

ECONOMIC INJURY LEVELS OF THE LEAFHOPPER
IDIOSCOPUS CLYPEALIS (LETH.) ON
MANGO (*MANGIFERA INDICA* (L.))¹

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ABSTRACT

The economic injury levels (EIL) of the leafhopper, *Idioscopus clypealis* (Leth.), were determined for two croppings in Cebu, Philippines. The values of the field EIL in the first cropping were 4.21, 4.30, 4.45 and 4.55 adults per panicle at 2, 10, 18, and 26 days after flower bud break (DAFBB), respectively, while in the second cropping these were 4.79, 4.88, 5.06, and 5.18 adults per panicle in the same order. The average field EIL, in two croppings, is 4.67 or 5 leafhoppers per panicle.

Keywords: *Idioscopus clypealis*, *Mangifera indica*, economic injury levels, mango leafhopper

Mango production is affected by several factors. In the Philippines and in other mango producing countries of the world, insect pests such as leafhoppers play a more important role in mango fruit losses. If not properly controlled, the mango leafhoppers (MLH) can destroy the whole crop for the season. Of the three leafhopper species commonly associated with mangoes in the Philippines, *Idioscopus clypealis* (Leth.) is the most prevalent and destructive (Bato 1978, and Corey, 1986). Distant (1908) called it mango leafhopper (MLH) due to its feeding habits on mango shoots, leaves and inflorescences. Aside from causing menace in the Philippines and various parts of India, the MLH has been found prevalent in most of the tropical and subtropical countries (Palo and Garcia 1935, Ghauri 1967, and Alam 1975). Adults and nymphs of this pest puncture the tender plant tissues and deprive flowers, fruits and tender shoots of their sap causing them to dry up and shed prematurely. Oviposition injury arrests development of flower buds and young fruits (Roy and Ram 1952, and Nachiappan 1982). In addition, molds develop on honey dew excreted by the insect so that the entire foliage of the tree may look black towards the end of the season. The honeydew also interferes with floral fertilization and the sooty molds affect photosynthesis (ICAR 1967). The pest is present throughout the year and becomes more serious as soon as the flower buds appear.

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Insecticide application is always the ultimate control remedy resorted to by mango farmers to reduce leafhopper population. Thus, knowledge of its economic injury level (EIL) is essential to the establishment of an efficient chemical spray program. Its use is considered as one of the fundamental principles of integrated pest management (Smith 1968). It is often used to evaluate the economic feasibility of controlling pests so that cost of pest control will be minimal and the impact on beneficial insects and environment will be minimized. Stern *et al.* (1959) defined EIL as the lowest population density that will cause economic damage. This latter term was defined as the amount of injury which will justify the cost of artificial control measures. Therefore, the concept of EIL refers to the relations between the population density of the pest and the profitability of control as well as the conservation and augmentation of helpful insects, spiders, and pathogens. Sylven (1968) stated that the term EIL may easily be misleading and should be replaced by more adequate terms. Instead of EIL, critical injury should be used. Smith (1968) analyzed this term from a practical viewpoint and though he agreed with Sylven, he concluded that using the term economic has the advantage of being more easily understood by growers and of its being widely used.

This study was conducted to determine the economic injury levels of *I. clypealis* on carabao mango in Cebu for two cropping seasons (August to November, 1985 and January to April, 1986).

MATERIALS AND METHODS

Percent Yield Loss — MLH Density Relationship

About 100 mature mango buds were induced to flower by spraying Agriblum, a commercial mango flower inducer. Two days after flower bud break (DAFBB), the first batch of 15 panicles were caged individually in a cylindrical nylon net (60 cm long by 27 cm diameter) and the rest were sprayed with cyfluthrin to protect them from leafhopper attack. Field collected adults of *I. clypealis* were introduced into the cages at density levels of 5, 10, 15, and 30 per panicle. Each density level was replicated three times. Cages without *I. clypealis* served as control treatments. Cages were mounted vertically by tying them to adjacent branches. The population of *I. clypealis* in each cage was monitored once every two days and dead insects were replaced with new ones to maintain the density. After eight days, the cages were removed and another batch of 15 panicles were caged. Uncaged panicles were sprayed with cyfluthrin every four or five days to continuously protect them from the pest. The same procedure was followed at 10, 18, and 26 DAFBB. A randomized complete block design with three replications was used. Yield (kg fruit weight) was recorded at harvest.

The evaluation of the relationship between percent yield loss and leafhopper density at different stages of mango panicle development were ana-

lyzed using the simple linear regression equation,

$$Y = a + b x,$$

where y represents estimated yield loss; a , the Y - intercept which reflects the percent yield loss in the absence of MLH, x , the number of MLH per panicle; and b , the regression coefficient (or the slope of the regression line), which reflects the amount of yield loss per leafhopper in every panicle. Positive coefficients imply an increase in yield losses as the independent variable is increased.

Method of Computing the Economic Injury Level (EIL)

In determining the EIL in number of *I. clypealis* per panicle, the model delineated by Stone and Pedigo (1972), and Ogunlana and Pedigo (1974) was used with slight modification. In this model, EIL was computed based on the following steps:

1. Gain threshold or Economic damage (kg/ha) =
$$\frac{\text{Cost of control (₱/ha)}}{\text{Market value of carabao mango (₱/kg)}}$$
2. Percent yield loss necessary =
$$\frac{\text{Gain threshold (Kg/ha)} \times 100}{\text{Expected yield (Kg/ha)}}$$
3. Theoretical EIL =
$$\frac{\text{Percent yield loss necessary}}{\text{Percent damage or regression coefficient}}$$
4. Field EIL = (Theoretical EIL) X (1 + percent mortality rate of the insect nymphs and adults due to natural mortality factors)

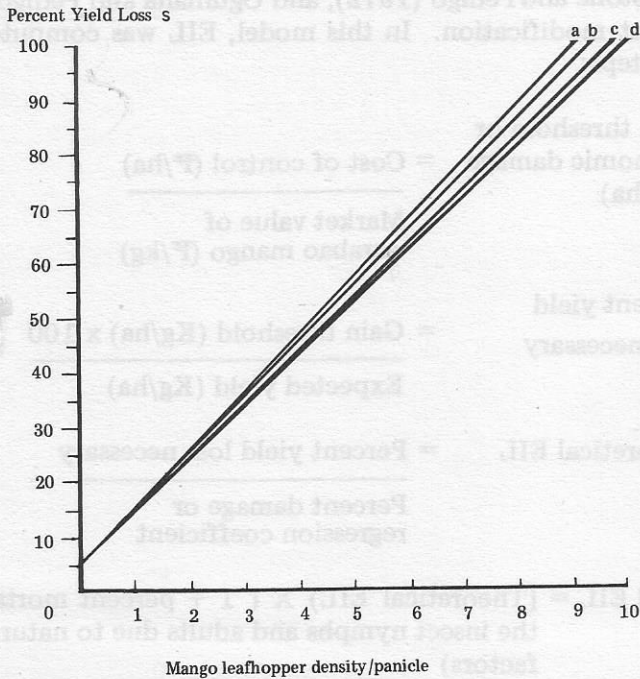
Step 4 was adopted because under field conditions natural mortality factors may contribute to the decrease in pest population, so that the theoretical EIL computed maybe initially high but may not be damaging to the crop after some time due to natural control. From this principle, a modification of the model was made by incorporating the natural field mortality rate of *I. clypealis* which is determined as 36.01 percent after seven days.

Data on cost of control (₱/tree), market value or field price of carabao fruit (₱/kg) and expected yield (kg/tree) obtained from the chemical control experiment conducted during the first (August - November 1985) and second (January - April 1986) croppings in Cebu, Philippines were utilized in computing the EIL.

RESULTS AND DISCUSSION

Percent Yield Loss — MLH Density Relationship

The relationship between percent yield loss and mango leafhopper (MLH) density at different stages of mango panicle development were tested by simple correlation and simple linear regression analyses. The analyses exhibited direct linear relationships between percent yield loss and leafhopper density at different stages of panicle development (Figure 1). Moreover, the coefficient of correlation (r) and determination (r^2) of the indicator variable tested were significant, suggesting that some portions or fractions of the total variability were explained by the independent variable or mango leafhopper density.



$$a_2 \text{ DAFBB, } Y_1 = 5.09 + 10.39X$$

$$b_{10} \text{ DAFBB, } Y_2 = 5.09 + 10.18X$$

$$c_{18} \text{ DAFBB, } Y_3 = 5.09 + 9.83X$$

$$d_{26} \text{ DAFBB, } Y_4 = 5.09 + 9.60X$$

$$r^2 = .72391 \quad r = .850829 \quad n = 36$$

Figure 1. Relationship between percent yield loss and mango leafhopper density at different stages of mango panicle development.

Estimation of Economic Injury Levels (EIL)

The field economic injury levels (EIL) of *I. clypealis* differed slightly between the two croppings. In the first cropping, the values: 4.21, 4.30, 4.45, and 4.55 adult leafhoppers per panicle at 2, 10, 18 and 26 DAFBB, respectively, were lower than those in the second cropping with 4.79, 4.88, 5.06, and 5.18 adult insects per panicle in the same order (Table 1). The same trend was observed in the theoretical EIL. This was due to field price difference between croppings. The field price of mango fruit in the first cropping (off season) was P7.00 per kilogram while in the second, it was only P5.00 per kilogram.

In both croppings, the computed field and theoretical EIL slightly increased with the stage of panicle development, indicating that the mango panicle had a tendency to be more tolerant to leafhopper attack as it became older as shown by slightly increasing EIL. (Table 1). The average field EIL is 4.67 or 5 leafhoppers per panicle in the two croppings.

The computed EIL of *I. clypealis* appeared to be low. This was due to the higher value of the crop and the relatively low cost of control. Headley (1972) and Mahalle *et al.* (1976) pointed out that the EIL is inversely related to the price of produce and directly related to the cost of control.

Table 1. Economic injury level of *I. clypealis* at different stages of mango panicle development in two croppings.

STAGE OF PANICLE DEVELOPMENT (DAFBB)	Cost Control (P/Tree)	Gain Threshold (Kg/Tree)	Percent YLD Loss Necessary	Theoretical Eil Per Panicle	Field Eil Per Panicle
<i>First Cropping</i>					
2	197	28	32.19	3.09	4.21
10	197	28	32.19	3.16	4.30
18	197	28	32.19	3.27	4.45
26	197	28	32.19	3.35	4.55
<i>Second Cropping</i>					
2	484	97	36.60	3.52	4.79
10	484	97	36.60	3.59	4.88
18	484	97	36.60	3.72	5.06
26	484	97	36.60	3.81	5.18
Average EIL				3.41	4.67

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