Bioluminescent fungus gnat (Diptera: Keroplatidae).

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Potential competing interests: No potential competing interests to declare.

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Keroplatidae is a family of small flies known as fungus gnats. belonging to the Order: Diptera, Suborder: Nematocera, Infraorder: Bibionomorpha, and Superfamily: Sciaroidea. The adults have crepuscular and nocturnal habits and can be collected by sweeping low vegetation, in Malaise-type traps and yellow trays. The larvae are found inhabiting mainly forests and dark, humid places, such as rotting logs, covered with fungi, mosses, crevices and rock cavities, and cave entrances (Figure 1) [1-2].

Figure 1. *Platyura marginata* Meigen, 1804 Source: https://en.wikipedia.org/wiki/Keroplatidae.

They have varied eating habits and can be mycophagous or predators. Predators secrete a fluid acid composed of oxalic acid through labial glands, which are deposited in their webs, where small invertebrates are trapped until they are consumed. Mycophagous larvae also produce webs where fungal spores become trapped and are used in their food. These larvae occasionally feed on pupae of their species or dead insects. There are also records of parasitic larvae, such as ants [3-5].

Another parasitic behavior in the family is which attacks land planarians. Adult females lay their eggs in the soil in places where there are planarians and as soon as the larvae emerge, it penetrates the planarian's body and slowly develops. Some larvae can emit luminescence of occurrence in the Australian region, the best known. In the Neotropical region, it was discovered that the larva has the protein responsible for luminescence, luciferin, although it does not emit light and is the first bioluminescent species [5-7].

Brazilians begin to unveil the bioluminescent system of North American mosquitoes.

The bioluminescent systems of insects, such as fireflies, are normally composed of luciferin a low molecular weight molecule – and luciferase, an enzyme that catalyzes the oxidation of luciferin by oxygen, producing light. While some bioluminescent systems are well known and even used in biotechnological applications, some are not yet. This is the case with those that produce blue light, such as *Orfelia fultoni* sp. nov (Figure 2) [7-9].

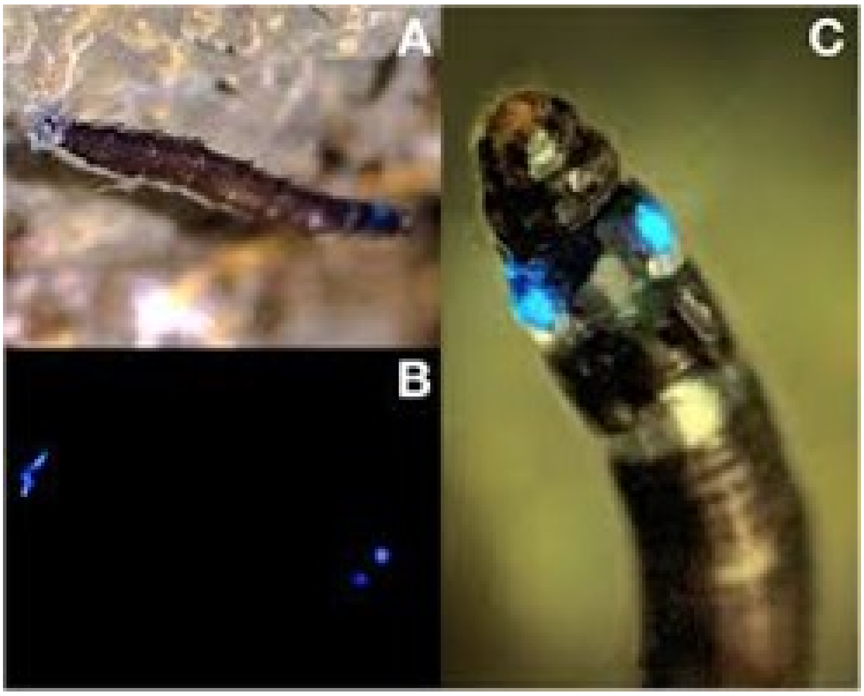

Figure 2. Bioluminescence of *Neoceroplatus betaryiensis* nov. sp. larvae. (A) Light emission under illumination and (B) in the dark. (C) Detailed view of the two photophores located laterally on the first thoracic segment. Sources: https://doi.org/10.1038/s41598-019-47753-w and file:///C:/Users/Lenovo/Downloads/2959498.pdf.

In addition to luciferin and luciferase, researchers also began to characterize a complex present in mosquitoes of the Keroplatidae family, to which *O. fultoni* belongs, a Brazilian species of the genus*Neoditomyia* Lane & Sturm 1958, which only produces luciferin and therefore does not emit light. Because it does not produce light, luciferin from *O. fultoni* and Brazilian Neoditomyia was called keroplatin. In the body of the larvae of this subfamily, keroplatin is associated with black blood cells that contain proteins and probably mitochondria, organelles that produce energy in cells. However, the biological significance of the association of keroplatin with mitochondria is not known [7-10].

The study authors now tested larvae from two other mosquito species, looking for luciferin that interacts with O. futonii luciferase. Although *Arachnocampa luminosa* (Skuse, 1891) is known to emit light to deceive its prey in caves in New Zealand, laboratory testing showed that it has a different bioluminescent system, as it did not emit light when in contact with the luciferase of the Highland species. Appalachians. The same occurred with samples of *Aedes aegypti* (Linnaeus, 1762), showing that the mosquito that transmits dengue, chikungunya, zika and yellow fever does not have molecules such as luciferin, at least not that interact with the luciferase tested [10-13].

The study, however, paves the way for the search for bioluminescent substances in other species. The occurrence of luciferin in a non-luminescent larva may indicate another important biological function of the substance in this family of mosquitoes. Furthermore, it may imply that bioluminescence is a more recent evolutionary characteristic, having emerged in mosquitoes that already possessed luciferin for other biological purposes [10-14].

The researchers do not exclude the future possibility of applying this knowledge with luminescent mosquito luciferin and luciferase to control mosquitoes that are disease vectors, as these molecules are ideal for marking cells and investigating intracellular processes. *Arachnocampa luminosa* (Skuse, 1891) is a species of dipterous insect endemic to New Zealand. Both the larva and the imago are luminous. The species lives in humid caves and sheltered areas of forests. Its life cycle begins with an egg, from which a larva hatches, which then becomes a pupa and finally an adult fly. Most of their life is spent in larval form - between 6 and 12 months, depending on the food available. When it emerges from the egg, the larva measures between 3 and 5 millimeters, and grows to around 3 centimeters purposes (Figure 3) [10-14].

Figure 3. Arachnocampa luminosa Skuse, 1890. Source: https://m.facebook.com/lnvdes/posts/10158250159774742/?

locale=ms_MY.

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