

ECOLOGIA, COMPORTAMENTO E BIONOMIA**Nymph and Adult Biology and Seasonal Abundance of *Loxa deducta* (Walker) on Privet, *Ligustrum lucidum***ANTÔNIO R. PANIZZI¹, ANA P. M. MOURÃO², AND ÉMERSON D. M. OLIVEIRA¹¹Embrapa, Centro Nacional de Pesquisa de Soja, Caixa postal 231, 86001-970, Londrina, PR.²Universidade Estadual de Londrina, Departamento de Agronomia, Caixa postal 6001, 86051-970, Londrina, PR.

An. Soc. Entomol. Brasil 27(2): 199-206 (1998)Biologia de Ninfas e de Adultos e Abundância Estacional de *Loxa deducta* (Walker) em Ligustro, *Ligustrum lucidum*

RESUMO - Estudos em laboratório e a campo indicaram que o ligustro (alfeneiro), *Ligustrum lucidum* (Oleaceae) é uma planta hospedeira importante do percevejo neotropical, *Loxa deducta* (Walker) (Hemiptera: Pentatomidae) no norte do estado do Paraná. A sobrevivência das ninfas foi alta (82,9%) quando se alimentaram de frutos imaturos do ligustro. O tempo de desenvolvimento ninfal (do 2º a adulto) foi de ≈ 49 d. No dia da emergência dos adultos, as fêmeas alcançaram um peso maior (199,5 mg) do que os machos (180,0 mg). A sobrevivência de adultos de *L. deducta* decresceu gradualmente com o tempo. A longevidade média foi de ≈ 62 d para as fêmeas e ≈ 55 d para os machos. De 30 fêmeas observadas, 25 (83,3%) ovipositaram quando alimentadas de frutos imaturos de ligustro. O período de pré-oviposição foi de $13,9 (\pm 0,51)$ d; a fecundidade foi de $17,8 (\pm 1,60)$ massas de ovos/fêmea, e de $236,0 (\pm 21,98)$ ovos/fêmea; a eclosibilidade dos ovos foi de $65,0 (\pm 6,48)\%$. Considerando o período total de quatro semanas, a percentagem de aumento em peso corporal fresco foi $\approx 70\%$ para fêmeas e $\approx 45\%$ para os machos. Durante os meses de verão (dezembro a fevereiro), os insetos foram coletados em baixo número no alfeneiro. Em março, as populações de ninfas e de adultos aumentaram, alcançando o pico máximo em abril, decrescendo em maio no final do outono. Essa tendência de queda continuou durante os meses de inverno (junho-julho-agosto), atingindo quase zero em setembro, no início da primavera, aumentando novamente em outubro-novembro.

PALAVRAS-CHAVE: Insecta, Hemiptera, Heteroptera, Pentatomidae, bioecologia, planta hospedeira.

ABSTRACT - Laboratory and field studies indicated that privet, *Ligustrum lucidum* (Oleaceae), is an important host plant of the neotropical stink bug, *Loxa deducta* (Walker) (Hemiptera: Pentatomidae) in northern Paraná state. Survivorship of nymphs was high (82.9%) when fed immature fruits of privet. Nymph developmental time (from the 2nd stadium to adult) lasted ≈ 49 d. At adult emergence, females attained greater (199.5 mg) fresh body weight than

males (180.0 mg). Survivorship of adult *L. deducta* decreased gradually with time. Mean total longevity was ≈ 62 d for females and ≈ 55 d for males. Of 30 females observed, 25 (83.3%) oviposited when fed fruits of privet. The preoviposition period was $13.9 (\pm 0.51)$ d; fecundity was $17.8 (\pm 1.60)$ egg masses/female, and $236.0 (\pm 21.98)$ eggs/female; egg hatchability was $65.0 (\pm 6.48)\%$. Considering the total period of 4-wks, the percentage increase in fresh body weight was $\approx 70\%$ for females, and $\approx 45\%$ for males. During summer months (December to February), relatively low numbers of insects were collected on privet. During March, nymph and adult populations increased reaching a peak during April, and decreasing in May at the end of autumn. This tendency continued throughout winter (June-July-August), reaching almost zero in September at the beginning of spring, and increasing somewhat again in October-November.

KEY WORDS: Insecta, Hemiptera, Heteroptera, Pentatomidae, bioecology, host plant.

The neotropical stink bug *Loxa deducta* (Walker) has been little investigated. It has been reported from several plants, but to feed and reproduce only on *Citrus reticulata* (D. Link, personal communication to ARP), and on the the legume trees *Bauhinia candicans* in Rio Grande do Sul state, south Brazil (Link & Grazia 1987), and leucaena, *Leucaena leucocephala* in Paraná and São Paulo states in the southeast (Panizzi & Rossi 1991). It has also been said to feed on soybean, *Glycine max*, but in low numbers (Link & Grazia 1987). Two other species of *Loxa* are recorded from Brazil [*L. virescens* Amyot & Serville, a former synonym of *L. flavicollis* (Drury), and *L. viridis* Palisot de Beauvois = *L. picticornis* Horwath) but all are of minor economic importance (Silva *et al.* 1968 revised by Grazia 1977; see also Eger 1978). In Argentina, *L. virescens* (referred as *L. flavicollis*) is reported as a secondary pest of soybean (Rizzo 1972).

During 1996, nymphs and adults of *L. deducta* were observed colonizing privet, *Ligustrum lucidum* (Oleaceae) in Londrina, Paraná state (latitude $23^{\circ} 11' S$, longitude $51^{\circ} 11' S$). This plant is very abundant and is used as an ornamental tree in the urban area of Londrina. It is an exotic plant, originating from China (Milano 1949). During most of

the year plants carry fruits (berries), which are very abundant, especially on the outer surface of the plant. This gives to the plant a typical light-green coloration when fruits are immature, and darkish-purple at the time of fruit maturation.

In a previous study it was found that *L. lucidum* (which was misidentified as *L. japonicum*) is an important host of the southern green stink bug, *Nezara viridula* (L.) (Panizzi *et al.* 1996). Nymphs and adults perform very well on fruits of this plant, which are now used as a standard diet for mass rearing of the bug in our laboratory. Because of this, and because of the presence of *L. deducta* on this plant, this study was conducted to test the suitability of privet fruits for nymphal development and adult reproduction. In addition, surveys of *L. deducta* were carried out to determine the seasonal abundance of nymphs and adults on this host plant throughout the year.

Material and Methods

Laboratory Study with Nymphs. *L. deducta* adults were collected from *L. lucidum* and taken to the laboratory. A variable number (two to three) pairs were placed in plastic boxes (12.0 x 12.0 x 3.8 cm) lined with filter

paper and covered with a lid. Adults were fed immature fruits of *L. lucidum*. Egg masses were collected on the day of oviposition and placed in petri dishes (9.0 x 1.5 cm) with moistened filter paper. On the 1st d of the 2nd stadium (1st instars do not feed), nymphs were removed and placed individually in petri dishes. Immature fruits of *L. lucidum* were offered to 82 nymphs (replicates).

Petri dishes were placed at random in an environmental chamber maintained at 25 ± 1 °C and $65 \pm 5\%$ RH with a photoperiod of 14:10 (L:D) h. During September to November 1996, daily observations were made on molting and mortality, and food was replaced every 2 d. Nymphal development time and percentage of mortality of each instar (except the 1st) and from 2nd instar to adult, were calculated. Fresh body weight at adult emergence was taken using an electronic balance. Data on time of development among instars were submitted to analysis of variance and means compared using Duncan's multiple range test ($P \leq 0.05$). Fresh body weight between females and males were compared using student's *t*-test ($P \leq 0.05$).

Laboratory Study with Adults. From additional nymphs reared in the laboratory using immature fruits of *L. lucidum*, adults were obtained. Single female/male pairs were placed in a rearing plastic box (12.0 x 12.0 x 3.8 cm) with moistened filter paper and covered with a lid. Thirty pairs were fed immature fruits of *L. lucidum*. Food was replaced every 2 d.

During November 1996 to February, 1997, daily observations were made on adult survivorship and reproduction. Survivorship up to day 120 and total longevity, percentage of females ovipositing, female age at 1st oviposition, mean number of egg masses and eggs/female, and percentage of egg hatch were calculated. Adult body weight gain (%) during the 1st, 2nd, 3rd, 4th, and 1st-4th weeks of life was calculated. Data on total longevity, and percentage fresh body weight changes between females and males, and among weeks, were compared using Duncan's mul-

tiply range test (for more than two means) and student's *t*-test (for two means) at $P \leq 0.05$.

Field Survey of Nymphs and Adults. To monitor the abundance of *L. deducta* nymphs and adults on *L. lucidum*, weekly samples were taken from April 1996 to March 1997. Each sample consisted of shaking a branch section (30 cm) with fruits inside a sweep net. A total of 30 samples were taken each week, out of 10 trees (three samples/tree) chosen at random at the urban area of Londrina, and taken to the laboratory. The number of nymphs and adults *L. deducta* were recorded. Data were calculated as the total number of nymphs and adults obtained each month (total of 120 samples/month) for the 12 months covered during the study.

Results and Discussion

Laboratory Study with Nymphs. Survivorship of *L. deducta* nymphs was relatively great (17.1% mortality) (Table 1) compared to what has been observed for this bug fed on other hosts such as leucaena (53.9% mortality on immature seeds, and 82.6% on immature pods) or soybean (68.8% mortality on immature pods) (Panizzi & Rossi 1991). Feeding on fruits of the the same privet species, another pentatomid, *N. viridula* showed greater mortality (38.7%; Panizzi *et al.* 1996). Besides a possibly greater nutritional quality of privet fruits for nymphs, the fact that they fed on exposed fruits, which are free of pilosity allowing free access, may have enhanced nymph survivorship. Nymph mortality at each instar varied from 1.2% (for the 4th instar) to 7.3% (for the 3rd instar) (Table 1).

Nymph developmental time (from the 2nd stadium to adult) lasted ca. 49 d (Table 1). This value is lower than the one observed for *L. deducta* nymphs of immature pods of leucaena (≈ 56 d) but greater than the time needed to complete development on immature seeds of leucaena (≈ 44 d) or on immature soybean pods (≈ 36 d) (Panizzi & Rossi 1991). Second and 3rd stadia took less time

Table 1. Mean \pm SEM developmental time and survivorship of *Loxa deducta* nymphs feeding on immature fruits of privet, *Ligustrum lucidum* in the laboratory (numbers of nymphs surviving each stadium are given in parentheses).

Stadia	Stadium duration, days ¹	Mortality (%)
Second	7.1 \pm 0.11 a (78)	4.9
Third	7.6 \pm 0.25 a (72)	7.3
Fourth	12.2 \pm 0.39 b (71)	1.2
Fifth	22.2 \pm 1.23 c (68)	3.7
Second-Fifth	49.1 \pm 1.48 (68)	17.1

¹Means followed by the same letter do not differ significantly ($P < 0.05$) using Duncan's multiple range test.

to complete development, and the 4th and 5th stadia took 2-3 fold as much time (Table 1).

At adult emergence, females attained greater fresh body weight than males (Table 2), which is considered a common event among heteropterans. Compared with other

Laboratory Study with Adults.

Survivorship of adult *L. deducta* decreased gradually with time. For instance, 20 d after adult life, $\approx 90\%$ of females and males were alive (Fig. 1). After 60 d, 60% of females and 45% of males were alive; less than 10% sur-

Table 2. Mean \pm SEM of fresh body weight of one day adult *Loxa deducta* feeding on immature fruits of privet, *Ligustrum lucidum* in the laboratory (numbers of adults are given in parentheses).

Adults	Fresh body weight, mg ¹
Females	199.5 \pm 5.23 a (36)
Males	180.0 \pm 3.74 b (32)

¹Means differed significantly ($P > 0.05$) using student's *t* test.

phytophagous pentatomids, *L. deducta* may be considered a large species, females weighing ≈ 200 mg, a weight greater than those referred to other pentatomids common in soybean fields (body weight range of females 56 - 134 mg; Panizzi 1987).

vived day 100, and no adults reached day 120. Mean total longevity was ≈ 62 d for females and ≈ 55 d for males (Fig. 1). These observed values of life span for *L. deducta* on *L. lucidum* fruits are much higher than those observed when they fed on other food plants.

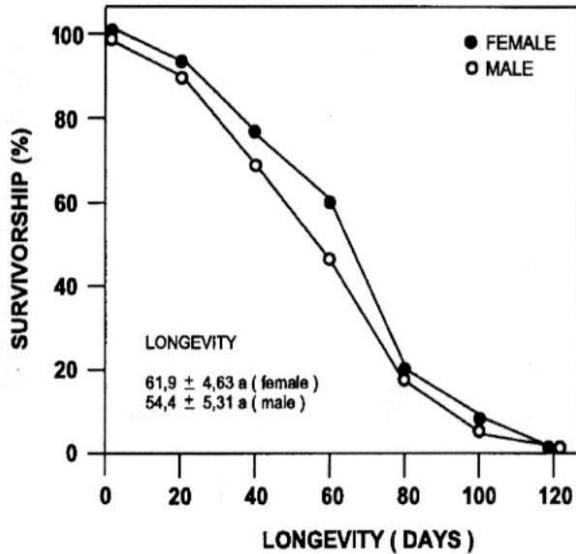


Fig. 1. Survivorship up to 120 days and total longevity of adult *Loxa deducta* feeding on immature fruits of *Ligustrum lucidum* in the laboratory. Mean longevity between genders did not differ significantly ($P < 0.05$) using student's *t* test.

For example, on leucaena pods total longevity was 33.9 d for females and 18.5 d for males; on soybean these values were even smaller: 20 d for females and 15.6 d for males (Panizzi & Rossi 1991).

In a similar way, the adult reproductive performance of *L. deducta* on privet was impressive compared to that observed on other food plants [leucaena and soybean - Panizzi & Rossi (1991)]. Of 30 females observed, 25 (83.3%) oviposited when fed fruits of privet; on leucaena 60% of females oviposited, and on soybean only 12.5% of females laid eggs. The preoviposition period was 13.9 (± 0.51) d on privet; on leucaena it was 17.1 d, and up to 39.0 d on soybean. On privet, fecundity was 17.8 (± 1.60) egg masses/female, and 236.0 (± 21.98) eggs/female; on leucaena these values were 5.0 and 65.6, and on soybean 2.0 and 27.0, respectively. Egg hatchability on privet was 65.0 (± 6.48)%; on leucaena egg hatchability was 42.0%, and on soybean no eggs hatched. These values on reproduction indicate that *L. lucidum* is a very suitable food for female *L. deducta*, and that other hosts

such as the legumes leucaena and soybean are much less appropriate for this insect's reproduction.

Adult *L. deducta* gained fresh body weight, especially during the 1st week of life (55% for females and 40% for males - Fig. 2). During the 2nd week of life, body weight increased an additional 11% for females and 8% for males; during the following 2-wks no substantial change in body weight was observed. Considering the total period of 4-wks, the percentage increase in fresh body weight was ca. 70% for females, and ca. 45% for males. These values are greater than those observed for *L. deducta* females and males fed on leucaena pods (51.7% and 33.9%, respectively) or fed on soybean pods (27.7% and 26.0%, respectively) (Panizzi & Rossi 1991). Females gained significantly ($P < 0.05$) more weight than males during the 1st week, and during the total period of 4-wks (Fig. 2).

Field Survey of Nymphs and Adults. The seasonal abundance of *L. deducta* nymphs and

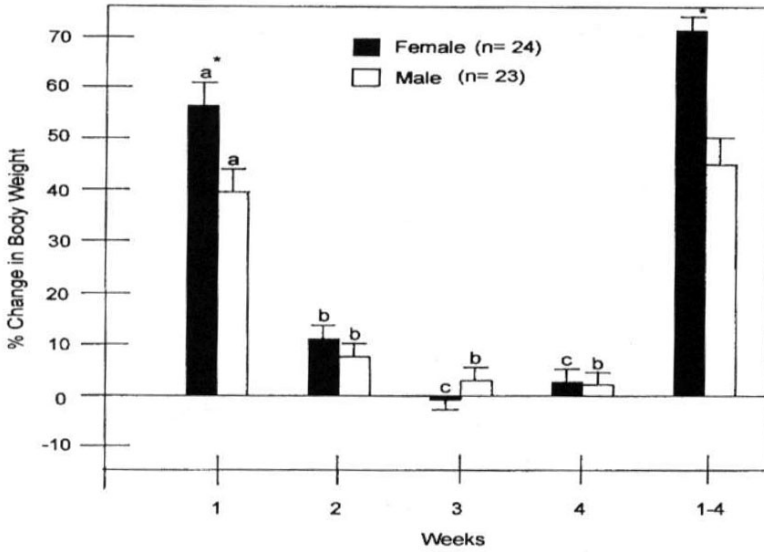


Fig. 2. Mean \pm SEM percentage of fresh body weight change of *Loxa deducta* feeding on immature fruits of privet, *Ligustrum lucidum* in the laboratory. Means (within each gender) followed by the same letter do not differ significantly ($P < 0.05$) using Duncan's multiple range test. Asterisks indicate significant difference ($P < 0.05$) between genders at each week, and from weeks 1-4, using student's *t* test.

adults on privet trees was variable, although the bugs were present year round. The nymph and adult populations showed similar trends.

During summer months (December to February), relatively low numbers of insects were collected (Fig. 3). During March, nymph and

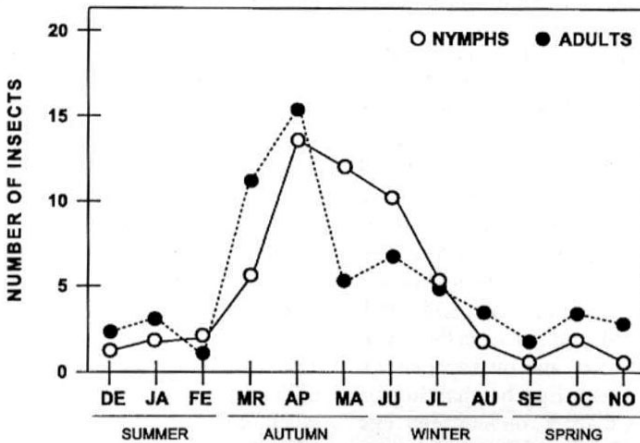


Fig. 3. Seasonal abundance of *Loxa deducta* on privet, *Ligustrum lucidum* from December 1996 to November 1997. Each point corresponds to the mean number of insects from weekly samples taken at each month. Each sample consisted of 30 branch sections (30 cm) with fruits, shaken inside a sweep net.

adult populations increased substantially, reaching a peak during April, and decreasing in May at the end of autumn. This tendency continued throughout winter (June-July-August), reaching almost zero in September at the beginning of spring, and rising up again in October (Fig. 3). The decrease in populations observed during spring, particularly of nymphs, may be explained by the low availability of plants carrying fruits, which at this time are initiating bloom. Thus, the rate of reproduction of *L. deducta* will decrease during spring-early summer. In Rio Grande do Sul state, *L. deducta* occurs on several host plants during autumn-winter-spring, including a species of privet, *Ligustrum ovalifolium*; no hosts plants were found during summer, except for the legume tree *B. candicans* (Lopes *et al.* 1974, Link & Grazia 1987).

In conclusion, these results demonstrate that privet, *L. lucidum*, is a very important host of *L. deducta*; nymphs develop on it and adults reproduce at a much higher rate than on other plant species, hosting the bugs year round. Therefore, this plant plays an important role in the build up of populations of this bug, as do many hosts of other pentatomid species (Panizzi 1997). Fortunately, *L. deducta* is a minor pest of economically important crops.

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