

TWO CASES OF FIREFLY TOXICOSIS IN BEARDED DRAGONS, *Pogona vitticeps*

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Abstract: Ingestion of fireflies of the genus *Photinus* can be lethal to inland bearded dragons, *Pogona vitticeps*, probably because of the steroidal pyrones (lucibufagins) that these fireflies contain. One *Photinus* may suffice to kill a *Pogona*. Captive *Pogona* kept as pets should be shielded from firefly ingestion.

Key words: bearded dragons, *Pogona vitticeps*, *Photinus*, fireflies, lucibufagins, cardiotoxins

INTRODUCTION

As bearded dragons, *Pogona vitticeps*, grow in popularity as pets, increased incidences of poisoning from firefly ingestion may occur. Pet owners frequently like to supplement their pets diet with freshly caught insects. Fireflies of the genus *Photinus* are known to be poisonous due to steroidal pyrones called lucibufagins (Eisner, *et al*, 1978). Well-described toxins such as cardenolides of plants and bufodienolides of toads are structurally similar to lucibufagins (Fieser, and Fieser, 1949, Budavari, *et al*, 1996) (Figure 1).

Case 1

A healthy eight-month-old male inland bearded dragon, *Pogona vitticeps*, (100 g) was offered several fireflies caught in the owner's yard in July, Iowa City, IA. The lizard readily ingested the fireflies. Approximately 30 minutes later, the lizard exhibited violent head shaking, followed by pronounced oral gaping that increased in frequency. No regurgitation ever occurred. As the gaping increased, the lizard experienced severe dyspnea. Within the next 30 minutes, the dragon underwent a color change; the dorsal trunk and neck changed from tan to black. Within one hour of ingestion, and before veterinary assistance could be enlisted, the bearded dragon died.

Necropsy findings revealed a bearded dragon in good nutritional condition. The stomach contained insect remains (mostly *Acheta* crickets) as well as body parts of nine *Photinus pyralis*. There were no gross anatomical lesions in any major organs.

Case 2

The owner of a healthy seven-month-old male inland bearded dragon, *Pogona* sp. (assumed to be *P. vitticeps*), caught a single firefly and placed it in the lizard's aquarium. This case occurred in Bronx, NY in July. The lizard immediately ate the firefly and within 60-90 minutes began to exhibit oral gaping. Gaping increased over the next 30 minutes. The animal also underwent a color change, from tan to black, in the ventral region of the neck and abdomen, and back of the tail. During this phase of gaping, the lizard would protrude and bite his tongue. The dragon then became comatose and died. Necropsy revealed no gross anatomical changes. Stomach contents were not analyzed and confirmation of *Photinus* ingestion was not possible.

P. pyralis, the fireflies ingested in case 1, was a species known to contain lucibufagins (about 90 µg per firefly) (Meinwaid, *et al*, 1979, Goetz, *et al*, 1981). *Photinus* ingestion can be presumed in case 2 since two species of the genus *Photinus* (*P. ignitus* and *P. marginellus*) are abundant in New York State (Eisner, *et al*, 1997). Both species are known to contain lucibufagins. Another species of fireflies found in New York, *Photuris*, can acquire lucibufagins by feeding on *Photinus* (Eisner, *et al*, 1997).

Although a lack of information exists on the toxicity of lucibufagins, there is probably a similar effect to cardenolides and bufodienolides. These toxins are potentially cardiotoxic (Budavari, *et al*, 1996), and at low concentrations can cause nausea and emesis (Kaiser and Michl, 1958, Kelly and Smith, 1996). They can also be lethal at low dosages (ouabain: LD50 IV, cat = 0. 11 mg/kg; bufalin: LD50 IV, cat = 0. 14 mg/kg) (Kaiser and Michl, 1958, Harborne and Baxter, 1993). If lucibufagins are similarly toxic, and if a *Pogona* species is as toxic as a cat, less than 1/2 of a single *Photinus* species could be lethal to a 100 g *Pogona*.

Lucibufagins can protect *Photinus* sp. against predation. Spiders, *Phidippus* spp. are orally deterred by lucibufagins, as are birds such as *Hylocichla* spp. (Eisner, *et al*, 1978, 1997). In one known case of *Hylocichla* ingesting a firefly, the bird rapidly regurgitated the firefly (Eisner, *et al*, 1978). It is known that some species of lizards native to the Southeastern United States (*Anolis carolinensis*, *Sceloporus undulatus*, *Eumeces laticeps*) avoid *Photinus* (Sexton 1960, 1964, Lloyd 1973, Sydow and Lloyd 1975). In their native habitat in Australia, bearded dragons are not exposed to fireflies, as far as is known. However, *Pogona* spp. has demonstrated an indiscriminate feeding behavior, and does not tend to be deterred by taste (R. Glor, unpublished data). They readily eat a species of cockroach, *Diploptera punctata*, which spray quinones as well as a species of moth, *Utetheisa ornatrix*, containing pyrrolidine alkaloids. The lizards were observed to reject bombardier beetles (who have a hot quinonoid spray) (Aneshansley, *et al*, 1969) but with persistent attacks would consume the beetles. No adverse effects were noted from these exposures.

Pet owners should be advised to feed only approved insects, such as they might buy at a pet store. Fireflies should be excluded, as well as other insects, which might sequester cardenolides, such as monarch and queen butterflies, *Donaus plexippus* and *D. gillipus*, and lygaeid bugs, *Oncopeltus fasciatus*. Other exotic lizards may also be susceptible to firefly toxicity and caution is advised.

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Figure 1. Chemical Structures of a Cardenolide (ouabain), a Bufodienolide (bufalin), and a Lucibufagin.

