PRÁTICAS EDUCATIVAS, MEMÓRIAS E ORALIDADES

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# Bees and pollination: an analysis of textbooks

ARTICLE

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**Abstract**
Bees are responsible for most of the biotic pollination carried out in plants, playing a fundamental role in food production and the perpetuation of some plant species. Given the relevance of this topic, this study sought to examine how textbooks approved by the National Textbook Program (PNTB) address this content. This qualitative study analyzed seven different textbooks. The criteria used to analyze the books included the number of mentions of the terms “bees” and “pollination,” the reflection of the texts' content, the quality of the images, the proposed learning assessments, and the language used. It was found that most textbooks attribute the pollination process to bees, use appropriate language, include images and diagrams that aid understanding of the process, and propose various learning assessment activities, albeit at varying levels of depth.
**Keywords:** Bees. Science Teaching. Teaching Materials. Environment.

**Abelhas e polinização: uma análise dos livros didáticos**

**Resumo**
As abelhas são responsáveis pela maior parte da polinização biótica realizada nas plantas, desempenhando um papel fundamental para a produção de alimento e na perpetuação de algumas espécies de plantas. Diante da relevância do tema, esse estudo buscou, sobretudo, examinar de que maneira os livros didáticos aprovados pelo Programa Nacional do Livro Didático (PNTB) abordam esse conteúdo. Trata-se de uma pesquisa de cunho qualitativo que analisou 7 diferentes livros didáticos. Os critérios utilizados para análise dos livros contemplam a quantidade de menções aos termos “abelhas” e “polinização”, a reflexão do conteúdo dos textos, a qualidade das imagens, as propostas da verificação de aprendizagem e a linguagem empregada. Verificou-se que a maioria dos livros atribui o processo de polinização às abelhas, utiliza linguagem adequada, possui imagens e esquemas que auxiliam a compreensão do processo e propõe várias atividades de verificação de aprendizagem, porém em níveis de profundidade diferentes.
**Palavras-chave:** Abelhas. Ensino de ciências. Material Didático. Meio Ambiente.


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## 1 Introduction

The word “pollination” derives from “pollen,” which refers to minute grains produced by the male organs of the flower (Embrapa, 2025). The process of plant pollination is related to the reproductive mechanism of plants and essentially occurs when pollen grains are transferred from the male part of one plant to the female part of another (Scabin, 2023; Pinto et al., 2023). Pollination may occur through abiotic factors, when carried out by water, wind, or even gravity, or through biotic factors, when performed by animals such as certain insects (Scabin, 2023; Pinto et al., 2023).



When compared from a static perspective, pollination mediated by biotic factors tends to be more effective (Pinto et al., 2023). According to the portal of the Brazilian Agricultural Research Corporation (Embrapa, 2020), approximately 90% of plant species worldwide depend on animal-mediated pollination. For this reason, plants employ olfactory and visual stimuli to attract pollinating insects, such as bees and wasps, as well as birds and bats (Scabin, 2023). This relationship is essentially mutualistic, since, by offering essential food resources for the nutrition of these insects, such as oils, pollen, and nectar, the animals come into contact with pollen from multiple flowers, thereby completing the pollination process, which is fundamental to plant reproduction and species perpetuation (Pinto et al., 2023).

In addition, Embrapa (2020), drawing on data presented by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), emphasizes that the work carried out by these small animals is essential to agribusiness (Pires; Maués, 2020). IPBES indicates that approximately 75% of global agricultural production depends on biotic pollination, with bees playing a prominent role in this process. However, land-use changes associated with agricultural activities have caused alterations in landscapes, resulting in the worldwide decline of bee populations (Pires; Maués, 2020).

Thus, it becomes crucial to expand the knowledge base related to bees and pollinators in order to promote incentives for the conservation and appreciation of the services provided by these animals. One way to foster awareness among future

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generations and to highlight the importance that bees play in society is to address this topic didactically in schools. To this end, the quality of school materials must be consistent with the relevance of the subject, and the content presented in the texts and images of these materials must be appropriate so as to promote a clear understanding of the topic (Menezes; Araújo; Porpino, 2021).



TBs are considered not only the main teaching and support tool for teachers (Meneghetti et al., 2021; Serafim et al., 2024), but also an extremely important pedagogical resource for students, since many of them have their first contact with reading through these materials (Menezes; Araújo; Porpino, 2021). They present a logical sequence of topics and are generally organized into chapters or units, thus facilitating teachers' planning (Meneghetti et al., 2021). In addition, the TB is an instrument that facilitates the teaching–learning process because it helps students develop critical thinking and curiosity regarding scientific topics. Moreover, its messages also convey information that may influence how students think and act as members of society (Menezes; Araújo; Porpino, 2021; Miceli; Rocha, 2020).

However, TBs that present content entirely disconnected from students' social contexts, thereby prioritizing the fragmented memorization of facts and disconnected information, do not contribute to an adequate understanding of the topic being addressed (Meneghetti et al., 2021). In order to ensure the quality and standards of the books offered by publishers to Basic Education within school systems, the PNTB (National Textbook Program), together with the Ministry of Education (MEC), establishes, through public calls, the mandatory guidelines and criteria for their development (BRASIL, 2025).

Given the relevance of bees to the pollination process and the potential for raising awareness of this topic among part of the school community through TBs, it becomes essential to understand in detail how this process actually takes place. In order to meet these premises, this study conducted a survey of information related to bees and pollination in selected TBs published by major Brazilian publishers and approved by the PNTB, with authorized digital access. Subsequently, an analysis and discussion were carried out

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regarding the content of the texts, images, language employed, and activities proposed in the TBs that address this theme.

In summary, this study sought, under a critical epistemological lens, to systematically and rationally organize and discuss fundamental aspects related to science education and to awareness of the ecological preservation of bees as presented in selected TBs. Following the conceptions of this epistemological perspective as outlined by Sousa, Pires, and Queiros (2021), the analysis emphasizes a constructive critical reflection on the didactic material in question, addressing political, ethical, and socio-environmental issues.



## 2 Methodology

The present research, centered on the analysis and interpretation of the collected data, adopts a qualitative methodology. Within this type of approach, it is possible to promote reinterpretations and debates based primarily on human perception and understanding of a given research topic (Stake, 2011). The object of this study is the science TB, and the content analyzed concerns pollination and its pollinating agents, with an emphasis on bees, given their ecological and economic relevance to the maintenance of biodiversity and agricultural activities.

For data collection, seven TBs with authorized digital access were selected, as presented in Box 1, from different publishers of the science curriculum component intended for the 8th grade of Elementary School (Final Years), and which are currently within the validity period established by the PNTB. The analyzed TBs were renamed using acronyms and sequentially numbered according to the alphabetical order of their respective titles.

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**Box 1 –** Science curriculum TBs analyzed

| Book title | Acronym | Publisher | Edition | NPA |
|---|---|---|---|---|
| A Conquista | TB1 | FTD | 1st ed., 2022 | 24 a 42 |
| Araribá Conecta Ciências | TB2 | Moderna | 1st ed., 2022 | 84 a 117 |
| Ciências Vida e Universo | TB3 | FTD | 1st ed., 2022 | 42 a 47 |
| Geração Alpha | TB4 | SM Educação | 4th ed., 2022 | 142 a 153 |
| Jornadas Novos Caminhos | TB5 | Saraiva | 1st ed., 2022 | 100 a 147 |
| Sou + Ciências | TB6 | Scipione | 1st ed., 2022 | 10 a 30 |
| Teláris Essencial | TB7 | Ática | 1st ed., 2022 | 28 a 54 |

Source: Prepared by the authors (2025). Legend: TB (Textbook), NPA (Number of Pages Analyzed).



For the analysis of content related to pollination in the aforementioned TBs, two keywords were defined: *pollination* and *bees*. With the aid of the Windows 11 search function (Ctrl + F), the frequency with which these keywords appear in the texts was initially examined. It is worth noting that occurrences of the terms *pollination* and *bees* found in teaching guidelines, tables of contents, and suggested answers for teachers were excluded from the analysis.

Subsequently, the following aspects were analyzed: (1) the quality and quantity of images provided on pollination, whether they present an aesthetic standard and promote understanding of the interdependence between living beings and the environment; (2) the relationship established in the texts between pollination and bees; (3) the language used in the TBs to present the information, assessing whether it is clear and easily understood; and, finally, (4) whether the learning assessment approaches proposed by the TBs encourage assimilation, reflection, and comprehension of the topic.

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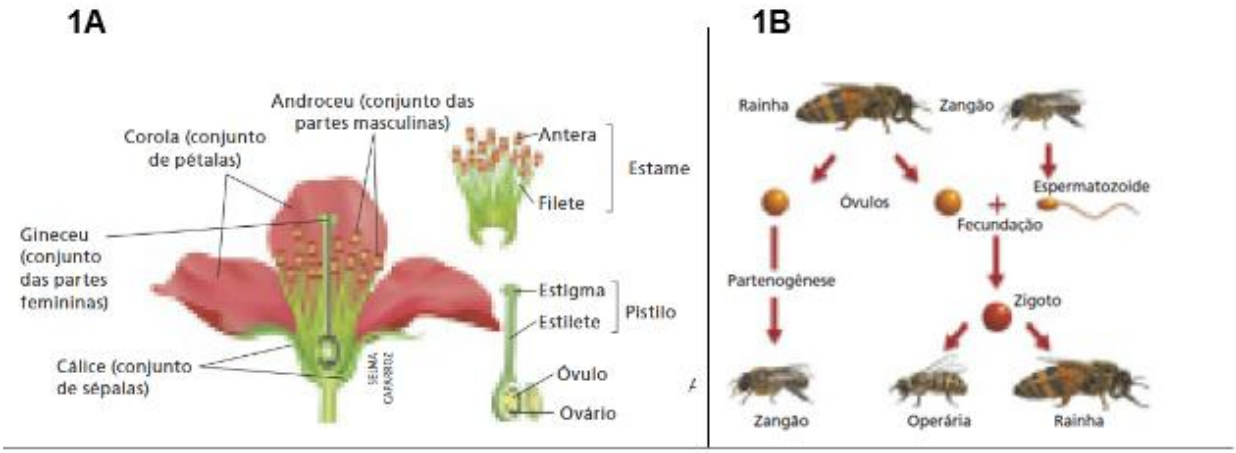
## 3 Results and Discussion

With regard to the frequency of the keywords, an examination using the search function in TB1 showed that the term *pollination* is mentioned four times throughout the book, while *bees* appears five times. Concerning visual support, the book presents two images (Figure 1) illustrating the process of pollination in plants and the reproductive system of bees. Well-designed illustrations play an essential role in the assimilation of complex concepts, especially in biological topics, in which natural processes such as pollination can be more easily understood.



**Figure 1 –** Illustrative scheme of the reproductive process in plants and animals. 1A – Diagram of the hibiscus flower. 1B – Diagram of bee reproduction




Source: HIRANAKA, Roberta Aparecida Bueno; HORTENCIO, Thiago Macedo de Abreu. **A conquista. Ciências**: 8º ano: ensino fundamental: anos finais. 1ª ed. São Paulo: FTD, 2022.

In its informational texts, TB1 directly relates and attributes the pollination process to bees. Moreover, the language used by the book to explain pollination stands out for being clear and easily comprehensible, which is a positive aspect, as it facilitates content assimilation by Elementary School students. The way the content is presented could be further enriched through a more interactive approach, encouraging connections with students' everyday experiences. The strategies proposed by TB1 for assessing learning

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indicate that the suggested activities stimulate reflection and the development of argumentative writing skills.

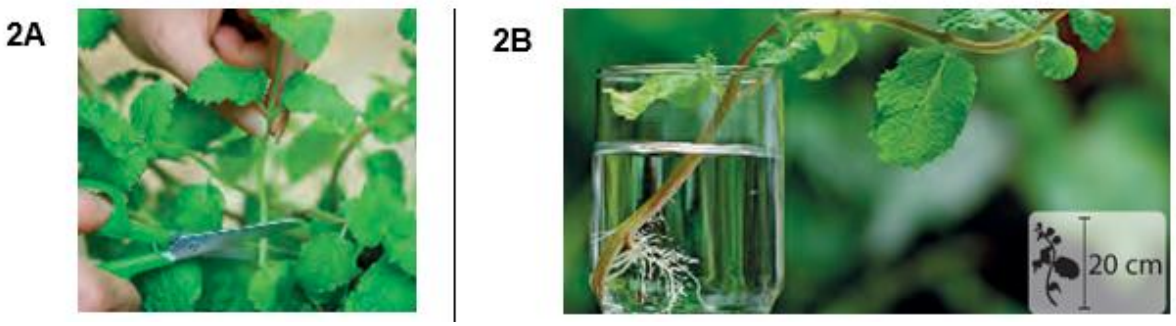
In TB2, the word *pollination* is not mentioned at all, whereas the term *bees* appears twice throughout the book, in two different topics and units. Initially, bees are mentioned in content related to organism nutrition, since the nutritional value of their wax is rich in lipids (Magalhães, 2020).



Only in Unit 4 of TB2, entitled *Reproduction and Life Stages*, is skill EF08CI07 identified. This skill is included in the Base Nacional Comum Curricular (BNCC, 2018) and aims to compare different reproductive processes in plants and animals, thus encompassing the object of study of this article.

In this unit, bees are presented as an example of animals that reproduce asexually through parthenogenesis, that is, when reproduction occurs without sexual processes and is characterized by the formation of offspring or clones within the same plant and animal species (Hofstatter; Lahr, 2024). The image in TB2 related to the explanation of parthenogenesis (Figure 2) presents adequate aesthetic quality; however, it only illustrates how this process occurs in plants, which hinders students' understanding of how this form of reproduction takes place in animals.

**Figure 2 –** Informative image from TB2 related to the process of parthenogenesis. 2A – Plant stem being removed for cutting propagation. 2B – Rooted plant stem, ready to be transplanted into the soil




Source: EDITORA MODERNA (org.). **Araribá Conecta Ciências**. 1. ed. São Paulo: Moderna, 2022.

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Although the language used in the texts of TB2 is well articulated and easy to understand, the book does not mention the term *pollination* and therefore does not establish a connection between pollination content and bees. Nevertheless, overall, the book provides, through links, extracurricular research materials on the topic of human and animal reproduction, in addition to offering activities that stimulate reflection, writing, hypothesis formulation, and group work.



In TB3, published by FTD, the frequency of the word *pollination* is seven occurrences, while *bees* appears five times. Unit 4, *Plant Reproduction*, introduces the topic of pollination. Its images, as shown in the excerpts presented in Figure 3, include several informative and well-designed diagrams that explain everything from the reproductive organs of flowers to the pollination process carried out by bees. The images are of good quality and include captions that progressively guide students through each stage of pollination.

The book also mentions other examples of pollinating agents but establishes a direct relationship between bees and the pollination process in both the images and the accompanying texts, which are easy to understand and assimilate. Another relevant aspect observed was the use of the guava tree as an example of a plant being pollinated, since it is typical of the region and familiar to students, which may facilitate the implementation of practical experiences and observations related to pollination.

Regarding the activity suggestions proposed by TB3, it is evident that they do not encourage teamwork, dispense with practical experiments and debates, and fail to foster adequate reflection on the topic explored in such detail by the texts and images. The book could, for example, suggest a moment of research or discussion among students, mediated by the teacher, about human actions that may interfere with this dynamic between humans and nature.

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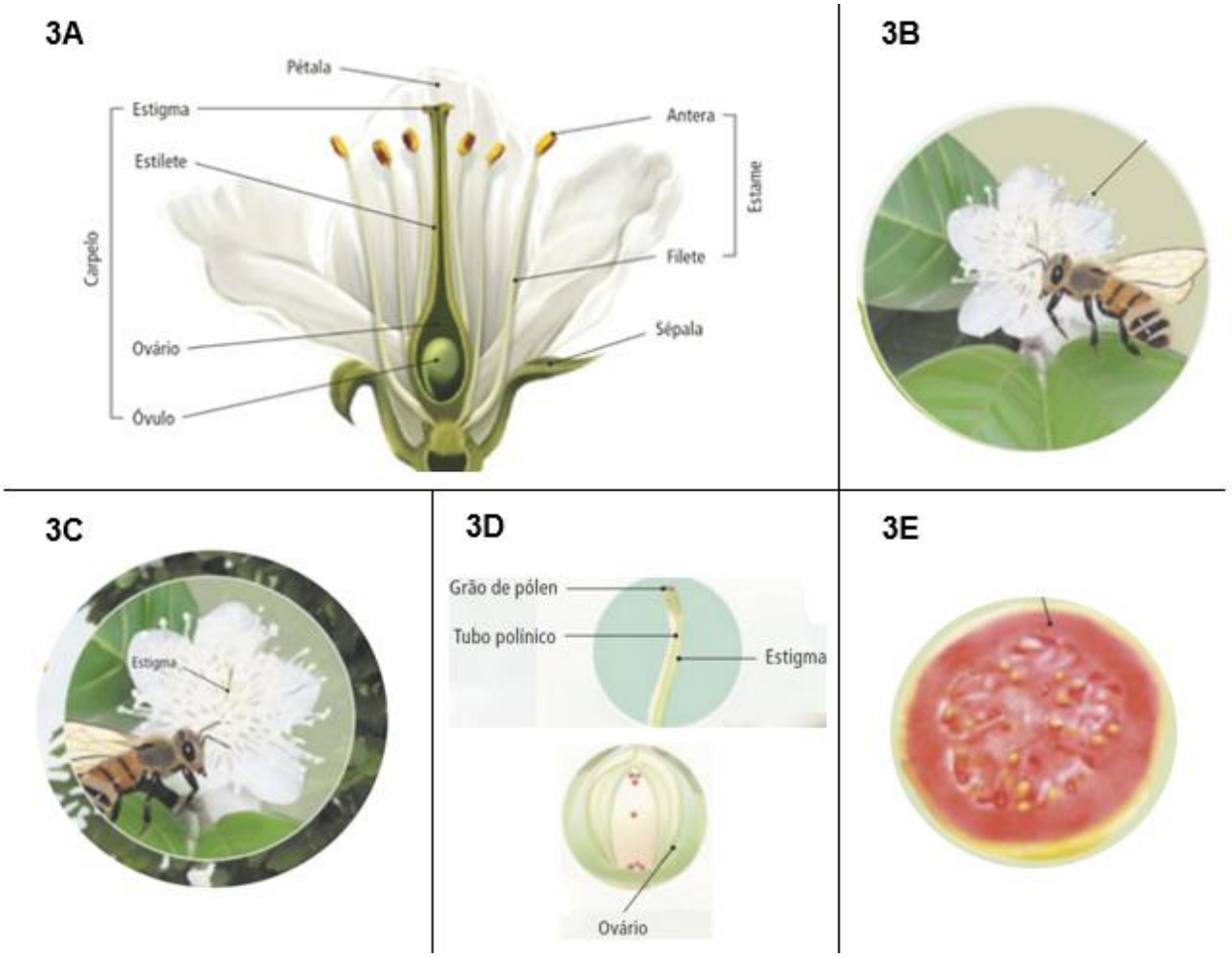
**Figure 3 –** Informative image illustrating the stages of the pollination process. 3A – Reproductive organs of flowers. 3B – Bee initiating the pollination process while visiting flowers in search of food. 3C – Bee transporting pollen from one flower to another. 3D – Fertilization process in the flower. 3E – Formed fruit (guava)




Source: GODOY. Leandro Pereira de; MELO, Wolney Candido de. **Ciências vida & universo**: 8º anos ensino fundamental: anos finais. 1ª ed. São Paulo: FTD, 2022.

The use of pesticides in crops, for example, has been identified by the Agrosilvopastoral Sanitary Defense Agency of the State of Rondônia (IDARON) as the main cause of bee extermination in the region. However, if pesticide use is so harmful to bees and the environment, why is its use still permitted in agricultural fields? What other alternatives do farmers have to produce food? What environmental impacts might the extinction of bees cause? Questions such as these could be proposed to students as a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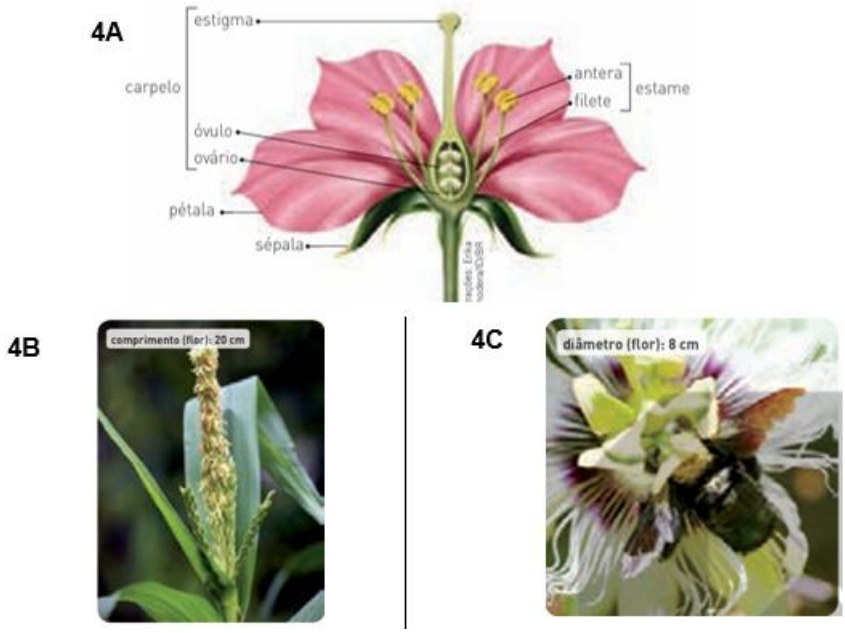
way to stimulate individual reflection and collective debates on pollination and bees. Following the didactic approach of the previously analyzed books, TB3 could also suggest extracurricular research websites, reading recommendations, and informative videos on pollination.



So far, TB4 is the book that presents the highest number of mentions of the terms *pollination* (18 occurrences) and *bees* (28 occurrences). The topic begins in Unit 6, *Plant Reproduction*, and despite the high number of references to these terms, the book provides few images and diagrams to support and mediate students' understanding of the subject. The three images used to explain the pollination process (Figure 4) are presented separately on different pages, and two of these images are merely photographs that capture only part of the process already in progress, without exploring all stages of the process in its entirety.

**Figure 4 –** Images related to pollination and bees found in TB4.
4A – Reproductive parts of the flower. 4B – Example of a plant pollinated by physical agents (wind). 4C – Passion fruit flower being pollinated by a bee




Source: CATANI, André; KILLNER, Gustavo Isaac; AGUILAR, João Batista. **Geração Alpha Ciências**: 8º ano: ensino fundamental anos finais. 4. ed. São Paulo: Edições SM, 2022.

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The texts of TB4 directly relate and attribute the pollination process to bees, highlighting their relevance to the evolution of angiosperms and promoting extensive diversification in species characteristics. Moreover, this book emphasizes the distinction between pollination by physical agents and pollination by animals and explores the consequences of pesticide use in the international context. The language used in TB4 is not complex and contains essential information about the importance and effectiveness of animal-mediated pollination.

Although the texts in TB4 provide, throughout the reading, a substantial amount of information that could be used to foster classroom debates, this proposal is not explicitly included as an activity to be developed. On the other hand, this TB focuses on several activities that incorporate images. These activities individually encourage reflection, the written formulation of hypotheses, text comprehension, and practical tasks such as the collection and observation of flowers, table completion, and pair work.

In TB5, the frequency of mentions of the term *bees* is eight occurrences, whereas *pollination* appears three times. The first mention of the word *bees* occurs in Track 7 of the book, whose theme is food; therefore, bees are not related to pollination but are instead presented as food-producing insects. The second mention occurs in Track 9, *Reproduction in Living Beings*, which presents, in its very first image, a bee pollinating a flower, as shown in Figure 5.

It can be observed that the images presented in TB5 that explain the pollination process are of good quality, consisting of both real photographs and representative diagrams. In particular, Image 5B presents information not found in the previously analyzed books, depicting the rounded structure in which bees transport pollen grains to the hive. Until then, the books had only mentioned that pollen transport by bees occurred through their legs. The textual content related to this theme clearly associates the interdependence between plants and pollinating animals. The language used in the texts, including the captions, is clear, which facilitates student understanding.

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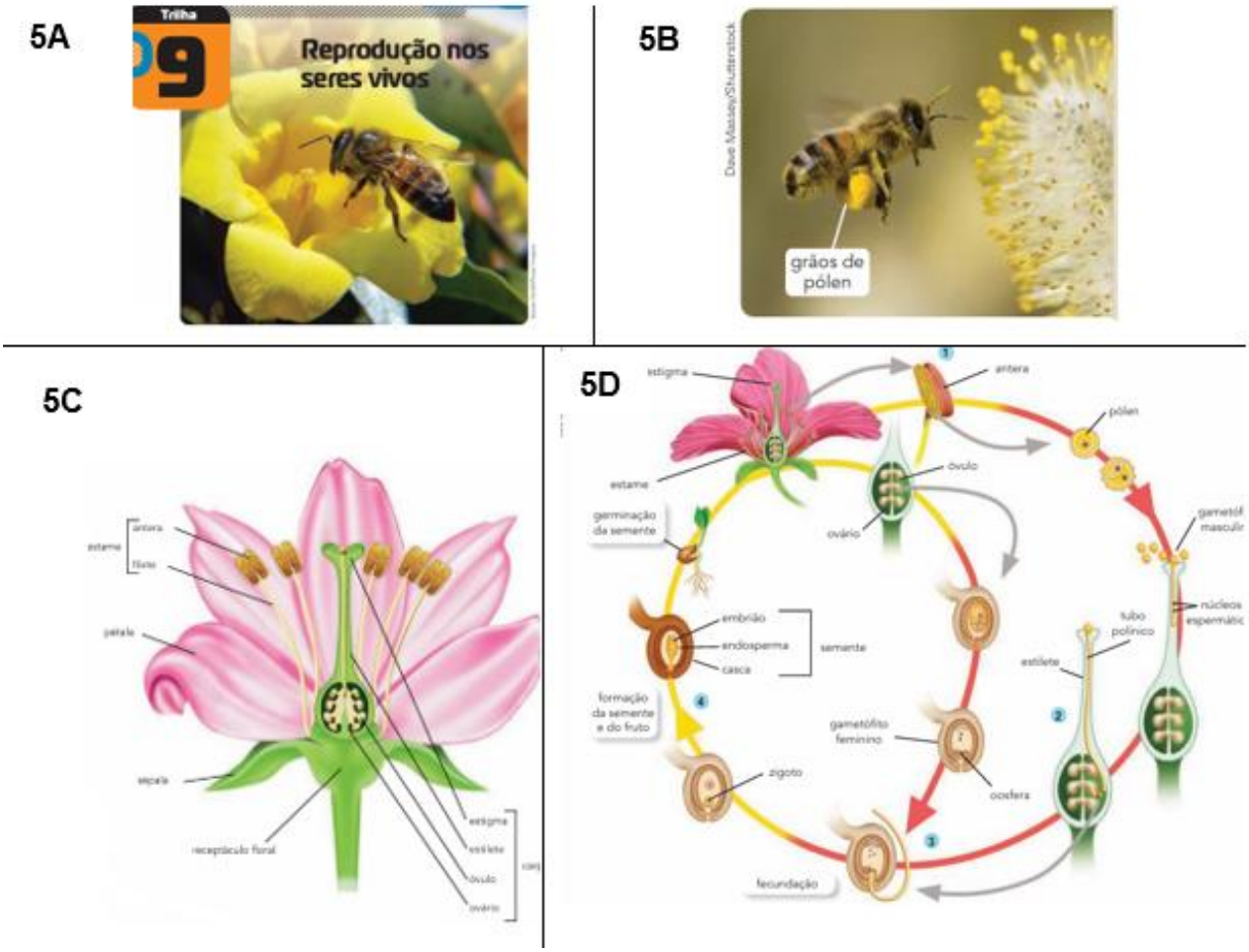
**Figure 5 –** Images related to pollination and bees found in TB5.
5A – First image of Track 9. 5B – Bee pollinating. 5C – Reproductive parts of the flower.
5D – Representative diagram of the fertilization process




Source: NARDI, Daniela Teves (ed.). **Jornadas: novos caminhos: ciências: 8º ano**. 1. ed. São Paulo: Saraiva Educação, 2022.

The didactic approach used to assess student learning is based mainly on text production and hypothesis formulation. Although the proposed activities are highly reflective, they do not encourage collective engagement; therefore, there are no activities that promote debates or research. Throughout Track 9 of TB5, not a single activity is suggested that includes practical experiences.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In TB6, the frequency of mentions of the term *bees* is only two occurrences, whereas *pollination* appears five times, all of which occur in Chapter 1, *Reproduction in Living Beings*. One of the mentions of bees appears in the caption of an image in which an African bee is shown pollinating an almond flower. As can be seen in Figure 6, this image has good aesthetic quality; however, it does not depict the pollination process in its entirety and is therefore insufficient to promote adequate student understanding through visual resources.



When referring to pollination, TB6 describes it as a process involving the transfer of pollen between plants and highlights its strong influence on food production, since, without pollination, the formation of fruits and seeds does not occur. This book also draws students' attention to the excessive use of pesticides in crops, at which point the second mention of bees appears. In this text, Ferreira (2019) presents data from his research on the relationship between Brazilian agriculture and the extinction of certain pollinating agents, including bees, which account for approximately 66% of the insects responsible for pollination.

The language used in TB6 is not complex and, overall, the texts in this book present valuable information about pollination; however, they do not compensate for the lack of images, diagrams, and illustrative figures related to the process. This book also suggests few learning assessment activities, especially with regard to pollination. Nevertheless, the activities that are proposed encourage reflection on the impacts that the extinction of pollinating insects may have on the environment and on agricultural activities.

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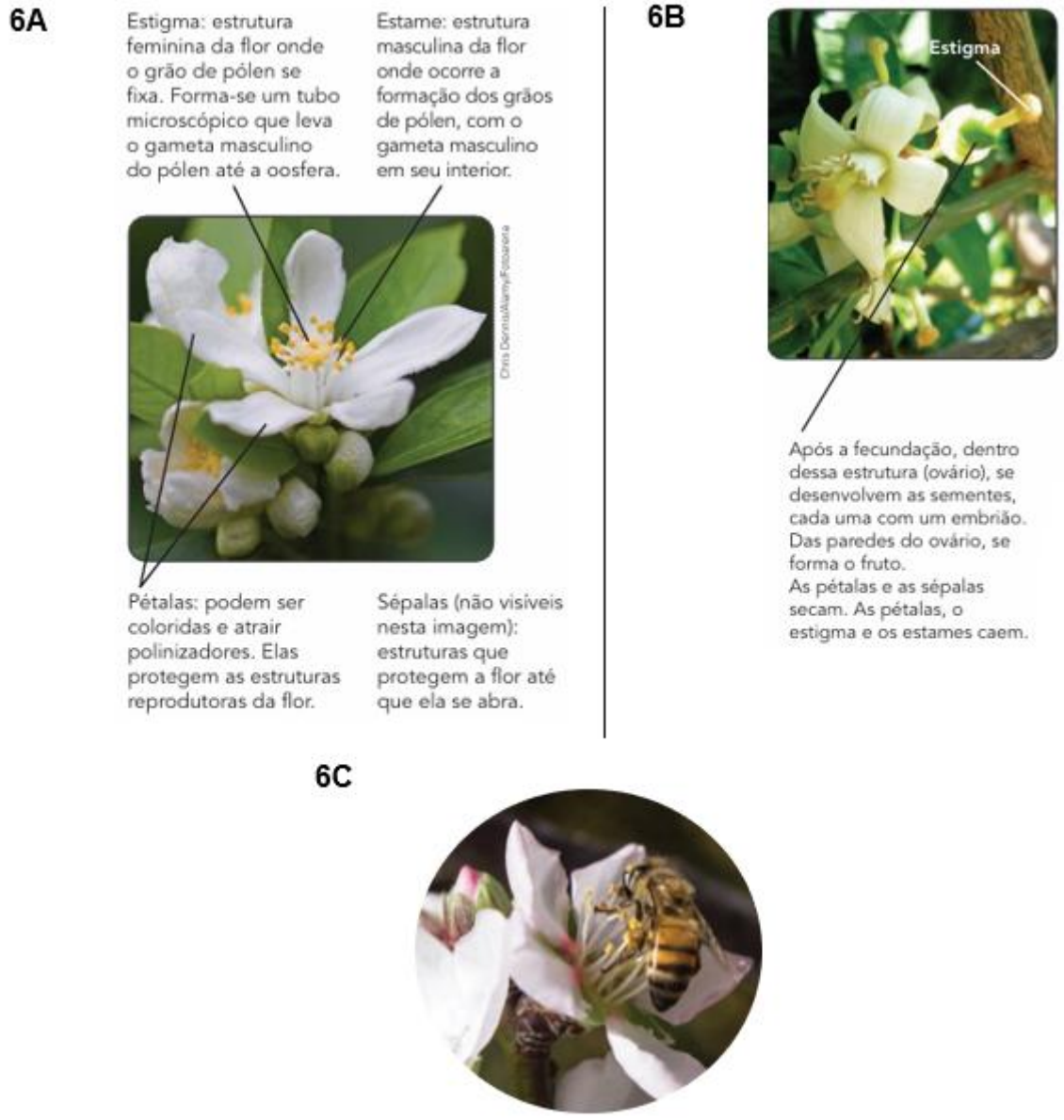
**Figure 6 –** Images related to pollination and bees found in TB6.
6A – Reproductive parts of the flower. 6B – Fertilized flower. 6C – Bee pollinating an almond flower




Source: ARTUSO, Alysson Ramos *et al*. **Sou+Ciências**: 8º ano. 1ª ed. São Paulo: Scipione, 2022.

TB7 mentions the term *bees* five times and *pollination* ten times; all of these mentions occur in Chapter 2, *Sexual Reproduction*. The images are of excellent quality;

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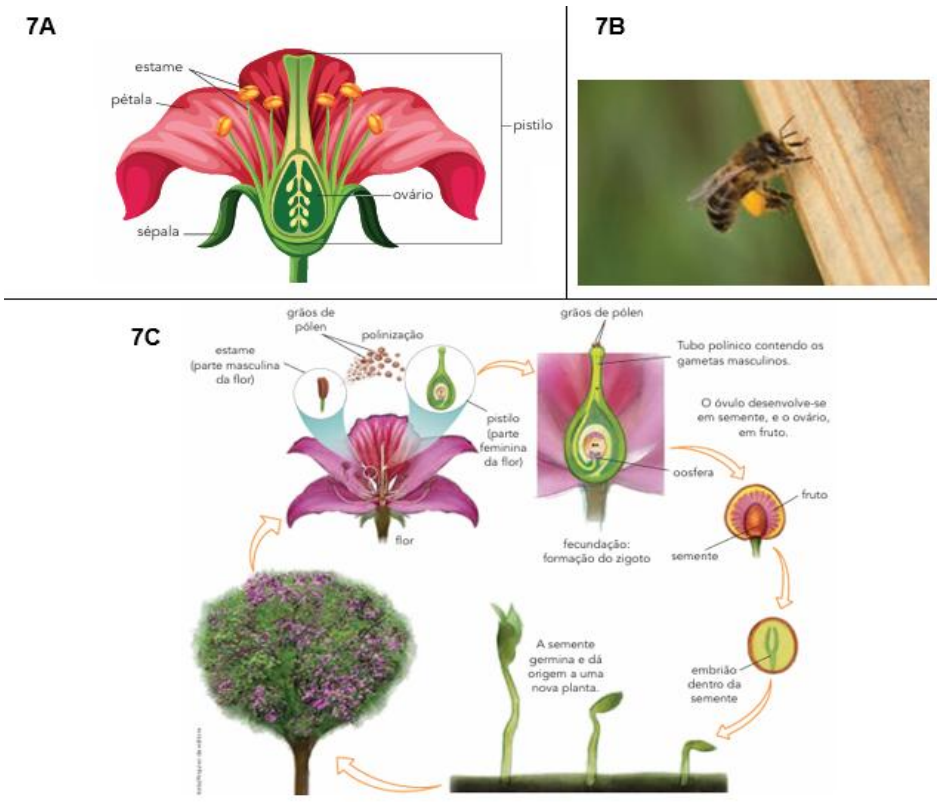
however, they do not demonstrate the interdependence between living beings and the environment. As shown in Figure 7, there are no images that directly associate bees with the pollination process. TB7 first presents a representative image of the reproductive parts of flowers (Figure 7A); shortly thereafter, in an activity, the book draws students' attention to the yellow part of the bee located between its legs (Figure 7B). This image certainly arouses student curiosity, but it does not explain how this process occurs. Finally, in Figure 7C, the book represents, in schematic form, the pollination process occurring spontaneously in nature; however, there is no direct linkage between the process and any specific pollinating insect.



**Figure 7 –** Images related to pollination and bees found in TB7. 7A – Reproductive parts of the flower. 7B – Real image of a bee in its habitat. 7C – Representation of the pollination process




Source: GEWANDSZNAJDER, Fernando; PACCA, Helena. **Teláris Essencial**: Ciências: 8º ano. 1ª ed. São Paulo: Ática, 2022.

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The images in TB7 do not directly attribute the pollination process to bees; however, the texts that make up this chapter do establish this relationship. The language used in the texts is not complex and encourages reflection on how bees influence plant reproduction, thereby reinforcing students' understanding of the interdependence between living beings and the environment. The learning assessment process in TB7 proposes guided research activities aimed at deepening knowledge about the relationship between pesticide use and the extinction of certain bee species. It also encourages writing and hypothesis formulation, fostering reflection on the topic, and includes multiple-choice questions that prepare students for external assessments.

In summary, the results of the data collection can be observed in Box 2, which shows that only one of the investigated books does not relate bees to the pollination process. Meanwhile, the other books demonstrate, through their texts, images, and activities, a concern with exploring and explaining this topic, which is so essential for students.

**Box 2 – Research data: items investigated in the TBs**

| Livro | Relaciona o processo de polinização às abelhas | Qualidade das imagens | Linguagem empregada | Verificação de aprendizagem |
|---|---|---|---|---|
| **LD1** | Sim | Mediana | Adequada | Adequada |
| **LD2** | x | x | x | x |
| **LD3** | Sim | Excelente | Excelente | Adequada |
| **LD4** | Sim | Adequada | Excelente | Excelente |
| **LD5** | Sim | Adequada | Adequada | Adequada |
| **LD6** | Sim | Mediana | Excelente | Adequada |
| **LD7** | Sim | Mediana | Excelente | Excelente |

Source: Prepared by the authors (2025).

The absence of the term *pollination* in the text of TB2 significantly compromises the construction of a systemic view of natural phenomena, causing a fundamental


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pedagogical opportunity to be missed: presenting bees as a vital link in the maintenance of biodiversity and the sustainability of ecosystems. The other books, in turn, highlighted the essential role of bees in food production in agricultural fields, which is extremely relevant; however, they could also have mentioned the importance of bees for well-being and ecological balance in urban environments. Even in cities, bees are identified as the main pollinators of angiosperms, which, by producing fruits, help sustain birds and frugivorous mammals that are tolerant of urbanization (Embrapa, 2025; Figueiredo; Oliveira; Meireles, 2024).



With regard to images, TB3 stood out for presenting a diagram that draws attention due to its use of colors, landscape elements, and integrated information that explain the pollination process in its entirety. According to Sobral, Lopes, and Trinchão (2017), the use of well-designed images in educational settings is an important method for the assimilation of new knowledge. This is because, as the authors argue, when students leaf through a well-illustrated and colorful book, they may be impressed by the images and feel motivated to learn. Moreover, images and the very act of drawing can be understood as tools for investigation, perception, and recording, since they complement the text and enable scientific communication (Sobral; Lopes; Trinchão, 2017).

The images presented in the other TBs meet quality criteria and display good aesthetic standards; however, those related to bees and the pollination process are provided in a fragmented manner, which hinders students' understanding of the interdependence between living beings and the environment. Even so, all the books identified bees as one of the main pollinating insects and clearly and objectively highlighted their fundamental role in the survival of humans, certain animals, and even some plant species.

The language used in all the books is direct and objective, which can facilitate students' reading and comprehension of the content (Colusso et al., 2016). Furthermore, Colusso et al. (2016) point out that the language of didactic texts should be formulated in a dialogical manner, that is, it should "converse" with the reader so that the text flows smoothly, remains light, and consistently seeks to establish a sense of proximity with

students. However, the same authors clarify that the use of more accessible language for students does not prevent the inclusion of scientific terms and citations in TBs.

The scientific terms directly related to the pollination process appear in bold in all the analyzed books, which is an interesting strategy to draw readers' attention. Nevertheless, TB4 stands out for presenting a series of text excerpts derived from scientific articles that provide relevant information on the importance of bees and the pollination process for food production. Regarding text organization in the TBs, there is a predominance of short, well-punctuated sentences, which are essential factors for maintaining students' focus and making reading more enjoyable (Colusso et al., 2016).



With respect to the learning assessment activities proposed within the science curriculum component, Silva and Sasseron (2021) explain that they should stimulate scientific inquiry rather than focus solely on the memorization of concepts, laws, or theories. The authors also argue that investigative practices are necessary for the development of competencies related to hypothesis formulation and the interpretation of scientific evidence, thereby supporting students' understanding of the nature of science and its social applications.

We understand that social practices related to the preservation of bees, as well as their recognition through scientific evidence, can trigger a series of actions capable of promoting awareness among the local population about the importance of the pollination process for the balance of entire ecosystems, which may even affect food production. In view of this, TBs could propose to students, in addition to practical pollination experiments, social awareness actions, such as the development of small campaigns on social media, radio, or print media, in order to provide opportunities for active and meaningful learning. Learning is considered *active* because it places students as protagonists of their own learning process, and *meaningful* because it is connected to social practices contextualized to students' lived realities (Luchesi; Oliveira; Santos, 2022; Oliveira, 2022). In this way, students build knowledge based on practice rather than solely through the mechanical appropriation of a code (Silva; Sasseron, 2021).

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The TB activities that most closely meet the aforementioned criteria are those found in TB4 and TB7. TB4 offers activities that include reading and text comprehension, table completion, group work, practical activities, diagram drawing, and open-ended questions. TB7 proposes reflective open-ended and multiple-choice questions, research activities, and the written chronological organization of the stages of the pollination process. The wide variety of activities proposed by both books encourages the contextualization of students' realities as well as reflection. This can contribute to the development of various skills, such as communication and teamwork, and also demonstrates a greater concern with content assimilation (Luchesi; Oliveira; Santos, 2022).

Meanwhile, TB1 proposed only essay-type questions, TB3 presented activities that stimulate reflection and text comprehension, TB5 suggested activities focused on text comprehension and production, and, finally, TB6 recommended only two activities, one open-ended question and one text comprehension task. The quantity of activities, as well as their level of difficulty and coherence with the content addressed, are identified by Perovano and Amaral (2024) as fundamental criteria used by teachers when selecting TBs.

The selection of TBs by teachers, together with school coordinators and education departments, is crucial to students' teaching–learning process. For this reason, choosing appropriate materials that meet students' real needs can be challenging. In this article, we have proposed reflections and considerations regarding content related to bees and the pollination process, as this is an extremely relevant topic for the region in which students are situated. Raising awareness within the local community about the role of bees in maintaining ecosystem balance is essential for fostering social actions that promote their conservation.

## 4 Final considerations

This study qualitatively analyzed the occurrence of the terms *bees* and *pollination* in 8th-grade science TBs. The aim was to gain an in-depth understanding of how the theme of pollination is addressed in each TB, investigating whether pollination is presented as an

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essential ecological process and whether it is connected to other biological concepts. In addition, consideration was given to whether the information related to pollination presented in the TBs highlights the relevance of bees to biodiversity and agricultural activities, given that this relationship is frequently emphasized in the scientific literature.



However, the mere repetition of a word does not necessarily indicate adequate conceptual depth. It is essential to analyze whether mentions of the term are embedded within an explanatory context that enables knowledge construction, or whether they are merely superficial references that do not effectively contribute to student learning.

The analysis of the TBs showed that most publishers understand and recognize the fundamental role that bees play in enabling the pollination process in plants. With the exception of TB2, all the books cited bees as one of the main pollinating animals and highlighted their relevance to ecosystem balance. Moreover, the presence of explanatory images of the pollination process in all the books was considered important.

The language used in the informational texts of the TBs is accessible to students and easy to understand. Additionally, the books highlight scientific terms, which may contribute to content memorization and assimilation. The learning assessment proposals in TB4 and TB7 stood out from the other books for presenting a variety of question formats, indicating a greater concern with students' assimilation of this specific content.

We understand that the guidelines for the formulation of TBs are diverse and that the range of contents covered by each area of knowledge in 8th-grade Elementary School is extensive. Each publisher is free to prioritize the theme, content, or topic it deems most appropriate; therefore, the intention of this article is not to evaluate the TB as a whole, but rather to investigate how bees and the pollination process are addressed in each book, given their importance to the environment and the economy. We believe that further analyses of teaching materials are essential, as the most recent contributions from research in science education reinforce the need to overcome traditional practices centered on content transmission.

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