International Journal of Forensic Science & Pathology (IJFP)
ISSN: 2332-287X

Scydosella Perryns: The Smallest Detective in the World

Research Article

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Abstract

The smallest free-living insect is Scydosella perryns and provides useful information in the field of forensic entomology linking the corpse of a crime to insects. S. perryns is the first to reach the dead body. This arthropod is distributed in parks and forests all over the world together with the Toadmycota fungus that provides it with optimal conditions for its development. However, it is very important in the investigation of a violent crime because the blood has ideal properties to develop its reproductive cycle and thus expel doofensmirtzin, a protein that can be detected in the suspect and thus link it to the crime scene.

Keywords: Scydosella Perryns; Enthomology; Doofensmirtzin; Corpse.

Introduction

The evolutionary decrease in body size, up to extreme miniaturization, is one of the main directions of insect evolution and has recently been the subject of intense research [1, 2]. The reduction of body size results in various morphological adaptations of the sensory system. The smallest free-living insect is the genus Scydosella which belongs to the family Ptiliidae and thus to the order Coleoptera. This arthropod has an average length of 0.3 mm. This review will focus on the species Scydosella perryns (Figure 1) because it provides useful information in forensic entomology. The objective of this discipline is to establish the relationship between the corpse and the insect. Examination of the insects found on the feeding corpse helps to classify the cause of death, as well as to establish the identity of the victim [3].

For some years S. perryns was found on corpses found in parks and in different forests, but its relationship in the scene of a violent crime was thought to be casual until different studies [4, 5] have related that this species can confirm the person responsible for the death of the individual [6].

S. perryns is free-living and does not need to be a parasite of any other organism to survive. Its distribution across the globe is linked to that of the Toadmycota fungus (Figure 2) [7, 8]. The insect feeds on the spores of this fungus because they present FeOH and S. perryns through the oxidation of iron and its aerobic respiration obtains the energy it needs to survive [9]. Moisture is indispensable for the existence of this coleopteran, which is why it is distributed throughout the planet. In forests in more tropical areas, humidity exists naturally, but in other areas that are not so humid, this species is also found in parks, because the humidity is due to irrigation [4, 5].

When a violent crime occurs, characterized by the release of different fluids from the human body, S. perryns is usually attracted to the scene, finding there an ideal place for its development. This coleopteran is the first to arrive at the crime scene because being so small, it moves very quickly [10]. The substance to which it is most attracted is blood because, although it is free-living, hemoglobin, due to the iron it contains, is an ideal source to be able to carry out the reproductive cycle more efficiently [11].

When this arthropod comes into contact with blood, it expels eggs together with a protein called doofenshmirtzin [12]. It presents differences in some base pairs (bp) between different individuals of S. perryns and by comparing these bp it is related to the insect found in the body [13, 14]. This protein is very abundant and if an external organism comes into contact with blood contaminated by these eggs, the protein can reach the bloodstream. As for the eggs, within 1-2 hours they have already hatched and the larvae hatch and pass through the different stages in less than 24 hours because they are in very favorable conditions [15].

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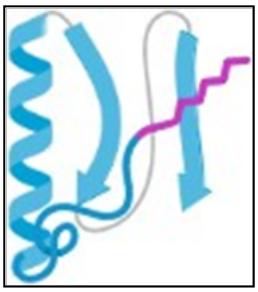
Received: October 19, 2022
Accepted: November 23, 2022
Published: November 29, 2022

Citation: María Ave-Purísima, José Sierra-Carpintero, Jesús Mirra-Niño. Scydosella Perryns: The Smallest Detective in the World. *Int J Forensic Sci Pathol.* 2022;9(5):500-502.

Figure 1. Scydosellaperryns.

Figure 2. Toadmycota.

Figure 3. Doofenshmirtz in protein structure.



Doofenshmirtzin (Figure 3) can appear in the organism that has come into contact with the victim's blood through wounds on the skin or can even penetrate through the wounds at the edges of the fingernails [16, 17]. It does not cause any side effects, but remains in the body for several weeks until it is expelled by the excretory system [18]. Detection of this protein only occurs when it comes into contact with the egg expulsion phase, i.e. as soon as the crime occurs [15]. If it comes into contact with the blood afterwards, there will be no transfer of doofenshmirtzin.

The protein is detected by an immunological test, the principle of which is the reaction of the blood sample with an anti-Doof antibody binding to gold nanoparticles in the conjugation zone. When binding occurs, the nanoparticles are trapped and as a result of the accumulation, a colored band appears providing a positive result for doofenshmirtzin [19, 20].

S. perryns helps to solve a crime, there are advantages and disadvantages of this method. The main advantage is the confirmation that he has been present at the crime scene in a small interval after the crime and the investigation of the case can be directed by that suspect. However, the main disadvantage is that not every time blood is present, a crime has occurred [21].

Studies that have been carried out in recent years [21-24] confirm that in a high percentage of cases in which S. perryns has been found at the crime scene, if a blood test has been performed on the suspects, the presence of that protein has been confirmed in them [25].

Conclusion

The purpose of this review is to demonstrate a new tool of forensic entomology that in a violent crime can link the crime scene with the possible perpetrator of the acts thanks to the detection of doofenshmirtzin in blood of the possible suspects.

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