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Academic entomotourism as a strategy for the conservation of lepidoptera in meta, Colombia

Entomoturismo académico como estrategia para la conservación de lepidópteros en el Meta, Colombia

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ABSTRACT

Entomotourism, in addition to being a service based on tourism, also includes an environmental education approach towards the protection of insects, the preservation of ecosystems and the conservation of their diversity. With this service, focused on lepidopterans, the importance of this class of insects and the services offered are made known. Therefore, this research focuses on presenting the establishment of a line of academic entomotourism with lepidopterans to promote the conservation of biodiversity through environmental education in the María Lucía Metropolitan Park of Villavicencio, Meta. During the process, through observation, bibliographic search and field work, the morphology, life cycle, behavior and relationship with the host plant were analyzed. In addition, the ecosystem services provided by lepidopterans were studied as a platform to implement environmental education strategies towards communities and the general public. Likewise, visits were made to institutions, in order to share knowledge with students about the conservation, identification and preservation of lepidopteran species in the area, through tours in a territory that covers several ecosystems, as the basis of the academic entomotourism service.

Keywords: ecotourism, educational sciences and environment, environmental conservation, environmental education.

JEL Classification: H51, H52, I10

RESUMEN

El entomoturismo, además de ser un servicio en función del turismo, también incluye un enfoque de educación ambiental hacia la protección de insectos, la preservación de los ecosistemas y la conservación de su diversidad. Con este servicio, enfocado en los lepidópteros, se da a conocer la importancia de esta clase de insectos y los servicios ofrecidos. Por ello, esta investigación se enfoca en presentar el establecimiento de una línea de entomoturismo académico con lepidópteros, para promover la conservación de la biodiversidad a partir la educación ambiental en el Parque Metropolitano María Lucía de Villavicencio, Meta. Durante el proceso, por medio de la observación, búsqueda bibliográfica y trabajo de campo, se analizaron la morfología, el ciclo de vida, el comportamiento y la relación con la planta hospedera. Asimismo, se estudiaron los servicios ecosistémicos que brindan los lepidópteros, como plataforma para implementar estrategias de educación ambiental hacia las comunidades y el público en general. También, se realizaron visitas a instituciones, con el fin de compartir conocimientos con los estudiantes sobre la conservación, identificación y preservación de las especies de lepidópteros de la zona, mediante recorridos en un territorio que abarca varios ecosistemas, como base del servicio de entomoturismo académico.

Palabras clave: ciencias de la educación y ambiente educacional, conservación ambiental, ecoturismo, educación ambiental.

Clasificación JEL: H51, H52, I10

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INTRODUCTION

Entomotourism is a derivative of ecotourism and, in turn, of tourism (Lemelin & Jaramillo-López, 2020). Recently, tourism has focused on natural attractions and how a connection is created between the natural environment and the people who coexist in these places. Similarly, entomotourism is basically nature tourism enriched with an environmental

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education approach to insects. This activity is carried out under the principles of conservation of ecosystems and their biodiversity. The term "entomotourism" is relatively new; there are very few records of this activity, and the purpose of this research project was to describe the processes and contributions that occur as a result of implementing it.

At the 1968 General Assembly of the International Union for Conservation of Nature, Baba Dioum stated that conservation would largely depend on love and knowledge, hence the importance of environmental education and bringing new generations closer to the problems and needs of the socio-environmental environment (Ostermann-Miyashita et al., 2023; Papp, 2023; Tabares, 2021). Therefore, environmental education is considered a tool that allows for the integration of entomotourism with the conservation of lepidopterans in the region's ecosystems, especially considering the disparate international results regarding the acceptance of insects and their tourist appeal (Fukano & Soga, 2023; Lemelin & Jaramillo-López, 2020; Rendón-Salinas et al., 2023).

The union of entomotourism and environmental education seeks to raise awareness among the population to conserve endemic species and protect those on the red list. This disciplinary integration facilitates the conservation of ecosystems by mitigating the expansion of the agricultural-livestock frontier and the planting of nectariferous and host species, but it must be taught from an early age and be part of the remaining educational levels (Bassols, 2020; Sándorová et al., 2020; Tomasi et al., 2020; Walker & Manyamba, 2020). Furthermore, it promotes tourism that is sensitive and committed to the environment, culture, and personal growth of visitors (Bowan & Dallam, 2020; Hurst et al., 2021; Ríos et al., 2020; Stinson & Grimwood, 2022).

Entomotourism is offered not only as a tourist attraction but as a symbol of education and conservation, a means of raising awareness about the importance of butterflies and how they can coexist without affecting their environment (Abukari & Mwalyosi, 2020; Durak & Topçu, 2023; Obradović et al., 2021). Along with this, knowledge and awareness help the community and visitors take ownership of their environment, starting with the conservation of butterflies and ecosystems.

Among the insects that play a fundamental role on the planet, the butterfly stands out; it is a species that makes up the most numerous taxonomic order of species on the planet, ranking third (An and Choi, 2021; Bibi et al., 2022; Miao et al., 2021). They offer goods and services and have great value in various aspects, including ecosystem, aesthetic, educational, cultural, and economic aspects. However, it is evident that the literature on the subject under study is still in its infancy.

METHODOLOGY

The research conducted was exploratory, considering that its purpose was to study a topic that has been little studied and with limited background information. Therefore, the results obtained while contributing to the field often represent superficial knowledge (Arias, 2012). The methodology was framed within a qualitative approach, as Lepidoptera's life cycles, morphology, and characteristics were described, and the importance of the ecosystem goods and services they provide was highlighted. Furthermore, the Santa Rosa district community in the municipality of Villavicencio was involved, thereby enhancing the direct participation of educational stakeholders in the process.

Participatory Action Research (PAR) was used to implement this approach, as it is a methodology that utilizes a socially reflective practice that allows for community inclusion, which is the central focus. This decision was made based on a background study in the fields of education and tourism, which demonstrates the varied benefits of this type of approach (Aguiar-Castillo et al., 2020; Li et al., 2022; Ndou et al., 2019; Sándorová et al., 2020). Taking into account the aforementioned conceptualization of the type of research, the project was carried out in three phases. A summary of the main methodological aspects is presented below.

Phase I. Diagnostic

This was achieved through reading bibliographic material and field observations. In this phase, students acquired knowledge about Lepidoptera, their life cycles, and the goods and services they offer for educational purposes. For this phase, weekly visits were made to María Lucía Metropolitan Park.

In order to understand their morphology, it was necessary to capture them using a hamster and a stereoscope, which showed each part of their anatomical structure in detail. Photographs were taken of their head, antennae, proboscis, thorax, abdomen, legs, and wings. In the butterfly house, it was possible to observe each stage of a butterfly's life cycle: oviposition, egg, larva, pupa, and adult butterfly. Likewise, cameras were used to record each

stage of their life cycle and record the time taken separately. Through bibliographical reading and fieldwork, it was possible to observe the ecosystem goods and services provided by Lepidoptera, including pollination for the reproduction of plants, fruits, and seeds. Their role as environmental bioindicators of climate change and ecosystem conservation was also identified, as they play a role in the food chain.

Phase II. Dialogue of knowledge and wisdom

Exercises were developed that allowed the integration of the community's prior knowledge for the construction and generation of new knowledge based on the principles of the Public Policy of Social Appropriation of Knowledge within the framework of Science, Technology, and Innovation, which are:

Context recognition

Exploration, evaluation, and diagnosis of the social and community reality of the locality, based on the study of interactions, interests, needs, and other units of meaning shared by the inhabitants. Its objective is to provide a sufficient basis to support the processes of social appropriation of knowledge from the own referents and transformation needs expressed by the subjects.

Participation

Promoting critical, committed, and ethical citizen participation, with the goal of including local actors in decision-making, governance, and development processes. This involves recognizing the plurality and complexity of the context, the frameworks and representations that underpin individuals' worldviews, and the ways to build common meanings and interpretations.

Dialogue of knowledge and wisdom

Establishment of citizen spaces for open dialogue and mediation on issues of social and community interest. The goal is to establish conditions of equality and inclusion of diverse actors so that all can participate in the construction of knowledge.

Transformation

This occurs as a change process, introducing ancestral knowledge, successful experiences, and scientific and technological knowledge into everyday community practice. Its objective is to align relationships, exchange experiences, and construct new knowledge.

Critical Reflection

This is based on analyzing and assessing citizens' and others' experiences, recognizing the results of their actions, and evaluating the process as a whole. The goal is to systematize the results and promote new interventions aimed at improving the community's living conditions.

Phase III: Design

Through environmental education strategies, such as educational guides and knowledge exchange, participants learned about the life cycle of a butterfly, its morphology, and the ecosystem goods and services these insects provide. Visits were made to the Apiay Educational Institution, Santa Rosa campus, in the Santa Rosa neighborhood of Villavicencio, to provide information aimed at raising awareness of the importance of protecting Lepidoptera species and ecosystem conservation.

Additionally, spaces in María Lucía Metropolitan Park were adapted, including trails for butterfly watching, nectar-bearing and host plant nurseries, and collection maintenance. An academic entomotourism service was designed to raise awareness about the importance of Lepidoptera in the ecosystem and the goods and services these insects provide. The tour was conducted primarily from the gatehouse to the butterfly house, where a wide variety of Lepidoptera species can be observed along the way. There, it was possible to find the butterfly in any stage; then, a visit to the collection and the laboratory was made, allowing us to observe each part of the butterfly in greater detail.

RESULTS AND DISCUSSION

Next, ecosystem services are analyzed from the perspective of Lepidoptera, with the aim of generating knowledge for the benefit of tourists. The main results of field observations and literature reviews are described. This analysis will be enriched with the results of triangulation and discussion, as well as images that contribute to the visual representation of data and the fulfillment of the research objective.

Life cycle of the butterfly

The life cycle of a butterfly is divided into four stages: egg, larva (caterpillar), pupa (chrysalis), and adult. During the research project, the life cycles of two butterfly species were monitored: Eueides isabella and Methona cofusa. Each stage is described below:

The egg

Embryonic stage, where the egg is the fertilized ovum, wrapped by the chorion, which is the egg layer; this has an orifice called the microphilus, whose function is to allow the entry of the male sperm for fertilization; it should be noted that the shape of the egg varies, some can be elongated, ovoid, spherical, among others, of great educational value (Hashim et al., 2020; McBain et al., 2022; Yu et al., 2022). The female butterfly looks for suitable plants to lay her eggs so that the larvae can feed when they hatch. The eggs of the Methona Confusa and Eueides Isabella butterflies are taken as a reference, as shown in figures 1 and 2.

Figure 1.
Methona Confusa Eggs

Figure 2.
Eueides Isabella Eggs

The larva or caterpillar

This phase is the feeding and growth stage, where the larvae, as shown in figure 3 and figure 4, transform their food into tissue and reserve a portion for use in the pupal or chrysalis stage. Many larvae have thirteen segments; pairs of legs: from the first to the third segment, called thoracic; those from the sixth to the ninth segment are called prolegs or false legs; and those positioned in the thirteenth segment are called anal legs. They also have a head with eyes called ocelli, a pair of antennae to identify their food, and an organ that produces silk to attach themselves to different surfaces, escape predators, and form their chrysalis. In addition, its body consists of an exoskeleton and an envelope of chitin and sclerotin, which molts between four and seven times depending on the species; this molting process is known as an instar. When the larva reaches its final instar, it ceases its activity and prepares for the pupal stage, known as the prepupa. Teaching the names and functions of each anatomical region, as well as their phenotypic expression in a butterfly's life, can be used as a strategy to promote cognitive development, science learning, and the use of digital images (Alexander et al., 2021; Reser et al., 2021).

Figure 3.
Methona Confusa larva

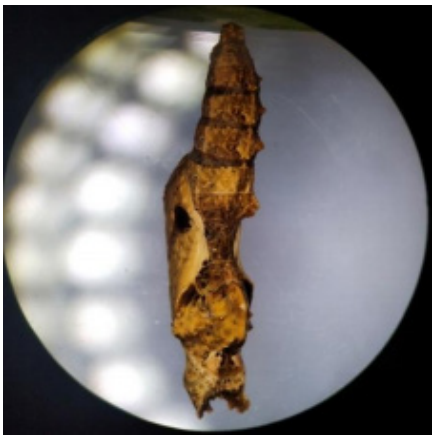
Figure 4.
Eueides Isabella larva

Pupa or chrysalis

This is the stage where metamorphosis takes place, as mentioned above. In the butterfly's last instar, the prepupa process takes place, and it is ready for the pupal stage (as evidenced in figures 5 and 6), where it remains immobile and attached to the cremaster, a connecting structure that holds it together. Inside, the tissues develop for the formation of the adult butterfly. Pupae adapt to their environment and have the ability to acquire different colors and shapes to camouflage themselves from predators. At the end of the metamorphosis stage, the center of the pupa opens for the birth of the adult butterfly.

Figure 5.
Methona Confusa Pupa

Figure 6.
Eueides Isabella Pupa



The adult butterfly

At this stage, the individual is sexually mature and has the capacity to copulate, reproduce, and fly; it has three main parts: Head, thorax, and abdomen (as shown in figure 7 and figure 8), with the two species of butterfly, which are Methona Confusa and Eueides Isabella. This particular stage is of interest to entomotourism specialists since observing the adult butterfly is one of the main attractions for visitors and academics (Putri et al., 2020; Le et al., 2021).

Figure 7.
Methona Confusa

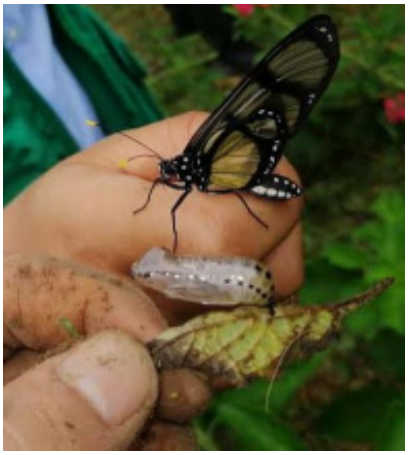
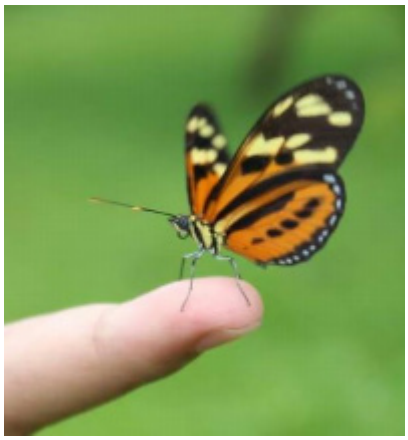


Figure 8.
Eueides Isabella



Morphology of Adult Insects

Head

The main feature of the head (which can be seen in figure 9) is the compound eyes (as seen in figure 10), which are made up of sensory units called ommatidia, which can distinguish between light and certain colors and are sensitive to movement. In addition, the antennae (figure 11) are located above the eyes. These vary in shape and size depending on the species. This sensory organ allows for balanced flight, the identification of individuals of the same species, and the location of food. This type of insect is very sensitive to volatile chemicals, which is why the thick tips of its antennae have chemical receptors. On the underside of the butterfly's head are structures called palps, whose function is to clean the butterfly's eyes when it eats fruit. Between this structure is the proboscis (see figure 12), which is a hollow tube connected by two halves. This organ remains coiled but lengthens to extract nectar, making it possible for the butterfly to feed.

Figure 9.
Head

Figure 10.
Eye

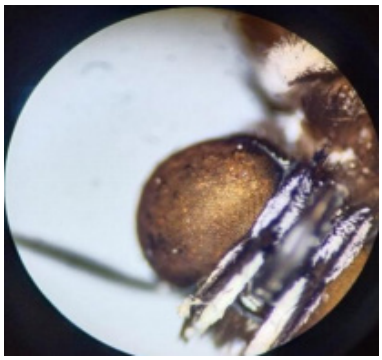


Figure 11.
Palps and proboscis Antenna

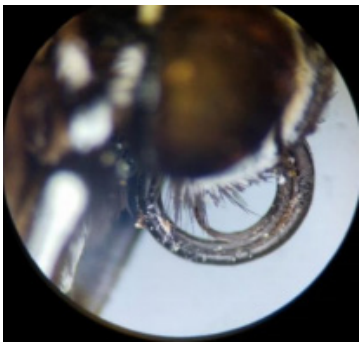
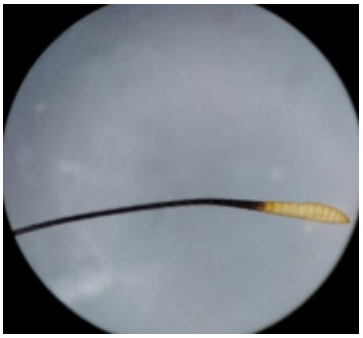


Figure 12.
Antenna



Thorax

Figure 13.
Thorax

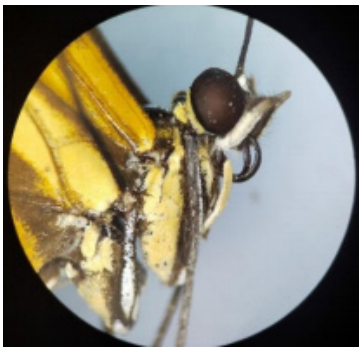
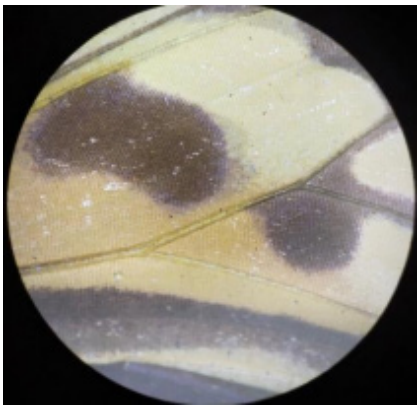


Figure 14.
Legs

This region, which can be seen in figure 13, is the strongest part; it contains the muscles for locomotion and internal organs. It is composed of three segments together, where the legs are located; one pair is distributed per segment for a total of six legs (as shown in figure 14). This section contains the wings, a pair of forewings, and a pair of hindwings, for a total of four wings, covered in scales with colors or patterns characteristic of each species (see figure 15). They are supported by a system of veins located from the inner to the outer edge of the wings.

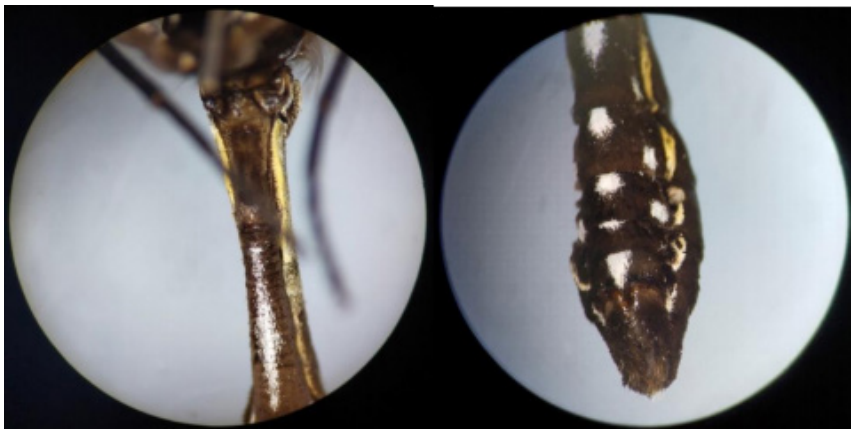
Figure 15.
Wing



Abdomen

This part contains the digestive and reproductive tracts; its reproductive organs are called the genitalia (their shape can be seen in figure 16). This region is divided into ten segments; the longest part is composed of seven or eight segments, and the genitalia are composed of the last two or three segments. Apart from the segment containing the reproductive organs, the abdomen can expand when filled with liquid food.

Figure 16.
Abdomen



Ecosystem services

Ecosystem services are the most important foundation of the environment and are essential for life. They include cultural, provisioning, regulating, and supporting services. Provisioning services are those obtained through ecosystems, such as raw materials, food, freshwater, and medicinal resources. Regulating services are those obtained from the regulated control of various ecosystem processes, such as air quality, erosion prevention and preservation of soil fertility, pollination, carbon sequestration, wastewater treatment, biological controls, and the regulation of various water flows. Cultural services, on the other hand, are those non-material benefits obtained from ecosystems through recreation systems, programs that promote mental and physical health, tourism for aesthetic appreciation and inspiration, and other cultural and personal benefits.

Supporting services, on the other hand, are those necessary for the creation and maintenance of the remaining services. Lepidoptera offer some of the ecosystem services mentioned above and are important in the food chain, as

they serve as food for different individuals, prevent erosion, and contribute to soil conservation (Brambilla, 2022; Jezeer et al., 2019; Kajzer-Bonk & Nowicki, 2022; Mason Jr et al., 2021). They are also excellent pollinators and contribute to pest control; they offer tourism services, specifically entomotourism, which, due to its beauty and variety of colors, promotes culture, art, and design. In many cultures, it even has spiritual value (Chester et al., 2022; Hussain et al., 2019; Lee et al., 2022; Lemelin & Jaramillo-López, 2020).

Strategies for knowledge transfer

Through this section, environmental education strategies are presented, related to the principles of social appropriation of knowledge already mentioned.

Context recognition

For this purpose, visits were made to the Apiay educational institution, Santa Rosa headquarters, in the Santa Rosa area, in the city of Villavicencio-Meta, as shown in the figure:

Figure 17.
Apiay educational institution, Santa Rosa headquarters

During these visits, it was identified that, being an institution located in rural areas, it was necessary to encourage students to incorporate basic knowledge about the germination, planting, and care of vegetables, as well as the link to projects in the institution. Even so, it was interpreted that the knowledge about butterflies was low since they identified what a butterfly was, but they had almost no knowledge about their life cycles, the role they play in ecosystems, and the importance of their conservation and protection.

A reconnaissance of the area where the educational institution is located was carried out, which made it possible to observe, evaluate and identify different areas with potential for the construction of gardens of nectar and host plants, thus guaranteeing the stay of butterflies. The purpose was to apply environmental education strategies focused on butterfly conservation.

Participation

Figure 18.
Planting of host and nectariferous species

Thanks to the commitment of the institution's teachers, it was possible – together with the students of the third, fourth, and fifth years – to carry out the germination and planting of host plants. In this case, passion fruit and French marigold plants were used as hosts, along with nectar-bearing plants such as verbena, French marigold, and milkweed. This ensured the presence of butterflies in the institution, thus creating an open-air butterfly house, which plays an important role in the institution. It also linked butterfly management with the natural sciences curriculum as a learning strategy, along with other activities such as planting (as evidenced in figure 18) and photo sessions with plants and butterflies (see figure 19).

Figure 19.
Plant and butterfly photo session

Dialogue of knowledge and wisdom

Talking circles were used as a resource to promote spaces for participation. The goal was to revive processes of dialogue, cooperation, and respect for the opinions of others. Through a talking circle (as shown in figure 20), each member had a space to express and share their ancestral knowledge through conversations about: What do children know about butterflies? What do butterflies mean to children?

- "Large brown butterflies have numbers on their wings; with those numbers, you can win the lottery."
- "When a black butterfly enters the house, it means someone close to the family is going to die."
- "Butterfly eggs are pests, so they must be killed."
- "When someone dies, and a colorful butterfly enters the house, it means that the soul of that person is visiting."
- "Butterfly larvae are poisonous, so when you see one near your house, you must kill it."
- "If a butterfly chases you, you will have bad luck."

Cultural identity was reflected as these beliefs were transformed into knowledge and will continue to be passed down from generation to generation. It is worth noting that although some aspects of butterflies were discussed, this exercise confirmed that the children lack knowledge about the ecosystem processes carried out by butterflies.

Transformation

It is important to remember this ancestral knowledge, as it has been weakened over time. Children are the future generation; hence, a return to these ancestral beliefs is crucial. By respecting the children's ancestral knowledge, we were able to help them discover butterflies in more scientific ways. In other words, we explained these ecosystemic aspects to the children (as seen in figure 20).

First, the children were taught scientific knowledge about butterflies, explaining that their scientific name is " Lepidoptera" and that they are part of the insect family. They also explained that butterflies play a fundamental role in the food chain. Their various functions were mentioned, namely, that they serve as food for other animals and that they are the second most important pollinator on the planet, thus fulfilling an extremely important ecosystem value. It was also explained that there are two types of butterflies: diurnal and nocturnal.

Figure 20.
Transmission of knowledge about butterflies

The morphology of butterflies was also explained, as well as their structure and composition: wings, abdomen, thorax, and head. It was emphasized that the head of a butterfly contains its antennae, eyes, and proboscis (trunk), with which it feeds. The children at the institution were also introduced to the life cycle of butterflies, explaining that the stages of this cycle consist of egg, larva or caterpillar, pupa or chrysalis (when the butterfly reaches its highest point and coils its silk), and finally, the adult butterfly. This process is essential for understanding the different species and their life processes and for tracking the entire process from egg-laying to the adult butterfly stage.

Likewise, it was explained that female butterflies are larger than male butterflies and that when mating, the female butterfly seeks a host plant to lay her eggs. This plant feeds the larva after birth; the larva eats its own eggshell upon hatching, as it contains beneficial properties. A life cycle recognition activity was conducted. Passion fruit plants (host plants) were sought, and butterflies were observed in different stages of their life cycle in one of the most attractive spaces.

Critical reflection

Reviving this ancestral knowledge for the children, along with their traditions when it came to interpreting butterflies, was an extremely important premise. Furthermore, it was necessary to highlight the willingness of the institution's educators, along with all the students, to open a space to weave information, express, listen, and receive knowledge. Butterflies play a role in communities, and it is important to preserve this knowledge. However, it is also important to generate new knowledge so that children rediscover butterflies in order to respect all parts. In other words, butterflies should be respected by understanding how they behave and their role in ecosystems without abandoning this ancestral knowledge, thus generating attitudes of conservation and ownership of their environment. Through field observations and characterizations—that is, allowing the institution's children to leave the classroom and encounter their natural surroundings—the goal was for students to embrace environmental values, engaging in experiential learning in association with the concepts learned in class and their ancestral knowledge about the reality of butterflies in ecosystems.

Design of the academic entomotourism service

The María Lucía Metropolitan Park (PMML) is home to a wide variety of Lepidoptera species, and its area is ideal for learning about the importance of these insects and the goods and services they provide. Therefore, a tour is offered, which includes stations where Lepidoptera sightings are offered.

Visitors enter the PMML for a tour that includes the butterfly dome, the host and nectar plant nurseries, the surrounding lake, the laboratory, and the butterfly collection. Below is a brief explanation of what is done at each specific site:

1. Butterfly dome: in this structure, a variety of butterflies can be observed for research purposes, in order to analyze and describe their behavior, as well as to monitor and characterize species.
2. Nurseries: this area has two structures: the host plant nursery, where the life cycle of butterflies can

be observed, and the nectar plant nursery, for pollinator observation.

3. Lake: a large number of Lepidoptera can be observed around the lake, making it possible to capture butterflies and collect eggs and larvae of different species.

4. Laboratory: monitoring is carried out to identify different characteristics using a stereoscope, such as the different shapes of eggs, larvae, and each part of the butterfly in detail.

5. Butterfly Collection: through the collection, it is possible to observe the different species that have been captured and identified at the PMML.

The tours taken within the PMML depend on the age or level of education, as shown below:

Table 1.
Routes according to age and education

Public offered	Established route
Elementary school students (Transition to fifth grade)	Tour of the butterfly dome, nurseries, laboratory, and collection
Secondary school students (sixth to eleventh grade)	Tour of the butterfly dome, nurseries, pollinator sightings, life cycle monitoring, laboratory, and collection
University and private students	Tour of the butterfly dome, nurseries, pollinator sightings, life cycle monitoring, butterfly capture for research, laboratory, recognition, classification, and collection

Source: own elaboration

Final words

Lepidoptera play a fundamental role in the ecosystem, taking into account their involvement in various processes such as pollination, where butterflies facilitate the spread of pollen for the reproduction and development of fruits, flowers, and seeds. To educate the public about the importance of Lepidoptera, it is necessary to implement alternatives such as entomotourism focused on Lepidoptera. This activity helps generate environmental awareness among visitors by connecting them with their natural surroundings, thus promoting the preservation of Lepidoptera and their ecosystems.

Environmental education is important when it comes to raising awareness about different aspects of nature for the protection, conservation, and preservation of the flora and fauna of ecosystems. Additionally, thanks to various strategies, such as the principles of social appropriation of knowledge, it was possible to learn about the ancestral knowledge of the target audience and share scientific knowledge. Through ecotourism, environmental education is imparted in a more dynamic way, thanks to the visitor's connection with the natural environment, thus fostering environmentally friendly habits and mitigating the impacts generated by traditional tourism activities.

Tourism can generate entertainment and enjoyment, but at the same time it generates different negative impacts on the environment, such as the disturbance and destruction of ecosystems. This causes the migration of fauna species, as well as the contamination of resources, affecting diverse communities; hence the importance of systematizing experiences such as the one presented and expanding efforts in scientific dissemination.

CONCLUSIONS

Through literature reviews and fieldwork, it was possible to analyze the ecosystem goods and services provided by Lepidoptera, and the specific characteristics of this class of insects were learned in detail. The findings highlight the importance of studying butterflies through environmental education strategies within entomotourism, taking into account and respecting the ancestral knowledge of communities, in this case, the children of the institution. Despite the current pedagogical model, it is possible to generate new knowledge through connection with the natural environment and the development of different activities. Experiences such as the one presented have the potential to promote the development of attitudes and skills regarding environmental issues, with the aim of generating conservation habits for butterflies and their ecosystems.

Through the entomotourism strategy, it was possible to relate the concepts of Lepidoptera and biodiversity with Environmental Education as a tool for the sustainable use of natural resources, generating opportunities for

community improvement, and, at the same time, conserving ecosystems. Through the knowledge acquired in the Environmental Engineering program, it was possible to address issues related to lepidopteran biodiversity and the opportunity to sustainably utilize this natural fauna resource.

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CONFLICT OF INTEREST STATEMENT
None.

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