Influence of Defoliation by the Cutworm *Melipotis indomita*[1] on Control of Honey Mesquite with 2,4,5-T in West Texas

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Highlight: *Cutworms,* Melipotis indomita *(Walker), caused severe defoliation of honey mesquite (*Prosopis glandulosa *Torr. var.* glandulosa*) on heavy clay and bottomland range sites in the Rolling Plains of Texas following a late spring freeze and a drought in 1971. In some areas cutworms reduced mesquite foliage by 95%. The percent of honey mesquite killed with foliar application of 2,4,5-T was very low on both sites and was not influenced by the degree of defoliation by cutworms.*

Control of undesirable woody plants such as honey mesquite (*Prosopis glandulosa* Torr. var. *glandulosa*) is a major concern to ranchers in Texas. Mesquite infests about 56 million acres of Texas rangeland[2]. The cutworm, *Melipotis indomita* Walker, caused widespread defoliation of honey mesquite on bottomland and heavy clay range sites in the Rolling Plains of Texas during the spring of 1971. This damage to foliage concerned aerial applicators and ranchers who were planning aerial application of herbicides such as 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid). Brisley (1924) observed similar injury to mesquite by *Melipotis indomita* (Walker) along

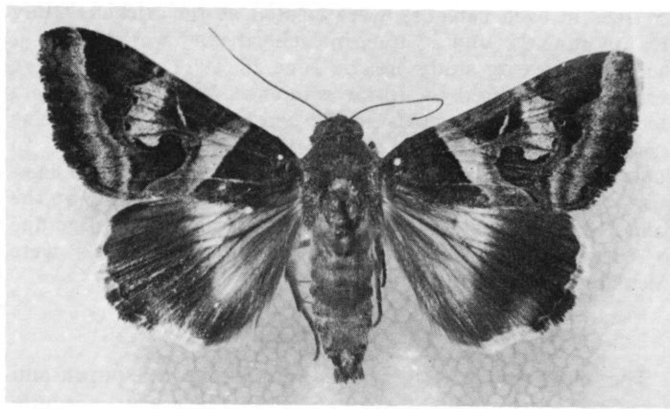

Fig. 1. Melipotis indomita *adult.*

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The report is designated Texas Tech University, College of Agricultural Sciences Publication No. T-9-122.

Manuscript received July 5, 1973.

[1] Lepidoptera: Noctuidae.

[2] H. N. Smith and C. A. Rechenthin. 1964. Grassland restoration—the Texas brush problem. Soil Conserv. Serv., U.S. Dep. Agr., Temple, Texas. 17 p.

the Verde River, Salt River, and in the Sulphur Springs Valley of Arizona. Brisley reported that mesquite along the Verde River was almost completely defoliated for a distance of about 20 miles until June 1. However, after June 1 the trees refoliated. According to Brisley, the worms rest in the litter at the base of mesquite during the day and climb the limbs to feed on the mesquite foliage during the night. They were most numerous about June 1, at which time they began burrowing into the soil and pupating. The objective of our study was to quantify the degree of defoliation of honey mesquite by *M. indomita* and to determine the influence of defoliation by this insect upon herbicidal control of mesquite.

Methods and Materials

Field studies were conducted on a bottomland range site dominated by honey mesquite and curly mesquite [*Hilaria belangeri* (Steud.) Nash] northwest of Paint Rock, Tex., and on two heavy clay range sites dominated by honey mesquite and tobosagrass [*Hilaria mutica* (Buckl.) Benth.]. One of the heavy clay range sites was south of Colorado City, Tex., and one was east of Dickens, Tex. The study was initiated on June 7, 1971. At that time essentially all cutworms had pupated in the soil. Population densities of pupae and larvae at the Paint Rock study area were estimated on June 7 by sifting the soil to a depth of 5 cm from 30 × 30-cm plots. One plot was sampled at the base of each of 60 randomly selected mesquite trees. Equal numbers of samples were taken from quartiles corresponding to each of the cardinal directions from the base of the trees. Adult moths (Fig. 1) were reared from pupae in the insectary for identification. On June 8, 25 trees in the cutworm-infested area and 25 trees in a nearby uninfested mesquite stand at the Paint Rock study area were cut with a chain saw, basal diameters recorded, all green leaves removed, sacked, and weighed, and the live weight of the wood of each tree determined. All foliage and the wood from 10 trees from each area were taken to the laboratory, oven dried in a forced-air drying room at 52° C, and oven-dry weights were recorded. These data were used to compare dry leaf/dry wood ratios, for calculation of regression equations of dry leaf weights on basal diameters, and for calculation of regression equations of dry leaf weights on dry wood weights.

To determine the effect of defoliation by cutworms on the effectiveness of 2,4,5-T for honey mesquite control, at each of the three study areas trees were sprayed at each of four estimated degrees of defoliation: 0–25%, 26–50%, 51–75%, and 76–100%. The trees were sprayed lightly, to simulate aerial application, with hand sprayers containing 92 ml of the propylene glycol butyl ether esters of 2,4,5-T in 92 ml diesel oil and enough water to make 12.3 liters of spray solution. Ten trees in each of the four categories of defoliation were treated with 2,4,5-T at the Paint Rock study area on June 9; 15 trees in each category were treated at the Dickens study area on June 22; and 15 trees in each category were treated at the Colorado City study area on June 28, 1971. All trees were permanently marked for future reference. Mortality data were recorded at all three areas at the end of the second growing season following herbicide application (September, 1972). In September, 1972, an additional 100 randomly selected mesquite trees in the heavily defoliated mesquite stand at the Paint Rock study area were examined for signs of damage due to cutworm defoliation. Confidence intervals (95%) were calculated for all sample means.

Results and Discussion

The mean population density was 34.6 ± 6.2 pupae and larvae per square meter of soil beneath the honey mesquite canopies: thus the population density of leaf-consuming larvae of *M. indomita* had been quite high. A few larvae were discovered beneath loose mesquite bark; however, only 0.5% of the total sample obtained from the upper 5 cm of soil consisted of larvae. A few observations of pupal parasitism were recorded and predation of soil-dwelling pupae by Rio Grande turkey (*Meleagris gallopavo intermedia* Sennett) was evident. Neither diurnal nor nocturnal activity of cutworm larvae on honey mesquite foliage was observed, thus it was felt that essentially all of the cutworm population had pupated.

The regression of dry wood weight on live wood weight, $y = -0.4831 + 0.7131\ X$ ($r = 0.995$), was used to calculate dry wood weights for those trees which were not oven dried. The mean dry leaf weight (g)/dry wood weight (kg) ratios were 293.5 ± 89.5 and 15.3 ± 4.7 for uninfested honey mesquite and cutworm-attacked mesquite, respectively. Thus, feeding by larvae of *M. indomita* had reduced the total photosynthetic and transpiring tissue of mesquite by 95%. The influence of cutworm defoliation upon the numerical relationship of dry leaf weights (g) with tree basal diameters (cm) and upon the relationship of dry leaf weights (g) with dry wood weights (kg) for the bottomland site near Paint Rock, Tex., are illustrated in Figures 2 and 3, respectively. Almost all 174

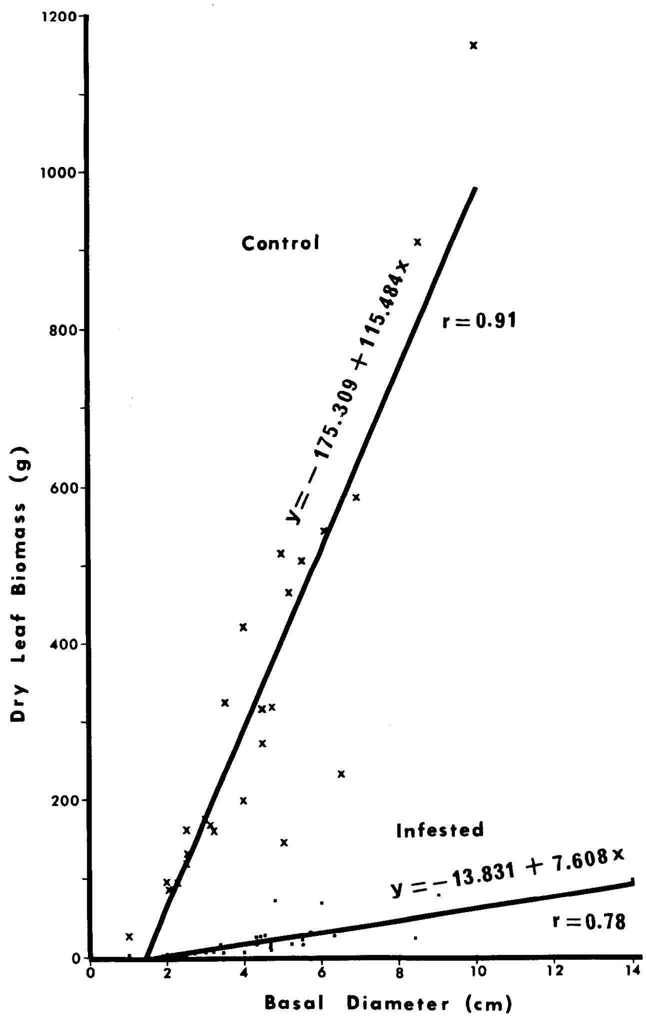

Fig. 2. *Relationship of dry leaf weights (g) with basal stem diameters (cm) of mesquite defoliated by larvae of* Melipotis indomita *and of uninfested mesquite in a bottomland range site near Paint Rock, Tex., June, 1971.*

papers concerning effects of insect defoliation on growth and mortality of trees reviewed by Kulman (1971) reported a reduction of tree growth proportionate to the quantity of foliage loss. Growth patterns of trees, typically determined by measuring growth rings on increment cores of wood, were not determined in this study; however, it is assumed that early summer growth of the defoliated mesquite was seriously reduced. The importance of foliage for growth and survival of trees decreases directly with tree age and inversely with its exposure to sunlight. Deciduous trees usually show an immediate response to defoliation if it occurs before shoot or ring growth is completed (Kulman, 1971). Kulman's summary that most deciduous trees survive defoliation and produce new sets of leaves in the same season was substantiated in this study. Most of the honey mesquite trees not sprayed with 2,4,5-T had developed full foliage by the end of the 1971 growing season.

Populations of *M. indomita* were restricted almost entirely to bottomland and heavy clay range sites, where honey mesquite foliage had been killed during the early spring of 1971 by an abnormally late spring freeze. The winter and summer of 1971 was also a period of a severe drought in the Rolling Plains of Texas. These factors appear to substantiate Kulman's (1971) review of Russian and German studies which indicated that some defoliating insects require "physiologically weakened stands" to develop large populations; and, that an unfavorable water balance results in increased sugar content of foliage, which may be favorable for growth and survival of defoliators. Precipitation was abundant in 1972, and populations of *M. indomida* were very low and their effects were not obvious in 1972. Stevens (1971) reported defoliation of ponderosa pine (*Pinus ponderosa* Laws.) by the pine needle sheathminer, *Zelleria haimbachi* Busck., in Modoc Co., California in years of below-average precipitation.

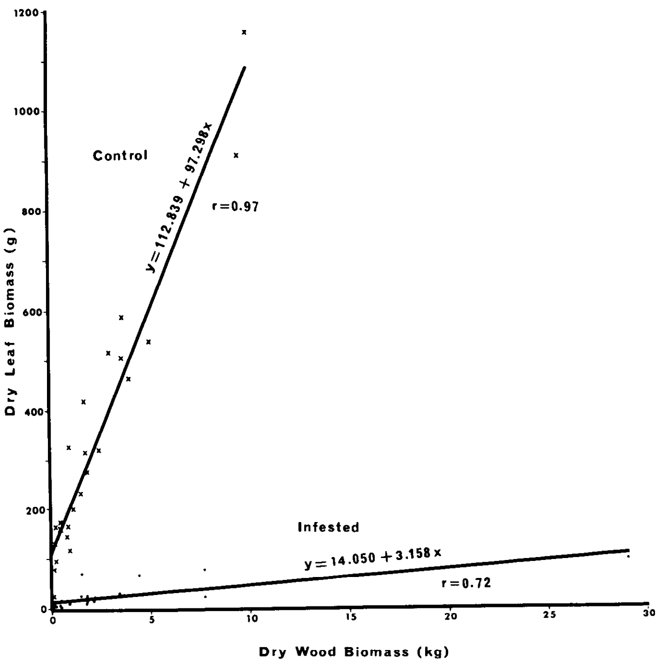

Fig. 3. *Relationship of dry leaf weights (g) with dry wood weights (kg) on mesquite defoliated by larvae of* Melipotis indomita *and of uninfested mesquite in a bottomland range site near Paint Rock, Tex., June, 1971.*

Table 1. Mortality (%) of honey mesquite treated with 2,4,5-T as influenced by four degrees of defoliation by *Melipotis indomita* on two heavy clay range sites and one bottomland site in the Rolling Plains of Texas.

	Degree of defoliation (%)			
Trees with tops killed[1]	0–25	26–50	51–75	76–100
Resprouting from basal buds	67.5a[2]	55a	52.5a	50a
Not resprouting	2.5a	0a	2.5a	2.5a

[1] Honey mesquite with dead aerial growth but resprouting from the base is referred to as "top-killed" by many workers. If tops are dead and no basal sprouts are evident, the plant is categorized as "root-killed."
[2] Values within a row followed by similar letters are not significantly different at the 95% level of probability as determined by X^2 analysis.

Observations during September, 1972 in the honey mesquite stand near Paint Rock, Texas which had been seriously defoliated by *M. indomita* during late spring of 1971 revealed that 58% of the trees showed symptoms of damage. Of the trees examined, 6% were top-killed but had basal sprouts, 11% were alive but had basal sprouts, 8% had basal sprouts and dead branches, 33% had dead branches and no basal sprouts, and 42% showed no signs of injury. The incidence of basal sprouts and dead branches was attributed to the cutworm defoliation, although it is probable that the late spring freeze and summer drought conditions may have attributed to these symptoms. Honey mesquite trees have an abundance of dormant buds at and above the cotyledonary node, which are stimulated by injury or stress, and produce new leaves and stems (Meyer et al., 1971).

Mortality data at the end of the second growing season following application of 2,4,5-T indicated that defoliation by *M. indomita* did not significantly reduce herbicide effectiveness (Table 1). The percentage of sprayed mesquite with dead topgrowth (top-kill) was somewhat higher on trees with lower degrees of defoliation; however, percentage of the trees not resprouting from the base (root-kill) was not influenced by cutworm defoliation. Mesquite on bottomland and heavy clay range sites is typically very difficult to control with hormone-type herbicides because of low soil temperatures, which result in a low growth rate of the roots, thus low susceptibility to herbicides. Bottomland and heavy clay range sites typically have cooler soils than sandy or upland sites, due to higher soil moisture percentages and to increased vegetative cover (Dahl et al., 1971; Sosebee et al., 1973). Defoliation by cutworms on sandy or upland soils (warmer sites) would probably reduce the effectiveness of foliar-applied herbicides.

Literature Cited

Brisley, H. R. 1924. The mesquite cutworm, *Melipotis indomita* Walker. Pan-Pacific Entomol. 1:94.

Dahl, B. E., R. B. Wadley, M. George, and J. Talbot. 1971. Influence of site on mesquite mortality from 2,4,5-T. J. Range Manage. 24:210-215.

Kulman, H. M. 1971. Effects of insect defoliation on growth and mortality of trees. Ann. Rev. Entomol. 16:289-324.

Meyer, R. E., H. L. Morton, R. H. Haas, E. D. Robison, and T. E. Riley. 1971. Morphology and anatomy of honey mesquite. U. S. Dep. Agr. Tech. Bull. No. 1423. 186 p.

Sosebee, R. E., B. E. Dahl, and J. P. Goen. 1973. Factors affecting mesquite control with Tordon 225 Mixture. J. Range Manage. 26:369-371.

Stevens, R. E. 1971. Pine growth retarded following defoliation by the pine needle sheathminer. J. Econ. Entomol. 64:1572-1573.