OCCURRENCE AND BIOLOGY OF *Tolype innocens* (Burmeister) ON BLUEBERRY[1]

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ABSTRACT - *Tolype innocens* (Burmeister, 1878) is reported for the first time damaging blueberry (*Vaccinium ashei*) plants in Brazil having the caterpillars feeding on leaves and new shoots. *T. innocens* biology was studied on blueberry leaves in laboratory conditions and then a fertility life table was elaborated. Developmental time and viability of egg, larval and pupal stages and egg-adult period were 15.0 and 35.3, 33.3 and 84.5, 20.6 and 100, and 69.2 days and 45%, respectively. Average pupal weight was 0.840g for the females and 0.580g for the males. The sex ratio was 0.5. Pre-oviposition and oviposition time lasted 6.34 and 12.1 days, respectively. Mean fecundity was 251 eggs per female. Eggs were laid either individually or in masses. Longevity was 19.0 and 20.0 days for males and females, respectively. *T. innocens* population increased 47 times per generation, with a mean generation time of 77 days, and a finite rate of increase of 1.02. This data on biological parameters will be useful for establishing control strategies.
Index terms: Lepidoptera, urticating caterpillar, pest of temperate fruit.

OCORRÊNCIA E BIOLOGIA DE *Tolype innocens* (Burmeister) EM MIRTILO

RESUMO - A ocorrência de *Tolype innocens* (Burmeister, 1878) (Lasiocampidae) é relatada pela primeira vez danificando o mirtileiro (*Vaccinium ashei*) no Brasil, sendo que as lagartas se alimentam das folhas e ramos novos. Em laboratório, foi estudada a biologia em folhas de mirtilo em condições controladas de temperatura (25±1ºC), umidade relativa (70±10%) e fotofase (12h) e elaborada a tabela de vida de fertilidade. A duração e a viabilidade dos estágios de ovo, lagarta e pupa, e período ovo-adulto foram de 15,0 e 35,3; 33,3 e 84,5; 20,6 e 100; e 69,2 dias e 45%, respectivamente. O peso médio de pupas foi de 0,840g para as fêmeas e 0,580g para os machos. A razão sexual foi de 0,5. Os períodos de pré-oviposição e oviposição foram de 6,34 e 12,1 dias, respectivamente. A fecundidade média foi de 251 ovos por fêmea, colocados de forma isolada ou em massas. A longevidade dos machos foi de 19,0 dias e das fêmeas de 20,0 dias. *T. innocens* apresentou aumento de 47 vezes a cada geração, e a duração média de uma geração foi de 77 dias, sendo a razão finita de aumento de 1,02. Os dados obtidos dos parâmetros biológicos poderão auxiliar no estabelecimento de estratégias de controle.
Termos para indexação: Lepidoptera, lagarta urticante, praga de frutífera de clima temperado.

INTRODUCTION

The blueberry (*Vaccinium ashei* Reade) (Ericaceae) is native from both Europe and to the United States (USA) (HOFFMANN; ANTUNES, 2006). This fruit has been recognized as the "fount of longevity" as well as being of great economic importance, valued by its nutritional composition (KALT et al., 2007). These characteristics have triggered production in non-traditional regions, such as South America, where it was benefited by its capacity to produce fruits during the offseason of Europe and the USA. Moreover, South America weather conditions are similar to the locations from where the plant is native from. However, blueberries are yet known and appreciated by few Brazilians due to its recent introduction in the country in the 1980s. Cropping has been made with "Rabbiteye" varieties, which have less need for coldness. Currently these varieties are cultivated on about 150 ha, mainly in the states of Rio Grande do Sul and Santa Catarina (L.E.C. Antunes, Embrapa Clima Temperado, personal com-

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munication). Usually this crop is into small farms, having agroecological production systems, without application of insecticides and using family labor to do usual practices (HOFFMANN; ANTUNES, 2006).

The good yields of this fruit reported in Brazil can be attributed to the relative lack of phytosanitary problems and favorable edaphoclimatic conditions. Nevertheless, among the insect-pests known to occur on this plant, the native stingless bee, Irapuá, *Trigona spinipes* (Fabricius) (Hymenoptera: Apidae), mainly damages the flowers, interfering in pollination and consequently fruit formation (SILVEIRA et al., 2010) and *Naupactus tremolesari* (Coleoptera: Curculionidae), which has been found damaging roots (larvae) and leaves (adults) (GONÇALVES et al., 2009). Although, control of the *N. tremolesari* has not been necessary, due to its common low population densities, the fact that it has been found in our country it has arisen some concerns, since of the genus *Naupactus* are the key pests of this crop in Chile (HETZ et al., 2004). Along with these species, caterpillars with urticating hairs were also found on blueberry leaves, during the 2007/2008 harvest. Even though no production losses due to defoliation were observed, there is a concern that burning due to contact with these caterpillars might interfere with fruit harvest, which is done manually.

The finding of new pest species can lead to a necessity for new control measures. This is the first report of urticating caterpillars on blueberry in Brazil; it was also examined the biology of this insect under laboratory conditions.

MATERIAL AND METHODS

Tolype innocens (Burmeister, 1878), known as "urticating caterpillar", was collected from the experimental blueberry fields of Temperate Climate Embrapa, located in Pelotas, RS, Brazil (31°40'47''S, 52°26'24''W; 60 m altitude). The insects were transferred to the Entomology Laboratory were they reared under controlled conditions (25±1ºC, 70±10% RH and 12h photophase). The rearing was kept in plastic pots (15 cm diameter x 12 cm high), in which the caterpillars were fed with blueberry leaves of the cultivar Bluebelle.

Pairs of recently-hatched (12h) larvae were separated using a fine brush and placed in 11 x 11 x 3 cm acrylic boxes (Gerbox®), which were lined on the bottom with filter paper. The caterpillars were fed with fresh blueberry leaves, which were replaced on a daily basis. Every two days, the filter paper, as well as the leftover leaves and insect excrements, were removed to avoid contamination. The biology study was carried out using 120 caterpillars from the first generation reared in the laboratory.

The caterpillars pupate inside the acrylic boxes; the filter paper was removed and a cotton ball dampened with water was included to maintain humidity. After adult emergence, 25 moth pairs were placed in PVC cages (8 cm high x 10 cm diameter). The internal part of these cages was covered with newspaper where the moths could lay their eggs. The adults were fed with a 10% honey solution, by capillary action from a small glass container (10 mL) containing a cotton dental roll. The paper covering the cages was removed and replaced on a daily basis to allow counting the eggs, and every two days the food supply was replaced.

The biological parameters evaluated were: duration and viability of the egg, larval and pupal stages, egg-adult interval, 24h pupal weight, fecundity, and male and female longevity. In order to weigh the pupae, the cocoons were cut with a scalpel. The sex ratio was calculated, using the formula: GR = number of females/(number of females + number of males).

Egg developmental time and viability were calculated for the second egg mass. The eggs were counted and placed in a Petri dish (6 cm diameter x 1.5 cm high) lined on the bottom with a wet piece of filter paper on the bottom and maintained in a climate controlled chamber, as explained before.

Development time (egg-adult) data, total viability, sex ratio, pre-oviposition period, number of eggs per day and daily mortality of males and females were used to calculate a fertility life table, to quantify the growth potential of *T. innocens* per generation, according to Nava et al. (2004).

The descriptions of the egg, caterpillar, pupal and adult stages were made based on insects reared in the laboratory, through daily observations and photographs. *Voucher specimens* were deposited in the Entomological Collection of Embrapa Clima Temperado (CEECT).

RESULTS AND DISCUSSION

Occurrence

The urticating caterpillars collected from December 2007 to January 2008, on blueberries of the cultivar Bluebelle in Pelotas, RS, were identified as *Tolype innocens* (Burmeister, 1878) (Lepidoptera: Lasiocampidae). *T. innocens* occurs in the South of Brazil, Middle and North of Argentina, in Paraguay and in Uruguay. This species had been previously reported in the state of Rio Grande do Sul, Brazil by

Biezanko et al. (1986) occurring in the physiographic region of Missões, and were collected in light traps.

They are caterpillars of the Lasiocampidae family, which including these from the genus *Tolype*, are characteristically polyphagous, feeding on leaves and sprouts of forest plants (SILVA et al., 1968). However, this is the first record of *T. innocens* causing damage to an agricultural crop in the world. Damage to fruit was not seen; only defoliation of up to 10%. It is important to point out that this group of insects is known for their medical importance, since these caterpillars have urticating properties against the humans (SPECHT et al., 2006). According to Pastrana (2004), in Argentina, larvae of the genus *Tolype* are commonly known as "burning beast" as they were found to occur during fruiting period of this crop, they could cause chemical burns in blueberry pickers, since harvest is done manually.

Biology and Description

Eggs laid on the substrate (paper) were glued together by a secretion from coleteric glands, as described by Fitzgerald (1995) for *Malacosoma americanum* (F.) (Lepidoptera: Lasiocampidae) other insect from the same family. The eggs were covered by a layer of scales (abdominal setae), as reported by Lemaire & Minet (1999) and Specht et al. (2004). Probably, this physical barrier gives protection against natural enemies.

The eggs were laid in egg masses on the paper (Figure 1A) that lined the inside of the adults rearing cage, with a mean of 51.03±23.24 eggs, giving a total mean of 251±68.30 eggs per female during the whole oviposition period. The incubation period was of 15 days, which is close to the 14.1 days reported for *M. americanum* (CHOATE; RIESKE, 2005) and shorter than the 65.2 days found for *Tolype ventriosa* Draudat (Lepidoptera: Lasiocampidae) (SPECHT et al., 2004). Viability during the embrionary period was 35.58%, which is low to the usual standart of Lasiocampidae, for which values above 80% have been reported (CHOATE; RIESKE, 2005).

T. innocens caterpillars are gregarious, feeding on leaves and new shoots of blueberry plants (Figure 1B). As much as 10 caterpillars can be found together during the first, second and third instars. After the third instars, the groupings are reduced to two or three individuals. However, the number of instars was not recorded in this trial. In the literature, seven instars were reported for *T. ventriosa* (SPECHT et al., 2004). Developmental time recorded for the larval stage was 33.3 ± 3.0 days, with a mean viability of 84.5%. Specht et al. (2004) reported 162.6 days and 24% viability. They indicated that the low viability could be due to inadequate host plants. Having collected the *T. innocens* caterpillars on blueberry, it is highly possible that this plant might be an adequate host for larval development, what is supported by the fact that we obtained above 80% viability. An effect of host species on Lasiocampidae development was also reported for *Malacosoma disstria* (Hübner) (NICOL et al., 1997) and *Malacosoma neustrium* (L.) (VERDINELLI; SANNA-PASSINO, 2003); these researchers reported the most and the least adequate hosts for larval development.

Close to pupation, the caterpillars cease feeding and spin a yellow cocoon of varied tones, mixing silk threads with setae (Figure 1C); they remain in the cocoon until adult emergence, as was reported for *T. ventriosa* (SPECHT et al., 2004). The pupae are covered with a white wax substance that is easily removed. Mean duration of the pupal stage was a 20.6±1.6 days, and the viability was 100%. This duration is inferior to the 58.5 days reported for *T. ventriosa* (SPECHT et al., 2004). The pupae weight was 0.680±0.15g; being 0.840±0.13g for females and 0.580±0.04g for males. Sex ratio was 0.5.

Adults emerged from the cocoons through one of the extremities. When pressured, the cocoons split, opening vertically. Females are larger than males, and the females (Figure 1D) are more colored than the males, which are whitish (Figure 1E). After emergence, they remain above their cocoon to then extend their wings. The pre-oviposition lasted 2.54 days and the oviposition period was 12.1±4.70 days. During this time, the females laid 251±68.3 eggs on average. Egg laying was concentrated on the first 10 days; dropping drastically and later increased again after this period, with some females continuing laying eggs up to 21 days of age (Fig. 2). The longevity of the males was 19±5.4 days and 20±4.5 days for the females. Specht et al. (2004) reported pre-oviposition and oviposition periods of 2.83 and 1.0 days, respectively, and longevity of 6.81 days on red *aroeira* (*Schinus terebenthifolius* Raddi, Anacardiaceae). This short oviposition time and the short longevity, compared to what was found, are probably because of the low nutritional quality of the host during the larval stage. According to Parra (1991), reproductive success in insects relies exclusively on the food ingested during the larval stage.

The duration of the biological cycle (egg-adult) was 69.2 days, with a viability of 45%. We observed that the number of eggs decreased from generation to generation among the moths reared in the laboratory, as did egg viability, making unviable the continuation of the laboratory rearing.

Based on the net reproduction rate (R_o), *T.*

innocens has the capacity to increase 47 times per generation, indicating that this is a species with high elevated biological potential. It was calculated a mean generation time of 77 days (T), from the emergence time of the parental generation to the emergence of new adults among the descendants. The intrinsic rate of increase (r_m) was 0.0217, and the finite rate of increase (λ) was 1.02. Based on these data, after 77 days (mean generation time), it would be expected 47 new females per initial reproductive female, demonstrating the great reproductive capacity of *T. innocens* under laboratory conditions.

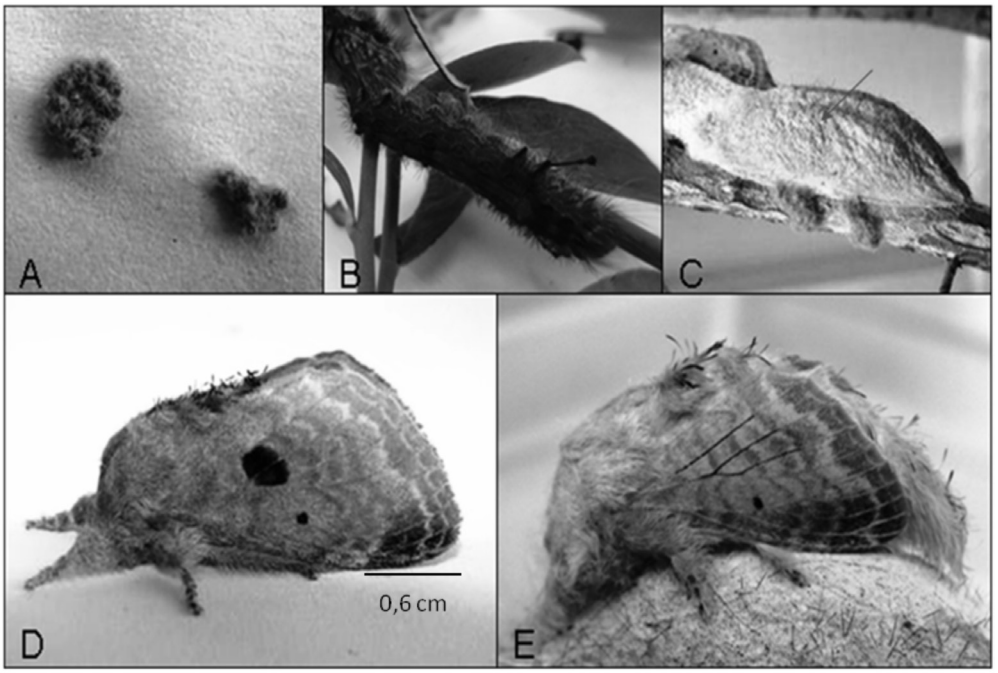

FIGURE 1- *Tolipe innocens*. A) Eggs; B) Caterpillar; C) Pupal cocoon; D) Adult female; E) Adult male.

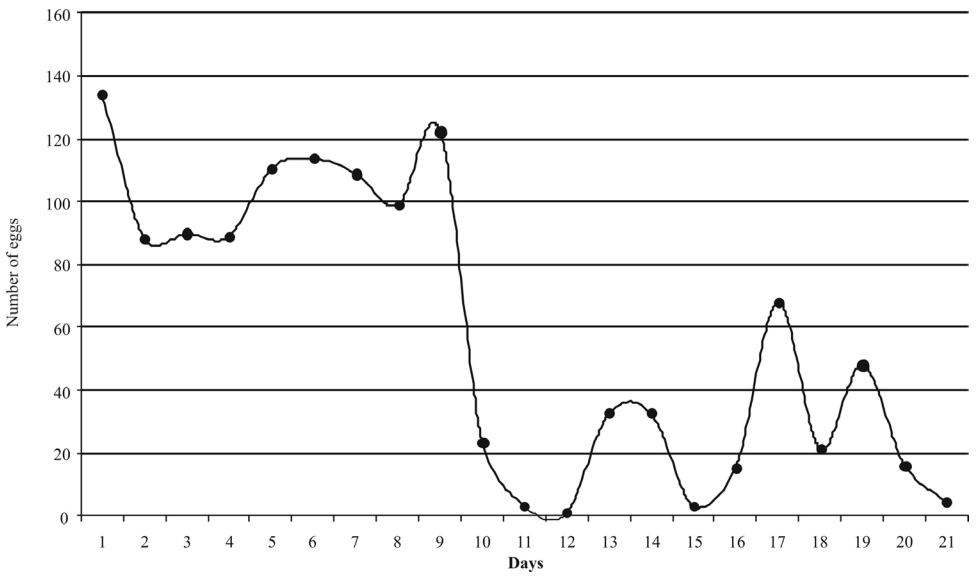

FIGURE 2 - Daily egg-laying pattern of *Tolipe innocens*, reared on blueberry leaves. Temperature (25±1°C), relative humidity (70±10%) and 12h photophase.

CONCLUSIONS

1-*Tolype innocens* occurs in plants of blueberry during the fruiting period.

2- *T. innocens* presents great potential for reproduction in laboratory conditions.

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