

## Biology and Impact of *Trichobaris texana* (Coleoptera: Curculionidae) on Silverleaf Nightshade, *Solanum elaeagnifolium* in Central Texas\*

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### Abstract

The biology of the curculionid *Trichobaris texana* was investigated in Brazos County, Texas. Females oviposit in leaf midribs and petioles of silverleaf nightshade, *Solanum elaeagnifolium*. The incubation period for the eggs averaged 6.2 days in the laboratory. Larvae mined the stem pith of the host plant and completed their development in an average of 56.0 days. Pupation occurred inside the stem in cells of loosely-packed wood fibers constructed by the mature larvae. Duration of the pupal stage averaged 11.1 days. Adults eclosed in the pupal cells and overwintered inside the stems. The temporal distribution of all life stages indicated that *T. texana* is univoltine. Life and fertility tables were constructed from laboratory cohorts to facilitate calculation of basic population statistics; the net reproductive rate ( $R_0$ ) for *T. texana* was 1.41, the cohort generation time ( $T_c$ ) was 92.55 days, and the capacity for increase ( $r_c$ ) was 0.0037. Thus, the population would increase 1.004 times/day, and 187 days would be required for the population to double. The effect of larval feeding on the seasonal rate of growth of silverleaf nightshade was also evaluated. The data suggest that tunneling activity of larvae inside the stems ultimately stunts plant growth.

### Biologie de *Trichobaris texana* (Coléoptères: Curculionidés) et ses Effets sur la Morelle *Solanum elaeagnifolium* au Centre du Texas

La biologie de *Trichobaris texana* a été étudiée dans la Brazos County, au Texas. Les femelles pondaient leurs oeufs sur les nervures et les pétioles des feuilles de la morelle *Solanum elaeagnifolium*. En moyenne, la période d'incubation des oeufs était de 6.20 jours en laboratoire. Les larves mineuses pénétraient dans la médulle des tiges et le stade larvaire durait, en moyenne, 56.01 jours. La pupation se produisait à l'intérieur de la tige de la plant hôte, dans des cellules de fibres lâches construites par les larves matures. La pupation prenait une moyenne de 11.10 jours. Les adultes éclosaient dans les cellules de la pupa et hibernaient dans les tiges. D'après la répartition temporelle de toutes les étapes de développement de l'insecte, *T. texana* est univoltine. Les tables de survie et de fertilité ont été établies à partir de cohortes élevées en laboratoire afin de faciliter le calcul des statistiques de base relatives aux populations; le taux net de reproduction ( $R_0$ ) de *T. texana* était de 1.41, la durée entre deux générations de la cohorte ( $T_c$ ) était de 92.55 jours et la capacité d'augmentation ( $r_c$ ) était de 0.0037. Par conséquent, la population pourrait augmenter 1.004 fois par jour et ainsi doubler en 187 jours. Les effets de l'alimentation des larves sur le taux saisonnier de croissance de la morelle ont également été évalués. D'après les données, les tunnels creusés par les larves à l'intérieur des tiges entravent la croissance des plantes et entraînent finalement leur rabougrissement.

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## Introduction

Silverleaf nightshade (SLN), *Solanum elaeagnifolium* Cav. (Solanaceae), is believed to be native to the United States and Mexico (Goeden 1971) or is perhaps indigenous to South America (Siebert 1975). This weedy solanum occurs across the southwestern United States primarily along roadsides, railroad rights-of-way, and in disturbed but less intensively cultivated areas of irrigated agriculture (Goeden 1971). According to the latter author, SLN was apparently introduced into California c. 1890, and by 1965 infested 3200 ha of prime agricultural land in 34 counties.

In addition to its status as a weed, all parts of SLN contain the chemical compound solanine which is toxic to humans and livestock when ingested (Kingsbury 1964). Sperry *et al.* (1977) reported that SLN is the most poisonous solanum in Texas and is frequently the cause of extensive cattle losses.

Recent faunistic surveys of the phytophagous insects associated with SLN and related solanums (Burke 1963; Goeden 1971) revealed that *Trichobaris texana* LeConte (Coleoptera: Curculionidae) (Fig. 1) is an important natural enemy of this weed. All stages of *T. texana* were dissected from visibly weakened SLN plants in south central and southeastern Arizona; the obvious stress in some plants was attributed to the stem boring activity of the larvae (Goeden 1971).

*T. texana* is found primarily in the southwestern United States, but ranges into Colorado, Kansas, Arkansas, and Mexico (Fig. 2). In addition to SLN, other host plants of *T. texana* are *S. rostratum* Dunal (Barber 1935; Burke 1963), *S. dimidiatum* Raf. (= *S. torreyi* Gray), and *S. citrullifolium* A. Br. (= *S. heterodoxum* Dunal) (Barber 1935). A host plant is defined here as one on which larval development is normally initiated and completed.

The biology of *T. texana*, a potential control agent for SLN, has not been previously studied. This paper presents information on a study that was conducted in Central Texas during the period 1978–79. The primary purpose of this research was to determine the life cycle and ecology of *T. texana* on SLN, and assess the impact of this weevil on its host plant.

## Methods and Materials

An established stand of SLN located in a pasture of the Beef Cattle Center at Texas A & M University, College Station, Texas, U.S.A., was selected as the sampling area. Insect and plant populations were sampled periodically from July to September 1978 and then once a week from April to December 1979. The purpose of the 1978 sampling program was to obtain a sufficient number of experimental larvae to develop a successful laboratory rearing procedure and to obtain an ample supply of pupae and teneral adults for laboratory experiments conducted during 1979. To simulate overwintering conditions, stem sections of SLN with adults *in situ* were kept in an incubator maintained at c. 4°C from December 1978 to April 1979.

In March 1979, a sampling area was selected which consisted of a c. 0.46 ha block (87.5 × 52.5 m) located in the northeast corner of pasture no. 12. The high density of SLN, low probability of extraneous disturbances (e.g. mowing, disking, and herbicide application), and close proximity to the laboratory were the primary criteria for block selection.

The sampling block was divided into 15 plots. Each plot was 306.25 m<sup>2</sup>. Samples were collected from each plot on a weekly basis by the stratified random sampling method to minimize the variance between plots (Southwood 1978). The actual sampling site was chosen by using a table of random numbers to select different coordinates for

each sampling date within each plot. A sample of 15 plants was obtained on each sampling date (1 plant/plot). Insect population estimates for a given sampling date were reported as the number/plant, which is a measure of population intensity (Southwood 1978).

The destructive and tedious nature of the sampling technique and the limited sampling area were the major factors for restricting sampling to a total of 15 plants/wk.

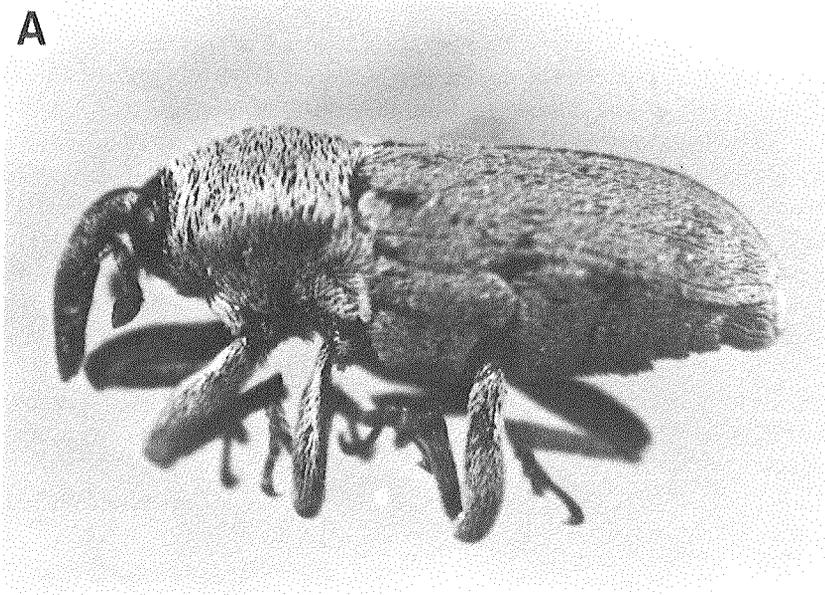
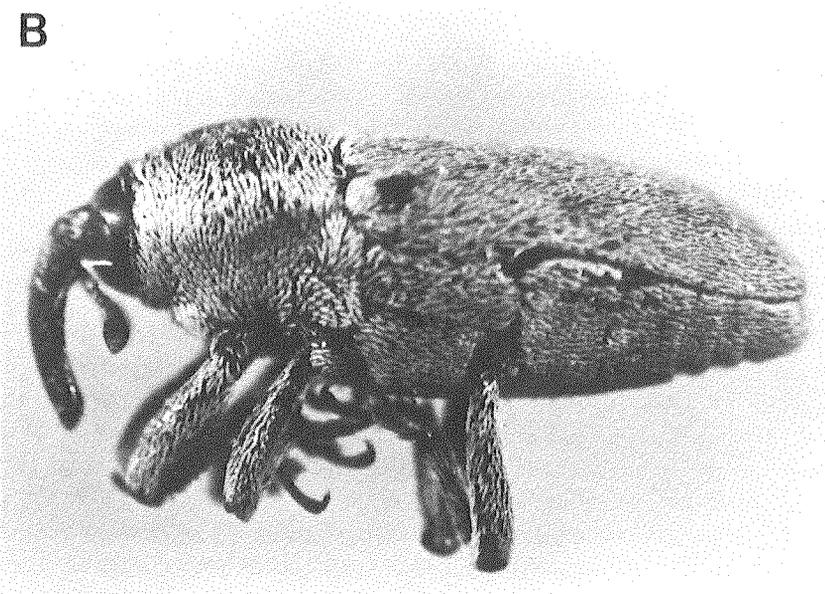
**A****B**

Fig. 1. *Trichobaris texana* LeConte. (A) male; (B) female.

Samples were taken by closing the two halves of a 25 cm diam. circular plywood disk around the base of a plant; the area encircled was then searched quickly for insects that might crawl or fly out of the marked area. The plants were then examined for insects, removed by clipping the stems at ground level with pruning shears, and placed in large plastic bags. The plants were transported to the laboratory for detailed examination.

In the laboratory, host plant growth was monitored by measuring overall height of infested and normal plants. These data were used to determine the impact of the insect on its host. The plants were then carefully dissected and examined for all the life stages of *T. texana*.

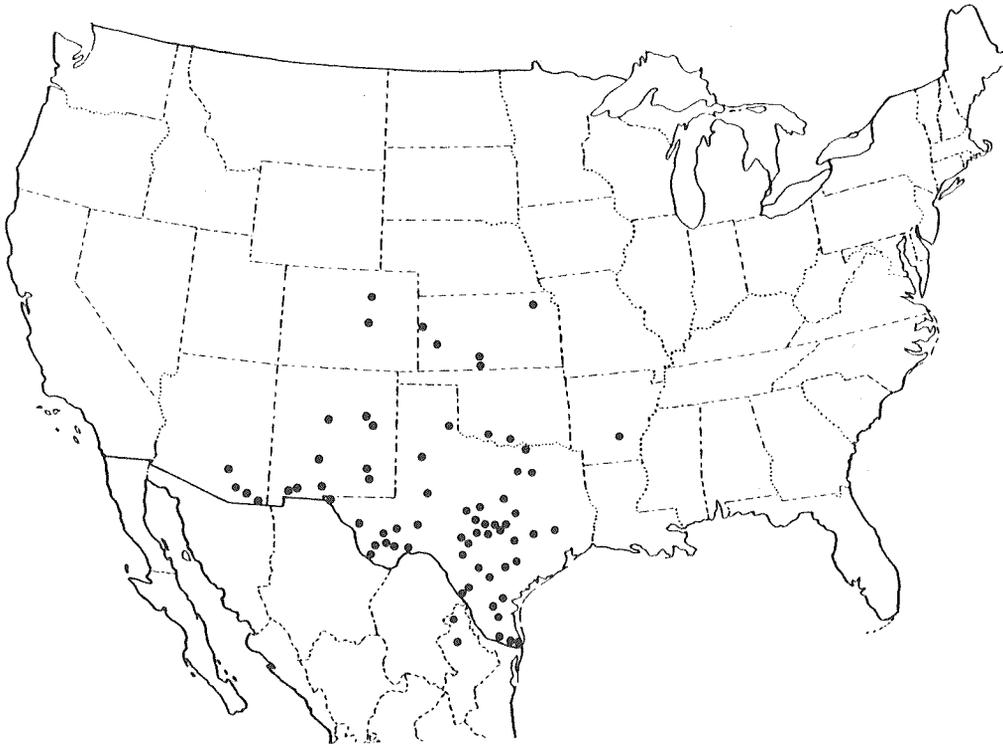


Fig. 2. Distribution of *Trichobaris texana* LeConte as determined by examination of specimens and from records in the literature.

All life stages recovered from the 1979 series of samples were counted and, except for parasitized individuals, preserved. Parasitized individuals were transferred to no. 3 gelatin capsules (1 host/capsule) to facilitate observations of subsequent parasite development. Hymenopterous parasites reared from the immature stages of *T. texana* were submitted to the Insect Identification and Beneficial Insect Introduction Institute, Beltsville, Maryland, for identification.

After identification and sexing, surviving adults of the 1978 generation were placed in feeding and oviposition cages (1 male, 1 female/cage). Each cage consisted of a plastic vial (c. 3 cm diam, 10 cm ht) furnished with a young terminal of SLN placed upright with the cut end in a c. 0.5 ml shell vial containing distilled water. Preliminary observations suggested that a young terminal with attached leaves was the most likely

site of oviposition. A fresh terminal was provided daily from plants growing along roadsides. The plastic vial cage was closed with a foam rubber plug.

Eggs were dissected from the plant tissue and reared by following a method similar to that described by Goode and Randolph (1961) for laboratory rearing of the sugarcane rootstock weevil, *Anacetrinus deplanatus* Casey (Coleoptera: Curculionidae). Each egg was placed in a small depression made with forceps in the exposed pith of a c. 7 cm section of a SLN stem split longitudinally. The two plant sections were reassembled and sealed at each end with paraffin and then placed in a plastic vial cage (1 stem section/cage). The number and duration of the various stages of the insect were determined by breaking the paraffin seal, separating the two plant parts and observing the successive stages of development of the insect. Stem sections were reassembled and resealed with melted paraffin after each daily inspection and were replaced as needed.

The oviposition and rearing cages were kept on a laboratory bench in a rearing room at c. 24°C with fluorescent Grolux® lights on a 14L:10D photoperiod. Simple life and fertility tables were constructed for *T. texana* reared under constant temperature in the laboratory. Data for the construction of the life table were obtained from monitoring the fate of a cohort of eggs; data for the age-specific fertility table were obtained by monitoring oviposition and survival of previously unmated females exposed to males in the laboratory. The construction and interpretation of the life and fertility tables follow the methods summarized by Southwood (1978).

Voucher specimens of the developmental stages and parasites of *T. texana* were deposited in the Department of Entomology Insect Collection, Texas A & M University.

## Results and Discussion

### *Biology of Trichobaris texana*

The study of the biology of *T. texana* reported in this section includes laboratory and field investigations on all developmental stages.

*Egg.* Eggs of *T. texana* are yellowish, ovoid, c. 0.70 mm in length and 0.44 mm in width. All of the eggs deposited during this study were inserted in the petiole or midrib on the underside of a leaf near the base of the lamina.

The duration of the egg stage was 4–18 days and averaged 6.2 days (Table 1). Survival (% of larval eclosion) of the laboratory cohort of 108 eggs deposited by 10 females at c. 24°C was 88% (Table 2).

Eggs were observed in the field from mid-April to late June (Fig. 3); they were most numerous during the latter part of May. A maximum of 7 eggs was observed on a single plant, each deposited on a different leaf.

A mymarid, *Anaphes* sp. (Hymenoptera: Mymaridae), parasitized in excess of 10% of field-collected eggs (Table 3). This species is reported here for the first time as a true egg parasite of *T. texana*. Although the life cycle of this parasite was not studied, *Anaphes* sp. is a solitary, internal egg parasite, and its temporal distribution coincided with peak host density (Fig. 4).

*Larva.* Newly hatched larvae tunneled toward the base of the petioles, entering the stem pith as 2nd or 3rd instar larvae. Larval feeding inside the leaf petioles caused premature abscission of the leaves. Evidence for this early abscission was obtained by splitting the stems longitudinally to expose frass tunnels in the stem pith originating from leaf nodes.

Subsequent feeding and maturation of larvae occurred entirely within the stem pith of SLN. In a given plant, intraspecific competition between the developing larvae for food was generally fatal to all but a single larva. It was uncommon for 2 larvae to develop to maturity in the same plant as indicated by frequent observations of partially devoured or fragments of larvae mixed with frass. Although the exact nature and significance of this accidental cannibalism are unknown, one possible explanation for the observed intraspecific predation is increased survival of an individual at the expense of siblings (Eikwort 1973), assuming that a within-plant infestation of multiple larvae resulted from eggs produced and deposited by the same female.

Table 1. Duration (in days) of each immature stage of *Trichobaris texana* under laboratory conditions of c. 24°C and 14L:10D photoperiod.

Stage	No. completing stage	Range	$\bar{x} \pm SE$	Cumulative mean age (days)
Egg	95 <sup>1</sup>	4-18	6.20±0.22	6.20
Larva				
1st instar	70	1-10	4.13±0.23	10.33
2nd instar	53	3-11	5.23±0.20	15.56
3rd instar	42	4-10	5.52±0.18	21.08
4th instar	36	4-15	6.47±0.45	27.55
5th instar	27	5-13	6.67±0.29	34.22
6th instar	18	6-27	12.39±1.70	46.61
7th instar	5	7-21	15.60±2.31	62.21
Pupa	10	10-12	11.10±0.18	73.31

<sup>1</sup>108 eggs were deposited.

Table 2. Life table for *Trichobaris texana* cohort reared at c. 24°C and 14L:10D photoperiod.<sup>1</sup>

x	$l_x$	$d_x$	$L_x$	$T_x$	$e_x$	100 $q_x$	100 $r_x$
Eggs	108	13	101.5	170.0	1.57	12.04	12.04
Larvae	95	84	53.0	68.5	0.72	88.42	77.78
Pupae	11	1	10.5	15.5	1.41	9.09	0.93
Adults	10	10	5.0	5.0	0.50	100.00	9.26

<sup>1</sup> $e_x$  value represents life expectancy in 'life stages' remaining.

*T. texana* has 6 or 7 larval instars in the laboratory. The 1st, 2nd, 3rd, 4th, 5th, 6th, and 7th instars averaged 4.1, 5.2, 5.5, 6.5, 6.7, 12.4, and 15.6 days, respectively (Table 1). The duration of the entire larval period was 23-86 days for 6 instars and 30-107 days for 7 instars. Of the developmental stages of *T. texana*, the larval stage experienced the greatest mortality. Ten percent of the cohort survived the larval stage (Table 2).

The number of instars increases in many species of insects with insufficient or inadequate food (Gaines and Campbell 1935; Cuda and McPherson 1976; Frick and Wilson 1978); thus, the number of instars (6 or 7) observed for *T. texana* in the laboratory may have resulted from a dietary deficiency. To test the hypothesis of inadequate diet, head capsule measurements of preserved, field-collected larvae were analyzed by Dyar's 'Rule' (Dyar 1890) and the least squares method (Forbes 1934; Gaines and Campbell 1935; Cave and Smith 1983). Table 4 includes observed and

expected values of head capsule widths for field-collected larvae of *T. texana*. The mean of the observed growth ratios ( $r = 1.31$ ) was used as a common ratio for calculating an expected progression beginning with the first term of the observed progression. The observed and calculated values are reasonably close indicating Dyar's law corroborates the 6 or 7 instars observed in the laboratory.

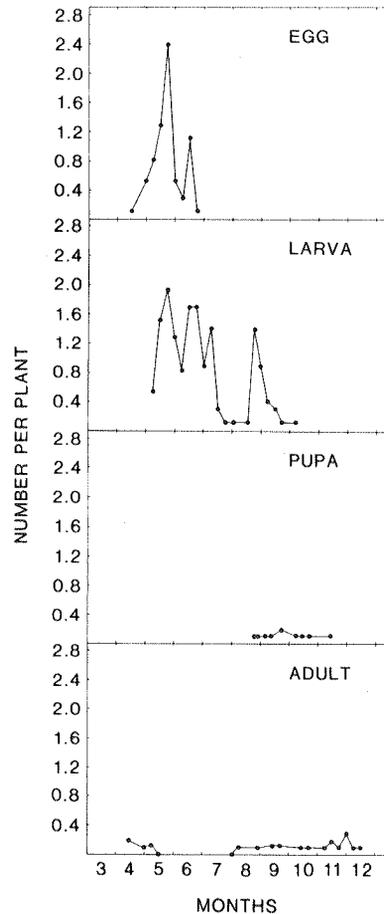


Fig. 3. Temporal distribution of the developmental stages of *Trichobaris texana* LeConte for 1979 on *Solanum elaeagnifolium* Cav. in Brazos County, Texas, U.S.A.

A perfect geometrical progression of head capsule widths can be represented by a straight line if the logarithms of the head measurements are plotted against the number of instars (Forbes 1934). A plot of the equation  $\log Y = -0.687 + 0.119X$  for larvae of *T. texana* (Fig. 5) reveals a strong positive linear relationship between instar number and larval head capsule width ( $r^2 = 0.985$ ). The expected values found by substituting for  $X$  in the foregoing equation are given in Table 4 together with the difference between them and the observed values. Although development was not perfectly geometrical, this linear model provides additional evidence that *T. texana* has 6 or 7 instars.

Larvae were found in field samples from the 2nd week of May to the 2nd week of October (Fig. 3). Parasites reared from the larvae were *Neocatolaccus tylodermae* (Ashmead) (Hymenoptera: Pteromalidae) and *Eurytoma* sp. (Hymenoptera: Eurytomidae) (Table 3). The latter could be *E. tylodermatis* Ashmead, which is known from existing host records to attack *T. texana* and *T. trinotata* (Burks 1979). In addition,

a species of the genus *Eurytoma* was previously reported as a parasite of *T. texana* in stems of buffalobur, *S. rostratum* (Chesnut and Cross 1971); whether it is conspecific with the species attacking *T. texana* in SLN could not be determined. It should be noted that *N. tylodermae*, which accounted for 3.2% parasitism, was reared from larvae collected during preliminary sampling in 1978; it was not observed in 1979. Total larval mortality due to parasitism was 4.5%. The larval parasites were present from late July to early November (Fig. 4).

Table 3. Parasites of the egg and larval stages of *Trichobaris texana* on *Solanum elaeagnifolium*, 1978 and 1979, Brazos County, Texas, U.S.A.

Parasite	Host stage attacked	No. of each host stage collected	% Parasitism
<i>Anaphes</i> sp. (Hymenoptera: Myrmaridae)	Egg	104	10.6
<i>Neocatolaccus tylodermae</i> (Ashmead) <sup>1</sup> (Hymenoptera: Pteromalidae)	Larva	94	3.2
<i>Eurytoma</i> sp. (Hymenoptera: Eurytomidae)	Larva	237	0.8
Unidentified species <sup>2</sup>	Larva	237	Total 6.0

<sup>1</sup>Collected in 1978.

<sup>2</sup>Only host remains recovered.

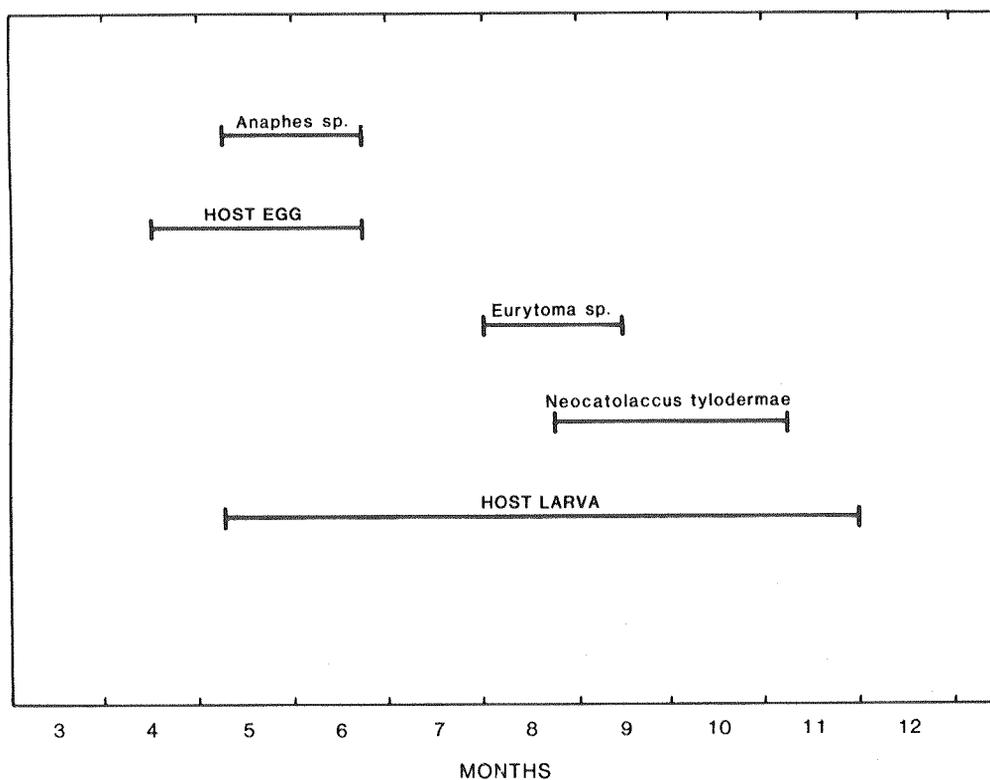


Fig. 4. Temporal distribution of the parasites of the egg and larval stages of *Trichobaris texana* LeConte during 1978-79, Brazos County, Texas, U.S.A.

*Pupa.* Mature larvae pupated in the stems of SLN. Prior to pupation, the larva bores a hole outward that penetrates the extensive woody secondary xylem but not the cortical or epidermal layers of the stem. This behavior facilitates subsequent adult emergence. The larva then constructs a pupal chamber of woody secondary xylem fibers before entering a nonfeeding quiescent prepupal period which in the laboratory lasted 4–9 days. The pupa is white to pale yellow initially but tanning of the pharate adult cuticle commences 9–11 days prior to eclosion. Under laboratory conditions, the pupal stage ranges from 10–12 days with an average duration of 11.1 days (Table 1). Nine percent of the laboratory cohort completed the pupal stage (Table 2).

Pupae were observed in field samples from late August to mid-November (Fig. 3). The appearance of new adults during the 2nd week of August (Fig. 3), however, clearly indicates pupae were present earlier but none were collected.

Table 4. Comparison of observed and expected values of head capsule widths (mm) of larvae of *Trichobaris texana*.

Instar	Observed <sup>1</sup>	Expected	Difference	% Difference
I	0.27	0.27 <sup>2</sup>	0.00	0.00
		0.27 <sup>3</sup>	0.00	0.00
II	0.38	0.35	+0.03	+8.57
		0.36	+0.02	+5.56
III	0.48	0.46	+0.02	+4.35
		0.48	0.00	0.00
IV	0.56	0.60	-0.04	-6.67
		0.62	-0.06	-9.67
V	0.73	0.79	-0.06	-7.59
		0.81	-0.04	-4.94
VI	1.14	1.03	+0.11	+10.68
		1.06	+0.08	+7.55
VII	1.40	1.35	+0.05	+3.70
		1.40	0.00	0.00

<sup>1</sup>Mode.

<sup>2</sup>Calculated from the mean of the observed Dyar ratios ( $r = 1.31$ ) and the observed first term.

<sup>3</sup>Calculated by linear regression, using the equation  $\log Y = -0.687 + 0.119X$ .

*Adult.* Feeding, mating, and oviposition were observed in the laboratory. Adults feed on the epidermal layer and a few layers of underlying cells from small areas located on a leaf petiole or terminal portion of the stem.

A single pair was observed *in copulo* on three different dates. The adults assume the normal copulatory position with the male on the back of the female. Copulation was in progress each time this pair was observed but lasted an additional  $115 \pm 54.1$  min. for the three observations.

Oviposition commences 1–23 days after mating. One female was observed ovipositing. The female first chewed a hold deep enough to completely conceal the egg just below the epidermis of a leaf midrib. The excavation was placed ventrally near the base of the lamina. The female then turned 180°, located the hole with the tip of the abdomen, and inserted the ovipositor into the opening. After depositing the egg, the female returned to the original position and chewed two arcuate slits that united laterally

forming an ellipse around the hole and, using these slits, excavated a chamber around the egg. The total time for oviposition and construction of the chamber was *c.* 30 min.

The reproductive capacity of *T. texana* was also measured in the laboratory. Three females were tested, each in a separate feeding and oviposition cage at *c.* 24°C and a 14 h photophase. Excluding the time spent in reproductive diapause (which is likely to be highly dependent on climatic conditions), active adult females lived a maximum of 39 days (avg. of  $35 \pm 5.3$  days). Peak oviposition occurred within *c.* 30 days after mating with a maximum production of *c.* 5 eggs/female/day (Fig. 6). The three females deposited from 10–44 eggs ( $x \pm SD = 33 \pm 20$ ) each over a period of *c.* 5.5 wks.

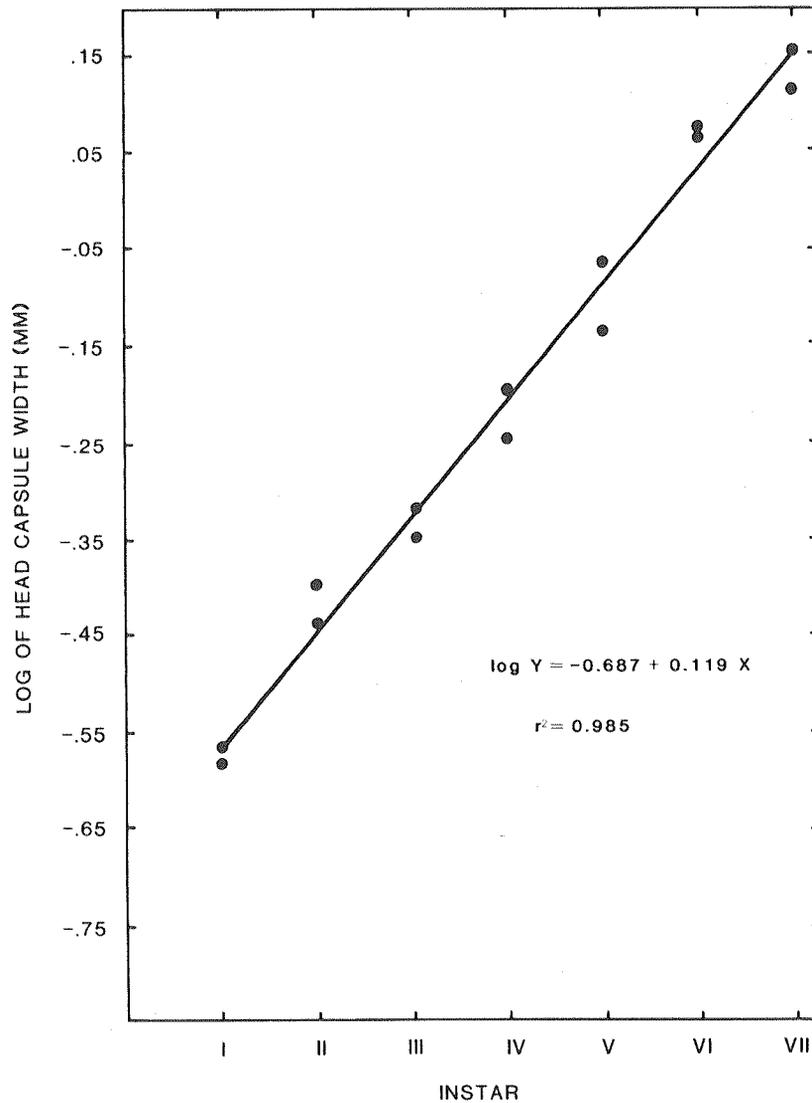


Fig. 5. Semilog plot of the mode larval head capsule widths of *Trichobaris texana* LeConte versus the number of instars using the regression equation,  $\log Y = -0.687 + 0.119X$ .

From laboratory rearing, duration and survival of the immature stages were found to be: egg — 6.2 days, 88.0%; larva — 56.0 days, 11.6%; and pupa — 11.1 days, 90.9%. Thus, the best estimate of total developmental time and survival through the

immature stages was 74 days and 9.0%, respectively (Tables 1 and 2). When the number of living individuals within the cohort at a given age ( $I_x$ ) were plotted against the age ( $x$ ), the staircase type of survivorship curve with three distinct steps (Ito 1959) indicated that *T. texana* had three critical periods throughout its development — from the egg to the first larval instar, from the last larval instar to the pupa, and the senescent adult (Fig. 6).

Using the aforementioned information on duration and survival of the immature stages and that of oviposition and survival of the females, the basic population parameters were then calculated according to the methods of Birch (1948) and Laughlin (1965). The net reproductive rate ( $R_0$ ) for *T. texana* was 1.41, the cohort generation time ( $T_c$ ) was 92.55 days, and the capacity for increase ( $r_c$ ) was 0.0037. Thus, the population would increase 1.004 times/day and 187 days would be required for the population to double.

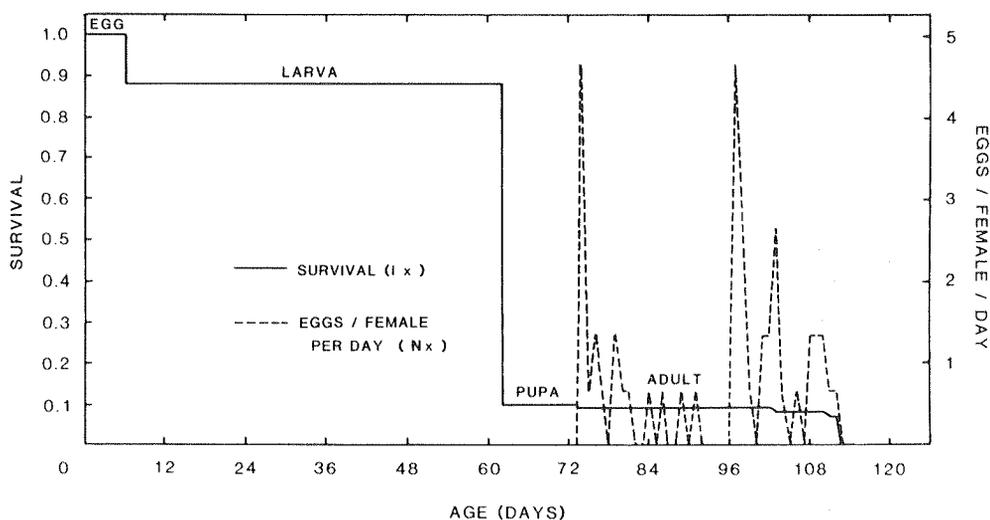


Fig. 6. Survival and age-specific oviposition of three newly emerged females of *Trichobaris texana* LeConte in the laboratory (survival of immature stages is based on a separate cohort of eggs).

In the field, adults emerged from overwintering sites and were present from mid-April to early May but died soon afterward (Fig. 3). Diapausing adults appeared inside the stems of SLN in early August; they were most numerous from mid- to late November (Fig. 3). In general, adults overwinter inside the stems but occasionally complete the excavation of the emergence hole initiated by the larvae, emerge from the stems, and apparently overwinter in adjacent ground litter. Although no adults were recovered from ground litter samples analyzed in December 1979 by the Berlese-Tullgren funnel extraction method (Southwood 1978), the ground litter hibernation site hypothesis is supported by the observation of adult emergence holes in stems of 6.0% of plants sampled between 3 October and 10 December and the report of an adult overwintering in old stalks of little bluestem, *Schizachyrium scoparium* (Michx.) Nash. (Poaceae) (Salsbury, pers. comm.).

#### *Impact of Trichobaris texana on Silverleaf Nightshade*

Since feeding of the larvae inside the stems is potentially destructive and will determine the efficacy of *T. texana* as a biological control agent of SLN, the effect of

this feeding was evaluated by comparing the seasonal rate of growth (i.e. height) of normal and infested plants. After plotting the mean heights of infested and uninfested plants against time (Fig. 7), growth curves were fitted to the data by curvilinear regression. The asymptotic growth model of Snedecor and Cochran (1980), which is expressed by the equation:

$$Y = A - B(C^x)$$

where:  $Y$  = height (cm);  $x$  = time (days);  $A$  = maximum height;  $B$  = difference between maximum height and height at  $t = 0$ ; and  $C$  = rate of growth, yielded significantly different estimates for  $A$  and  $B$  from infested and uninfested plants ( $F_{3,62} = 20.633$ , Table 5) when the reduced and full models were analyzed by the 'Extra Sum of Squares Principle' (Draper and Smith 1981). These data suggest that tunneling activity of larvae inside stems ultimately stunts growth of SLN.

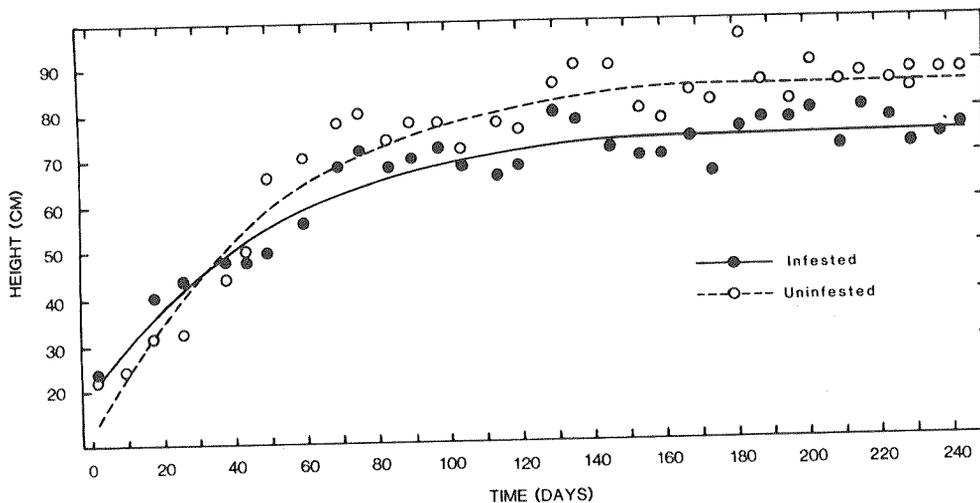


Fig. 7. Seasonal growth pattern of uninfested *Solanum elaeagnifolium* Cav. and plants infested with larvae of *Trichobaris texana* LeConte.

Table 5. Range of values of the coefficients of the asymptotic function fitted to the growth data on silverleaf nightshade at the 95% confidence interval.<sup>1</sup>

Coefficient	Uninfested	Infested
A	84.6 -91.1* <sup>2</sup>	72.8 -79.3*
B	69.1 -83.4*	47.8 -64.6*
C	0.976- 0.984	0.974- 0.986

<sup>1</sup>Model:  $Y = A - B(C^x)$ .

<sup>2</sup>Values across the row followed by an asterisk are significant at  $P < 0.05$  according to the Extra Sum of Squares Principle (Draper and Smith 1981).

## Conclusions

SLN is a major perennial weed in cultivated and otherwise disturbed areas both here and abroad. Millions of acres of cotton cropland in the southwestern United States

are infested with this native weed (Orr *et al.* 1975). Furthermore, SLN was accidentally introduced into South Africa and Australia, where it also is becoming a troublesome weed in agricultural land and pastures (Siebert 1975).

Since chemical and mechanical control measures have met with limited success, biological control may be a viable alternative. To date, four species of insects and one nematode have been considered as candidates for biological control of SLN (Goeden and Ricker 1971; Siebert 1975; Julien 1982).

The results of this study suggest that *T. texana* may afford some measure of biological control for SLN. Infested plants are stunted by the stem-boring activity of the larvae. Since SLN reproduces both by seed and by perennial root propagation, the stem-boring action of this natural enemy may curtail regrowth from underground parts of the plant and thus reduce the rate of spread of this noxious weed.

The biology of *T. texana* was studied herein primarily to contribute to the limited knowledge of the Curculionidae. However, in view of this insect's apparent ability to retard the growth of SLN, continued research on the host range, climatic tolerances and potential control value of *T. texana* is recommended.

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