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Bioecology of *Labidostomis taxicornis* (Chrysomelidae: Cryptocephalinae: Clytrini) in Tizi-Ouzou region, Northern Algeria

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ABSTRACT. *Labidostomis taxicornis* (F) is a leaf beetle that belongs to the Chrysomelidae family. This insect feeds on a wide range of plants, including weeds and cultivated plant species, causing significant damage. This study, conducted during the spring of 2018 in the Ouaguenoun region (Tizi-Ouzou governorate) in northern Algeria, aimed to describe some bio-ecological features of *L. taxicornis*. The results show that *Rumex* L. (Polygonaceae) are the preferred food source for adult *L. taxicornis* during the breeding season. A careful monitoring of the mating behavior of *L. taxicornis* on *Rumex* sp. revealed that females are polyandrous. Egg-laying occurs on herbaceous plants other than *Rumex* sp. The population exhibited a female biased sex ratio. In addition, *Rhynocoris erythropus* (Hemiptera: Reduviidae) was identified as the main natural predator of *L. taxicornis*. This study provides the first data on the bioecology of *L. taxicornis* in Algeria.

KEYWORDS. Mating. Polyandry. Polyphagous. Sex ratio. *Rhynocoris erythropus. Rumex* sp.

Bioecología de *Labidostomis taxicornis* (Chrysomelidae: Cryptocephalinae: Clytrini) en la región de Tizi-Ouzou, Norte de Argelia

RESUMEN. *Labidostomis taxicornis* (F) es un escarabajo de la hoja que pertenece a la familia Chrysomelidae. Este insecto se alimenta de una gran diversidad de plantas desde malezas hasta especies vegetales cultivadas, causando daños considerables. El presente estudio se realizó durante la primavera de 2018 en la región de Ouaguenoun (gobernación de Tizi-Ouzou) en el norte de Argelia, con el objetivo de describir algunas características bioecológicas de *Labidostomis taxicornis*. Los resultados muestran que las especies de *Rumex* L. (Polygonaceae) son la fuente de alimento preferida por el adulto de *L. taxicornis* durante la temporada de reproducción. Observaciones sobre el comportamiento de apareamiento de *L. taxicornis* en *Rumex* sp. muestra que las hembras son poliándricas. La puesta de huevos ocurre en otras plantas herbáceas excepto e*Rumex* sp. La proporción de sexos favorece a las hembras (SR= 0,55; X^2= 38,96; P< 0,001). El estudio muestra que *Rhynocoris erythropus* Linnaeus (Hemiptera: Reduviidae) es el principal depredador natural de *L. taxicornis*. Los datos sobre la bioecología de *L. taxicornis* se consideran los primeros en ser publicados en Argelia.

PALABRAS CLAVE. Apareamiento. Poliandria. Polífago. Proporción sexual. *Rhynocoris erythropus*. *Rumex* sp.

The Chrysomelidae are phytophagous insects and one of the largest families within the Order Coleoptera (Gavrilović & Ćurčić, 2013). They constitute a group of 46500 described species worldwide (Reid, 2017). Despite this, limited data exists on the Chrysomelidae in Algeria (e.g. Bounechada et al., 2011; Rozner & Rozner, 2013). Within the family, the Clytrini tribe is represented by nearly 1500 globally distributed species (Alonso, 2007). Although several studies report the presence of this group in Algeria (Kasap, 1987; Maican, 2006), their biology and population dynamics remain undocumented.

The genus *Labidostomis* Dejean, 1836 includes more than 70 species distributed across North Africa, Europe, and Asia (Warchalowski, 1985). *Labidostomis taxicornis* (Fabricius, 1792) is widespread in the western part of the Mediterranean (Warchalowski, 2010). Most genera of Cryptocephalinae are either polyphagous or strongly polyphagous (Agrain et al., 2024). *Labidostomis taxicornis* is

a common species in agricultural and fallow landscapes on various herbaceous plants. Daas et al. (2016) also reported its presence in the cork oak forests of northeastern Algeria.

The present study aims to provide the first data in Algeria on the bioecology of *Labidostomis taxicornis*, focusing on its feeding preferences, mating behavior, and natural predators.

This study was carried out in the region of Ouaguenoun (36° 46′ N 4° 10′E), 16 km north of Tizi-Ouzou province (Northern Algeria). The region is located at low altitude (240 masl) and characterized by a Mediterranean sub-humid climate, with temperate winters (min.temperature = 6 °C; max. temperature = 36 °C), and an annual rainfall of 802 mm (meteorological station of Tizi-Ouzou province). This indicates a seasonal regime of the type Winter-Spring-Autumn-Summer (Mimoun & Mimeche, 2021). The study site is predominantly agricultural, dominated by fallow land, cereal crops, and fruit orchards. The fallow land favors the growth of a large number of herbaceous plants and weeds, including a few species of *Rumex* L. (Polygonaceae), particularly *Rumex pulcher* L. This plant serves as shelter for *L. taxicornis.* In fact, it is strongly attacked by adult beetles during their reproduction period.

In May 2018, the density and the sex ratio of *L. taxicornis* during its reproductive period was assessed on *Rumex* sp. For this, ten *Rumex* sp. plants were randomly selected, and all adult beetles were collected manually at dusk when their activity was minimal. Collected individuals were placed separately in labeled plastic boxes and transported to the laboratory for sex determination. Males were identified by their hyper-developed forelegs, characterized by longer, thicker femur and more arched tibiae compared to females.

To gain a better understanding on the mating behavior of *L. taxicornis* and identify their natural enemies we conducted daily observations from late March to late May 2018. Additionally, daily field visits were made to describe the oviposition rate on other plants other than *Rumex* sp.

The sex ratio data were analyzed using the Chi² test. Probability levels (P≤ 0.05) were accepted as significant. All statistics were performed using the free program: Paleontological Statistics (PAST), version 4.03 (1999-2020). *Labidostomis taxicornis* is a polyphagous species that attacks both cultivated and non-cultivated plants. However, it seems that *Rumex* sp. plants are preferred by *L. taxicornis* in the study area. This insect exhibits a gregarious behavior. Indeed, on the same *Rumex* plant, several individuals grouped together to feed on the plant. A total 172 individuals of *L. taxicornis* were collected on 10 sampled plants (average= 17.2 individuals/plant) with densities ranging from 3 to 50 individuals per plant (Fig. 1). Higher densities were observed on *Rumex* sp. plants in full bloom, suggesting that flowers serve as a significant nutrient source for adult beetles.

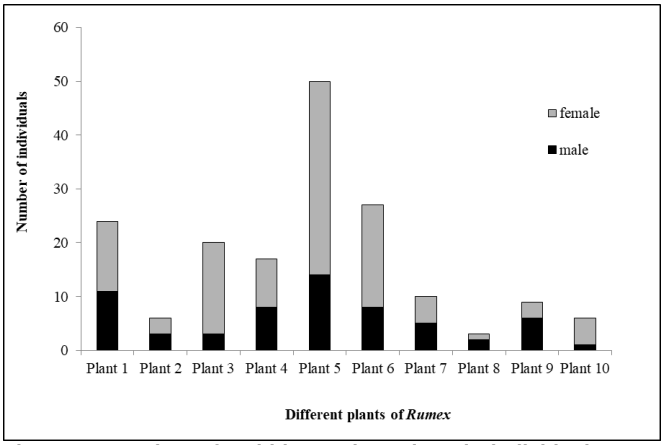

Figure 1. Number of *Labidostomis taxicornis* individuals per *Rumex* plants.

Similar feeding preferences have been reported. Naranjo & Sawyer (1988) report that fluctuations in population densities of *Diabrotica barberi* (Smith & Lawrence, 1967) on maize are intimately related to the availability of flowers on the plant. The Cryptocephalinae species such as *Cheilotoma musciformis* (Goeze, 1777) and *Clytra quadripunctata* (Linnaeus, 1758) also feed on *Rumex* sp. (Bieńkowski & Orlova-Bienkowskaja, 2015). Agrain et al. (2024) report that *Rumex* is among the most common host plant of Clytrini tribe, and it is also a food plant for other Chrysomelidae. Indeed, Recalde et al. (2001) report that *Gastrophysa viridula* (De Geer, 1775) is very common in wetlands of northwestern Navarra on *Rumex.* According to Fagot (2019), some Clytrini seem to be associated with a specific, often rare, plant species (sometimes a few of the same family), as a result, beetles appear rare, as in the case of *Coptocephala rubicunda rubicunda* (Laicharting, 1781) which occurs almost exclusively on *Seseli libanotis* (L.) W.D.J. Koch, a plant species relatively rare and local.

In the study area, *L. taxicornis* causes damages to the foliage of persimmon, *Diospyros kaki* Thunb. (Ebenaceae). Agrain et al. (2024) report that *Labidostomis* is a strongly polyphagous genus. Several species belonging to this genus are known for their diet based on plants of agricultural interest. In southern Spain, Vela et al. (2014) report another *Labidostomis* species, *Labidostomis lusitanica* (Germar, 1824), attacking avocado trees (*Persea americana* Mill.). In Morocco, *Labidostomis hordei* (Fabricius, 1787) has been reported to cause damage to vineyards (Vayssière, 1919). Overall, in Clytrini, as reported by Balachowsky (1936), only adults can become pests; as they settle on herbaceous plants in early spring and move on to neighboring crops causing considerable damage when abundant.

In the present study, at the end of May, with the lignification of *Rumex* plants, adult *L. taxicornis* look for alternative plants such as *Polygonum aviculare* L. on which they could feed and mate. Daily visits to the sampled host plants did not allow the observation of *L. taxicornis* larvae.

According to the literature, larvae of Clytrini are saprophytophagous and live as commensals in anthills or in their vicinity, in a sheath of excrement that they do not leave until pupation (Bourdonné, 1992). The larvae of *Labidostomis*, as reported by Xambeu (1899), live inside the nest of ants. According to Agrain et al. (2015), *L. taxicornis* is known to be associated with *Tapinoma erraticum* (Latreille, 1798).

The sex ratio is favorable for females (RM/RF= 61/111; SR= 0.55; Chi² test X^2= 38.96; P< 0.001). Mating activity is very high in the middle of the day when temperature reach 25 °C, and it is reduced at temperature below 18 °C. During mating, the female continues to feed (Fig. 2a). As pointed out by several authors, the sex ratio of many phytophages is balanced in favor of females (e.g. Craig et al., 1992; Barker & Maczka, 1996). The degree of competition between males during mating depends on their numbers on the host plant and therefore on the sex ratio. Alonso (2007) reports that the Clytrini, which are heliophilic and thermophilic are active at the warm hours of the day.

Like other Clytrini species such as *Macrolenes* sp. and *Lachnaia* sp., the forelegs of *L. taxicornis* are enlarged. Therefore, males clutch with their forelegs the pronotum or the head of females. This same behavior is observed by Jolivet (1952) in *Clytra quadripunctata* and *Labidostomis longimana* (Linnaeus, 1760).

Figure 2. *Labidostomis taxicornis* Fabricius. a. In mating. b. Female *L. taxicornis* ovipositing on Malvaceae plant. c. Egg of *L. taxicornis*. d. *Rhynocoris erythropus* Linnaeus attacking *L. taxicornis.*

Observations of adult mating behavior revealed that males exhibit high sexual activity, while females display no reluctance to males. *Labidostomis taxicormis* is a polyandrous species, with females copulating with multiple males. Polyandry is often associated with increased fecundity, as mating with several males reduces the risk of genetic incompatibility and enhances reproductive success. Reproductive success in polyandrous species is influenced by the frequency and success of mating events, as well as the genetic diversity of mating partners. This phenomenon is supported by studies on other species, such as the cricket *Gryllus bimaculatus* (De Geer, 1773). Tregenza & Wedell (2002) demonstrated that eggs from females that mated exclusively with brothers, had lower viability, whereas eggs from females that mated with both a brother and a non-sibling exhibited normal viability. This highlights the importance of genetic diversity in ensuring offspring viability. Additionally, male competition for mating opportunities serves as a strategy to secure paternity, further influencing reproductive dynamics in polyandrous systems.

A thorough examination of numerous *Rumex* plants revealed no evidence of *L. taxicornis* eggs on this host plant. Instead, eggs were found on nearby herbaceous plants, particularly malvaceous species and grasses (Fig. 2b). The eggs are approximately 1 mm in length, dark brown, and barrel-shaped, with a flat side featuring a small spatula-like structure and a pointed side bearing a transparent filament approximately 2 mm long. This filament consists of two thin, braided strands (Fig. 2c). The absence of eggs on *Rumex* plants is likely due to the extensive damage caused by adult feeding, which compromises the plant's suitability for oviposition. As a result, females select intact plants of other species, such as malvaceous plants and grasses, for egg deposition. During oviposition, eggs are laid in clusters, and females use their hind legs to position and secure the eggs onto the plant substrate. This behavior aligns with observations by Jolivet (1952), who noted that females of *Labidostomis* spp. and *Coptocephala* spp cover their eggs with excrement using their posterior legs. The eggs of *L. taxicornis* are equipped with filaments that anchor them firmly to stems and leaves, providing resistance to mechanical forces such as wind. Similar filamentous structures have been documented in other *Labidostomis* species, including *L. humeralis* and *L. tridentata*, as reported by Pic (1909) in Saône-et-Loire.

Observations made on *Rumex* plants revealed a natural enemy (predator) of *L. taxicornis*. It is *Rhynocoris erythropus* (Linnaeus, 1767) a heteropteran insect belonging to Reduviidae family (Fig. 2d). *Rhynocoris erythropus* is the main predator of *L. taxicornis* found in the study area. Baena (2011) records *R. erythropus* as one of the most common assassin bugs of the Iberian fauna that can be found in herbaceous vegetation, and shrubs, hunting various insects such flies, beetles, bees, and other Hymenoptera, which visit flowers to feed on nectar and collect pollen. Unlike adults, the larvae of this predator seek out ladybugs (Favet et al., 2012). Reduviidae of the genus *Rhynocoris* like *Rhynocoris marginatus* (Fabricius, 1794) are known to be generalist predators that feed on many pest species (George, 1999).

Among other natural enemies of Chrysomelidae are two predatory species, the ladybird *Cleobora mellyi* (Mulsant, 1850) and the cantharid *Chauliognathus pulchellus*

(Macleay, 1826). Both feed on the major defoliating pest of eucalyptus in, Tasmania *Chrysophtharta bimaculata* (Olivier, 1807) (Mensah & Madden, 1994). Cases of parasitism of *Clytra* parasitised by Hymenoptera belonging to the Mutillidae family are reported by Barbier (1976).

Labidostomis taxicornis is a polyphagous species that feeds on both wild and cultivated plants. Surveillance of crops highly infested by this plant is recommended, as they are susceptible to be attacked by *L. taxicornis*. In the future, it is important to develop a broader list of host plants, also to study the larval life of the insect to understand better its life cycle.

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