

# Status of the Greater Wax Moth, *Galleria mellonella*,<sup>1</sup> in the United States Beekeeping Industry<sup>2, 3</sup>

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*Recent research indicates that the wax moth causes considerable damage to apiaries amounting to as much as \$1 million a year in states like Florida. This compares, for example, to only \$300,000 to \$400,000 a year for AFB in the state.*

THE greater wax moth, *Galleria mellonella* (L.), has been recognized as a pest of honey bees, *Apis mellifera* L., in the United States for many years (Eckert and Shaw 1960, Paddock 1918, Whitcomb 1942). The moth larvae often destroy unprotected combs in storage facilities or in colonies that become weakened or die. In the North, populations of this pest are ordinarily small because *Galleria* is unable to survive subzero winter temperatures. There, the main sources of reinfestation each year appear to be surviving individuals in beekeeping storage facilities and infested honey bee colonies which are transported from southern locations in the spring. In the southern United States and other warm areas, larvae of the greater wax

moth cause extensive losses because they may develop continuously throughout the year (Smith 1960, Whitcomb 1942). In warm climates, normal honey bee colonies often support such large numbers of early-instar larvae that all combs in weakened units can be reduced to a mass of webbing and debris within a short period.<sup>4</sup>

Little information exists concerning the economic importance of the greater wax moth to the U.S. beekeeping industry, in part because of the lack of continuing economic studies of beekeeping management (Anderson 1969). A recent review of problems of the beekeeping industry by specialists in 11 states, including California and Texas, did not mention the greater wax moth (USDA Ext. Serv. 1970). Nevertheless, in early 1975, the research committee of the California State Beekeepers' Association designated the greater wax moth as the most important beekeeping problem in their state.<sup>5</sup>

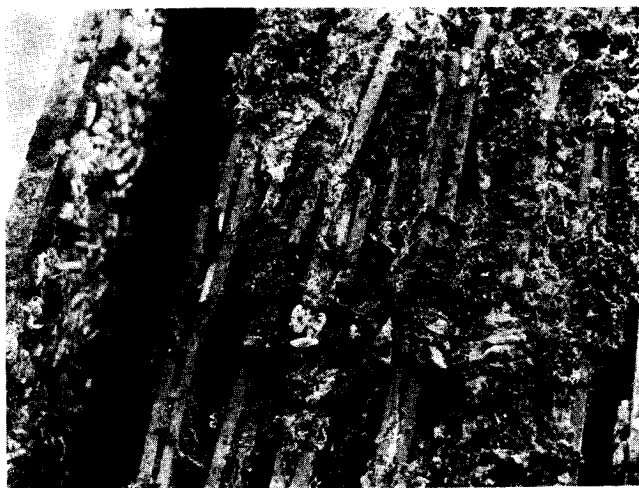
Beekeeping in the southern United States comprises a large and important segment of the industry. The moderate climates and adequate nectar sources there have led to the development of a package bee and queen industry in addition to the use of bees for honey production and crop pollination. Young

queens, package bees, and nucleus colonies are shipped from the South, principally in April and May, so they will arrive at northern locations prior to the honey seasons there. The southern beekeeping industry is concentrated in Florida, Texas, and California where about 1/5 of the ca. 4 million colonies in the United States are located. About 1 million pounds of package bees and 1.2 million queens were produced during the 1966 season in the southern states, including California, for sale in the North (Roberts and Stanger 1969).

To determine the economic importance of the greater wax moth in the United States, a questionnaire covering losses for the calendar year 1973 was distributed to semicommercial beekeepers (200-800 colonies) and commercial beekeepers (1,000 or more colonies) in the Gulf Coast States and in Georgia, Arizona, and California. The beekeepers were asked to report the monetary loss per unit, the number of combs lost in Langstroth colonies and nuclei, the average cost of all comb production components, including frames, wax foundation and labor, and various management procedures related to wax moth control.

Usable returns were received from 114 southern beekeepers who reported the operation of over 180,000 Langstroth colonies, ca. 13.9 per cent of the Langstroth colonies estimated to be located in the 8 states surveyed (USDA 1974), and over 250,000 queen mating nuclei (Table 1). The largest operations included 9,000 Langstroth colonies; 36 of the 114 respondents had 2,000 colonies or more. Thirty-six per cent of the respondents were California-based.

Total losses of \$243,184 and \$50,153 in the operation of the standard colonies and nuclei, respectively, were reported for 1973 by the participating beekeepers. Additional data were submitted by 19 interstate beekeepers (California, 7; Texas, 10; and Missis-



Severe wax moth damage

ssippi, 2) who sustained very minor losses in 39,800 standard colonies and 11,900 nuclei, averages of only \$0.12 and \$0.17 per unit, respectively.

Average loss per Langstroth colony varied considerably in the three major package bee and queen producing states: California — \$0.89, Texas — \$1.49, Florida — \$2.79. One southern Georgia beekeeper (3,500 colonies) reported a loss of only 8c per unit, but in a subsequent discussion the reason for such small losses could not be identified. Another commercial Georgia beekeeper, who also has operated in North Dakota, Florida, and the Caribbean area, felt that losses in Georgia and Florida are actually comparable. Losses in Texas, Alabama, Arizona, and Louisiana were comparable (\$1.40-\$1.55/unit).

The information about losses obtained in the present survey was considered representative of the total losses incurred in each of the eight states since it covered from 5.0 per cent (Florida) to 26.7 per cent (Arizona) of the 1973 colonies resident in each state (USDA 1974). Also, the total losses of \$48,050 in Louisiana for 1973 extrapolated from this study are similar to the 1966 losses of \$31,000 reported for the state by Oertel (1969).

Based on the average loss per colony, total losses for the states surveyed are estimated to be \$2.084 million as follows. Florida, \$1,016,000; California, \$420,000; Texas, \$313,000; Mississippi, \$143,000; Arizona, \$78,000; Georgia, \$67,000; Alabama, \$66,000; and Louisiana, \$48,000. If additional losses of \$900,000 (nuclei — \$100,000; Langstroth colonies — \$800,000) occurred in the states not included in the survey, damage by the greater wax moth to beekeeping in the United States totaled \$3 million or more during 1973. The rapid cost advances for wax foundation, frames, and other beekeeping supplies following the survey period indicate that United States beekeeping losses from the greater wax moth will reach ca. 4 million dollars in 1976.

Unusual circumstances (i.e., severe pesticide poisoning, localized storms, inadequate fumigation) occasionally enable *Galleria* to cause disastrous comb losses in outapiaries or storage buildings. The worst such recent losses occurred in Arizona during 1967 when

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Wax moth larva

ca. 50,000 honey bee colonies died largely because of exposure to insecticides applied to cotton for control of the pink bollworm, *Pectinophora gossypiella* (Saunders). Well over 1 million combs from the weakened and dead colonies were destroyed subsequently by *Galleria* and beekeeping in the state was seriously reduced. Undoubtedly, there have been many similar cases on a smaller scale, but none have been documented to the author's knowledge. Numerous instances of huge losses of stored combs have occurred as a result of inadequate chemical protection. For example, a Texas beekeeper reported over 9,000 stored combs destroyed in 1973, apparently because an improperly formulated fumigant was used.

It is difficult to place the losses caused by the greater wax moth in perspective, partly because there have been few attempts to collect economic data about the 2 major sources of honey bee losses, American foulbrood

(AFB) and pesticides. Nationwide, colony losses from AFB, generally estimated at about 1-2 per cent annually, would range from \$2.5 million to \$5.0 million if each lost colony was valued at \$65. Then, if one adds the cost of operating state apiary inspection programs for AFB, the cost would probably double. For example, inspection records for the State of Florida since 1941 (Florida Dept. Agric. and Consumer Serv. 1975) show that losses due to AFB for 56.8 per cent of the colonies in the state in fiscal 1973 amounted to \$110,630 (@ an estimated \$65/unit burned by inspectors). This loss plus the operating expenses of the Bureau of Apiary Inspection (69c/unit) plus estimated AFB damage to the other ca. 43 per cent of the colonies brings the overall cost of AFB in Florida in 1973 to about \$300,000-\$400,000. In contrast, 1973 wax moth losses for the state are estimated from the survey to be about \$1 million.

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# WAX MOTH —

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The feeling among many researchers that control of the greater wax moth by beekeepers is simply a matter of proper colony management reflects a lack of awareness of the management requirements of commercial operations in which apiaries are located over a radius of 25-50 miles or more (Anderson 1969). In fact, one respondent who operates over 3,000 colonies in a southeastern state commented that a full 5-day week would be used in driving to all his apiaries and observing the colonies just long enough to count them; there would be no time for inspections or other work. The time required for travel between apiaries and for manipulation of frames in individual units thus greatly limits colony management as an effective tool for control of the wax moth in the South though the annual rate of inspection in commercial outfits is often substantial. For example, 52 southern operators reported averaging 10 inspections per year. Unfortunately, most of them are performed before the period of July through October when wax moth damage is worst in the South.

Replacement of wax combs destroyed by larvae of the greater wax moth requires large investments of labor and of capital each season by many southern beekeepers. Little information is available concerning the total cost of producing combs, but Oertel (1969) suggested \$1.00/comb as an average value. In the present survey, beekeepers were asked to submit information about the cost of all aspects of comb production, including labor required for assembly or salvage. A cost factor of 60c (honey @ 40c/lb) was added to the expenses reported to compensate

for the ca. 1.5 lb of honey metabolized by a honey bee colony while building each new comb (Whitcomb 1946). Returns from 102 beekeepers showed an average cost of \$1.40 for each new comb (frame size: 19 $\frac{7}{8}$ " x 9 $\frac{7}{8}$ " ) produced.

Colony management favoring strong populations (maintaining young, productive queens and adequate food stores, controlling disease, etc.) is presently the only method by which the southern beekeeper can prevent or control *Galleria* infestations in outapiaries.

In the United States, a number of biological agents are associated naturally with the greater wax moth. For example, a braconid wasp, *Apanteles galleriae* Wilkinson, various species of predaceous ants, especially the red imported fire ant, *Solenopsis invicta* Burden, and an entomophilous bacterium, *Bacillus thuringiensis* Berliner, were observed by the author from 1970 to 1975 commonly attacking larval or pupal *Galleria* in the vicinity of Baton Rouge, La. At least 2 viruses specific to the wax moth, a nuclear-polyhedrosis type and a nonoccluded type, are known from Europe (Gershenson 1957, Lavie et al. 1965). However, there is presently no evidence to indicate that biological controls significantly reduce or prevent comb losses by *Galleria* populations in the U.S. beekeeping industry. Because of the many problems inherent with the development and use of such agents, it is doubtful that a commercially useful technique for controlling *Galleria* with parasites, predators, or microbes will be developed in the foreseeable future.

Recent laboratory studies at Baton Rouge, La. indicate that it may be feasible to suppress natural *Galleria* populations with moths possessing radiation-induced, heritable genetic aber-

rations (Nielsen and Lambremont 1976).

## FOOTNOTES

- <sup>1</sup> Lepidoptera: Pyralidae.
- <sup>2</sup> In cooperation with the Louisiana Agricultural Experiment Station.
- <sup>3</sup> Mention of a commercial or proprietary product in this paper does not constitute an endorsement of this product by the USDA.
- <sup>4</sup> Nielsen, R. A. Bee Breeding and Stock Center Laboratory, ARS, USDA, Baton Rouge. Personal communication. 1975.
- <sup>5</sup> Stanger, W. Univ. Calif., Davis. Personal communication. 1975.

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TABLE 1. — WAX MOTH LOSSES REPORTED BY SOUTHERN BEEKEEPERS FOR 1973<sup>a</sup>

State	Respondents	Langstroth colonies		No. of nuclei reported	Average loss	
		No. reported	% of total <sup>b</sup>		Langstroth colonies	Nuclei
<b>Southwest</b>						
California .....	37 <sup>c</sup>	84,887	17.0	101,300	\$0.89	\$0.13
Arizona .....	9	15,441	27.6	6,900	1.40	
<b>Southeast</b>						
Florida .....	21	18,690	5.0	7,089	2.79	0.30
Texas .....	16 <sup>c</sup>	25,540	12.2	81,250	1.49	0.31
Mississippi .....	7 <sup>c</sup>	14,350	26.6	21,300	2.64	0.22
Georgia .....	5	9,700	5.8	14,250	0.39	0.22
Alabama .....	11	8,203	15.8	10,910	1.26	0.31
Louisiana .....	8	6,412	20.7	8,400	1.55	0.42

<sup>a</sup> Values represent expenses of required additional materials, transportation, and labor.

<sup>b</sup> Based on number of colonies listed by state in USDA Agric. Statistics (1974).

<sup>c</sup> Additional data are presented in the text from 19 northern commercial beekeepers who migrated into California, Texas, or Mississippi to raise queens and splits (new colonies) in the spring. These bees were moved to northern states for use in honey production.