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BUG'S LIFE: REPORT ON A PEDAGOGICAL WORKSHOP FOR HIGH SCHOOLS BASED ON DIDACTIC MODELS AND ENTOMOLOGICAL COLLECTIONS

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Abstract: The present article consists of the description of a didactic transdisciplinary workshop, applied to the technical high school of cooperativism at the Federal Institute of Paraná (IFPR) located in the municipality of Capanema/PR, in person. With this, we seek to establish the explanation of the activity, pointing out the methodology and the proposed materials, investigating the relevance of insects for biodiversity and for the economy, since these small animals are part of an extremely diverse and voluminous group, called arthropods, however, often going unnoticed, carrying with it several negative stigmas. This way, explain what are the main characteristics that differ the group from the others, also pointing out about zoonoses, specifying how and where they occur, exposing their risks and treatments. Finally, we comment on the importance of different activities for students' learning, focusing on everyday knowledge, offering more options for the materials described, thus seeking to reach a larger audience.
Keywords: Insects, biodiversity, zoonoses, workshop, PIBID.

INTRODUCTION

Even with enormous diversity and ecological importance, in everyday life insects are restricted to those occasionally observed in homes, such as cockroaches and ants, and are normally associated with feelings of aversion. This social imaginary built on the concept of insect is reflected in basic education students, who commonly attribute pejorative characteristics to these animals, projecting an ideology where these living beings are devoid of importance (GULLAN and CRANSTON, 2012; TRINDADE, SILVA JÚNIOR, TEIXEIRA, 2012). This way, the collective vision ends up conceiving insects only as pests that must be fought and, when added to the use of pesticides in agriculture and the deforestation of habitats, partially contributes to the population reduction of species of the group (SOUZA-LOPES E SILVA, 2020; SÁNCHEZ-BAYO, WYCKHUYSB, 2019).

Paying attention to a more meaningful form of learning is what the pedagogical workshops build together with the experiences of situations that combine theoretical and practical knowledge, inciting the enthusiasm of students who see in the workshops an interactive and fun way of learning (CAMPOS, BORTOLOTO, FELÍCIO, 2003; PAVIANI and FONTANA, 2009). Added to such considerations, didactic materials make up an important tool for the teaching-learning process, favoring the construction of much lighter and more lasting knowledge (CAMPOS, BORTOLOTO, FELÍCIO, 2003).

From this context, this report describes the creation and application of a theoretical-practical workshop prepared by scholarship students and volunteers from the Institutional Program for Teaching Initiation Scholarships (PIBID) - from the Biology project of ''Universidade Federal Fronteira Sul", Realeza *campus* (UFFS). The workshop aims to present the group of insects, as well as their characteristics, ecological importance and potential zoonoses, in order to arouse curiosity and break with the ideal built with common sense to students of technical education integrated into high school at the Federal Institute do Paraná - Capanema campus, using specimens from the entomological collection of the federal university of the southern border and a didactic model made by PIBID students as an application method.

THEORETICAL REFERENCE

Insects are invertebrate animals and belong to the group of arthropods (Arthropoda: Hexapoda), having jointed appendages as their main feature (HICKMAN et al., 2016).

The basic body plan of these living beings consists of the head, thorax and abdomen, with the presence of three pairs of jointed legs being observed in the thorax (HICKMAN et al., 2016). Most groups are winged and have a single pair of antennae (HICKMAN et al., 2016). As part of this group, insects have an external skeleton known as an exoskeleton (GULLAN and CRANSTON, 2012). Composed of chitin, this skeleton restricts the loss of water by these living beings, as well as offering protection against predators (GULLAN and CRANSTON, 2012; HICKMAN et al., 2016).

Being found in almost all terrestrial and aquatic environments, insects currently represent the most diverse and abundant group of organisms known on earth, and among these living beings, beetles (Coleoptera) make up the most numerous order of insects (BRUSCA, 2018). The enormous diversity of insects probably comes from the fruit of favorable elements throughout the evolutionary process, mainly in coevolution with plants, in the decrease in body size and in the ability to fly (BRUSCA, 2018). Due to this great diversity and wide capacity to adapt on Earth, it is possible to observe innumerable associated ecological functions that this class of living organisms, such as nutrient recycling, pollination, seed dispersal, being food for vertebrates and carrying out the maintenance of the community of plants and animals, being essential for life as we know it today (BRUSCA, 2018; GULLAN and CRANSTON, 2012).

A. IMPORTANCE OF INSECTS

When we talk about invertebrate animals, the first thoughts are related to pests, fear and disgust, however, what few people know is that insects have a very great ecological importance. Among them we can mention: pollination, since several flowering plants attract them with their colors and aromas, thus depending on them for their reproduction their decomposing function, recycling soil nutrients when feeding on trunks and plants, leaving the soil more fertile; and, the great importance in the food chain (MARTINEZ and ROCHA-LIMA, 2020).

Thus, arthropods have a wide biodiversity, being the most important phylum ecologically speaking, thus dominating terrestrial and aquatic ecosystems both in number of species and individuals (FELIX et al., 2010). As a result, they are more sensitive to environmental changes, and are also used as bioindicators, using the absence or presence of a particular species in the environment to determine the degree of environmental degradation (MARTINEZ and ROCHA-LIMA, 2020).

Within the economic area these small animals have a significant importance, being assiduous in the pharmaceutical and cosmetics industries, producing substances such as beeswax, honey, silk, lacquer, chitin, which acts in healing and blood clotting, exerting from that a positive impact on health (DESUÓ, 2010). Furthermore, using them as research sources provides technological advances in several areas of science, such as forensic entomology, which is the branch of forensic science that uses insects as evidence and traces for the elucidation of violent crimes.

B. ZOONOSIS

The term "Zoonosis" is used to refer to any infectious disease transmitted by animals to humans, directly or through another individual (SARWAR, 2017). When the disease is transmitted by an arthropod (in this case, insects) it is classified as: "Vector-Borne Disease", that is, a disease transmitted by a vector (BUENO-MARI, ALMEIDA, NAVARRO, 2015; SARWAR, 2017).

Between the 1940s and 1960s, diseases transmitted by vectors were considered

"interior diseases", since it was very difficult for someone residing in the city to be infected (TAUIL, 2006). But with accelerated urbanization, along with the radical climate changes that Brazil has been suffering in recent years, diseases once considered "inland" are now increasingly present in urban regions (TAUIL, 2006; ZANELLA, 2016; FILHO et al., 2017). In Brazil, among the most common diseases are: Dengue, Zika, Chikungunya, Leishmaniasis, Schistosomiasis, Yellow Fever, Chagas Disease, West Nile Fever (TAUIL, 2006; FILHO et al., 2017). Currently, when we focus on our region (Southwest of the state of Paraná), the disease we find most is dengue, and over the years the number of cases increases more and more.

The mosquito vector of dengue was first described in 1762 as Culex aegypti, reporting the Egyptian origin of the species. In 1818, the genus Aedes emerged and it was soon seen that the mosquito in question had more characteristics of this genus than the group of mosquitoes of the genus Culex, so the name Aedes aegypti became its official name (IOC, sd). It is believed that the great voyages that transported slaves from Africa were the main responsible for the spread of the mosquito in different regions of the world (IOC, sd). The first cases of dengue in Brazil were registered at the end of the 19th century and the beginning of the 20th century in Paraná and Rio de Janeiro respectively (IOC, sd). Between the 1930s and 1950s, the Aedes aegypti mosquito was already a big problem in our country, but not because of dengue, but because of yellow fever, for this reason, then-president Getúlio Vargas started several campaigns to eradicate the mosquito, and it was successful, with mosquito eradication being achieved before the early 1960s (MAGALHÃES, 2016). However, with the carelessness of the population and the weakening of campaigns, the mosquito was reintroduced in Brazil in the early 1970s and since then has been a problem in Brazil (BRASIL, 2014).

The disease is only transmitted by female Aedes aegypti mosquitoes, after 7 to 14 days of incubation of the virus in the female's body, they are capable of transmitting it through saliva for a lifetime (between 30-40 days) (AMARAL and DANSA-PETRETSKI, 2012). Dengue has as main symptoms: fever, pain in the body and eyes, vomiting, myalgia and in extreme cases bleeding, this way it ends up resembling other diseases, such as the flu (influenza), yellow fever, COVID-19, among others (KULARATNAM, et al. 2019; LORENZ, AZEVEDO, CHIARAVALLOTI-NETO, 2020). Due to this similarity, its diagnosis is very difficult and must be done through elimination (differential diagnosis) (BRASIL, 2016; LORENZ, AZEVEDO, CHIARAVALLOTI-NETO, 2020).

In Paraná, dengue has been continuously present since the late 1980s and early 1990s, and since 2010 the numbers have grown steadily, in the southern region, Paraná has always been the state with the highest number of cases (DUQUE et al., 2010). There are three levels of incidence: low (when the average of cases per 100,000 inhabitants is less than 100), medium (when the average of cases per 100,000 inhabitants is between 100 and 300) and severe (when the average of cases per 100,000 inhabitants is greater than 300), the severe level characterizes an Epidemic. Currently, Paraná has 1,980 cases per 100,000 inhabitants, so it is in a dengue epidemic (GONÇALVES, 2020).

C. MYTHS, FEARS AND BELIEFS ABOUT INSECTS

Even with several studies proving the importance of insects to society, the presence of prejudice against these animals is still very common (GRUZMAN, 2009). Insects always

end up being related to "bad" things, such as: diseases, dirt, fears, disgust. With this, the idea of "insect" is completely deformed among people (GRUZMAN, 2009; LIMA, CHAPANI, JUNIOR, 2017). A great example is the definition of the term "insect" in the Aurélio dictionary, which begins by describing the word as "segmented animals and hexapods" and ends with "referring to an "insignificant or despicable" person, this definition does not only happen in the Portuguese language, other languages such as Italian and English have definitions similar to the term insect (GRUZMAN, 2009).

In the work by Lima, Chapani and Junior (2017), where they analyzed the initial knowledge and popular cultures of elementary school students (8th and 9th grade) about insects, the terms "disgusting" and "disgusting" were the most used, showing that often the prejudice about these animals reach children even before they study them at school. For GRUZMAN (2009) there are two reasons that are the main causes of this early prejudice: the constant news of diseases caused by insects and the portrayals of insects in films, the first point comes from the constant growth of cases of diseases such as malaria, dengue, yellow fever, this growth ends up appearing in newspapers, news and can frighten the population; the second point refers to films like Them! (1964); They Nest (2000); The Fly (1986), among others who represent insects as "huge monsters" that want to exterminate human beings (Them!), or as plagues that proliferate inside the human body, causing people to die quickly and cruelly (They Nest) or even as possible mutations with the human being, where the individual becomes violent and hostile and presents characteristics such as super strength (The Fly).

Activities like the one we apply at the IFPR are possibly the best means of combating this prejudice, giving students the opportunity to look and feel the animals up close and thus draw new or their own conclusions. The works by GRUZMAN (2009) and Lima, Chapani and Junior (2017) reach similar conclusions, stating that the best way to end these thoughts is to work in a didactic and practical way with students.

TEACHING MODELS AND ENTOMOLOGICAL COLLECTIONS

According to Vieira and Volquind (2002), the pedagogical workshops are characterized by the union of theory and practice, with the main objective of instigating students to action and, thus, enabling them to investigate and reflect during the learning process. In order to promote the balance between theory and practice that pedagogical workshops require, it is necessary that they integrate three spheres: thinking, acting and feeling. Thus, it is necessary that the workshop space be prone to an innovative experience, going beyond learning in practice and also encompassing thinking, and problematizing, discovering and understanding.

Didactic models constitute a powerful means of reproducing reality, giving them the opportunity to simulate reality, based on the theory that sustains it (PIETROCOLA, 1999). Widely used by science and biology teachers with the aim of demonstrating objects in three dimensions and facilitating teaching-learning, didactic models present, however, some problems, mainly when they allow students to understand the real object as the model itself, and this representation, in most cases, is limited and simplified (KRASILCHIK, 2003).

An entomological collection is composed of biological material, usually whole organisms, which are properly treated so that they can be conserved, organized and systematized. Entomological collections

are important tools for the development of research, being used mainly as a database (CAMARGO et al., 2015). By having a beautiful appearance, an entomological collection makes the pedagogical practice more attractive and motivating, in addition to collaborating to alleviate the repulsive conception often associated with insects (SANTOS and SOUZA-SOUTO, 2011; CAMARGO et al., 2015).

For KRASILCHIK (2003) practical activities are great allies in the teaching of biology since they provide opportunities for students to manipulate and observe the materials. Diverse approaches such as practical activities can constitute a methodology that makes it possible to establish a connection between the students' daily lives and their prior knowledge with the themes seen at school, in order to establish a meaningful learning for them (FRASSON, LABURÚ, ZOMPERO, 2019; LOYAL 2020).

METHODOLOGY

Two pedagogical workshops were held in second-year classes of technical education integrated into high school at the Federal Institute of Paraná (IFPR) - Capanema campus. The workshops took place on February 24, 2022: one in the morning and another in the afternoon, lasting one hour and thirty minutes and taking place in the institution's science laboratory.

The choice of theme was based on the importance of insects to the environment, focusing on the characteristics mentioned above, providing students with a more didactic explanation, using slides produced on the Canva® platform to help visualize the content. For this, before our application, we provide students with a brief summary, made by us pibidians, containing arthropods as a theme, since it was necessary to refresh or even teach about this vast group before introducing the new content, so that this way did not arrive at the workshop without a base. Our speech was divided into explaining what an insect would be, its basic characteristics and examples of these animals, thus starting with its economic and ecological importance, finally developing on zoonoses, with emphasis on dengue, after all, the southwest of paraná is where more incidences of the disease occur. During the production of our class, we adapted it so that doubts were very welcome, seeking to create an environment without judgments, also choosing to question them when necessary.

As the first step of the application, we dialogued with the students about their preconceptions and ideas about these small animals, helping to visualize their participation and which points we must emphasize more. From there, with the help of the slides, we started the conversation clarifying the importance of insects, both for biodiversity and for the economy, always building an environment of participation in relation to the students. To introduce a more practical experience during our class, we used an entomological collection, belonging to the Entomology Laboratory of ''Universidade Federal Fronteira Sul" (UFFS), located in the municipality of Realeza in Paraná, which was loaned to us, with the objective of demonstrate the variety of existing insects, bringing them into the students' daily lives. The entomological collection, present in figure 1, used included insects from the fauna of Paraná, aiming at the insects that they might encounter in their daily lives, corroborating the scientific look of students outside the classroom. The specimens were observed by students using stereoscopic microscopes available at the institution where the workshop was held.

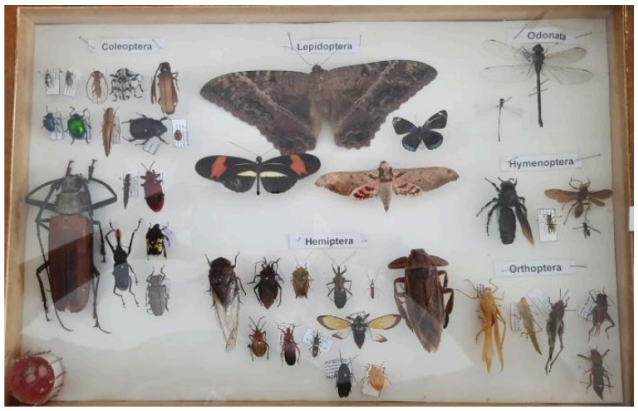

Figure 1: Entomological collection of the Entomology Laboratory of "Universidade Federal Fronteira Sul" (UFFS) - Realeza *campus*.

Source: Prepared by the authors.

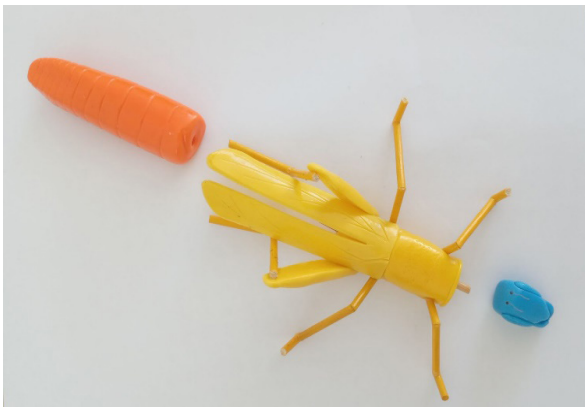

Figure 2: representation of the disassembled cold porcelain didactic model to highlight the body structures of insects: head (in blue), thorax (in yellow) and abdomen (in orange).

Source: Prepared by the authors.

We know that it is not easy to get an entomological collection, or even to have a laboratory with magnifying glasses for observation, since most primary schools are not available, therefore, we use a didactic model of cold porcelain (biscuit) built by the pibidians, illustrating the three body divisions characteristic of insects (Figure 2), so that students could manipulate the model, thus adding a more accessible element to our didactics, thinking about the teachers who will apply this class in the future. For this, the model is "detachable" and can be divided into three parts, following the body division: head, abdomen and thorax. Added to this, each of the parts had a distinct color, so that the three parts are visually identified by the students. For the construction of the model, the following materials were used: cold porcelain (biscuit), paint, barbecue skewers and wire.

To conclude our workshop, we applied the topic of zoonoses to students, focusing on explaining its meaning, highlighting only those committed by insects, thus using their vectors, effects, precautions and treatments. Following our speech, we allowed a more detailed observation of the entomological collection (Figure 3) and manipulation by the students of the didactic model (Figure 2), so that they responded to a script, built by the authors on the subject in question, seeking thus, a greater dialogue between the students, fixing the proposed theme. Each question is equivalent to an important topic about insects, working with students to manipulate a microscope magnifying glass and a more technical look, if these materials are not available in their application, another option is to ask students to observe the insects that are in their daily life, without the need for capture, only visualization in the same habitat, being able to use a simple magnifying glass (optional) for a better visualization.

The script contained the following questions regarding the animals observed in the magnifying glass:

• Does this animal have antennae? If yes, what are they like?
• How many pairs of legs does he have?
• Does he have wings? If yes, what are they like?
• What is his color? • Have you seen one of these before?
• Do you know a possible popular name?
• Which feature caught your attention the most?
• Is he or is he not an insect?
• Now having the basic knowledge of the main characteristics of insects, draw one.

Figure 3: Entomological collection used for observation in magnifying glasses.

Source: Prepared by the authors.

REPORT ANALYSIS AND DISCUSSION

According to Krasilchik (2008), when making use of different tools for the application of the pedagogical workshop, it is possible to attract and provide a greater interest to the students, making the classes more attractive. Thus, by diversifying the teaching methodology, it is observed that these tend to make the student active in the teaching-learning process, also motivating him to learn (LIMA, SIQUEIRA, COSTA, 2013).

According to Lima, Siqueira and Costa (2013), practical activities open up possibilities to relate the subject to their theory and awaken in them the scientific spirit and curiosity about the subject worked, so that there is the development of understanding of basic concepts. Thus, the pedagogical workshops, by contributing to this complementation of theory with practical activities, can also collaborate for the construction of a critical and autonomous view of the world by the students themselves (LIMA and GARCIA, 2011; PAVIANI and FONTANA, 2009).

This way, when we observe the methodology of this pedagogical workshop, it is notable that developed practices led students to have greater contact with the group of organisms worked on, thus awakening curiosity in students and stimulating them for scientific investigation, especially when perform the manipulation and observation of the specimens in the microscope magnifying glasses, being evident their interest in using the equipment. When carrying out this manipulation, it was notable that the students reacted with curiosity to the manipulation of the insects, carefully observing the details of each specimen. In addition, questions arose from these observations, here highlighting one in particular where we were asked whether insects have veins in the constitution of their circulatory system, opening space for us to explain how this is constituted in insects.

In view of all the above, we can consider that didactic models are suggestive instruments and that they can be effective in teaching practice in the face of approaching content that is often difficult for students to understand, especially with regard to subjects related to genetics, specifically, in teaching science and biology.

The use of the didactic model as a methodological tool enables students to better understand the contents addressed (SETÚVAL and BEJARANO, 2009), and, from its manipulation, it is possible to lead to an understanding of the external morphology,

given the segmentation and coloring of the same. Therefore, we observed the students' interest in observing the didactic model, either while viewing the insect specimens in the microscopic magnifying glass or while performing the answers in the script, indicating that they were correlating the corporal representation of the didactic model with the specimens from the entomological collection.

In an attempt to overcome the problem of limitation that didactic models may present, the use of an entomological collection, with specimens from different groups and genera of insects, demonstrating their diversity and their characteristic form, so that students could identify the group in question. their daily lives. Also, the entomological collection can be used as a support both for the identification of structures that change in insects, such as wings and antennae, and to relate these modifications to the ecological importance that these living beings present and collaborating in the reduction of the repulsive aspects related to the insects (SANTOS and SOUZA-SOUTO, 2011).

Practical scripts tend to demonstrate effectiveness in the teaching-learning process, being indicated so that students' potential is boosted, as well as their learning (SILVA JÚNIOR et al., 2014). Regarding the answers to the practical scripts constructed in the classroom, it was observed that most of the students understood the concepts applied, since the perceptions brought through the answers and the drawings made were consistent with the theme worked on in the workshop, demonstrating that it achieved the proposed objectives. Finally, it is necessary to emphasize that the responses of the scripts answered by the students were used only as a diagnosis of the effectiveness of the workshop.

FINAL CONSIDERATIONS

We understood that teaching in a more practical and didactic way is of paramount importance for the construction of a quality education, obtaining, as a consequence, excellent results of transformation regarding the students. Therefore, this change related to the student's view of insects can alter an entire culture related to fear and, consequently, the inappropriate death of these animals. It can be observed that with the use of the entomological collection and the didactic model, the students' interest was greater and their participation was constant, with many questions being asked. It was also possible to contemplate that the content worked was well understood by the students, since they were able to concretely express their ideas when responding to the applied report. Because of this, we conclude that the application of this activity helped in the students' learning, since, in addition to bringing diversified didactic and pedagogical materials, it sought to present a simple explanation of important themes and demonstrating with examples of their daily life.

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