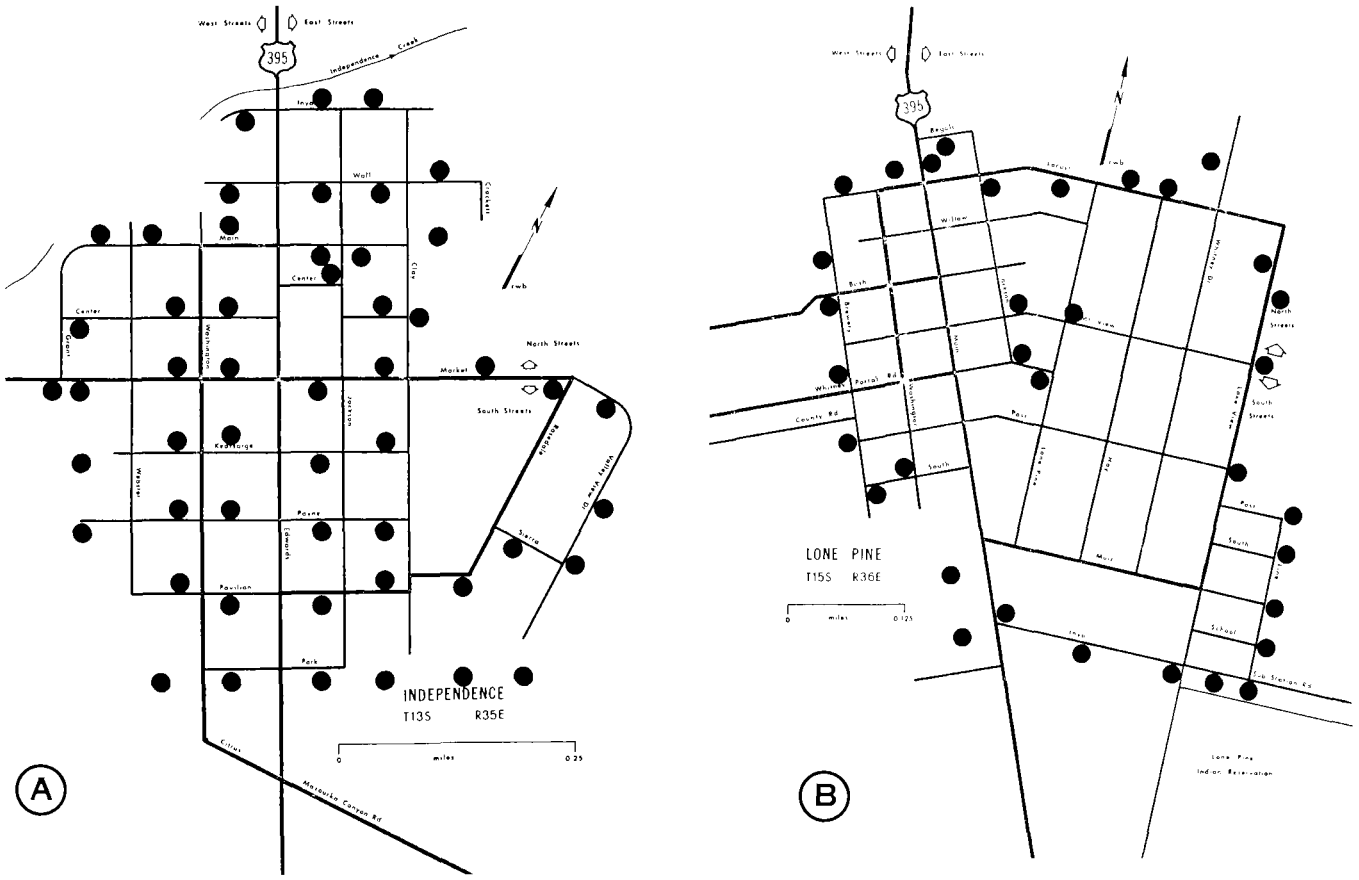

Fig. 3. Trap deployment: *A.* Grid in Independence; *B.* Perimeter in Lone Pine.

entire trapping period, with the highest catches on those traps along U.S. Highway 395. Some of these traps were five or more miles from any known elm, indicating that beetles may disperse far greater distances than previously thought.

In order to correlate the number of trapped beetles with the size of the local beetle population, a survey for brood material was attempted. All the elms in Independence (441 trees above 10 cm dbh) and Lone Pine (346 trees) were mapped. Some dead branches sampled from these trees contained live larvae of SEEBB: many others, particularly in Independence, showed evidence of brood production in previous years. A survey of woodpiles in Lone Pine indicated that four piles, which contained elm wood, were capable of producing 248,000 beetles, compared with the 323,059 that were trapped in Lone Pine during the summer. Thus, elm woodpiles appear to be a major source of beetles.

Field studies for the 1977 flight season commenced in mid-April. The 1976 trap deployment strategies are being repeated this year with the exception that only single traps and Conrel baits are being used. A major effort is also being made to identify all potential brood sources that could provide flying beetles in 1977. Unless the number of emerging beetles can be estimated, the impact of any trap-out strategy on natural beetle populations cannot be evaluated. The success or failure of our efforts in small isolated towns with a high ratio of traps to trees must then be extrapolated with care to larger communities with much larger numbers of elms.

Fig. 4. Elm woodpiles are a major source of beetles.

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