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# SYSTEMATIC REVIEW: PERSPECTIVE OF THE PHYTOCHEMICAL PROFILE AND BIOLOGICAL TESTS OF SOLALUM CAPSICOIDES (SOLANACEAE) FRUITS USING THE METHODI ORDINATIO PROTOCOL

# REVISÃO SISTEMÁTICA: PERSPECTIVA DO PERFIL FITOQUÍMICO E ENSAIOS BIOLÓGICOS DOS FRUTOS DA SOLALUM CAPSICOIDES (SOLANACEAE) MEDIANTE PROTOCOLO DE METHODI ORDINATIO

# REVISIÓN SISTEMÁTICA: PERSPECTIVA DEL PERFIL FITOQUÍMICO Y ENSAYOS BIOLÓGICOS DE FRUTOS DE SOLALUM CAPSICOIDES (SOLANACEAE) UTILIZANDO EL PROTOCOLO METHODI ORDINATIO

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**Thais Bordenowsky da Silva[1], Obdulio Gomes Miguel[2], Marilis Dallarmi Miguel[3], Josiane de Fátima G. Dias[4], Deise Prehs Montrucchio[5], Elisiane de Bona Sartor[6], Cintia Aparecida dos Anjos[7]**

## ABSTRACT

Nightshades demonstrate therapeutic potential that warrants further investigation. Several members of the Solanaceae family are used to treat a range of clinical conditions, such as respiratory and ophthalmological diseases, Parkinson's disease, spasmodic conditions, and as anti-inflammatories. The objective of this study is to present a systematic review protocol for extracts of the species Solanum capsicoides (SOLANACEAE): prospecting the phytochemical profile and biological assays of the fruits. The literature search was conducted in the Web of Science (WoS), Science Direct, and Scopus databases, according to the protocols established by the Methodi Ordinatio (MO). Concurrently, based on the results, bibliometric network visualizations and mapping of specific results were performed using the VOSviewer® software. The results obtained from the presented texts may contribute information about the characteristics of this species, based on its chemical composition and biological activities, which were previously unknown to the scientific community.

[1] Doctorate in Pharmaceutical Sciences. Universidade Federal do Paraná.
E-mail: thabordenowsky@gmail.com Lattes: http://lattes.cnpq.br/6495097078916254
[2] Dr. in Chemistry. Universidade Federal de Santa Catarina.
E-mail: obdulio@ufpr.br Lattes: http://lattes.cnpq.br/6686286192184001
[3] Dr. in Agronomy. Universidade Federal do Paraná. E-mail: dallarmi@ufpr.br
Lattes: http://lattes.cnpq.br/4747666293431338
[4] Dr. in Pharmaceutical Sciences. Universidade Federal do Paraná. E-mail: jodias@ufpr.br
Lattes: http://lattes.cnpq.br/5611247352060367
[5] Dr. in Pharmacology. Universidade Federal de Santa Maria. E-mail: dfarm@ufpr.br
Lattes: http://lattes.cnpq.br/7759064920324989
[6] Dr. in Pharmaceutical Sciences. Universidade Federal do Paraná. E-mail: elisartor@gmail.com
Lattes: http://lattes.cnpq.br/5482375295945080
[7] Dr. in Pharmaceutical Sciences. Universidade Federal do Paraná. E-mail: cintia08anjos@gmail.com
Lattes: http://lattes.cnpq.br/1475811202631506

**Keywords:** Medicinal Plants. Solanum Capsicoides. Alkaloids.

**RESUMO**

As solanáceas manifestam potencial terapêutico que deve ser investigado, sendo que diversos membros da família Solanaceae são utilizados no tratamento de uma série de quadros clínicos como em doenças respiratórias, oftalmológicas, doença de Parkinson, quadros espasmódicos e como anti-inflamatórios. O objetivo do estudo é apresentar um protocolo de revisão sistemática a respeito dos extratos da espécie Solanum capsicoides. (SOLANACEAE): prospecção do perfil fitoquímico e ensaios biológicos dos frutos. A pesquisa bibliográfica foi realizada nas bases de dados as bases de dados Web of Science (WoS), Science Direct e Scopus, conforme os protocolos estabelecidos pelo Methodi Ordinatio (MO). Paralelamente com base nos resultados foi feita as visualizações da rede bibliométrica e o mapeamento de resultados específicos usando o software VOSviewer®. Considera-se através dos textos apresentados que os resultados obtidos podem contrbuir, com informações sobre as características pautada na constituição química e atividades biológicas até então um tanto desconhecidas à comunidade científica para esta espécie.

**Palavras-chave:** Plantas Medicinais. Solanum Capsicoides. Alcalódes.

**RESUMEN**

Las solanáceas demuestran un potencial terapéutico que justifica una mayor investigación. Varios miembros de la familia Solanaceae se utilizan para tratar diversas afecciones clínicas, como enfermedades respiratorias y oftalmológicas, enfermedad de Parkinson, afecciones espasmódicas y como antiinflamatorios. El objetivo de este estudio es presentar un protocolo de revisión sistemática de extractos de la especie Solanum capsicoides (SOLANACEAE): prospectando el perfil fitoquímico y los ensayos biológicos de los frutos. La búsqueda bibliográfica se realizó en las bases de datos Web of Science (WoS), Science Direct y Scopus, de acuerdo con los protocolos establecidos por el Methodi Ordinatio (MO). Simultáneamente, con base en los resultados, se realizaron visualizaciones de redes bibliométricas y mapeo de resultados específicos utilizando el software VOSviewer®. Los resultados obtenidos de los textos presentados pueden aportar información sobre las características de esta especie, basadas en su composición química y actividades biológicas, previamente desconocidas para la comunidad científica.

**Palabras clave:** Plantas Medicinales. Solanum Capsicoides. Alcaloides.

## 1 INTRODUCTION

Medicinal plants have been used by various cultures throughout history to prevent and treat diseases. They are valuable sources of bioactive compounds, which have pharmacological properties, including anti-inflammatory, antimicrobial, and antioxidant activities. (Gadelha *et al,*, 2013). Brazil has biodiversity and is home to a variety of biomes, each with unique characteristics that support a wide range of flora and fauna, including many medicinal plants. (Adalgiso, 2024).

The Solanaceae family, popularly known as nightshade, is one of the largest families of flowering plants, with about 98 genera and approximately 2,000 species. This family is widely recognized for its morphological diversity and the economic importance of many of its species, which include food, ornamental and medicinal plants. (Särkinen; *et al,* 2018; Moura *et al,* 2021). Within this Solanaceae family, the genus Solanum is one of the most extensive, comprising about 1,000 species. Plants in this genus are often highlighted for their phenotypic characteristics, which include variations in fruits, leaves, and flowers, as well as a rich diversity of bioactive compounds (Spooner *et al,* 2018).

Among these species, *Solanum capsicoides* stands out as a plant native to South America, especially found in Brazil and Paraguay. Its relevance goes beyond ornamental use; Its fruits contain bioactive compounds that have been the subject of research for their medicinal and nutritional properties. Recent studies indicate that extracts of this plant have antioxidant and anti-inflammatory activities, as well as potential health benefits (Santos *et al,* 2022). These characteristics make S. capsicoides a promising candidate for investigations in phytotherapy, due to its diversity of secondary metabolites that may have beneficial effects. (Newman & Cragg, 2016).

Among their secondary metabolites, alkaloids stand out for their antimicrobial and anti-inflammatory activities, contributing to the prevention of infections (Santos *et al,* 2022). Flavonoids are recognized for their antioxidant properties, which help neutralize free radicals, playing an important role in preventing chronic diseases such as cancer and cardiovascular disease (Duarte *et al,* 2020).

Terpenoids have been investigated for their anti-inflammatory and antimicrobial properties (Del prado Audelo, *et al,* 2021). Although glycoalkaloids are known for their toxicity in high concentrations, at controlled doses, they can have beneficial effects, such as promoting digestive health (Almeida *et al,* 1995). In addition, phenolic compounds are appreciated for their anti-inflammatory and antioxidant properties, contributing to cardiovascular health and the prevention of degenerative diseases (da Silva *et al,* 2017)

Phytochemical screening is essential in the discovery of new sources of therapeutic agents of economic importance.

The objective of this study is to present a systematic review protocol regarding the extracts of the species *Solanum capsicoides*. (SOLANACEAE). The bibliographic search was carried out in the Web of Science (WoS), Science Direct and Scopus databases, according to the protocols established by the Methodi Ordinatio (MO).

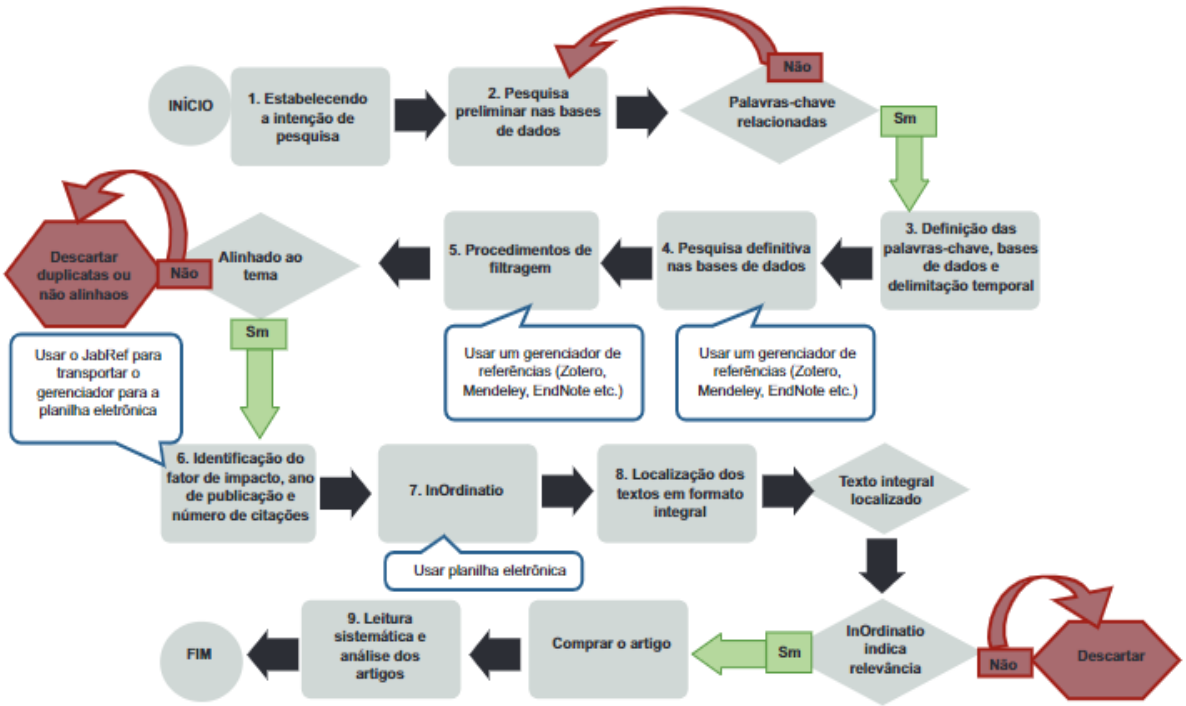
## 2 METHODOLOGY

The literature review is part of the investigation process, involving stages of localization, analysis and synthesis of scientific material already published. On the other hand, it is an in-depth analysis of the existing material of the area of study, with the purpose of defining problems and information about current knowledge and gaps in a given topic. (Pagani, *et al,* 2018),

In order to meet the perspectives of a literature review, it was decided to use the protocols established by Pagani, Kovaleski and Resende (2015; 2017; 2018), called Methodi Ordinatio (MO). The steps for conducting a systematic literature review, according to the OM protocol, are shown in Figure 1.

**Figure 1**

*Stages of Methodi Ordinatio and the use of information and communication technologies in each stage*

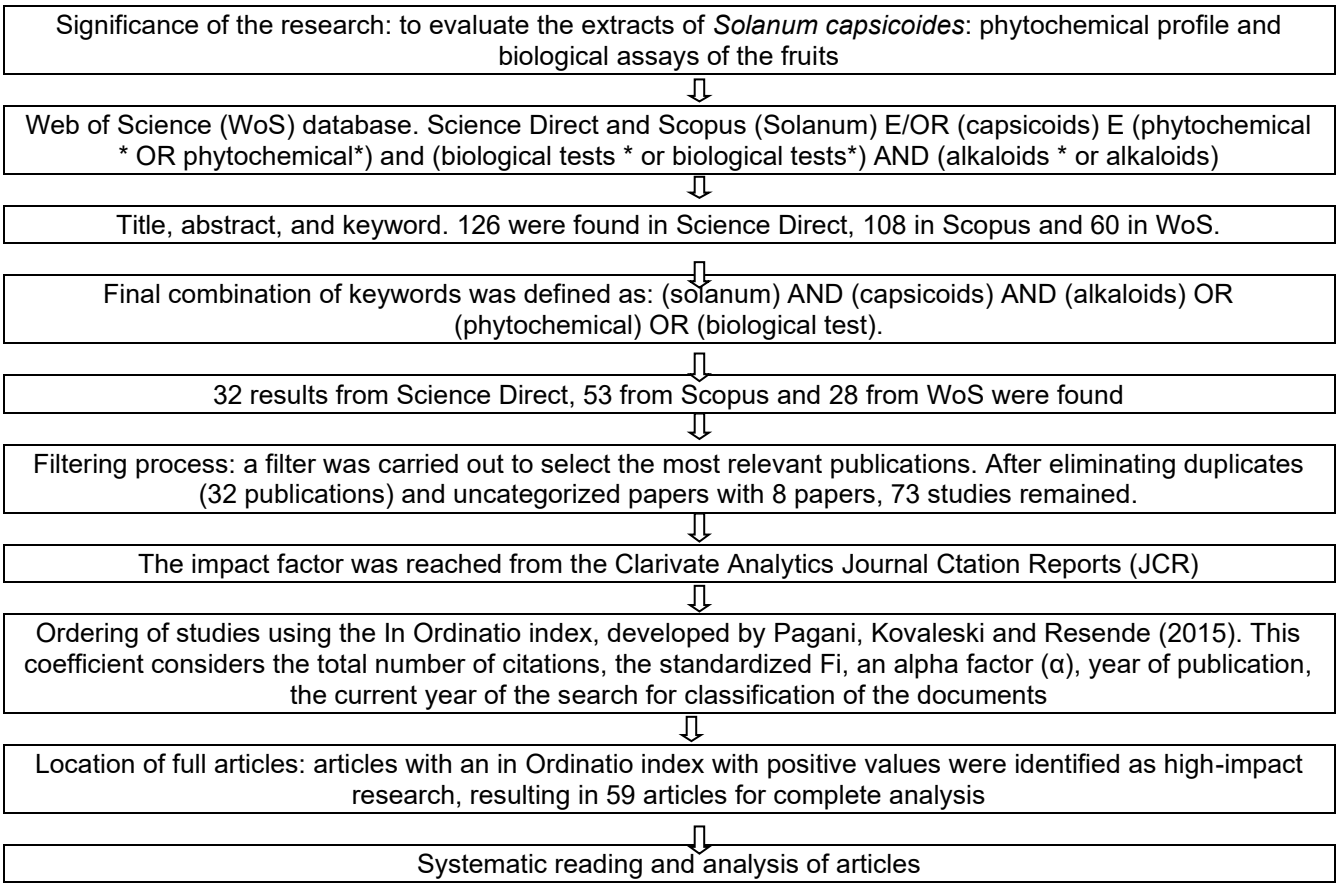



Source: Pagani, 2018.

Stages 1, 2 and 3 are considered preliminary, in these stages searches and experimental combinations were carried out in some databases. After these steps, the Web of Science (WoS), Science Direct, and Scopus databases were considered for the study, due to the articles related to the scope of the study. According to the flowchart of the steps of Methodi Ordinatio (Figure 2).

**Figure 2**

***F**lowchart of the Steps of Methodi Ordinatio and communication in each step*




Source: The author, 2025.

The search was composed of words using Boolean operators and wildcard symbols, with the topic field, which includes title, abstract, and keywords. The final combination of keywords was defined as: (solanum) AND (capsicoids) AND (alkaloids) OR (phytochemical) OR (biological test).

In step 4, the results of the 3 databases were exported by RIS format for further analysis by tools such as Mendeley reference manager. After the definitive search, the following filtering criteria were applied in step 5: I. Duplicate articles; and, II. Articles out of scope. After eliminating duplicates (32 publications) and works not categorized as article 8 works, 73 studies remained.

In step 6, the impact factor of each article in the journal of origin, the year of publication

collected of the article itself, and, finally, the number of citations obtained through Google Scholar® were identified. Martín-Martín *et al.*, (2018) showed that Google Scholar finds significantly more citations than Scopus and WoS in all subject fields. The impact factor was reached from the Clarivate Analytics Journal Citation Reports (JCR). Subsequently, in step 7, the InOrdinatio equation (1) was applied, where the journal's Impact Factor (Fi) is considered, Coefficient α which refers to the importance of the topicality for the researched topic (whose value is defined by the researcher from 1 to 10 (where the closer to α is to 10, the more important it is that the documents have been published in the current year), the year of publication and the current year of the search for classification of the documents. A α close to 1 resulted in wallets with classic papers. If recent papers are more important for the study, the value of α should be close to 10. This study selected a α equal to 5 to provide a balance in time, not favoring recent relevant published articles that present citations), Year of research (AnoPesq), Year of publication of the article (AnoPub), and Number of citations of the article in other studies (Ci). To apply the InOrdinatio formula, using Microsoft Excel® spreadsheets. InOrdinatio = (Fi / 1000) + α* [10 - (PesqAnnual – PubYear)] + (∑ Ci) (1).

Finally, in steps 8 and 9, the files were downloaded, articles with an InOrdinatio index with positive values (59 articles) were identified as high-impact research, and systematic reading of the selected articles was carried out. To perform the complete analysis of the final portfolio, some characteristics were considered, although not all articles covered all the topics analyzed.

At the same time, based on the results, the visualizations of the bibliometric network and the mapping of specific results were carried out using the VOSviewer software (Waltman, 2020; Van Eck; Waltman, 2010). The large label and circle will show the most important items. The larger the circle, the greater the contribution of that item and the closer and thicker the bond between two items, the greater the relationship, determined by the color of an item to which the cluster belongs.

## 3 RESULTS AND DISCUSSION

The collected material was classified and ordered according to the title of the article, authors, year of publication, journal, citations, impact factor and classification in ordinatio. Articles with productions related to the *plant Solanum capsicoides* using the Methodi Ordinatio Bibliometrics were presented in the identified material, which cannot directly measure articles, but is an indicator of quality, since it provides numbers of publications around the world (such as countries, largest references and largest cited articles).

It is detailed that from this production, this study presents the results provided by the

final set of 59 articles considered to be of high impact by the entire set of exclusion and support criteria by Methodi Ordinatio.

**Table 1**

*Table of articles according to order in Methodi Ordinatio (MO)*

| Raking | Author | Title | in Ordinatio |
|---|---|---|---|
| 1 | Xia, G.-y., Cao, S.-j., Chen, L.-x. and Qiu, F. | Natural withanolides, an update††Electronic supplementary information (ESI) available. See DOI: 10.1039/d1np00055a | 297,6842105 |
| 2 | Xia, G., Cao, S., Chen, L., & Qiu, F. | Natural withanolides, an update††Electronic supplementary information (ESI) available. | 208,68421 |
| 3 | Meyer, R.S., Whitaker, B.D., Little, D.P., Wu, S.-B., Kennelly, E.J., Long, C.-L. and Litt, A. | Parallel reductions in phenolic constituents resulting from the domestication of eggplant | 141,4736842 |
| 4 | Sitoe, E., & Van Wyk, B.-E. | An inventory and analysis of the medicinal plants of Mozambique. | 139 |
| 5 | Keenan, R., Lamb, D., Woldring, O., Irvine, T. and Jensen, R. | Restoration of plant biodiversity beneath tropical tree plantations in Northern Australia | 131,122807 |
| 6 | Yazbek, P.B., Matta, P., Passero, L.F., Santos, G.D., Braga, S., Assunção, L., Sauini, T., Cassas, F., Garcia, R.J.F., Honda, S., Barreto, E.H.P. and Rodrigues, E. | Plants utilized as medicines by residents of Quilombo da Fazenda, Núcleo Picinguaba, Ubatuba, São Paulo, Brazil: A participatory survey | 125,7368421 |
| 7 | Hasan, M.N., Azam, N.K., Ahmed, M.N. and Hirashima, A. | A randomized ethnomedicinal survey of snakebite treatment in southwestern parts of Bangladesh | 106,2894737 |
| 8 | Simões, L.O., Conceição, G., Ribeiro, T.S., Jesus, A.M., Fregoneze, J.B., Silva, A.Q.G., Petreanu, M., Cechinel, V., Niero, R., Niero, H., Tamanaha, M.S., Silva, D.F., Simões, L.O., Conceição-Filho, G., Ribeiro, T.S., Jesus, A.M., Fregoneze, J.B., Silva, A.Q.G., Petreanu, M., Cechinel-Filho, V., Niero, R., Niero, H., Tamanaha, M.S. and Silva, D.F. | Evidences of antihypertensive potential of extract from *Solanum capsicoides All*. in spontaneously hypertensive rats | 103,0394737 |
| 9 | Leitão, F., Leitão, S.G., da Fonseca-Kruel, V.S., Silva, I.M. and Martins, K. | Medicinal plants traded in the open-air markets in the State of Rio de Janeiro, Brazil: an overview on their botanical diversity and toxicological potential | 100,1578947 |
| 10 | Kohara, A., Nakajima, C., Hashimoto, K., Ikenaga, T., Tanaka, H., Shoyama, Y., Yoshida, S. and Muranaka, T. | A novel glucosyltransferase involved in steroid saponin biosynthesis in *Solanum aculeatissimum* | 95,57894737 |
| 11 | Longuefosse, J.-L. and Nossin, E. | Medical ethnobotany survey in Martinique | 89,54511278 |
| 12 | Gao, L., Hou, B., Cai, M.L., Zhai, J.J., Li, W.H. and Peng, C.L. | General laws of biological invasion based on the sampling of invasive plants in China and the United States | 85,0877193 |
| 13 | Ramadan, A. M., Mohammed, T., Al-Ghamdi, K. M., Alghamdi, A. J., & Atef, A. | The first report describes features of the chloroplast genome of Withania frutescens. | 80 |

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| 14 | Silva, T.M.S., Nascimento, R.J.B., Batista, M.M., Agra, M.F. and Camara, C.A. | Brine shrimp bioassay of some species of Solanum from Northestern Brazil | 78,53560372 |
| 15 | Lin, Y.C., Chao, C.H., Ahmed, A.F., Chen, Y.Y., Hwang, T.L., Liu, H.Y. and Sheu, J.H. | Withanolides and 26-Hydroxylated Derivatives with Anti-Inflammatory Property from *Solanum Capsicoide* | 73,73684211 |
| 16 | Haliski, &Istrok;. P., Samuels, J. and Stepnowski, P. | Multivariate analysis as a key tool in chemotaxonomy of brinjal eggplant, African eggplants and wild related species | 72,67669173 |
| 17 | French-Monar, R.D., Jones, J.B. and Roberts, P.D. | Characterization of *Phytophthora capsici* associated with roots of weeds on Florida vegetable farms | 71,52046784 |
| 18 | Liu, Y., Li, X.Y., Wu, J.T., Wang, H., Meng, X., Pan, J., Guan, W., Algradi, A.M., Naseem, A., Kuang, H.X., & Yang, B.Y | Fourteen undescribed steroidal saponins from *Solanum capsicoides* leaves and their neuroprotective effects. | 72 |
| 19 | Chen, B.W., Chen, Y.Y., Lin, Y.C., Huang, C.Y., Uvarani, C., Hwang, T.L., Chiang, M.Y., Liug, H.Y. and Sheu, J.H. | Capsisteroids A-F, withanolides from the leaves of *Solanum capsicoides* | 65,14035088 |
| 20 | Liu, Y., Meng, X., Wang, H., Sun, Y., Wang, S.-Y., Jiang, Y.-K., Algradi, A. M., Naseem, A., Kuang, H.-X., & Yang, B.-Y | Inositol Derivatives with Anti-Inflammatory Activity from Leaves of *Solanum capsicoides Allioni.* | 62,684211 |
| 21 | da Silva, R.S., Kumar, L., Shabani, F., Ribeiro, A.V. and Picanço, M.C. | Dry stress decreases areas suitable for Neoleucinodes elegantalis (Lepidoptera: Crambidae) and affects its survival under climate predictions in South America | 60,75438596 |
| 22 | Liu, Y., Meng, X., Wang, H., Sun, Y., Wang, S.Y., Jiang, Y.K., Algradi, A.M., Naseem, A., Kuang, H.X. and Yang, B.Y. | Inositol Derivatives with Anti-Inflammatory Activity from Leaves of *Solanum capsicoides Allioni* | 57,68421053 |
| 23 | Overholt, W.A., Markle, L., Rosskopf, E., Manrique, V., Albano, J., Cave, E. and Adkins, S. | The interactions of tropical soda apple mosaic tobamovirus and Gratiana boliviana (Coleoptera: Chrysomelidae), an introduced biological control agent of tropical soda apple (*Solanum viarum*) | 53,9122807 |
| 24 | Ikenaga, T., Handayani, R. and Oyama, T. | Steroidal saponin production in callus cultures of Solanum aculeatissimum Jacq. | 52,73684211 |
| 25 | Chen, B.W., Lin, Y.C. and Sheu, J.H. | Structures and bioactivities of withanolides from the leaves of *Solanum capsicoides* | 52,58479532 |
| 26 | Tsai, L.-C., Yu, Y.-C., Hsieh, H.-M., Wang, J.-C., Linacre, A. and Lee, J.C.-I. | Species identification using sequences of the trnL intron and the trnL-trnF IGS of chloroplast genome among popular plants in Taiwan | 50,52046784 |
| 27 | Ramadan, A.M., Mohammed, T., Al-Ghamdi, K.M., Alghamdi, A.J. and Atef, A. | The first report describes features of the chloroplast genome of Withania frutescens | 50 |
| 28 | Dharman, A.K. and Anilkumar, M. | Micropropagation through indirect organogenesis in *Solanum capsicoides All.*, and assessment of clonal fidelity using ISSR markers | 49,70175439 |
| 29 | Guézou, A., Pozo, P. and Buddenhagen, C. | Preventing establishment: An inventory of introduced plants in Puerto Villamil, Isabela Island, Galapagos | 47,3003096 |
| 30 | Mendes Resende, J.V., de Sá, N.M.D., de Oliveira, M.T.L., Lopes, R.C., Garrett, R. and Moreira Borges, R. | Chemical profiling of herbarium samples of *Solanum (Solanaceae)* using mass spectrometry | 47,05263158 |

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| 31 | Dey, A. and De, J.N. | Traditional use of plants against snakebite in indian subcontinent: A review of the recent literature | 44,69298246 |
| 32 | Medal, J.C., Pitelli, R.A., Santana, A., Gandolfo, D., Gravena, R. and Habeck, D.H. | Host specificity of Metriona elatior, a potential biological control agent of tropical soda apple, *Solanum viarum*, in the USA | 43,62105263 |
| 33 | Bubici, G. and Cirulli, M. | Screening and selection of eggplant and wild related species for resistance to Leveillula taurica | 25,51315789 |
| 34 | Cardoso, J., Tonelli, L., Kutz, T.S., Brandelero, F.D., Vargas, T.D. and Dallemole-Giaretta, R. | Reaction of wild Solanaceae rootstocks to the parasitism of Meloidogyne javanica | 24,73684211 |
| 35 | Silva, T.M.S., Batista, M.M., Camara, C.A. and Agra, M.F. | Molluscicidal activity of some Brazilian Solanum spp. (Solanaceae) against Biomphalaria glabrata | 22,63157895 |
| 36 | Feliciano, E.A. and Salimena, F.R.G. | Solanaceae in the Serra Negra, Rio Preto, Minas Gerais | 21,97975709 |
| 37 | Adkins, S. and Rosskopf, E.N. | Tropical soda apple mosaic virus identified in *Solanum capsicoides* in Florida | 20,7120743 |
| 38 | Diaz, R., Menocal, O., Montemayor, C. and Overholt, W.A. | Biology and host specificity of anthonomus tenebrosus (Coleoptera: Curculionidae) : A herbivore of tropical soda apple | 20,66028708 |
| 39 | Wang, H., Liu, Y., Jang, Y.K., Wang, S.Y., Li, X.M., Pan, J., Guan, W., Algradi, A.M., Kuang, H.X., & Yang, B.Y. (n.d.). | henylpropanoids from *Solanum capsicoides* and their anti-inflammatory activity. | 20 |
| 40 | Garbole, J., & Teklu, B. | Land use change impose variation on woody fodder species composition, and production in the dryland ecosystem of West Guji southern Ethiopia. | 19 |
| 41 | Bryson, C.T., Reddy, K.N. and Byrd, J.D. | Growth, Development, and Morphological Differences among Native and Nonnative Prickly Nightshades (Solanum spp.) of the Southeastern United States | 17,85964912 |
| 42 | Mala, B.R.J., Krishnamoorthy, S.V., Kumar, P.S., Singh, T.H., Shivashanakara, K.S. and Jayanthi, P.D.K. | Wild *Solanum* species exhibit feeding antixenosis against ash weevil, Myllocerus subfasciatus Guerin-Meneville (Coleoptera: Curculionidae) | 16 |
| 43 | Agra, M.D. and Berger, L.R. | Flora of Paraíba, Brazil: *Solanum L.* (Solanaceae) | 12,9122807 |
| 44 | Loiola, M.I.B., Rocha, E.A., Baracho, G.S. and Agra, M.D. | Flora of Paraíba, Brazil: *Solanum L.,* Solanaceae | 12,9122807 |
| 45 | Baptista, J. O., Alexandre, R. S., DE LIMA, P. A. M., Lopes, S. O., DE ARAUJO, C. P., DE OLIVEIRA, C. M. B., & Lopes, J. C. | LUMINOSITY, TEMPERATURE, AND SUBSTRATES ON THE GERMINATION OF *Solanum capsicoides.* | 11,684211 |
| 46 | Petreanu, M., Guimarães, A.A.A., Broering, M.F., Ferreira, E.K., Machado, I.D., Gois, A.L.T., de Carvalho, J.E., Delle Monache, F., Niero, R. and Santin, J.R. | Antiproliferative and toxicological properties of methanolic extract obtained from *Solanum capsicoides All.* seeds and carpesterol | 10,78947368 |
| 47 | Batista-Franklim, C.P.R. and Gonçalves-Esteves, V. | Palynology of species of *Solanum L.* (Solanaceae A. Juss.) from the restingas of Rio de Janeiro State, Brazil | 10,26315789 |
| 48 | Medal, J.C. and Cuda, J.P. | Establishment and Initial Impact of the Leaf-Beetle Gratiana boliviana (Chrysomelidae), first biocontrol | 10,03759398 |

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| | | agent released against tropical soda apple in Florida | |
| 49 | Wang, H., Liu, Y., Jang, Y.K., Wang, S.Y., Li, X.M., Pan, J., Guan, W., Algradi, A.M., Kuang, H.X. and Yang, B.Y. | Phenylpropanoids from *Solanum capsicoides* and their anti-inflammatory activity | 10 |
| 50 | da Silva, E.M., da Silva Rocha, F., Barbosa, E.A., Oliveira, J.A.A., Neves, J.M.G., do Rosário Barbosa, D.M.C. and de Fátima Silva Muniz, M. | Reaction of wild solanaceae species to Meloidogyne incognita | 9,684210526 |
| 51 | Petreanu, M., Maia, P., Pittarello, J.L.D., Loch, L.C., Delle Monache, F., Perez, A.L., Solano-Arias, G., Filho, V.C., de Souza, M.M. and Niero, R. | Antidepressant-like effect and toxicological parameters of extract and withanolides isolated from aerial parts of *Solanum capsicoides All.* (Solanaceae) | 8,736842105 |
| 52 | Anil Kumar, V.S., Nair, M.C., Soumya, M., Murugan, K., Kumar, V.S.A., Nair, M.C., Soumya, M. and Murugan, K. | Taxonomic delineation of *Solanum exarmatum*, a new species from *Solanum capsicoides All*. in Southern Western Ghats, Kerala, India | 8,584795322 |
| 53 | Baptista, J.O., Alexandre, R.S., DE LIMA, P.A.M., Lopes, S.O., DE ARAUJO, C.P., DE OLIVEIRA, C.M.B. and Lopes, J.C. | LUMINOSITY, TEMPERATURE, AND SUBSTRATES ON THE GERMINATION OF *Solanum capsicoides* | 6,684210526 |
| 54 | Anilkumar, V.S. and Murugan, K. | Floral morphometrics of *Solanum L* (Solanaceae) species in southern western ghats: Correlation with interspecific taxonomic affinities | 6,157894737 |
| 55 | Lyumugabe, F. and Bajyana Songa, E. | Traditional Fermented Alcoholic Beverages of Rwanda (Ikigage, Urwagwa, and Kanyanga): Production and Preservation | 4,736842105 |
| 56 | Nobee, M.M., Chowdhury, A.R., Rodru, F.I., Ahmed, J., Paul, H.K., Sarkar, K.K. and Islam, F. | Evaluation of Cytotoxic and Neuropharmacological Activity of Methanolic Extract of *Solanum capsicoides* Leaves | 4 |
| 57 | da Silva, E. M., da Silva Rocha, F., Barbosa, E. A., Oliveira, J. A. A., Neves, J. M. G., do Rosário Barbosa, D. M. C., & de Fátima Silva Muniz, M. | Reaction of wild solanaceae species to Meloidogyne incognita. | 3,6842105 |
| 58 | Welman, W.G. | The genus *Solanum* (Solanaceae) in southern Africa: subgenus Leptostemonum, the introduced sections Acanthophora and Torva | 2,11 |
| 59 | Jarret, R., Levy, I., Potter, T. and Cermak, S. | Oil and fatty acids in seed of eggplant *(Solanum Melongena L.)* and some related and unrelated *Solanum* species | 0,78947368 |

Source: The author, 2024.

The most relevant study on this subject, based on the InOrdinatio index, was published by Gui-yang Xia (2022), in Natural Product Reports. The review reports on the latest progress and perspectives on structural classification, biological activities and mechanisms, metabolism and pharmacokinetic investigations, biosynthesis, chemical synthesis and structural modifications, as well as future research directions of the promising natural withanolides.

The high InOrdinatio index of 297.68 achieved is due to a high IF of the journal (SE =

10.2) and number of citations of this study (52 citations). The journal with the highest number of publications in this portfolio was Phytochemistry with 7% of the articles, followed by Acta Botanica Brasilica with 5%. Among the others such as Journal of Ethnopharmacology, Naunyn-Schmiedebergs Archives Of Pharmacology, Plant Disease and Brazilian Journal of Pharmacognosy. As for the methodological survey, it was observed the presence of (n = 3) in research elaborated from Literature Reviews, being integrative reviews of qualitative approaches using the analysis of documents from various sources and research of an epidemiological nature.

The capture and analysis of material in various ways, surveying, identification, cataloguing and documentation of medicinal plant species (n=5) are recorded. Infectious, immunological, neurological, inflammatory, and other evaluations were evaluated (n=12)

**Table 2**

*Characterization of the types of studies regarding the methodological survey*

| Types of studies | No. of studies |
|---|---|
| Documentation, cataloging | 5 |
| Anti-inflammatory, neuroprotective, antivenom, antihypertensive, anticancer, antidepressant evaluation | 12 |

Source: The author, 2024.

In some selected studies (n=12), the methanol extract of *S. capsicoides* resulted in a potential attenuation of the development of hypertension in HRS, decreased cardiac hypertrophy, increased urine volume and improved vascular function and consequently antihypertensive effect in HRS. (Simões, *et al,* 2016). On the other hand, it did not show molluscicidal activity in relation to some species of Solanum. (Silva, *et al,* 2007). Steroids alone were not cytotoxic against a limited panel of cancerous cell lines (You-Cheng Lin, *et al,* 2019)

Modern pharmacological studies have shown that aerial parts of S. capsicoides have antihypertensive and antidepressant effects (Simões, *et al,* 2016; Petreanu, *et al,* 2019). Its extracts exhibited anti-inflammatory and analgesic effects (Chen, *et al,* 2015). treatment of neurodegenerative diseases. Therefore, the compounds solsurinositol E and solsurinositol G are promising for the treatment of neuroinflammation. Liu, Y, *et al,* 2022). In addition, phenylpropanoids, compounds found in the leaves of *Solanum capsicoides*, showed anti-inflammatory activities. (Han Wang, *et al,* 2023)

According to studies S. capsicoides extract exhibited antiproliferative activity mainly in the leukemia cell line (K562). (Petreanu *et al,* 2016)

Carpesterol also showed antiproliferative activity in glioma (U251), breast (MCF-7),

kidney (786-0), ovary (OVCAR-03) and K562 cell lines. The data obtained show that S. capsicoides extract has antiproliferative effects and has no toxicological effects. (Petreanu *et al,* 2016)

Among some plants, *Solanum capsicoides* is used for neutralization of snake venom have traditionally been pharmacologically tested for its anti-venom effectiveness. (Dey *et al*, 2012; Hasan *et al*, 2016)

However, Nobee *et al*, 2023, demonstrate that the results corroborate that the methanol extract of *Solanum capsicoides* , in addition to CNS depressant and anxiolytic effects, may have significant cytotoxic characteristics.

And finally, there are studies regarding venom inhibitor compounds that could be used in combination therapy with antiserum in the near future (Hasan *et al*, 2016)

In view of the studies, there is, in addition to scientific research on medicinal plants, characterization of ethnomedical data and the treatment of various types of diseases, along with a morphometric approach, detailed description, including distribution with relevant taxonomic notes; (Loiola, *et al;* Angra, *et al* 2009; Anil Kumar *et al*, 2015; 2014).

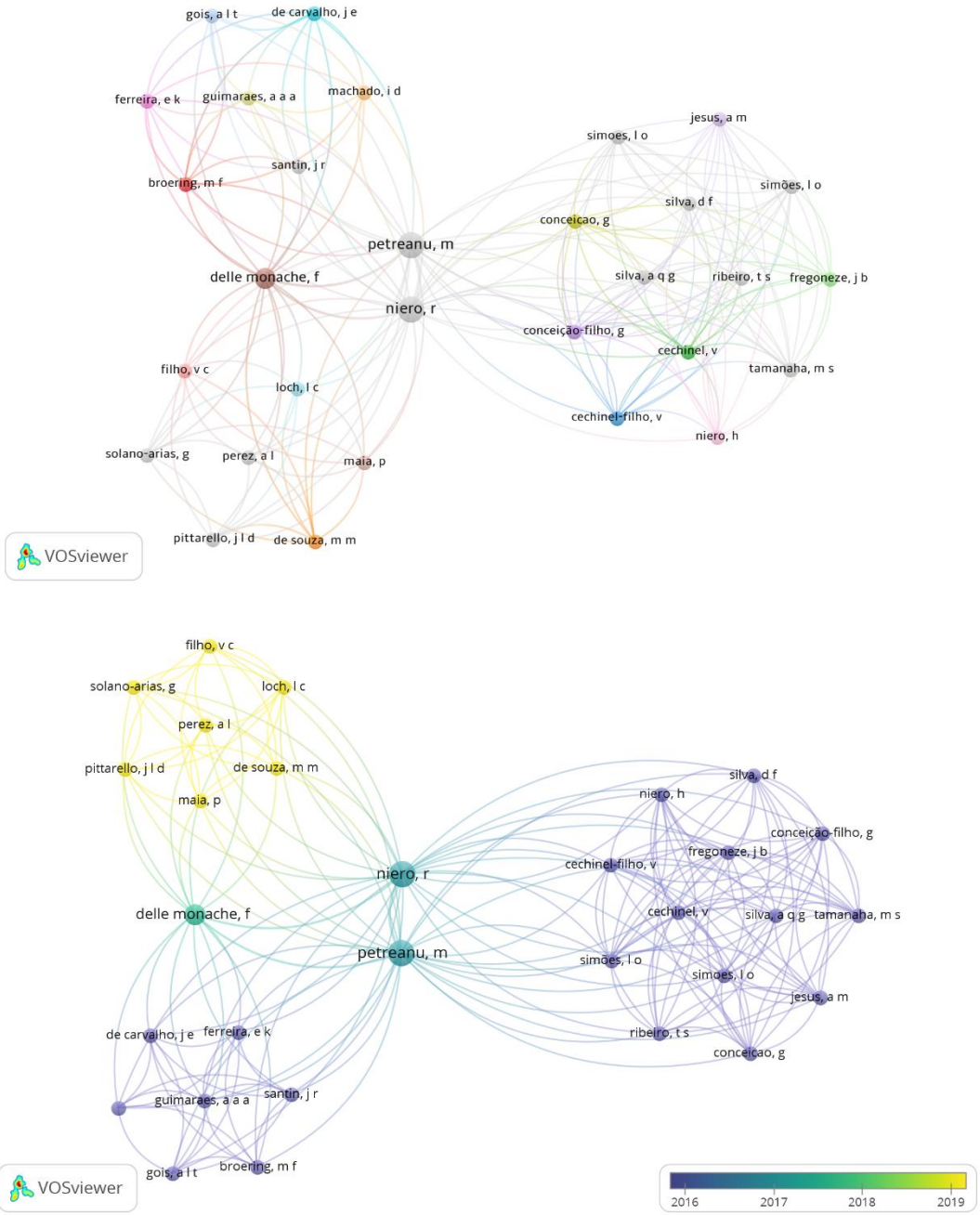
However, there is a need for detailed investigation under their traditional uses to confirm the potential of these plants as a source of new medicines

There is a need for new approaches through fragment consultations and meaningful identification of compounds based on molecular formulas. Studies report that this new and effective approach can help research expand the rate of compound identification in dereplication studies using molecular networks.

At the same time, based on the results, the visualizations of the bibliometric network and the mapping of specific results were carried out using the VOSviewer software (Waltman, 2020; Van Eck; Waltman, 2010).

**Figure 3**

*Mapping of authors and co-authors based on results from the Web of Science (WoS), Science Direct, and Scopus databases and year of publication*




Source: Prepared by the author, with the contribution of the VOSviewer software for the generation of the map, 2025.

Figure 3 shows 59 articles with the participation of 255 authors, co-authors, and affiliates in several distributed regions. Formation through nodes that connect in networks of nuclei, Petreanu, M; Niero, R, and Delle Monache, F. are the authors – prominent co-authors on the research. Of the countries where the most studies were carried out in this field of research, 35% are from Brazil, followed by the United States 14%, India 12%, China 10%

and Taiwan 8%. The size of the node and the item indicate the frequency of occurrence and its relationship, the closer they are between them. The large label and circle show the most important items. The larger the circle, the greater the contribution and the closer and thicker the bond between them, determined by the color to which the cluster belongs. In this map, the distance between two authors indicates the degree of relationship between them, and the shorter the distance, the greater the relationship. Also, close authors have greater similarity in their partnerships. The size of the printed name and color intensity do not infer the role in the research team. Therefore, the most prominently featured researchers may not necessarily be the principal investigator or the research team leader. However, it is observed that this mapping is supported by the choice of the database and keywords, this may have hidden studies with the same theme, but not indexed. However, its data allows for effective visualization through the chosen method.

## 4 FINAL CONSIDERATIONS

It is pointed out that the theme of the present research represents a new and promising area. However, it was found that there is a scarcity of specific publications related to the prospection of the phytochemical profile, secondary metabolites and biological assays of the fruits of the species *Solanum capsicoides*.

Based on the analyzed texts, it is considered that the results obtained can contribute significantly to information about the chemical characteristics and biological activities of this species, aspects that have been little explored by the scientific community until now. In addition, the study can favor the awareness of the population about the importance of native species for the environmental balance and the pharmacological potential that they can present, encouraging local preservation and avoiding their possible extinction.

It is noteworthy, however, that the appreciation of this traditional knowledge has been gradually decreasing, due to the growing use of modern medicine and the reduction in the transmission of popular knowledge between generations.

As a suggestion for future research, the need for additional studies aimed at the precise identification of the bioactive compounds responsible for the observed activities is highlighted. The literature reinforces that rigorous evidence is needed to enable the safe clinical use of these natural products.

## REFERENCES


Adalgiso, J. C. S., & Others. (2024). Jardim de suculentas como ferramenta de aprendizado: Elaboração de um recurso didático para o ensino da botânica. [Publisher or repository details needed].

Agra, M. D., & Berger, L. R. (2009). Flora of Paraíba, Brazil: Solanum L. (Solanaceae). Acta Botanica Brasilica, 23(3), 826–842. https://doi.org/10.1590/S0102-33062009000300023

Almeida, A. E. de, & Rocco, M. A. (1995). Glicoalcalóides dos frutos do Solanum flaccidum Vell. [Publisher or repository details needed].

Anil Kumar, V. S., Murugan, K., Nair, M. C., & Soumya, M. (2015). Taxonomic delineation of Solanum exarmatum, a new species from Solanum capsicoides All. in Southern Western Ghats, Kerala, India. Phytotaxa, 221(3), 295–300. https://doi.org/10.11646/phytotaxa.221.3.7

Anil Kumar, V. S., & Murugan, K. (2014). Floral morphometrics of Solanum L. (Solanaceae) species in Southern Western Ghats: Correlation with interspecific taxonomic affinities. Webbia, 69(2), 259–268. https://doi.org/10.1080/00837792.2014.955688

Chen, B. W., Lin, Y. C., Huang, C. Y., Uvarani, T. L., Hwang, M. Y., Chiang, H. Y., & Sheu, J. H. (2015). Capsisteroids A–F, withanolides from the leaves of Solanum capsicoides. RSC Advances, 5(108), 88841–88847. https://doi.org/10.1039/c5ra12014d

Chen, B. W., Lin, Y. C., & Sheu, J. H. (2015). Structures and bioactivities of withanolides from the leaves of Solanum capsicoides. Planta Medica, 81(16), 1430. https://doi.org/10.1055/s-0035-1558042

Da Silva, C. F. G., & Others. (2017). Otimização do processo de extração de compostos fenólicos antioxidantes do jiló (Solanum gilo Radi) e aplicação na estabilidade oxidativa do óleo de soja. Revista Virtual de Química, 9(2), 729–739. https://doi.org/10.21577/1984-6835.20170045

Del Prado-Audelo, M. L., & Others. (2021). Therapeutic applications of terpenes on inflammatory diseases. Frontiers in Pharmacology, 12, 704473. https://doi.org/10.3389/fphar.2021.704473

Dey, A., & De, J. N. (2012). Traditional use of plants against snakebite in Indian subcontinent: A review of the recent literature. African Journal of Traditional, Complementary and Alternative Medicines, 9(1), 153–174. https://doi.org/10.4314/ajtcam.v9i1.20

Duarte, M. M. (2020). Ilex paraguariensis A. St.-Hil.: Caracterização de morfotipos e genótipos para produção de compostos bioativos e propagação. [Doctoral dissertation]. [Repository or publisher details needed].

Gadelha, C. S., & Others. (2013). Estudo bibliográfico sobre o uso das plantas medicinais e fitoterápicos no Brasil. Revista Verde de Agroecologia e Desenvolvimento Sustentável, 8(5), 27–33.

Hasan, M. N., Azam, N. K., Ahmed, M. N., & Hirashima, A. (2016). A randomized ethnomedicinal survey of snakebite treatment in southwestern parts of Bangladesh.

Journal of Traditional and Complementary Medicine, 6(4), 337–342. https://doi.org/10.1016/j.jtcme.2015.03.007

Lin, Y. C., Chen, B. W., Huang, C. Y., & Sheu, J. H. (2019). Withanolides and 26-hydroxylated derivatives with anti-inflammatory property from Solanum capsicoides. Bulletin of the Chemical Society of Japan, 92(2), 336–343. https://doi.org/10.1246/bcsj.20180225

Liu, Y., & Others. (2024). Fourteen undescribed steroidal saponins from Solanum capsicoides leaves and their neuroprotective effects. Phytochemistry, 222, 114091. https://doi.org/10.1016/j.phytochem.2024.114091

Liu, Y., & Others. (2022). Inositol derivatives with anti-inflammatory activity from leaves of Solanum capsicoides Allioni. Molecules, 27(18), 6063. https://doi.org/10.3390/molecules27186063

Loiola, M. I. B., & Others. (2009). Flora of Paraíba, Brazil: Solanum L., Solanaceae. Acta Botanica Brasilica, 23(2), 330–342. https://doi.org/10.1590/S0102-33062009000200005

Martín-Martín, A., & Others. (2018). Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories. Journal of Informetrics, 12(4), 1160–1177. https://doi.org/10.1016/j.joi.2018.09.002

Moura, J. N., & Caires, C. S. (2021). A família Solanaceae Juss. no município de Vitória da Conquista, Bahia, Brasil. Paubrasilia, 4, e0049. https://doi.org/10.33447/paubrasilia.2021.e0049

Newman, D. J., & Cragg, G. M. (2016). Natural products as sources of new drugs from 1981 to 2014. Journal of Natural Products, 79(3), 629–661. https://doi.org/10.1021/acs.jnatprod.5b01055

Nobee, M. M., & Others. (2023). Evaluation of cytotoxic and neuropharmacological activity of methanolic extract of Solanum capsicoides leaves. Current Traditional Medicine, 9(6), e191022210333. https://doi.org/10.2174/2215083809666221019150333

Pagani, R. N., Kovaleski, J. L., & de Resende, L. M. M. (2017). Avanços na composição da Methodi Ordinatio para revisão sistemática de literatura. Ciência da Informação, 46(2), 161–176.

Pagani, R. N., Kovaleski, J. L., & Resende, L. M. (2015). Methodi Ordinatio: Uma proposta de metodologia para selecionar e classificar artigos científicos relevantes abrangendo o fator de impacto, número de citações e ano de publicação. Scientometrics, 105(3), 2109–2135. https://doi.org/10.1007/s11192-015-1744-x

Pagani, R. N., Kovaleski, J. L., & Resende, L. M. (2018). TICs na composição da Methodi Ordinatio: Construção de portfólio bibliográfico sobre modelos de transferência de tecnologia. Ciência da Informação, 47(1), 19–34.

Petreanu, M., & Others. (2019). Antidepressant-like effect and toxicological parameters of extract and withanolides isolated from aerial parts of Solanum capsicoides All. (Solanaceae). Naunyn-Schmiedeberg's Archives of Pharmacology, 392(8), 979–990. https://doi.org/10.1007/s00210-019-01648-9

Petreanu, M., & Others. (2016). Antiproliferative and toxicological properties of methanolic extract obtained from Solanum capsicoides All. seeds and carpesterol. Naunyn-Schmiedeberg's Archives of Pharmacology, 389(10), 1123–1131. https://doi.org/10.1007/s00210-016-1275-x

Santos, D. G., & Others. (2022). Bactérias promotoras de crescimento vegetal na produção de inflorescências de boca-de-leão (Antirrhinum majus L.). [Publisher or repository details needed].

Särkkinen, T., & Others. (2018). A revision of the Old World Black Nightshades (Morelloid clade of Solanum L., Solanaceae). PhytoKeys, 106, 1–223. https://doi.org/10.3897/phytokeys.106.21991

Silva, T. M. S., & Others. (2007). Brine shrimp bioassay of some species of Solanum from Northeastern Brazil. Revista Brasileira de Farmacognosia, 17(1), 35–38. https://doi.org/10.1590/S0102-695X2007000100008

Simões, L. O., & Others. (2016). Evidences of antihypertensive potential of extract from Solanum capsicoides All. in spontaneously hypertensive rats. Phytomedicine, 23(5), 498–508. https://doi.org/10.1016/j.phymed.2016.02.020

Spooner, D., & Others. (2012). The enigma of Solanum maglia in the origin of the Chilean cultivated potato, Solanum tuberosum Chilotanum Group. Economic Botany, 66(1), 12–21. https://doi.org/10.1007/s12231-011-9183-0

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics, 84(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Waltman, L., & Larivière, V. (2020). Special issue on bibliographic data sources. Quantitative Science Studies, 1(1), 360–362. https://doi.org/10.1162/qss_e_00023

Wang, H., & Others. (2022). Phenylpropanoids from Solanum capsicoides and their anti-inflammatory activity. Journal of Asian Natural Products Research, 24(9), 841–848. https://doi.org/10.1080/10286020.2022.2066529

Xia, G. Y., & Others. (2022). Natural withanolides, an update. Natural Product Reports, 39(4), 784–813. https://doi.org/10.1039/d1np00055a