Effect of Simulated Rainfall on Eggs and Larvae of the Groundnut Leafminer, *Aproaerema modicella*

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The groundnut leafminer (GLM) *Aproaerema modicella* (Lepidoptera: Gelechiidae) is an important pest of groundnut (*Arachis hypogaea*) and soybean (*Glycine max*) across South and Southeast Asia (Shanower et al. 1993). GLM populations fluctuate dramatically between years, seasons, and even between generations at the same location (Amin and Mohammad 1980, Logiswaran and Mohanasundaram 1986, ICRISAT 1986, 1987, 1988). Weather factors are the most commonly cited explanation for the fluctuations, though there is no consensus on which factors are responsible. For example, Lewin et al. (1979) and Logiswaran et al. (1982) reached different conclusions concerning the effect of temperature and rainfall. Lewin et al. (1979) found temperature positively and rainfall negatively correlated with leafminer incidence, while Logiswaran et al. (1982) reported a significant negative correlation between maximum and minimum temperature and GLM infestation levels, and no correlation with rainfall. Another study compared changes in several climatic variables to GLM incidence over 2 years (Khan and Raodeo 1987). None of the four variables measured (rainfall, maximum and minimum temperature, and relative humidity) offered a reasonable explanation for the fluctuations. A fourth study found that while GLM was more abundant on drought-stressed plants, the intensity of irrigation by overhead sprinklers did influence GLM density (Wheatley et al. 1989).

We studied the effect of simulated rainfall on GLM egg and larval mortality at ICRISAT Asia Center in the 1988/89 postrainy season. Potted plants infested with eggs and larvae were exposed to 50 mm of rainfall produced by a mechanical rain simulator. Drop size and velocity in the rain simulator was roughly equivalent to natural rainfall in the area (G Smith, ICRISAT, personal communication).

For eggs, 10 pots (5 with rain, 5 control) with 5 plants each were used. Eight to 10 eggs were marked in each pot and the number before and immediately after the simulated rainfall compared to determine the direct effect on egg survival. Eggs were observed daily to compare hatch rates between the two groups.

The effect of rain on larval survival was tested using 10 pots with 10 plants per pot and infested with third, fourth, and fifth instar GLM larvae. Five pots were put into the rain simulator and five kept as control pots. The number of live larvae before and one week after exposure were recorded in each treatment. After exposure all pots were returned to the greenhouse.

Table 1. Effect of simulated rainfall on *Aproaerema modicella* egg and larval survival, ICRISAT Asia Center, 1988/89 postrainy season.

		Treatment	
		Rainfall	Control
Eggs	Original	48	51
	Number hatching	44	46
	Percentage hatched	92	90
Larvae	Original	360	315
	1 week later	322	299
	Percentage survival	89	95

Exposure to simulated rainfall resulted in only small differences in survival of both eggs and larvae (Table 1). The percentage of eggs hatching was nearly the same in the treated and control groups. Larvae also appeared unaffected by the direct effects of simulated rainfall. More than 89% of the larvae in both treated and control groups survived.

The differences in egg and larval mortality between treatment and control were small and do not appear to be related to the rainfall treatment. These results support the conclusions of Wheatley et al. (1989). Though GLM abundance may be greater under low-rainfall conditions, rainfall is not a direct mortality factor for GLM eggs and larvae. Rainfall may influence GLM populations in more subtle ways. For example, heavy and persistent rainfall may interfere with oviposition, or fungal and other pathogens may be favored by rainfall patterns different from the conditions in this experiment. This aspect of GLM ecology requires further investigation, and is needed to understand the large and erratic population fluctuations.

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Bio-efficacy and Development of a Reduviid Predator, *Rhinocoris marginatus*, on *Spodoptera litura*

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The tobacco caterpillar *Spodoptera litura* (Noctuidae: Lepidoptera) is a serious pest of groundnut. The larvae feed on the leaves, flowers, and flower buds, causing heavy yield losses. In nature these caterpillars are attacked by a number of natural enemies; in groundnut crops, members of the family Reduviidae are common predators. The majority of reduviids are predaceous. They usually feed on the body fluids of insects after paralyzing them by stinging with their stylets. *Rhinocoris marginatus* (Reduviidae: Heteroptera) were found feeding on *S. litura* larvae for the first time in groundnut fields in Karumathur, Madurai district, Tamil Nadu. This study was undertaken to study the life history and predatory potential of the nymphal instars and adults of this bug, which were not fully known.

Rhinocoris marginatus were collected from groundnut fields in mid Nov 1992 and reared in the laboratory on *S. litura* larvae. Laboratory-emerged nymphs were allowed to grow individually in plastic containers (5 × 5.5 cm) and were maintained on *S. litura* larvae (3–4 days old). Containers were examined daily to record the molting changes and the number of prey consumed/killed per stadia. Observations on sex ratio and adult longevity were recorded from adults that emerged in the laboratory. The prey insects used in this study were also laboratory-reared individuals originally collected in and around groundnut fields in Karumathur.

First-instar nymphs did not feed on the first day. Thereafter, they mainly attacked 3- and 4-day old prey, though younger caterpillars (less than 3 days old) were also available in the container. If 3–4 day old larvae were not available, the predators fed on younger larvae. The predatory potential increased from early nymphal instars to later nymphal instars. The first moult occurred after 5.30 ± 1.33 days, and the bugs developed through five instars within 38.82 ± 1.64 days, during which period each bug consumed 35.13 ± 3.50 larvae (3–4 day old *S. litura*). Ambrose et al. (1990) observed that the total nymphal period lasted for 84.70 ± 1.01 days in another groundnut pest, *Odontotermes obesus*; this difference