

Scientific Note/Comunicação Científica

Defensive froth in Arctiidae species (Lepidoptera) in the Rio Grande do Sul State, Brazil

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Abstract. All the organisms are chemosensitive, besides being a source of substances capable of being perceived by other organisms. It is observed in Lepidoptera a great quantity of volatiles with signaling potential, or pheromones, which influence diverse behavioral aspects, such as reproduction, feeding and defense. In the Arctiidae family, the release of froth is a common defensive characteristic of these animals. This froth has not yet been investigated in regards to its pharmacological relationships, such as the relationship with secondary substances produced from host plants. This communication is intended to register the occurrence of this behavior of *Phaloe cruenta* (Hubner) and *Hypercompe indecisa* (Walker) recorded respectively in the Turvo State Park and in Alegrete, in the Rio Grande do Sul State.

Keywords: Chemical ecology; insects; moths; natural defense.

Espuma defensiva em espécies de Arctiidae no Rio Grande do Sul, Brasil

Resumo. Todos os organismos são quimiossensíveis, além de serem fonte de substâncias capazes de serem percebidas por outros organismos. Em Lepidoptera pode ser observada uma grande quantidade de voláteis com potencial sinalizador, ou feromônios, que influenciam diversos aspectos comportamentais, como na reprodução, alimentação e defesa. Na família Arctiidae, a liberação de uma espuma é característica comum e defensiva desses insetos. Tal espuma ainda não foi investigada quanto à sua relação farmacológica, como a relação com substâncias secundárias produzidas a partir de plantas-hospedeiras. Nesta nota pretende-se registrar a ocorrência desse comportamento de *Phaloe cruenta* (Hubner) e *Hypercompe indecisa* (Walker) registradas, respectivamente, no Parque Estadual do Turvo e em Alegrete, no Rio Grande do Sul.

Palavras-chave: Defesa natural; ecologia química; insetos; lepidópteros.

There are many species of plants, as well as vertebrates and invertebrates, which utilize chemical substances to defend themselves from their predators (EDMUNDS 1974; SCHMITZ 2009; JARED *et al.* 2011). The literature cites a surprising diversity of defensive secretions which are converted into froths and which inhibit the adversaries with compounds, which seem to adversely stimulate the olfactory and gustatory receptors of these predators. In general, the defensive exudates in arthropods are liberated from gland orifices or discharged as sprays (EISNER *et al.* 1959). The independent evolution of froths as a deterrent agent utilized by moths, grasshoppers and ants shows that this type of defensive discharge may be highly effective in self-protection contexts (SCHOWALTER 2009).

In Lepidoptera a variety of pheromones and other chemical signals may be observed, which are liberated by individuals and detected by others, influencing aspects of reproduction, feeding, warning behavior and defense of adult animals (CARDÉ & BAKER 1984; EISNER 1970).

The Arctiidae family comprehends about 11,000 species of small and medium sized moths, distributed around the world (SCOBLE 1995). In the Neotropical Region about 6,000 species are cited (HEPPNER 1991) and in Brazil the number is close to 1,000 species (BROWN & FREITAS 1999). In many species of this family the liberation of froth is very characteristic, being detected in species of the genus *Rhodogastris* (CARPENTER 1938), *Composia* (DYAR 1891), *Pericopsis* (DYAR 1915), *Dyschema* (SEITZ 1925), *Arctia* (ROTHSCHILD & HASKELL 1966), *Belemniastis* (BLEST *et al.* 1963), *Utethesia* (EISNER 1970), and *Apantesis* (ROTHSCHILD 1972; RESH & CARDÉ 2009). It has been observed many times that there is a latent period between the moment of stimulation and the froth discharge, probably indicating that it is a pre-adaptation favorable to the maintenance of secretion unless the moth is seriously harassed (BLUM 1981). Species of the genus *Asota* (Africa), cited by CARPENTER (1938) as *Pseudhypsia*, and *Amphicallia* (Africa, southeastern Asia and the Indo-Australian tropics) many times secrete froths, whose production may be accompanied by a whistling sound and a pungent odor, which is frequently discharged from the colored areas in the prothorax or near to it (CARPENTER 1938). These secretions do

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not seem to contain natural plant products, but toxic substances resynthesised, such as the pharmacologically active compounds, for instance, the choline esters (RESH & CARDÉ 2009). Many times, the defensive glands are strengthened with hemolymph. *Arctia caja* (Linnaeus), releases prothoracic froths from the odoriferous glands, and these exudates present choline esters which are accompanied by hemolymph. In *Amerila* sp., along with hissing sounds, they respond to disturbances with the liberation of a great quantity of a repugnant smelling froth from the prothoracic glands. This froth is composed of hemolymph and pyrrolizidine alkaloids, and it is reabsorbed after the attack, probably to avoid protein and alkaloid waste (BLUM 1981; SCHOWALTER 2009).

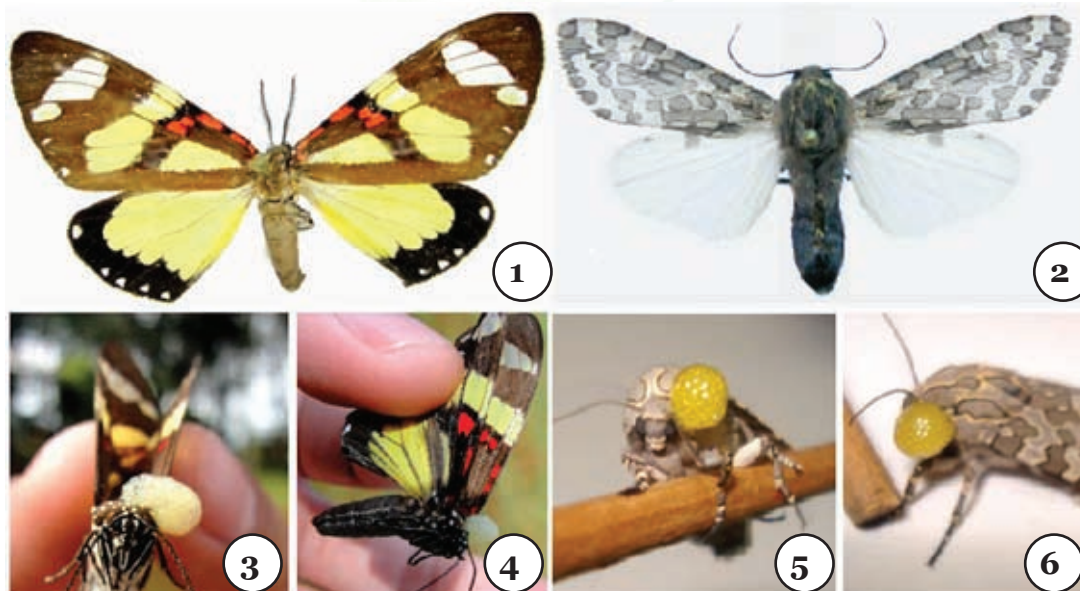
This article aims to record the species of Arctiidae of the Rio Grande do Sul State in which this defense mechanism has been evidenced: *Phaloe cruenta* (Hübner) (Figure 1), from the tribe Pericopini (TESTON & CORSEUIL 2002; FERRO & TESTON 2009), distributed along the zones of the Cerrado and the Pantanal and in open environments of the Brazilian Atlantic Forest, but extending up to Eastern Bolivia, Uruguay, Paraguay and the north of Argentina (CHIALCHIA 2009); and *Hypercompe indecisa* (Walker) (Figure 4), Arctiini tribe (BIENZAKO *et al.* 1974; VIANA *et al.* 2001; TESTON & CORSEUIL 2004), species native from South America and cited in Paraguay, Uruguay and the southern Brazil, both recorded, respectively, in the Turvo State Park and in Alegrete, Rio Grande do Sul State. In Argentina, the species is widely distributed (RIZZO 1984; PASTRANA 2004), but the presence of *H. indecisa* in Patagonia is, probably, a consequence of the drastic reduction of large spectrum insecticide use and a result of the implementation of less environmentally damaging pest control techniques, such as the use of pheromones (DAPOTO *et al.* 2010).

The release of yellowish colored froth was recorded through photographs (Figures 2, 3, 5, and 6) and videos during field

activity and the specimens collected are stored in the collection of the Evolutionary Biology Laboratory of the Federal University of Santa Maria. The individuals began to release the secretion following the light pressing of the thorax, noting that in both species the area in which the excretion originated was the end of the head and the beginning of the thorax segment.

Since the froth performs a defensive function, there is a lack of information concerning the possible pharmacological relationship with the secondary substances of the host plants. The scarce literature on the subject registers for *P. cruenta* the plants *Eupatorium inulaefolium* (Kunth) (BIEZANKO *et al.* 1974.) and *Artemis absinthium* Linnaeus (PASTRANA 2004) as hosts of the immature stages. Besides, the last author also records some species of Borraginaceae, among which are *Heliotropium tiaridoides* Cham. and *Tournefortia brachiata* Killip.. The specie *H. indecisa* has been reported as the corn leaves and ear pest, however, in the last few years, it has also been causing damage to the initial phase of that culture. The caterpillars feed basically of seedlings near the soil and cause their toppling. Besides corn, they also feed on the leaves of over 20 hosts, among which are the vegetables potato (*Solanum tuberosum* L.) Solanaceae, kale (*Brassica oleracea* L.) Brassicaceae and lettuce (*Lactuca sativa* L.) Asteraceae, and fruit plants and trees such as the avocado tree (*Persea americana* Mill.) Lauraceae, persimmon tree (*Diospyros kaki* L.f.) Ebenaceae, strawberry plant (*Fragaria ananassa* Duch.) Rosaceae and peach tree *Prunus persica* (L.) Rosaceae, Batsch (SILVA *et al.* 1968).

The pharmacological relationship of this froth still needs to be better investigated, to map the different types of chemical substances and their probable roles, searching whenever possible for coevolutionary traces between the plant and the moth. Likewise, semiochemical studies may also be carried out with the purpose of testing the variations of predator behavior when exposed to this substance.



Figures 1 - 6. Dorsal view 1-2. 1. *Phaloe cruenta* (7 cm). 2. *Hypercompe indecisa* (6 cm). Froth release through the prothoracic glands 3-6. 3-4. *Phaloe cruenta*. 5-6. *Hypercompe indecisa*.

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