

 Open access**Editor**

Elisio Custodio Brentan Junior,
State University of Northern Paraná (UENP),
Bandeirantes, Paraná, Brazil.

Reviewers

Blander Yoberson Mamani Yabar
National University of the Altiplano,
Puno, Peru.

Daniel de Carvalho Melo Costa
Federal University of Lavras,
Lavras, Brazil.

Rosângela da Silva Gomes
University of Lisbon,
Lisbon, Portugal.

***Correspondence**

Fabício Oliveira Fernandes
fabriciof9@gmail.com

History Received: October 15, 2025

First revision: November 25, 2025

Second revision: December 12, 2025

Accepted: December 22, 2025

Published: January 19, 2026

How to reference

FERNANDES, F. O. *et al.* Controle de *Leucoptera coffeella* Guérin-Méneville, 1842 com *Chrysoperla externa* Hagen, 1861 na cafeicultura sob a perspectiva da ciência aberta e de métricas científicas. *Ciência da Informação Express*, Lavras, MG, v. 7, 2026.
DOI: <https://doi.org/10.60144/v7i.2026.155>.

Research data

<https://doi.org/10.5281/zenodo.17496325>

Artificial intelligence

Scipace, ChatGPT e Napkin

Copyright and Public License

© 2026 Fernandes, Bastos, Valeriano, Silva, and Ribeiro. This is an open-access article distributed under the terms of the License [Creative Commons Atribuição \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). You may copy, distribute, remix, transform, and build upon this material for any purpose, including commercial use, provided that authorship is credited, the source is indicated, and any changes are disclosed, without implying endorsement by the authors.



Control of *Leucoptera coffeella* Guérin-Méneville, 1842 with *Chrysoperla externa* Hagen, 1861 in coffee farming from the perspective of open science and scientific metrics

Control de Leucoptera coffeella Guérin-Méneville, 1842 con Chrysoperla externa Hagen, 1861 en la caficultura desde la perspectiva de la ciencia abierta y las métricas científicas

Fabício Oliveira Fernandes*

PhD in Entomology.
São Paulo State University
“Júlio de Mesquita Filho”,
Jaboticabal, SP, Brasil.

<https://orcid.org/0000-0002-8776-8308>.

Maria Elisa de Rezende Bastos

Bachelor's degree in Agronomy.
Federal University of Lavras,
Lavras, MG, Brasil.

<https://orcid.org/0009-0000-7469-9692>

Ítalo Juliatté Valeriano

Bachelor's degree in Agronomy.
Federal University of Lavras,
Lavras, MG, Brasil.

<https://orcid.org/0009-0001-8679-5400>

Ana Paula Nascimento da Silva.

PhD in Entomology.
Federal University of Lavras,
Lavras, MG, Brasil.

Brasil.<https://orcid.org/0000-0001-5198-1492>

Abstract

Objective: Evaluate traditional bibliometric metrics and open science dimensions regarding the use of *Chrysoperla externa* Hagen, 1861 in the control of *Leucoptera coffeella* Guérin-Méneville, 1842. **Methodology:** the study is classified as bibliographic and bibliometric, exploratory-descriptive, applied in nature, and follows a mixed approach (quantitative + qualitative). A total of 11 articles were analyzed, retrieved through searches conducted in May 2025 in the Google Scholar, Web of Science, Scopus, Dimensions, and Science Direct databases, using both traditional metrics and open-science indicators. **Results:** most studies were laboratory-based, focusing on selective toxicity and functional response/biology of the predator, with fewer field trials and integrated ecological approaches. Although part of the publications appeared in high-impact journals, adherence to open science practices was low; open access was the most frequent

criterion. **Conclusion:** the incorporation of open science practices remains limited, even in prestigious journals. Editorial, institutional, and funding policies that promote openness, rigorous documentation, and data reuse are essential to strengthen the reliability and applicability of biological control in coffee farming.

Keywords: Open science; Impact metrics; Bibliometrics; Biological control; Chrysopid; coffee leaf miner.

Resumen

Objetivo: Evaluar las métricas bibliométricas tradicionales y las dimensiones de la ciencia abierta en relación con el uso de *Chrysoperla externa* Hagen, 1861 en el control de *Leucoptera coffeella* Guérin-Ménéville, 1842. **Metodología:** El estudio se clasifica como bibliográfico y bibliométrico, de carácter exploratorio-descriptivo, de naturaleza aplicada y con un enfoque mixto (cuantitativo + cualitativo). Se analizaron un total de 11 artículos, recuperados mediante búsquedas realizadas en mayo de 2025 en las bases de datos Google Scholar, Web of Science, Scopus, Dimensions y Science Direct, utilizando tanto métricas tradicionales como indicadores de ciencia abierta. **Resultados:** Predominaron los estudios de laboratorio, centrados en la toxicidad selectiva y en la respuesta funcional/biología del depredador, con menor presencia de ensayos de campo y enfoques ecológicos integrados. Aunque parte de las publicaciones apareció en revistas de alto impacto, la adhesión a las prácticas de ciencia abierta fue baja; el acceso abierto fue el criterio más frecuente. **Conclusión:** La incorporación de prácticas de ciencia abierta sigue siendo limitada, incluso en revistas prestigiosas. Son necesarias políticas editoriales, institucionales y de financiación que promuevan la apertura, la documentación rigurosa y la reutilización de datos, con el fin de fortalecer la fiabilidad y la aplicabilidad del control biológico en la caficultura.

Palabras clave: Ciencia abierta; Métricas de impacto; Bibliometría; Control biológico; Crisópido; Minador de la hoja del café.

1 INTRODUCTION

Brazilian coffee farming is one of the country's main agricultural activities, with prominence in the states of Minas Gerais, São Paulo, and Espírito Santo. *Coffea arabica* predominates in the main producing regions, while *Coffea canephora* is more prevalent in Espírito Santo (Silva *et al.*, 2024). In this context, production dynamics have been strongly shaped by climatic and phytosanitary factors, among which infestation by the coffee leaf miner, *Leucoptera coffeella* Guérin-Ménéville (1842), stands out (Silva *et al.*, 2024).

Regarding bioecology and damage, *L. coffeella* was introduced into Brazil in the nineteenth century; its larvae feed on the leaf mesophyll, reducing photosynthesis and causing defoliation (Souza; Reis; Rigitano, 1998). These impacts underscore the need for management strategies that minimize productive and environmental losses.

Against this backdrop, integrated pest management (IPM) using biological control agents has gained prominence. Among these agents, larvae of *Chrysoperla externa* Hagen, 1861 show predatory efficiency against eggs, larvae, and pupae of *L. coffeella*. Adults are not predatory and feed on nectar, pollen, and sugary exudates secreted by sap-sucking insects such as aphids, scale insects, and leafhoppers (Serrão; Zanuncio, 2002; Figueiredo *et al.*, 2021; Dami *et al.*, 2023; Braghini *et al.*, 2024). Under field conditions, releases of *C. externa* eggs have been associated with reductions in *L. coffeella* populations (Figueiredo *et al.*, 2021), and recent studies demonstrate the predator's strong performance against natural prey, reinforcing its suitability for IPM programs (Braghini *et al.*, 2024; Dami *et al.*, 2023).

The adoption of biological control with chrysopids depends on the production and wide dissemination of information on behavior, predation rates, optimal application conditions, and field efficacy, as well as operational factors such as the cost of mass production of the natural enemy, feasibility of large-scale releases, storage time, and logistics. In this context, open science has the potential to expand the circulation of such data by making datasets, code, and standardized protocols available, thereby fostering replication, meta-analyses, and collaboration among researchers, extension agents, and producers. As a result, evidence-based

sustainable practices can gain scale, quality, and alignment with local realities in integrated pest management.

Despite the relevance of the topic, few studies examine the adherence of research on biological control with chrysopids to open science principles. Most scientific assessments still rely exclusively on traditional metrics, such as impact factor and Qualis classification, without considering the openness of methods and results. This limits the visibility of studies that adopt good transparency practices, even when published in journals with lower editorial prestige.

Therefore, it is necessary to understand how scientific articles on the control of *L. coffeella* with *C. externa* position themselves with respect to open science. Analyzing traditional metrics alongside open science dimensions makes it possible to identify gaps in scientific communication and propose strategies to enhance reproducibility and access to technical information. The combined use of qualitative approaches, thematic categorization, and statistical cluster analysis can contribute to building editorial and scientific profiles that are more closely aligned with the demands of contemporary science (Piwowar *et al.*, 2018).

Accordingly, this study aims to analyze scientific publications addressing the use of *C. externa* in the control of *L. coffeella* through traditional impact metrics and open science dimensions.

In light of the above, this study is justified by the need to consolidate sustainable agricultural practices based on scientific evidence that is accessible, transparent, and reusable. Understanding the economic and environmental impacts of the coffee leaf miner on national production is essential to guide the adoption of biological control as an alternative to the intensive use of synthetic insecticides. However, the effectiveness of these strategies depends on reliable and replicable methodological data, which remain limited due to the low incorporation of open science principles in the literature. By examining how studies on the use of *C. externa* in the control of *L. coffeella* align (or fail to align) with contemporary standards of scientific openness, this study contributes to identifying gaps and providing inputs to strengthen scientific communication in the agricultural sector, in a context of growing demand for sustainable and democratic solutions.

2 THEORETICAL FRAMEWORK

Brazilian coffee farming sustains millions of people and remains under strong pressure from the coffee leaf miner, whose foliar consumption reduces plant photosynthesis, causing significant yield losses (Dantas *et al.*, 2021; Venzon, 2021). Recent evidence shows that management intensity and the surrounding landscape modulate both infestation levels and natural parasitism, reinforcing the need to implement integrated pest management (IPM) in coffee production systems worldwide (Shimales *et al.*, 2023; Santos *et al.*, 2024). Remote sensing technologies, such as RGB imagery and machine learning, already assist in locating infestation hotspots and guiding control decisions with greater field precision (Vilela *et al.*, 2024).

In this context, macrobiological control has gained increasing prominence through the release of the predator *C. externa* for controlling the coffee leaf miner over large commercial areas (Figueiredo *et al.*, 2021; Braghini *et al.*, 2024). Studies demonstrate that habitat management, including the use of *Varronia curassavica* to attract chrysopids, can increase predator retention within plots (Martins *et al.*, 2025). In parallel, research on the parasitoid *Closterocerus coffeellae* Ihering, 1914 (Hymenoptera: Eulophidae), including its rearing and feeding, has advanced, paving the way for combined and more selective strategies (Clercq, 2024).

Together, these approaches tend to reduce dependence on insecticides and enhance the resilience of the coffee agroecosystem when integrated into IPM programs. The use of this biological agent can support more sustainable control programs, provided it is underpinned by studies with accessible and replicable data.

Recent research has investigated the efficacy of *C. externa* in different contexts, emphasizing laboratory bioassays and field releases. Studies such as Figueiredo *et al.* (2021) demonstrate the feasibility of releasing predator eggs to control *L. coffeella*, while Lima *et al.* (2024) evaluated the selectivity of botanical insecticides across different stages of the pest's life cycle, considering their compatibility with the predator. However, the predominance of restricted experimental designs and the absence of open data still limit reproducibility and the reuse of

results by other researchers, hindering comparisons among trials, meta-analyses, and technology transfer to large-scale management.

At this point, open science strengthens the continuity and impact of these studies: by requiring FAIR repositories, open licenses, and the sharing of code, protocols, and raw data, it creates conditions for independent verification, methodological standardization, and more robust syntheses (UNESCO, 2021; COAR, 2023).

According to UNESCO's recommendation (2021), open science can be understood as an inclusive paradigm that expands transparency, collaboration, and reproducibility throughout the research cycle by making publications, data, software, and hardware openly available and reusable. It is grounded in values such as quality, collective benefit, equity, and diversity, and supported by pillars that include open scientific knowledge, open infrastructures, scientific communication, social engagement, and dialogue with other knowledge systems.

Open science can be represented through its taxonomy, proposed by Silveira *et al.* (2023), which organizes the domain into ten facets with specific labels such as open licensing and FAIR principles.

UNESCO (2021) further proposes coordinated actions for implementation, including public policy development, investment in infrastructure and capacity building, alignment of incentives, and international cooperation, aiming to reduce digital asymmetries and accelerate progress toward the Sustainable Development Goals (SDGs).

In this study, six dimensions directly mapped from facets of the revised taxonomy were operationalized. The indicators applied were: open access to the article, presence of a CC-BY license, open peer review, data availability, source code availability, and mention of FAIR repositories. Facets such as Open Education/OER, Citizen and Participatory Science, and Open Dialogue with other knowledge systems were not measured as study variables.

The literature on biological control with *C. externa* shows low adherence to these practices. Martins Filho *et al.* (2023), for example, conducted trials with neem-based products to test

selectivity toward the chrysopid but did not make the complete data available in open repositories. Piwowar *et al.* (2018) emphasize that while open access to the text is an advance, it does not ensure methodological transparency or scientific reproducibility.

The adoption of open practices is especially relevant in applied contexts such as agricultural entomology. Braghini *et al.* (2024) demonstrated the effect of prey type on the life history of *C. externa* in an article that included a CC-BY license and open peer review, in accordance with the editorial requirements of the journal *Insects*. The absence of institutional, editorial, and funding requirements for data sharing remains an obstacle to openness (SPARC, 2022). Initiatives such as Open Science Indicators provide parameters to measure the transparency of scientific articles and can be incorporated into academic production evaluation systems (PLOS, 2024).

Given this scenario, it is essential to incorporate open science indicators into the conduct and evaluation of research applied to biological control. Strengthening editorial policies, encouraging publication with open data, and using platforms such as SciELO Data, Zenodo, and Figshare can expand the reach and applicability of studies. The articulation between scientific research and agricultural practices—especially in strategic crops such as coffee—depends on the availability of reliable and accessible evidence (Open Government Partnership, 2023). The consolidation of an open data ecosystem, with an emphasis on transparency and reuse, can contribute to more resilient and informed agricultural practices.

3 METHODOLOGY

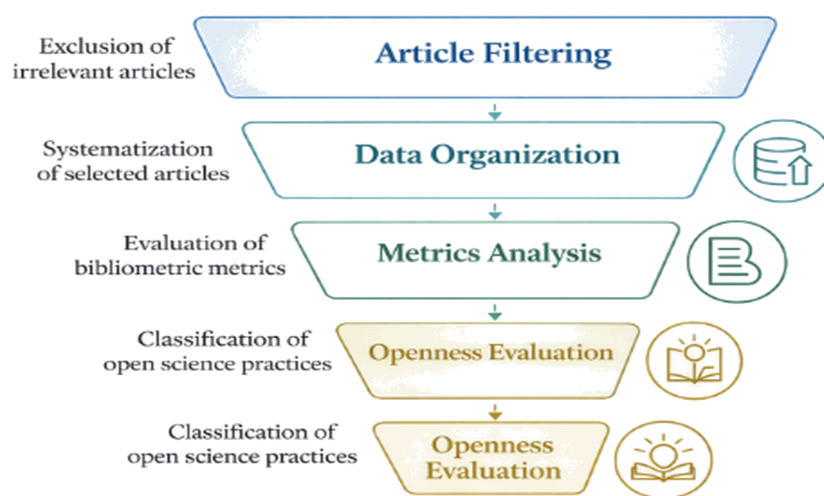
Following the guidelines of Creswell and Creswell (2017), this research can be classified as a bibliometric study, as it conducts a quantitative analysis of scientific production on the use of *C. externa* in the control of *L. coffeella*. Bibliometric indicators such as Qualis, Journal Impact Factor (JIF), SCImago Journal Rank (SJR), and h-index were used, in addition to examining the presence of practices associated with open science.

Although the study primarily focuses on agronomy and entomology, it is also related to the field of Information Science. The analysis of open science practices—such as transparency, accessibility, and reproducibility of scientific research—falls within the scope of Information Science (Ribeiro, 2022), which addresses the dissemination, organization, and access to information (Bawden; Robinson, 2019).

The methodological approach is applied in nature, employing both quantitative and qualitative methods to analyze the articles (Creswell; Creswell, 2017), with an emphasis on bibliometric and methodological variables. Applied analysis, as highlighted by Gil (2010), is common in studies aimed at understanding patterns of scientific production. In addition, the research can be characterized as documentary (Bruyne; Herman; Schoutheete, 1974), as it is based on the analysis of scientific articles.

Considering the thematic focus, the study can be understood as having a dual perspective: on the one hand, it is centered on biological pest control and agricultural sustainability, investigating the use of biological agents in controlling *L. coffeella* in coffee production systems; on the other hand, it examines the impact of open science by assessing how this approach can improve transparency, reproducibility, and accessibility of studies in agricultural entomology. Figure 1 summarizes the methodological steps and the refinement of the articles selected for analysis.

Figure 1 – Article selection process for analysis



Source: authors' own elaboration.

Data collection was carried out through searches on the Google Scholar, Web of Science, Scopus, Dimensions, and ScienceDirect platforms, using the terms “Crisopídeo no controle do bicho-mineiro-do-cafeeiro” and their translations into Spanish, “Chrysopidae en el control del minador de la hoja del café,” and English, “Chrysopidae in the control of the coffee leaf miner” (Table 1). Prepositions were not considered during the search process.

Table 1 – Publication surveys

Database consulted	English	Spanish	Portuguese
Dimensions*	7	6	18
Google Scholar	100	100	54
ScienceDirect	25	0	0
Scopus	54	8	54
Web of Science	6	0	0

Source: authors' own elaboration.

For the analyses, 11 articles were selected. The inclusion criteria comprised studies published up to May 2025 that presented data related to the use of *C. externa* as a biological control agent, including information on the target pest, control organism, crop, objective (toxicity, functional response, field study, or review), and experimental environment (Table 2). In addition, peer-reviewed articles were prioritized. Exclusion criteria included duplicate documents, inaccessible links, studies without methodological description, non-systematic reviews, extended abstracts, and technical reports.

Table 2 – Study Corpus

Articles cited in narrative form (in-text citations)			
1	Braghini <i>et al.</i> (2024)	7	Borkhataria, Collazo in Groom (2012)
2	Limas <i>et al.</i> (2024)	8	Lomeli-Flores (2009)
3	Lima <i>et al.</i> (2023)	9	Silva <i>et al.</i> (2006)
4	Fernandes <i>et al.</i> (2023)	10	Silva <i>et al.</i> (2005)

5	Dami <i>et al.</i> (2023)	11	Ecole <i>et al.</i> (2002)
6	Figueiredo <i>et al.</i> (2021)		

Source: authors' own elaboration.

The selected articles were organized in a spreadsheet containing bibliometric and methodological variables. Data such as title, authors, journal, year of publication, type of access, study scope, experimental parameters, Qualis classification, h-index, SJR, and impact factor (JIF) were recorded. Aspects related to open science were also examined, using the article files themselves and the journals' editorial policies as data sources. Dimensions such as open access, use of Creative Commons licenses, open peer review, coauthorship, presence of supplementary data, availability of source code, and linkage to FAIR repositories were identified. The dataset was deposited in Zenodo and can be accessed via the DOI: <https://doi.org/10.5281/zenodo.17496325>. To facilitate the interpretation of the results, the analysis was organized into six categories, to which specific indicators and corresponding score assignments were applied:

1. **Thematic categorization:** the articles were grouped according to their objectives and contexts (selective toxicity; functional response/biology; field control; ecology/communities; reviews), considering the control organism, target pest, and experimental environment (laboratory, semi-field trials, or field).
2. **Qualitative analysis:** each study was evaluated according to four criteria: (i) methodological design, (ii) level of ecological integration, (iii) conduct of field trials, and (iv) descriptive quality of procedures. For each criterion, an integer score from one to five was assigned on a predefined scale (1 = very insufficient; 2 = insufficient; 3 = moderate; 4 = good; 5 = excellent). The final score for each study corresponded to the average of the four scores; lower values indicate lower methodological consistency and practical applicability, whereas higher values indicate greater potential for use in management and biological control programs.

3. **Classification by levels of openness:** the presence of open access, data and code availability, open peer review, preregistration, international collaboration, and accessible language was assessed. Based on the frequency with which these indicators were met, articles were classified into three categories: low (up to two indicators), moderate (three to five), and high level of adoption (six or more).
4. **Traditional impact metrics:** for each journal, indicators of quality and relevance were recorded (Qualis stratum, JIF, CiteScore, SJR, and main indexations in international databases), based on information available from official sources. Given that these indicators have different natures and scales (continuous, categorical ranges, or binary—presence/absence in databases), they were not directly compared to one another; instead, they were used jointly to construct an ordinal editorial impact score ranging from 1 to 5. Initially, the journal's Qualis stratum was converted to a one-five scale (e.g., A1 = 5; A2 = 4; B1 = 3; B2/B3 = 2; B4/C or unclassified = 1), with Qualis adopted as the primary reference. This value was then adjusted according to the other indicators: one point was added when the journal presented at least two indicators (JIF, CiteScore, or SJR); one point was subtracted when the journal had none of JIF, CiteScore, or SJR and was not indexed in the main databases consulted (Scopus and/or Web of Science). In this study, editorial impact refers to journal conditions and practices that influence the quality, reproducibility, and applicability of published studies, approximating—but not equating to—traditional citation-based impact. The set of bibliometric indicators (JIF, CiteScore, SJR, citations, and Qualis) was thus used as a proxy for real visibility and editorial insertion of the studies, through an explicit procedure that can be replicated in other mappings.
5. **Open science practices:** for each article, a score on an ordinal scale from zero to three was assigned, considering open access to the text, availability of data and code, open peer review, preregistration, international collaboration, and accessible language. On the adopted scale, zero indicates no evidence of open science practices; one indicates the presence of only one element; two indicates two or three elements, still in a partial

form; and three indicates broader adoption, combining open access with other components such as clear licenses, open review, or supplementary data.

6. **Evaluation dimensions for open science:** the frequency of occurrence of each dimension (open access, Creative Commons licenses, open peer review, open data, open code, and FAIR principles) was counted, allowing the identification of advances and gaps in the analyzed set.

Analyses were performed using the R software, employing the Bibliometrix package (Aria; Cuccurullo, 2017) for descriptive and exploratory analysis of bibliographic metadata, enabling identification of production by year and journal, keyword frequency, and the thematic structure of the articles. Variables included authors, year of publication, journal, keywords, and country of affiliation.

The analyses were conducted independently, although organized within the same processing environment. Variables related to traditional metrics (Qualis, JIF, SJR, indexations, and h-index) were treated as numerical or ordinal variables in R and used to construct synthetic indicators of editorial impact through descriptive procedures and simple ranking. For the open science dimension, a set of binary variables was adopted, coded as one (presence) or zero (absence) for each of the six evaluated dimensions. These variables were recorded manually based on reading the articles and checking the journals' editorial policies.

For the textual review stage, organization of ideas, and visual enhancement of this work, technological support resources were used, including the platforms Scipace, ChatGPT, and Napkin. Scipace/ChatGPT were employed to assist with structural analysis of the text, argumentative clarity, and linguistic correction, while Napkin was used to support the creation, refinement, and improvement of images. It is emphasized that the final decisions regarding writing, interpretation, and image construction are the responsibility of the authors, with the tools serving solely as technical support to the creative and editorial process.

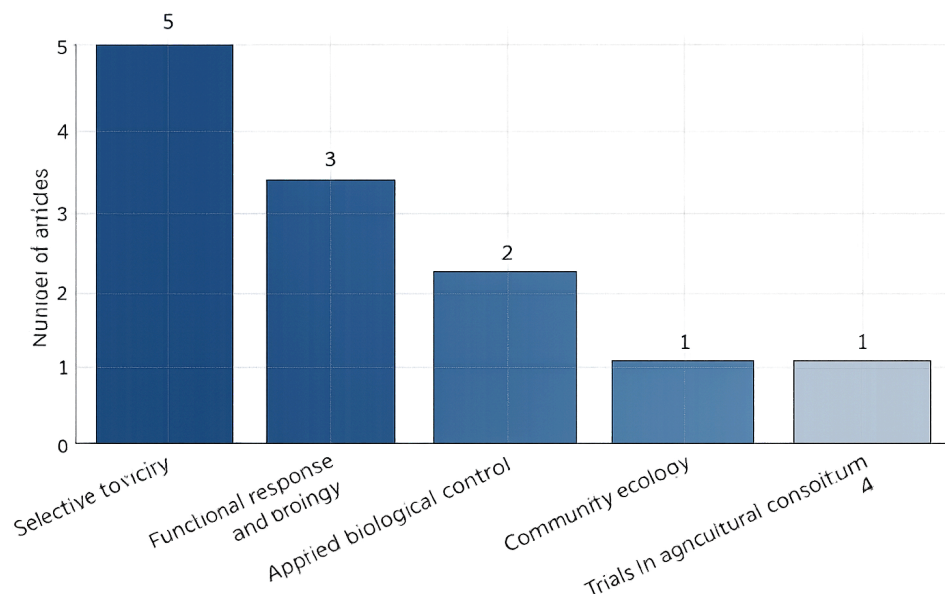
4. RESULTS

To guide the analysis and foster an integrated understanding of the findings, the results were organized into six categories, in order to highlight the relationships between the editorial impact of journals and the presence of practices associated with open science in the analyzed articles. This structure aims to demonstrate not only quantitative patterns but also qualitative nuances that indicate different dimensions of scientific openness related to the biological control of pests.

4.1 Thematic Categorization

The thematic categorization of the articles made it possible to identify five main research axes: selective toxicity, functional response and predator biology, applied biological control, community ecology, and intercropping field trials. The highest concentration of studies was found in the categories “selective toxicity” (five articles) and “functional response/biology” (three articles), indicating a predominance of laboratory-based studies focused on evaluating the performance of *C. externa* when exposed to different inputs and prey (Figure 2).

Figure 2 – Thematic categorization of articles on biological control.



Source: authors' own elaboration.

The *selective toxicity* category includes the studies by Fernandes *et al.* (2023), Lima *et al.* (2024), Silva *et al.* (2005), and Silva *et al.* (2006). These articles evaluated the effects of synthetic or botanical insecticides on different developmental stages of the predator, focusing on lethal and sublethal impacts. Such research supports the selection of products compatible with integrated pest management programs but does not address ecological interactions under field conditions.

Studies classified under *functional response and biology* include the works of Braghini *et al.* (2024), Dami *et al.* (2023), and École *et al.* (2002). These studies analyzed the influence of food type on population parameters and the predatory behavior of *C. externa*, such as development time, consumption rate, and fecundity. This category concentrates investigations that expand knowledge about the predator's potential and its biological requirements.

The *applied biological control* category refers to the articles by Figueiredo *et al.* (2021) and Lomeli-Flores *et al.* (2009). These studies conducted field trials involving predator release and assessed the action of biological control agents on the pest, considering population dynamics in real cropping systems. The emphasis is on practical application and monitoring the effectiveness of biological control under varied environmental conditions.

Only one article was included in the *community ecology category*, represented by Borkhataria *et al.* (2012), which analyzed the composition of entomological and vertebrate fauna in sun- and shade-grown coffee systems, relating biodiversity to ecosystem services of pest control. This study adopts an integrated approach that considers multiple trophic groups.

Finally, the article by Lima *et al.* (2023) was categorized as *intercropping field trials*, as it investigated pest control in pepper-coffee intercropping systems. The study addressed the performance of different control methods in mixed production arrangements, indicating concern with complex agricultural systems and diversified management practices.

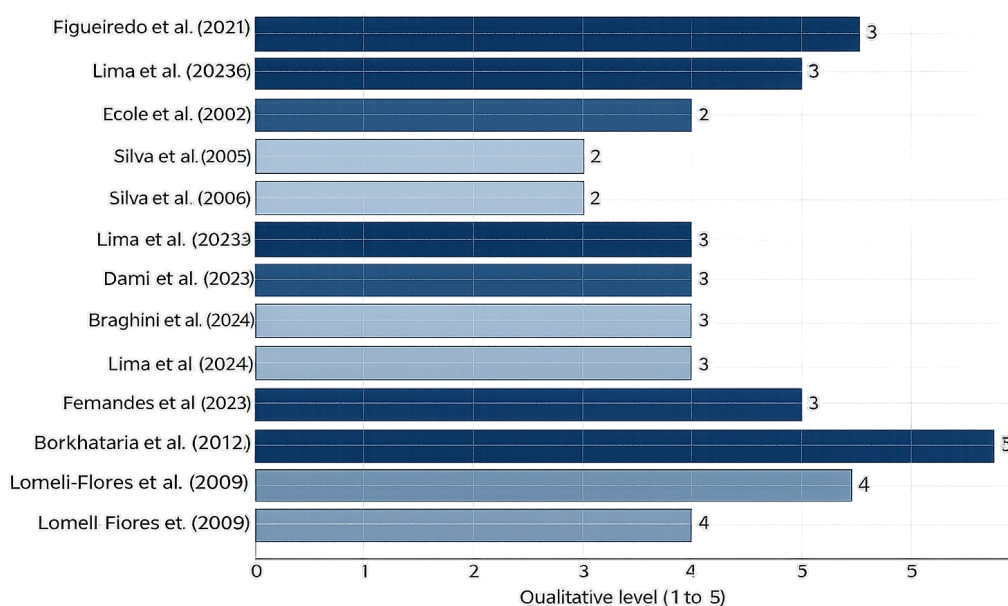
Overall, the results indicate that scientific production in the area remains centered on experimental designs with a narrow focus on predator performance or input toxicity. The

expansion toward ecological and integrated studies, incorporating multiple environmental and social factors, remains limited.

4.2 Qualitative Analysis

The qualitative analysis considered the degree of methodological complexity of the studies, ranging from simple observational approaches to applied field investigations involving multiple variables. The articles were classified on a scale from one to five, according to the level of experimental detail, integration of ecological factors, and applicability of the results (Figure 3).

Figure 3 – Qualitative classification and depth of the articles.



Source: authors' own elaboration.

Studies by Silva *et al.* (2005; 2006), École *et al.* (2002), and Lima *et al.* (2023) were classified with a score of two, corresponding to laboratory or field assays focused on evaluating the toxicity of phytosanitary products on *C. externa*. These studies concentrate on lethal or sublethal effects of pesticides, without exploring broader predator–pest relationships in agricultural environments.

The group with a score of three includes the articles by Fernandes *et al.* (2023), Lima *et al.* (2024), Braghini *et al.* (2024), and Dami *et al.* (2023). These studies employed experimental

designs with multiple variables, such as prey type, developmental stage, and population performance parameters. Braghini *et al.* (2024) analyzed the influence of food type on the life history of *C. externa*, while Dami *et al.* (2023) measured the functional response of three predatory species to *L. coffeella*. These experimental designs broaden the understanding of predator behavioral ecology in agricultural contexts.

The articles by Figueiredo *et al.* (2021) and Lomeli-Flores *et al.* (2009) received a score of four for integrating field variables and biological interactions into their designs. Figueiredo *et al.* (2021) evaluated the release of *C. externa* eggs in coffee plantations, considering their influence on pest control. Lomeli-Flores *et al.* (2009) analyzed the population dynamics of *L. coffeella* as a function of biological control agents across different altitudes. Both studies explored environmental and biological factors under non-controlled conditions, contributing to the planning of biological control strategies.

A score of five was assigned to the work by Borkhataria *et al.* (2012), which investigated ecosystem services of biological control in agroforestry systems. The study compared sun-grown and shade-grown coffee plantations, assessing predator fauna composition and potential effects on pests. By integrating ecological and socio-environmental factors, the article provides evidence-based support for agronomic decision-making (Borkhataria *et al.*, 2012).

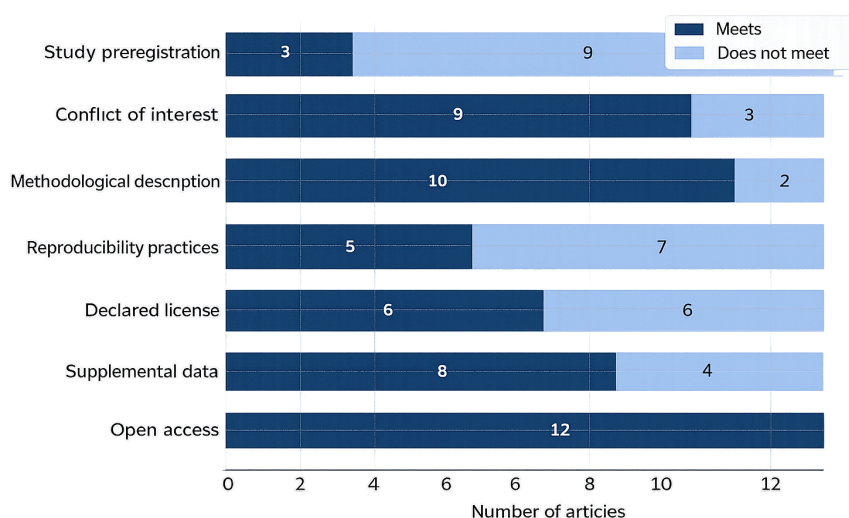
Overall, the analysis indicates that most studies remain centered on toxicity assessment and individual predator performance, with fewer systemic approaches. Integrating ecological methods, field trials, and practical efficacy assessments tends to enhance result applicability and contributes to the formulation of sustainable agricultural policies.

4.3 Classification by Levels of Openness

The analysis of articles on the use of *C. externa* in the control of *L. coffeella* indicated a low level of adoption of open science practices. Articles meeting up to two openness indicators were classified as *low level*. Those meeting three to five indicators were classified as *moderate*, and those meeting six or more were classified as *high level of adoption*, considering the following

indicators: open data, open code, open peer review, open access, preregistration, international authorship, and accessible language. The most frequent indicator was *open access*, identified in all 11 analyzed articles, indicating that these documents are freely available in journals or repositories (Piwowar *et al.*, 2018; SPARC, 2022) (Figure 4).

Figure 4 – Classification by levels of openness by indicator.



Source: authors' own elaboration.

When examining the other indicators, a lack of implementation was observed. None of the articles provided data or code in digital repositories, nor did they include prior registration of research protocols. These elements are part of UNESCO's (2021) recommendations to enable reproducibility and reuse of scientific results.

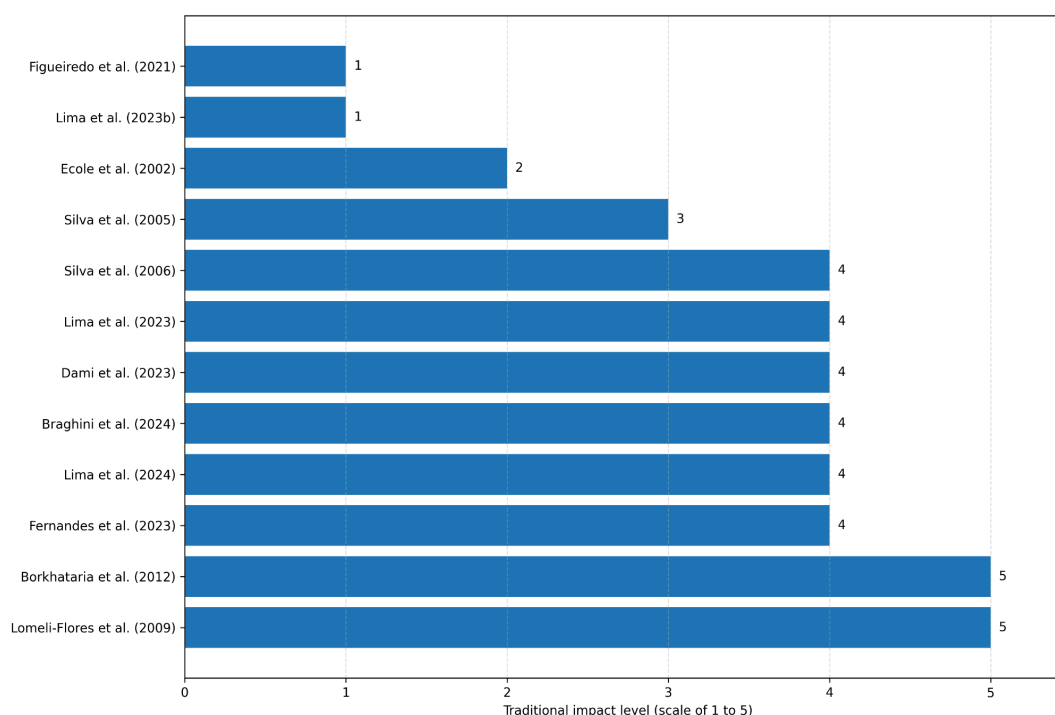
Open peer review was not identified in the analyzed publications. This review modality is provided for in editorial policies that prioritize transparency in the publication process (Silveira *et al.*, 2023). Only two articles involved coauthorship with researchers from foreign institutions, which limits the international circulation of the research.

No complementary texts using language oriented toward society or simplified versions of the abstracts were identified. The absence of this resource limits access to the generated scientific information by non-specialist users. The use of standardized instruments such as the Open Science Indicators is recommended to guide the assessment of transparency in scientific publications (Elsevier, 2023).

4.4 Traditional Impact Metrics

The analysis of traditional impact metrics of articles on the control of *L. coffeella* by *C. externa* reveals a predominance of publications in journals well positioned in the national evaluation system, with a higher concentration in the A1, A2, and B1 Qualis strata (Figure 5). For comparison purposes among journals, an ordinal scale from one to five was adopted, constructed in a reproducible manner. The Qualis stratum was used as the primary reference (A1 = 5; A2/B1 = 4; B2 = 3; B3–B4 = 2; B5/no Qualis = 1), and, when necessary, complementary indicators were applied to resolve ties or address the absence of classification in the relevant area. These indicators, considered in this order, were: international indexation (Scopus and/or Web of Science); presence of consolidated metrics (JCR, SJR, CiteScore); impact factor; and the journal's editorial track record. This procedure sought to reduce arbitrariness and standardize the evaluation across journals with different profiles.

Figure 5 – Classification of articles by traditional impact metrics.



Source: authors' own elaboration.

The observed pattern indicates a diversity of journals used for knowledge dissemination, with a strong presence of periodicals specialized in applied entomology, predator ecology, and plant protection.

The articles by Lomeli-Flores *et al.* (2009) and Borkhataria *et al.* (2012), published respectively in *Biological Control* and *Agriculture, Ecosystems & Environment*, received a score of five, the highest rating, due to the combination of an A1 Qualis classification, consolidated international indexation, and impact factors above the median for the field. Both studies explore ecological mechanisms of natural pest regulation in coffee systems, using field experiments and integrated analyses.

In the score four category are the studies by Fernandes *et al.* (2023), Lima *et al.* (2024), Braghini *et al.* (2024), and Dami *et al.* (2023), published in journals such as *Crop Protection*, *Insects*, and *Journal of Insect Science*. These outlets present intermediate bibliometric impact and are recognized for their emphasis on biological control, bioecology, and functional studies of predators, predominantly based on bioassays.

The works by Silva *et al.* (2005), Silva *et al.* (2006), and École *et al.* (2002) received scores between two and three, reflecting the lower international visibility of the journals *Neotropical Entomology*, *Ciência Rural*, and *Ciência e Agrotecnologia*. Nevertheless, these studies contribute important assessments of selective toxicity and analyses of predatory efficacy across different developmental stages of the pest insect.

The lowest score one was assigned to Figueiredo *et al.* (2021), published in *Arthropod Management Tests*, classified as B1 in Qualis but lacking international metrics that would increase its score according to the complementary criteria. Even so, this is an applied study involving egg release and field management, providing practical support for IPM programs.

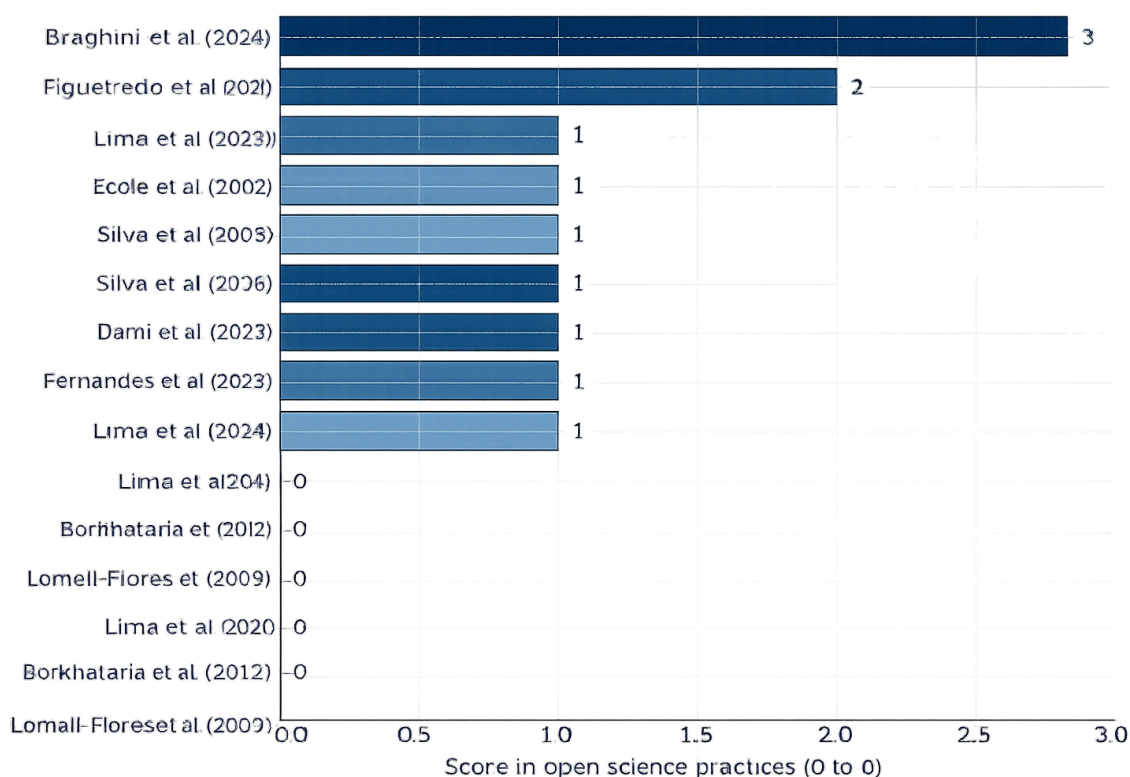
Overall, the analysis shows that while traditional metrics help position scientific production in terms of visibility, international circulation, and editorial prestige, they do not fully capture aspects such as practical applicability, methodological transparency, or data openness. Therefore, the incorporation of open science indicators complements this perspective,

broadening the understanding of the actual reach and value of studies in specific agricultural contexts.

4.5 Open Science Practices

The analysis of open science metrics revealed a low level of adoption of practices related to transparency, data sharing, and open peer review. This classification corresponds to articles that scored two or lower on the zero–three scale, that is, those that did not make data, code, or protocols openly available, or did so incompletely, without metadata, DOI, or an explicit license. Among the evaluated studies, eight received a score of one or lower, and none exceeded three points, highlighting the limited incorporation of open science principles in the analyzed research (Figure 6).

Figure 6 – Adherence of articles to open science practices.



Source: authors' own elaboration.

The articles by Lomeli-Flores *et al.* (2009), Borkhataria *et al.* (2012), and Lima *et al.* (2024) did not present supplementary data, code, open-use licenses, or links to repositories. Although these articles were published in high-impact journals, they do not provide openness compatible with the principles defined by UNESCO (2021) and the guidelines of COAR (2023).

Five articles received a score of one, including the studies by Fernandes *et al.* (2023), Dami *et al.* (2023), Silva *et al.* (2006), Silva *et al.* (2005), and École *et al.* (2002). In these cases, the score was attributed solely due to open access to the text, with no evidence of data sharing, open peer review, or use of open licenses. Open access represents a partial advance, but it does not ensure reproducibility or reuse of results, as discussed by Piwowar *et al.* (2018).

Two articles achieved higher scores: Figueiredo *et al.* (2021), with a score of two, and Braghini *et al.* (2024), with a score of three points. The latter was the only study that presented open peer review, open-access text under a Creative Commons license (CC-BY), and mention of the use of supplementary data, albeit without direct linkage to FAIR repositories. The journal *Insects*, in which the article was published, adopts institutional policies more closely aligned with open science (MDPI, 2024), which contributes to the presence of these elements.

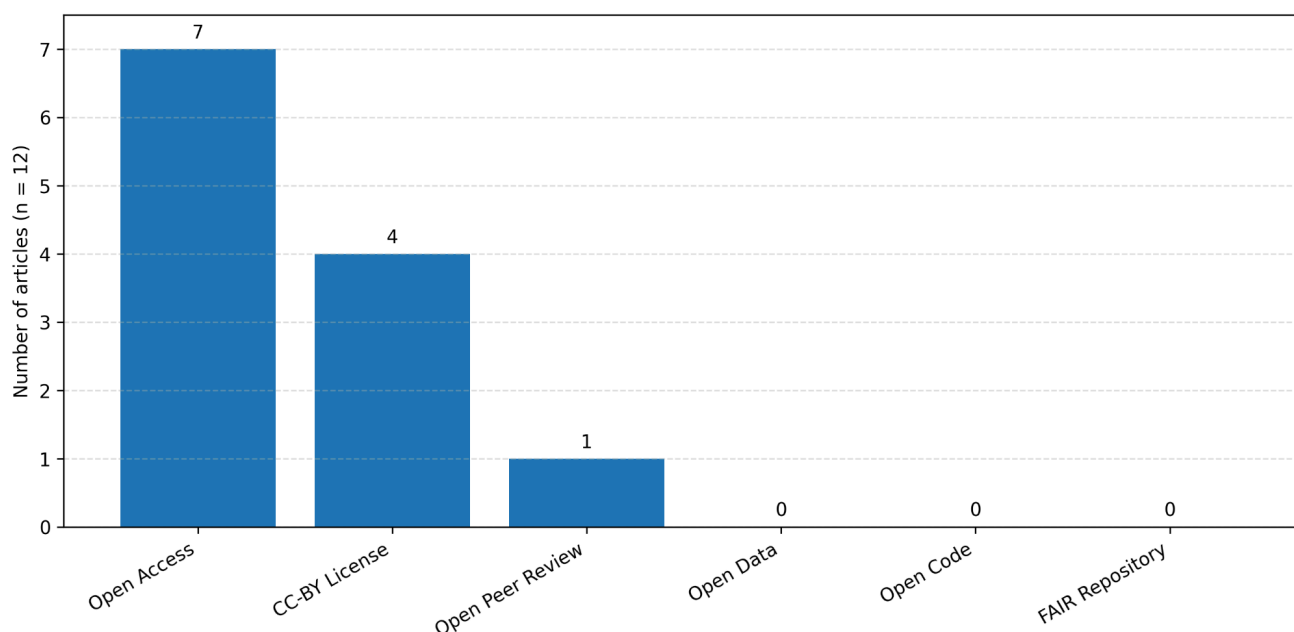
The overall low scores can be explained by the lack of editorial requirements regarding data and methodological openness. There is also evidence that authors prioritize evaluation indicators based on traditional metrics, such as impact factor and Qualis, to the detriment of openness in scientific processes. This pattern was observed even in journals that offer infrastructure for open practices, indicating that adoption depends on clearer guidelines and specific incentives.

Integrating open science into editorial workflows and scientific evaluation systems can foster knowledge circulation, increase trust in research, and promote reproducibility. The adoption of complementary indicators, such as Open Science Indicators and FAIR principles, can help redefine quality metrics and expand the social utility of science (UNESCO, 2021; COAR, 2023).

4.6 Evaluation Dimensions for Open Science

The analysis of evaluation dimensions for Open Science identified uneven adoption of the principles proposed by international bodies such as UNESCO (2021) and repository networks such as COAR (2023) (Figure 6). Six dimensions were considered: open access to the article, use of CC-BY licenses, presence of open peer review, source code availability, data sharing, and linkage to FAIR repositories. The most frequently met dimension was open access to the article, identified in seven of the eleven studies. The remaining indicators showed limited or absent adoption (Figure 7).

Figure 7 – Evaluation dimensions for open science.



Source: authors' own elaboration.

The use of *Creative Commons licenses (CC-BY)* was observed in three articles, specifically those published in journals with editorial policies that require or encourage this type of license, such as the journal *Insects* (Braghini *et al.*, 2024). Although free access to the text is important for increasing research visibility, the absence of clear licenses compromises content reuse and redistribution, as discussed by Piwowar *et al.* (2018).

Open peer review, understood as the availability of review reports or reviewer identities (Silveira; Ernest, 2024), was identified in only one of the analyzed articles. This practice is linked to the editorial policy of MDPI, the publisher of *Insects*, and represents a strategy to increase transparency in the peer review process (MDPI, 2024). However, the low adoption of this dimension among the other analyzed articles indicates a systemic limitation of journals in incorporating this indicator.

The last three dimensions—*open data*, *open source code*, and *FAIR repositories*—were not identified in any of the articles. There was no mention of supplementary files containing raw data, computational scripts, or links to platforms such as Zenodo, Figshare, or SciELO Data. This absence compromises study reproducibility and the potential reuse of results in meta-analyses or systematic reviews (UNESCO, 2021; Silveira *et al.*, 2023).

These results reflect a pattern identified in other areas of agricultural and environmental research, where scientific production remains focused on publishing results and achieving traditional impact metrics, such as impact factor and citations. The absence of open data may also be associated with the lack of journal requirements and insufficient institutional infrastructure for research data storage and curation (SPARC, 2022). According to Ribeiro (2020), journals that adopt open data expand scientific publication by supporting original findings and enabling the reuse of organized and well-documented data in new research.

The adoption of Open Science dimensions depends on institutional guidelines, editorial policies, and incentives from funding agencies. Implementing evaluative indicators that take these dimensions into account can contribute to the democratization of scientific knowledge, increased reproducibility, and result traceability (Silveira *et al.*, 2023; COAR, 2023; UNESCO, 2021).

5 DISCUSSION

The results demonstrate a structural dissociation between the editorial impact of articles published in prestigious journals and the effective adoption of open science practices. This

situation confirms a trend already identified in international analyses, which point to a strong “*political economy of prestige*” in scholarly communication, where traditional metrics prevail over openness, transparency, and reproducibility practices (Benkler, 2006). Although open access to the text is present in part of the sample, dimensions considered essential by UNESCO (2021)—such as FAIR data, open peer review, or source code availability—remain absent. This suggests that openness may be treated more as a circumstantial outcome of editorial models than as a cultural scientific value.

From a methodological perspective, production on *C. externa* remains centered on laboratory designs focused on selective toxicity and predatory performance, reproducing historical patterns of applied entomology since the classical studies of École *et al.* (2002) and Silva *et al.* (2005; 2006). It is noteworthy that more recent research advancing into field contexts, such as Lomeli-Flores *et al.* (2009) and Borkhataria *et al.* (2012), demonstrates that biological control depends on multiple ecological and socio-environmental variables, whose rigorous analysis requires methodological openness. The absence of raw data in these studies prevents comparisons and limits reuse, contradicting one of the core principles of cumulative science formulated by Merton (1973), namely communalism and public verifiability.

Critical open science literature reinforces that merely making the text available does not transform the scientific ecosystem if the underlying inputs of knowledge production remain closed. Authors such as Willinsky (2006), Suber (2012), and Fecher and Friesike (2014) argue that open science should be understood as a movement involving infrastructure, institutional culture, and incentives. According to the analyzed data, low adherence to open practices indicates that incentives in this field remain strongly oriented toward impact metrics, to the detriment of transparency. This phenomenon, already observed by Latour and Woolgar (1986) in the sociology of science, suggests that credibility in the field is constructed primarily through editorial authority rather than through openness of processes.

At the national level, this diagnosis converges with Ribeiro (2022), who identifies cultural, normative, and infrastructural barriers to the adoption of open science in Brazilian institutions. The low incidence of data repositories dedicated to agriculture and the absence of

specific editorial policies help explain the low scores observed in this study. Even international initiatives such as the Open Science Indicators proposed by PLOS (2024) and the recommendations of COAR (2023) have not yet been incorporated into agricultural entomology. This creates a critical gap: although Brazilian agriculture increasingly depends on replicable and comparable evidence, the scientific production ecosystem remains closed, fragmented, and poorly documented.

The practical implications of this study are significant. Without open data and transparent methodologies, research on integrated pest management (IPM) cannot be fully replicated, adapted, or incorporated into decision-making models by farmers, extension agents, and researchers. Biological control based on *C. externa*, whose effectiveness depends on complex ecological interactions, requires an open science ecosystem to evolve sustainably. Thus, the findings of this study reinforce that the transition toward more resilient coffee production depends not only on biological advances but also on an epistemological and institutional reorganization grounded in the classical principles of open science: transparency, reuse, collaboration, and science as a common good.

6 FINAL CONSIDERATIONS

A predominance of laboratory assays and point-based evaluations was observed, with a focus on selective toxicity and predator performance, while practices related to transparency, data/code sharing, open peer review, and the use of FAIR repositories remain incipient—even when part of the literature is published in high-impact journals.

As a theoretical contribution, this study proposes an integrated evaluation approach that combines traditional metrics with open science indicators, providing a comparable framework for syntheses and meta-analyses. On a practical level, the study offers operational indicators for the design and reporting of applied research (e.g., detailed protocols, data/code with DOI and license, standardized metadata), supporting editors, reviewers, and IPM teams in selecting and reapplying evidence in productive contexts.

Among the limitations, reliance on bibliometric proxies (Qualis, indexations and quartiles) and the potential underreporting of non-indexed supplementary materials should be noted. We recommend that future investigations prioritize more integrated and reproducible field trials, with FAIR-compliant documentation, to accelerate technology transfer and align sustainable coffee production not only with the efficacy of biological control agents but also with the democratization of the knowledge that underpins these strategies.

NOTES AND CREDITS OF THE ARTICLE

Acknowledgements: Not applicable.

Funding: Not applicable.

Conflicts of Interest: Not applicable.

Ethical Approval: Not applicable.

Manuscript Published as a Preprint: Not applicable.

Author Contributions: To be specified.

Author Contributions (CRediT taxonomy)

Conceptualization: Fernandes, F. O. Data Curation: Fernandes, F. O. Formal Analysis: Fernandes, F. O.; Bastos, M. E. R.; Valeriano, I. J.; Silva, A. P. N. Funding Acquisition: Not applicable. Investigation: Fernandes, F. O.; Bastos, M. E. R.; Valeriano, I. J.; Silva, A. P. N. Methodology: Fernandes, F. O. Project Administration: Fernandes, F. O. Resources: Not applicable. Software: Not applicable. Supervision: Fernandes, F. O. Validation: Fernandes, F. O. Visualization: Fernandes, F. O. Writing – Original Draft: Fernandes, F. O.; Bastos, M. E. R.; Valeriano, I. J.; Silva, A. P. N. Writing – Review & Editing: Fernandes, F. O.

Publisher

Universidade Federal de Lavras (UFLA).

The ideas expressed in this article are the sole responsibility of the authors and do not necessarily reflect the views of the editors or the university.

REFERENCES

- ARIA, M.; CUCCURULLO, C. Bibliometrix: An R-tool for comprehensive science mapping analysis. **Journal of Informetrics**, Amsterdam, v. 11, n. 4, p. 959–975, 2017. Disponível em: <https://doi.org/10.1016/j.joi.2017.08.007>. Acesso em: 12 nov. 2025.
- BAWDEN, David; ROBINSON, Lyn. **Introduction to information science**. 3rd ed. London: Facet Publishing, 2019.
- BARRETO, L. P.; SILVA, F. J.; OLIVEIRA, A. M. Análise de conteúdo na pesquisa acadêmica: uma revisão. **Revista Brasileira de Educação**, São Paulo, v. 19, n. 60, p. 215–234, 2014. Disponível em: <https://www.redalyc.org/pdf/1891/189118067002.pdf>. Acesso em: 12 nov. 2025.
- BENKLER, Yochai. **The wealth of networks: how social production transforms markets and freedom**. New Haven: Yale University Press, 2006.
- BORKHATARIA, R. R. *et al.* Species abundance and potential biological control services in shade vs. sun coffee in Puerto Rico. **Agriculture, Ecosystems & Environment**, Amsterdam, v. 151, p. 1–5, 2012. Disponível em: <https://doi.org/10.1016/j.agee.2012.01.025>. Acesso em: 12 nov. 2025.
- BRAGHINI, A. *et al.* Testing the effects of prey type on the life history and population-level parameters of *Chrysoperla externa*. **Insects**, Basel, v. 15, n. 5, p. 330, 2024. Disponível em: <https://doi.org/10.3390/insects15050330>. Acesso em: 12 nov. 2025.
- BRUYNE, P.; HERMAN, J.; SCHOUTHEETE, M. **Dinâmica da pesquisa em ciências sociais: os polos da prática metodológica**. Rio de Janeiro: Francisco Alves, 1974.
- CLERCQ, P. Plants in the rearing of arthropod predators and parasitoids. **Current Opinion in Insect Science**, Amsterdam, v. 66, e101187, 2024. Disponível em: <https://doi.org/10.1016/j.cois.2023.101139>. Acesso em: 12 nov. 2025.
- COAR – Confederation of Open Access Repositories. **Incentivando a Ciência Aberta nas Américas**. 2023. Disponível em: <https://www.coar-repositories.org/>. Acesso em: 12 nov. 2025.
- CRESWELL, John W.; CRESWELL, J. David. **Projeto de pesquisa: métodos qualitativo, quantitativo e misto**. eBook Kindle. São Paulo: Penso, 2017.
- DAMI, B. G. *et al.* Functional response of three green lacewing species (Neuroptera: Chrysopidae) to *Leucoptera coffeella*. **Journal of Insect Science**, Tempe, v. 23, 2023. Disponível em: <https://doi.org/10.1093/jisesa/iead038>. Acesso em: 12 nov. 2025.
- DANTAS, J. *et al.* A comprehensive review of the coffee leaf miner *Leucoptera coffeella*: a major pest for the coffee crop in Brazil and other Neotropical countries. **Insects**, Basel, v. 12, n. 12, e1130, 2021. Disponível em: <https://doi.org/10.3390/insects12121130>. Acesso em: 12 nov. 2025.

ECOLE, R. A. *et al.* Predação de ovos, larvas e pupas do bicho-mineiro-do-cafeeiro *Leucoptera coffeella* por *Chrysoperla externa*. **Ciência e Agrotecnologia**, Lavras, v. 26, n. 2, p. 318-324, 2002. Disponível em: https://cienciaeagrotecnologia.ufla.br/images/26-2-2002_12.pdf. Acesso em: 12 nov. 2025.

FECHER, Benedikt; FRIESIKE, Sascha. Open science: one term, five schools of thought. In: BARTLING, S.; FRIESIKE, S. (org.). **Opening science: the evolving guide on how the internet is changing research, collaboration and scholarly publishing**. Cham: Springer, 2014. p. 17-47. DOI: https://doi.org/10.1007/978-3-319-00026-8_2

FERNANDES, E. S. F. *et al.* Comparative toxicity of coffee insecticides to the green lacewing *Chrysoperla externa*. **Crop Protection**, Amsterdam, v. 172, 2023. Disponível em: <https://doi.org/10.1016/j.cropro.2023.106336>. Acesso em: 12 nov. 2025.

FIGUEIREDO, G. P. *et al.* Releases of *Chrysoperla externa* eggs for the control of the coffee leaf miner. **Arthropod Management Tests**, Champaign, v. 46, 2021. Disponível em: <https://doi.org/10.1093/amt/tsab148>. Acesso em: 12 nov. 2025.

Gil, A. C. **Como elaborar projetos de pesquisa**. 7. ed. São Paulo: Atlas, 2019.

JAMES, G. *et al.* **An introduction to statistical learning: with applications in R**. 2. ed. New York: Springer, 2021.

LATOUR, Bruno; WOOLGAR, Steve. **Laboratory life: the construction of scientific facts**. 2. ed. Princeton: Princeton University Press, 1986.

LIMA, S. H. *et al.* Estudo comparativo de métodos de controle de pragas nas culturas consorciadas de pimenta e café. **Revista GETEC**, Campinas, v. 12, n. 41, p. 91-108, 2023. Disponível em: <https://revistas.fucamp.edu.br/index.php/getec/article/view/3128>. Acesso em: 12 nov. 2025.

LIMA, V. de O. *et al.* Toxicity of botanical insecticides at different developmental stages of the coffee leaf miner, *Leucoptera coffeella* (Lepidoptera: Lynetiidae), and their side effects on predator *Chrysoperla externa* (Neuroptera: Chrysopidae). **Crop Protection**, Amsterdam, v. 181, art. 106678, 2024. Disponível em: <https://doi.org/10.1016/j.cropro.2024.106678>. Acesso em: 12 nov. 2025.

LOMELI-FLORES, J. R. *et al.* Impact of natural enemies on coffee leafminer population dynamics. **Biological Control**, Amsterdam, v. 51, p. 51-60, 2009. Disponível em: <https://doi.org/10.1016/j.biocontrol.2009.03.021>. Acesso em: 12 nov. 2025.

MARTINS FILHO, S.; DUARTE, M. L.; VENZON, M. Survival analysis of the green lacewing, *Chrysoperla externa*, exposed to neem-based products. **Agriculture**, Basel, v. 13, n. 2, p. 292, 2023. Disponível em: <https://doi.org/10.3390/agriculture13020292>. Acesso em: 12 nov. 2025.

MARTINS, E. F. *et al.* Role of a medicinal plant (*Varronia curassavica*) in attracting Chrysopidae predators and controlling *Leucoptera coffeella*. **Crop Protection**, Amsterdam, v. 184, 2025. Disponível em: <https://doi.org/10.1016/j.cropro.2024.106944>. Acesso em: 12 nov. 2025.

MDPI. **Open science policy and data availability statement guidelines**. 2024. Disponível em: <https://www.mdpi.com/about/openaccess>. Acesso em: 07 maio 2025.

MERTON, Robert K. **The sociology of science: theoretical and empirical investigations**. Chicago: University of Chicago Press, 1973.

OPEN GOVERNMENT PARTNERSHIP. **Open Agricultural Data (BR0115)**. 2023. Disponível em: <https://www.opengovpartnership.org/members/brazil/commitments/BR0115/>. Acesso em: 12 nov. 2025.

PIWOWAR, H. *et al.* The state of OA: a large-scale analysis of open access articles. **PeerJ**, London, v. 6, e4375, 2018. Disponível em: <https://doi.org/10.7717/peerj.4375>.

PIWOWAR, H. *et al.* The state of OA: a large-scale analysis of the prevalence and impact of Open Access articles. **PeerJ**, London, v. 6, e4375, 2018. Disponível em: <https://doi.org/10.7717/peerj.4375>. Acesso em: 12 nov. 2025.

PLOS. **Open Science Indicators**. 2024. Disponível em: <https://plos.org/open-science-indicators>. Acesso em: 12 nov. 2025.

RIBEIRO, Nivaldo Calixto. **Ciência Aberta em universidades públicas federais brasileiras: políticas, ações e iniciativas**. 2022. 339 p. Tese (Doutorado em Gestão e Organização do Conhecimento) – Universidade Federal de Minas Gerais, Belo Horizonte, 2022.

RIBEIRO, Nivaldo Calixto. Revistas de dados abertos. **Ciência da Informação Express**, Lavras, MG, v. 1, p. 1-3, 2020. Disponível em: <https://cienciadainformacaoexpress.ufla.br/index.php/revista/article/view/44>. Acesso em: 12 nov. 2025.

SANTOS, M. P. dos *et al.* Landscape and insecticide use affecting the *Leucoptera coffeella* infestation and the natural parasitism spatiotemporal distribution in Brazilian coffee agroecosystems. **Crop Protection**, Amsterdam, v. 185, 2024. Disponível em: <https://doi.org/10.1016/j.cropro.2024.106908>. Acesso em: 12 nov. 2025.

SERRÃO, J. E.; ZANUNCIO, J. C. Predação de ovos, larvas e pupas do bicho-mineiro (*Liriomyza sativae*) por *Chrysoperla externa* (Hagen) (Neuroptera: Chrysopidae). **Ciência e Agrotecnologia**, Lavras, v. 26, n. 2, p. 334-340, 2002. Disponível em: https://cienciaeagrotecnologia.ufla.br/images/26-2-2002_12.pdf. Acesso em: 12 nov. 2025.

SHIMALES, T. *et al.* Management intensity affects insect pests and natural pest control on Arabica coffee in its native range. **Journal of Applied Ecology**, London, v. 60, n. 5, p. 911–922, 2023. Disponível em: <https://doi.org/10.1111/1365-2664.14410>. Acesso em: 12 nov. 2025.

SILVA, A. F. O. *et al.* O café como destaque para o agronegócio brasileiro. In: SOUZA, Maurício Novaes; SIMÃO, João Batista Pavesi (Orgs.). **Tópicos em cafeicultura: cafés especiais**. Canoas: Mérida Publishers, 2024. v. 4, p. 33–55. Disponível em: <https://doi.org/10.69570/mp.978-65-84548-28-8.c2>. Acesso em: 12 nov. 2025.

SILVA, R. A. *et al.* Ação de produtos fitossanitários sobre pupas e adultos de *Chrysoperla externa*. **Ciência Rural**, Santa Maria, v. 36, n. 1, p. 8–14, 2006. Disponível em: <https://doi.org/10.1590/S0103-84782006000100002>. Acesso em: 12 nov. 2025.

SILVA, R. A. *et al.* Toxicidade de produtos fitossanitários a larvas de *Chrysoperla externa*. **Neotropical Entomology**, Piracicaba, v. 34, n. 6, p. 951–959, 2005. Disponível em: <https://doi.org/10.1590/S1519-566X2005000600012>. Acesso em: 12 nov. 2025.

SILVEIRA, L. D. *et al.* Taxonomia da Ciência Aberta: revisada e ampliada. **Encontros Bibli: revista de biblioteconomia e Ciência da Informação**, Florianópolis, v. 28, p. 1–22, 2023. Disponível em: <https://doi.org/10.5007/1518-2924.2023.e91712>. Acesso em: 12 nov. 2025.

SILVEIRA, L.; ABADAL, E. Open peer review: mais um passo das revistas científicas em direção à ciência aberta. **Ciência da Informação Express**, Lavras, MG, v. 5, p. 1–18, 2024. Disponível em: [10.60144/v5i.2024.122](https://doi.org/10.60144/v5i.2024.122). Disponível em: <https://doi.org/10.60144/v5i.2024.122>. Acesso em: 12 nov. 2025.

SOUZA, J. C. de; REIS, P. R.; RIGITANO, R. L. de O. **Bicho-mineiro do cafeeiro: biologia, danos e manejo integrado**. 2. ed. rev. aum. Belo Horizonte: EPAMIG, 1998. 48 p. (EPAMIG. Boletim Técnico, 54).

SPARC. **Open Data and Repositories**. 2022. Disponível em: <https://sparcopen.org/>. Acesso em: 12 nov. 2025.

SUBER, Peter. **Open access**. Cambridge, MA: MIT Press, 2012.

UNESCO. **Recomendação sobre Ciência Aberta**. Paris: Organização das Nações Unidas para a Educação, a Ciência e a Cultura, 2021. Disponível em: <https://unesdoc.unesco.org/ark:/48223/pf0000379983>. Acesso em: 12 nov. 2025.

VAN LENTEREN, J. C. **IOBC Internet Book of Biological Control: version 6**. Wageningen: Wageningen University, 2012a. Disponível em: https://www.iobc-global.org/publications_iobc_internet_book_biological_control.html. Acesso em: 12 nov. 2025.

VAN LENTEREN, J. C. The state of commercial augmentative biological control: plenty of natural enemies, but a frustrating lack of uptake. **BioControl**, Dordrecht, v. 57, n. 1, p. 1-20, 2012b. Disponível em: <https://doi.org/10.1007/s10526-011-9395-1>.

VENZON, M. Agro-ecological management of coffee pests in Brazil. **Frontiers in Sustainable Food Systems**, London, v. 5, p. 721117, 2021. Disponível em: <https://doi.org/10.3389/fsufs.2021.721117>. Acesso em: 12 nov. 2025.

VILELA, E. F. *et al.* Detection of coffee leaf miner using RGB aerial imagery and machine learning. **AgriEngineering**, Basel, v. 6, n. 3, p. 3174–3186, 2024. Disponível em: <https://doi.org/10.3390/agriengineering6030181>. Acesso em: 12 nov. 2025.

WILLINSKY, John. **The access principle: the case for open access to research and scholarship**. Cambridge, MA: MIT Press, 2006.

WILKINSON, M. D. *et al.* The FAIR Guiding Principles for scientific data management and stewardship. **Scientific Data**, London, v. 3, art. 160018, 2016. Disponível em: <https://doi.org/10.1038/sdata.2016.18>. Acesso em: 12 nov. 2025.