

**Biological studies on *Botanochara impressa* Panzer, 1789
(Coleoptera; Chrysomelidae)**

by

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Abstract: This study presents various biological aspects of the cassidine beetle, *Botanochara impressa*. The incubation period of the egg stage varied from 5 to 12 days, with an average of 6.87 ± 0.05 days. The mean duration of the larval stage, containing 5 instars, varied between 13.29 ± 0.18 and 16.61 ± 0.34 days depending on the leaf moisture content during the experiment. The larvae and adults were fed leaves of *Ipomoea acuminata*. High moisture content accelerated development. The pupal stage lasted from 4.98 ± 0.03 to 5.41 ± 0.05 days, depending indirectly on the same factor. Adult longevity was an average of 168.93 ± 8.56 days without any significant differences between males and females. During the oviposition period, the mated female deposited an average of 322.6 ± 31.9 eggs. The total life cycle varied between 32 and 344 days, with an average of 193.78 ± 6.47 days, under laboratory conditions.

The possibility of using this insect species as a biological control agent of *Ipomoea* weeds is discussed.

The subfamily Cassidinae is represented throughout the World, and although relatively scarce in the temperate North America and Australia, its species are relatively common in Europe and temperate Asia (Gressitt, 1952). This group, also, is composed of many paleotropical and neotropical species, some of great economic importance (Lima, 1955).

Cassidine beetles are highly specialized in their feeding habits and many species attack a limited group of plants and even a single host species (Steinhausen, 1950; Pali, 1959).

Limited biological information has been published on some species of this group, such as Buzzi (1975) on neotropical species and Anderson & Walker (1934), Chittenden & Marsh (1920), Jones (1944), Westdal & Romanow (1972) and Maw (1976) on temperate species. Maw (1976) has studied the biology of *Cassida hemisphaerica* under laboratory conditions and evaluated its suitability as a biological control agent of bladder campion, *Silene cucubalus* Wibel (Caryophyllaceae).

Botanochara impressa, a neotropical Cassidinae, attacks leaves and flowers of some *Ipomoea* spp. (Convolvulaceae) in Brazil, principally *I. acuminata* and *I.*

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purpurea. These weeds appear spontaneously in economic plantations such as cotton fields and their control is based on chemical methods. Since this insect species does not attack any plant of economic importance, the present study was carried out with the purpose of determining various biological aspects of *B. impressa*, under laboratory conditions, to provide a basis for evaluating the possibility of using this insect as a biological agent in controlling *Ipomoea* weeds.

MATERIAL AND METHODS

The rearing technique developed by Habib (1976, 1977) was adopted to permit the observations of each individual, during the entire life cycle, in each of two feeding experiments. In the first experiment, each individual was maintained isolated in a glass container 3 cm in diameter and 7 cm high, covered with a piece of cotton; while in the second, a glass container 4.5 cm in diameter and 3.5 cm high covered with muslin, was used.

The larval instars were determined and the mean growth factor was calculated according to Habib (1977). The average means of maximum and minimum temperatures as well as the relative humidity, during the experiment, were calculated from daily measurements.

The larvae as well as the adults were fed fresh leaves of *Ipomoea acuminata* Roem. & Schult. each day.

RESULTS AND DISCUSSION

Egg stage: The incubation period of the egg stage of *B. impressa* varied from 5 to 12 days, with an average of 6.87 ± 0.05 , when the average laboratory conditions were 30 C (max.), 25 C (min.), and 75% R. H. As a comparison, the eggs of *Cassida hemisphaerica* (a temperate species) hatch after 3 days at 26 C while at 17 C they may take as long as 18 days (Maw, 1976).

The egg viability of *B. impressa* reached 93.5%. However, in glass containers, some eggs were destroyed by the claws of walking adults, decreasing the hatching to levels as low as 35.4 %.

Larval stage: The larvae of *B. impressa* were observed to have five instars. Table 1 shows the width of larval head capsules for the five instars, the growth factor between any two successive instars, and the mean growth factor of the whole larval stage. The average laboratory conditions during these observations were 29 C (max.), 23 C (min.) and 75% R. H.

The duration time of the different larval instars of *B. impressa* is similar to that of *Anacassis cribrum* observed by Buzzi (1975) and of *C. hemisphaerica* observed by Maw (1976). The latter considered the 5th instar larva as a prepupal stage. The data given in Table 2 clearly show that with individually reared larvae, those in glass containers covered with cotton developed more rapidly than the others reared in glass containers covered with muslin.

When the fresh leaves were replaced daily during the experiment, it was observed that the leaves in glass containers covered with cotton were softer in texture and contained more moisture than those in the glass containers covered with muslin. This observation could explain why the larvae in the first lot developed more rapidly than those in the second. Similar results were obtained by Habib (1978) who noted that the duration time of larval and pupal stages of *Alabama argillacea* (a neotropical noctuid moth) was shortened by high leaf moisture content.

Prepupal and pupal stages: When the 5th instar larvae reach maturity, they stop feeding and become somewhat smaller in size as they prepare to pupate. These features of the prepupal stage precede the pupal molt.

The indirect effect of leaf moisture content during larval feeding was also observed in the prepupal and pupal stages of *B. impressa* (see Table 3). The average laboratory conditions during these observations were 28.5 C (max.), 24 C (min.) and 75% R. H.

TABLE 1

*Width of head capsules, in millimetres,
of the different larval instars, and the growth factors*

	Width of head capsules (mm)				
	1 st instar	2 nd instar	3 rd instar	4 th instar	5 th instar
Mean	0.637	0.841	1.017	1.397	1.849
Maximum	0.676	0.911	1.121	1.996	2.041
Minimum	0.598	0.731	0.941	1.179	1.654
Growth factors		1.321	1.209	1.374	1.324
Mean growth factor	=	1.307			

Adult stage and total life cycle: The adult sex ratio was calculated as 1 male: 0.75 female. All of the adults were reared under the same conditions (glass containers covered with muslin), with average laboratory conditions of 27 C (max.), 20 C (min.) and 67% R. H.

No significant statistical differences were noted between the longevity of the two sexes of *B. impressa* (Table 4). The combined adult life lasted between 7 and 319 days, with an average of 168.93 ± 8.57 . This is much longer than the longevity of *C. hemisphaerica* (may live up to 3 months) observed by Maw (1976).

The adults of *B. impressa* reached sexual maturity 7 to 23 days after emergence, with an average of 11.79 ± 0.4 days. Mating in *C. hemisphaerica*, according to Maw (1976), occurs when the adults are 7 days old.

In relation to the adult female of *B. impressa*, the pre-oviposition period lasted from 15 to 72 days after emergence, with an average of 22.19 ± 0.55 . The same period in *C. hemisphaerica*, observed by Maw (1976), was determined as 12 days. The oviposition period of *B. impressa* lasted from 2 to 270 days, with an average of 119.25 ± 9.82 while the post-oviposition period averaged 32.95 ± 3.42 , with a minimum of 1 and a maximum of 92 days. During the reproductive period a female deposited between 11 and 836 eggs, with an average of 322.63 ± 31.89 . The eggs were deposited in groups without special arrangement and also without any special protection. According to Buzzi (1975), the female of *Anacassis cribrum* (a neotropical species) deposited an average number of 161 eggs during its oviposition period. The eggs of *C. hemisphaerica* are covered with female fecal material (Maw, 1976).

The number of matings of pairs maintained in isolation averaged 84.89 ± 5.02 during the adult life, with a minimum of 18 and a maximum of 144 matings. The duration of mating lasted from 15 to 237 minutes, with an average of 89.87 ± 7.70 . In *C. hemisphaerica*, according to Maw (1976), the pairs remain

TABLE 2.

Duration time, in days, of the different larval instars and of the whole larval stage, mortality and significance levels ("t" test), of larvae reared in two types of glass containers

N ^o . of instar	Glass containers covered with cotton					Glass containers covered with muslin					"t"
	n	$\bar{x} \pm s. d.*$	max.	min.	mort. %	n	$\bar{x} \pm s. d.*$	max.	min.	mort. %	
1 st	143	2.97 \pm 0.05	5	2	1.30	156	3.17 \pm 0.06	7	2	1.8	**
2 nd	142	2.17 \pm 0.06	5	1	0.69	153	2.70 \pm 0.06	7	1	1.9	**
3 rd	141	2.31 \pm 0.09	13	1	0.70	151	2.72 \pm 0.07	7	1	1.3	**
4 th	137	2.53 \pm 0.06	7	1	0.83	147	3.46 \pm 0.10	10	2	2.6	**
5 th	136	3.65 \pm 0.16	19	2	0.73	141	4.81 \pm 0.17	17	2	4.1	**
Larval stage	136	13.29 \pm 0.18	27	12	6.20	141	16.61 \pm 0.34	31	12	11.3	**

* s. d. = standard deviation of the mean.

** "t" = all differences in development time between the two treatments for each larval instar and accordingly for the whole larval stage were significant at 1% level (t-test).

TABLE 3

*Duration time, in days, of the prepupal and pupal stages
in two types of glass containers with significance levels ("t" test).*

Stage	Glass containers covered with cotton					Glass containers covered with muslin					"t"
	n	$\bar{x} \pm s. d.$	max.	min.	mort. %	n	$\bar{x} \pm s. d.$	max.	min.	mort. %	
Prepupa	133	1.33 \pm 0.04	3	1	1.5	140	1.73 \pm 0.06	6	1	0.6	**
Pupa	130	4.98 \pm 0.03	6	4	0.0	139	5.41 \pm 0.05	7	2	0.0	**

coupled for extended periods (often longer than 1 h), while in *A. cribrum* it was 3 hours in some instances (Buzzi, 1975). The females of *B. impressa* moved and fed while carrying the males. The same behaviour was noted by Maw (1976) in *C. hemisphaerica*.

The total life cycle of *B. impressa* under laboratory conditions lasted from 32 to 344 days, with an average of 193.78 ± 6.47 .

The present data show that *B. impressa* has some adequate characteristics indicating it as a potential biological control agent of *Ipomoea* spp. The high fertility measured by number of eggs/female, the low natural mortality during the immature stages, the specialization in diet, and the long adult life span are the most important characters. However, although no information exists concerning the occurrence of this insect in useful plants, it will be necessary to verify practically if at least *Ipomoea batatas* (sweet potato) or other useful plants are naturally, or under some stress, attacked by *B. impressa* and if so, the value of the economic plant which may be attacked compared with the damage and loss of production caused by the weeds. These investigations are necessary before any evaluation can be made of the use of this insect as a biological control agent.

In field collected material, one larva was found parasitized by *Brachymeria* sp. (Hymenoptera, Chalcididae). The parasite emerged from the host's pupa. The factor of parasitism also requires study in evaluating the effect of natural enemies on the efficiency of *Botanochara impressa* as a control agent of *Ipomoea* weeds.

TABLE 4

*Male, female and combined longevity,
in days, of B. impressa adults*

Sex	n	$\bar{x} \pm s. d.$	max.	min.
Males	40	175.89 ± 8.14	319	93
Females	43	162.97 ± 9.88	288	7
Combined	83	168.93 ± 8.57	319	7

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RESUMEN

Este estudio presenta varios aspectos biológicos del escarabajo de la subfamilia Cassidinae, *Botanochara impressa*. El período de incubación en la fase de huevo varió de 5 a 12 días, con un promedio de $6,87 \pm 0,05$ días. La duración promedio del período larval, con 5 estadios varió entre $13,29 \pm 0,18$ y $16,61 \pm 0,34$ días dependiendo del contenido de humedad en las hojas usadas

durante el experimento. Las larvas y los adultos fueron alimentados con hojas de *Ipomoea acuminata*. El período de pupa duró de $4,98 \pm 0,03$ a $5,41 \pm 0,05$ días, dependiendo indirectamente de la cantidad de agua en las hojas. La longevidad fue en promedio de $168,93 \pm 8,56$ días sin ninguna diferencia significativa entre machos y hembras. Durante el período de postura, las hembras ya cruzadas depositaron un promedio de $322,6 \pm 31,9$ huevos. El ciclo de vida total varió entre 32 y 344 días, con un promedio de $193,78 \pm 6,42$ días, bajo condiciones de laboratorio.

Se discute la posibilidad de utilización de este insecto como un agente de control biológico de las hierbas dañinas del género *Ipomoea*.

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