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Legal Protection of New Plant Varieties: *Lamiaceae* Patent Cases Based on International Patent Classification †

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Abstract: This study aims to analyze patents relating to new plant varieties of *Lamiaceae*, a plant family recognized for the interest of these genera in the medicinal and aromatic fields. The study also seeks to identify the genera and species most exploited in innovative applications. To identify the latest trends in this area, we systematically reviewed patents concentrating on new varieties of *Lamiaceae*. The relevant patent documents were identified within a specialized database using the International Patent Classification. The United States encompasses all plant patents in this area, and it is considered the leading jurisdiction. This is also confirmed by the American organizations, which led the way with the most applicants. The *Lamiaceae* genera concerned with the legal protection of new plant varieties comprise 23 genera. Among them are *Plectranthus*, *Salvia*, and *Lavandula*, which present 55.4% of total patent documents in this area. The essential objective claimed by the majority of patent documents analyzed in this study is ornamental. Furthermore, other inventive purposes are also claimed in the patent documents, but with a low percentage, such as genetic engineering, the selection of a compound, etc.

Keywords: plant varieties, *Lamiaceae*; innovation; legal protection; plant patent

1. Introduction

The principal goal of sustainable agricultural development is to ensure food production to meet the needs of an ever-growing world population [1]. However, agriculture faces multiple challenges, including climate change, energy supply, and the scarcity of arable land [2,3]. Medicinal and aromatic plants play a significant role in the sustainable agricultural development. Their cultivation diversifies crops, helps conserve biodiversity, reduces the use of chemicals, improves soil health, creates income for farmers, promotes sustainable agriculture and conserves traditional knowledge [4,5]. These facts show the relevance of encouraging innovation in agriculture, especially that directly related to the development and selection of plant varieties expressing traits of interest [6].

Protecting researchers' intellectual property through a plant variety certificate or patent is highly relevant in this context [7]. The United States, followed by some other jurisdictions, has even introduced plant patent protection, which, like a patent, grants a 20-year monopoly of exploitation, especially to breeders who have invented or asexually discovered and reproduced a distinct and novel plant variety [8].

In addition, the patent system incorporates several classifications specific to plant production. Further, since 2018, a particular update on classification within the International Patent Classification (IPC) has concerned new plants or processes to obtain and reproduce them by tissue culture techniques (i.e., the subclass IPC code A01H). Furthermore, in this sub-class, angiosperms are classified in group A01H6/00 according to their

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botanic taxonomy (e.g., *Cannabaceae*, *Ericaceae*, *Hydrangeacae*, *Lamiaceae*, *Lauraceae*, etc.); however, in group A01H5/00, angiosperms are classified according to their plant parts (i.e., flowers, stems, roots, fruits, seeds, or leaves) [9].

Patent classification is a system for categorizing patents into technical fields that include all aspects of technology [10]. The most commonly used patent classification is IPC. This internationally recognized classification system, which is maintained by the World Intellectual Property Organization (WIPO), is used to classify almost all patent filings [11]. The IPC is organized hierarchically into sections, classes, sub-classes, groups, and subgroups. At each subsequent level or subdivision, classification becomes increasingly detailed [9].

Among medicinal and aromatic plants concerned by the new classification A01H6/50 (Figure 1), the *Lamiaceae* family is the largest and most distinctive flowering plant worldwide [12]. Also known as the mint family, it comprises approximately 200 genera (e.g., *Mentha*, *Thymus*, *Origanum*, *Rosmarinus*, *Ocimum*, *Salvia*, *Lavandula*, etc.) and around 3,300 species [13]. Plants in this family are herbs or shrubs often cultivated for medicinal, perfumery, culinary, and ornamental purposes [14].

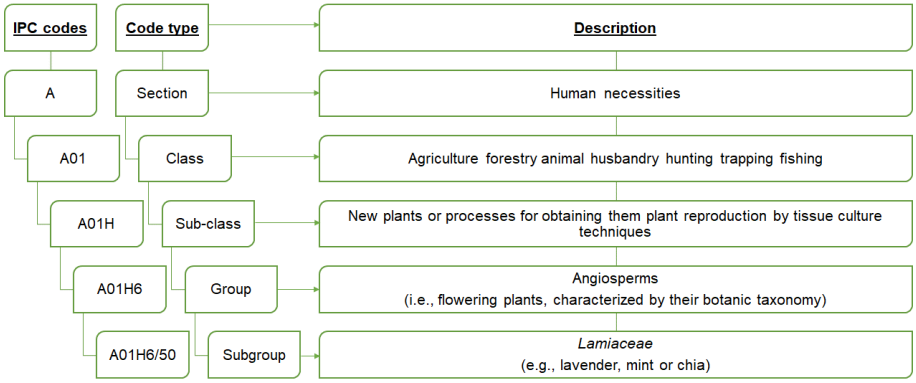

Figure 1. IPC main subgroup (A01H6/50) concerning *Lamiaceae* family since 2018 (Adapted from ref. [9]).

This study aims to analyze patents relating to new plant varieties of *Lamiaceae* family as well as to identify the genera and species most exploited in innovative applications. To identify the latest trends in this area, we systematically reviewed patents concentrating on new varieties of *Lamiaceae*. The relevant patents were identified through a specialized database, using the IPC code.

2. Resources and methods

The Lens database has been used [15], and research has been carried out into the IPC code of the patent documents (i.e., A01H6/50). Patent documents were then filtered to include only the following two types:

- Granted patents;
- Plant patents.

3. Results and discussion

3.1. Patent documents and publication

The first plant patent related to the IPC code A01H6/50 concerns a patent dedicated to an *Ajuga* reptans mutation named "Arctic Fox". It is a mutation with a completely unusual color that has never been recorded or documented in *Ajuga*. (also known as bugleweed). It features primarily white or creamy-white leaves that are edged with a deep avacodo-green edging of various widths, with the green edging being ruffled, with the degree

of ruffling depending on the thickness of the green margin. Furthermore, during cool seasons, the core of the leaf has a mottled part of silver-grey of various sizes, adding to the already stunning foliage effect [16]. On the other hand, 2017 was the year of the first granted patent. That concerns a method of extracting thymol from plant tissue of an oregano plant, *Origanum vulgare* [17].

Figure 2 presents the publication date of patent documents (granted patents and plant patents) related to the IPC code A01H6/50 (*Lamiaceae*) until 2023. In total, 443 patent documents have been found. 89.4% of these patent documents concern plant patents (396); however, granted patents present only 10.6%. The year 2022 was the year with the most granted patents and plant patents as well as patent documents. We identify 64 patent documents distributed as 20 granted patents and 44 plant patents.

Over time, the record of granted patents is almost low in relation to plant patents. This shows that inventors and/or applicants always tend to choose to protect their intellectual property through plant patents, which provide exclusive rights to the inventor of new and asexually reproduced plant varieties. This means that plant patent protection is beneficial in the case of the development of new and unique plant varieties [18].

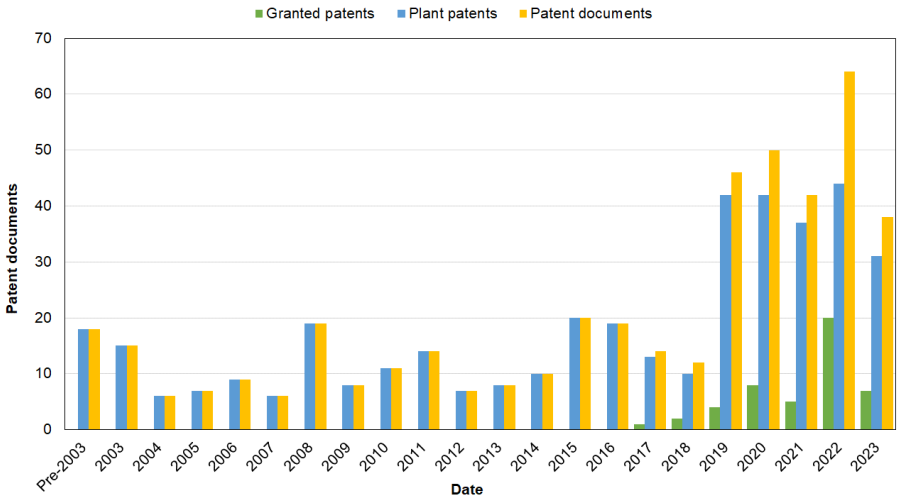

Figure 2. Publication date of patent documents (i.e., granted patents and plant patents) related to the IPC code A01H6/50 (*Lamiaceae*) until 2023.

3.2. Patent applicants

Patent applicants refer to individuals or entities that file a patent application to seek legal protection for their inventions [19]. The application concerns either a granted or a plant patent. In our case of the *Lamiaceae* family, the top 5 patent applicants as a function of patent documents until 2023 are displayed in Figure 3.

These top 5 include four organizations considered legal entities as well as one natural person. As a legal entity, the company "Walters Gardens, Inc." (Zeeland, MI, United States) is ranked as the first applicant that has recorded 43 patent documents. As a natural person, the applicant "Hansen Hans A." from the company "Walters Gardens, Inc." is ranked as the second applicant that has recorded 41 patent documents. In third place, the legal entity "Florida Foundation Seed Producers, Inc." (Marianna, FL, United States), as a legal entity, has recorded 30 patent documents. Finally, as for the fourth and fifth places on the podium, the legal entities "Ball Horticultural Company" (West Chicago, IL, United States) and "Terra Nova® Nurseries, Inc." (Canby, OR, United States) have recorded 29 and 25 patent documents, respectively. It is important to note that all patent documents registered in these top 5 are plant patents. As seen above, applicants always tend to choose to protect their intellectual property through plant patents in the case of the development of new and unique plant varieties.

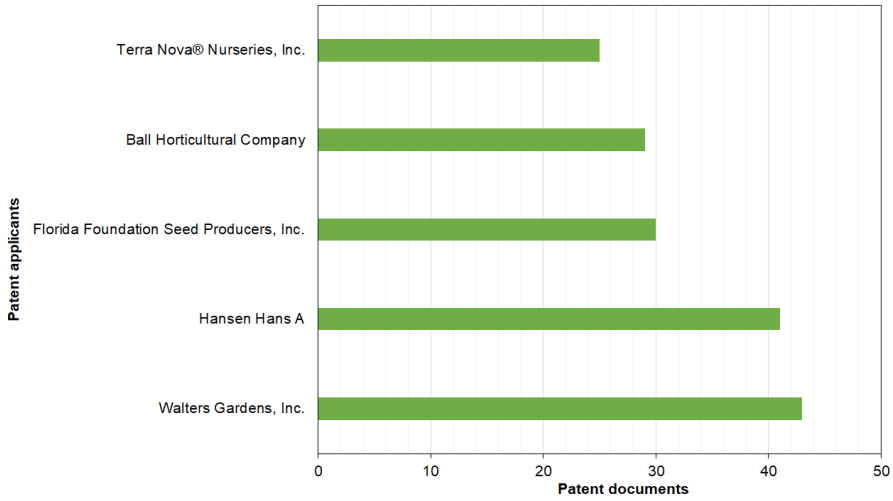

Figure 3. Patent applicants (top 5) as a function of patent documents (i.e., granted patents and plant patents) related to the IPC code A01H6/50 (*Lamiaceae*) until 2023.

3.3. Patent jurisdictions

In summary, patent jurisdictions are geographic regions or countries where patent laws and regulations are enforced, governing the granting and protection of patents within their respective borders. A patent jurisdiction through the government authority can be national (e.g., Moroccan Office of Industrial and Commercial Property), regional (e.g., European Patent Office), or international (e.g., World Intellectual Property Organization that administers the international agreement: Patent Cooperation Treaty) [20].

Regarding Figure 4, which presents the jurisdictions of patent documents related to the IPC code A01H6/50 (*Lamiaceae*), there are only four jurisdictions in this area of legal protection of new *Lamiaceae* varieties.

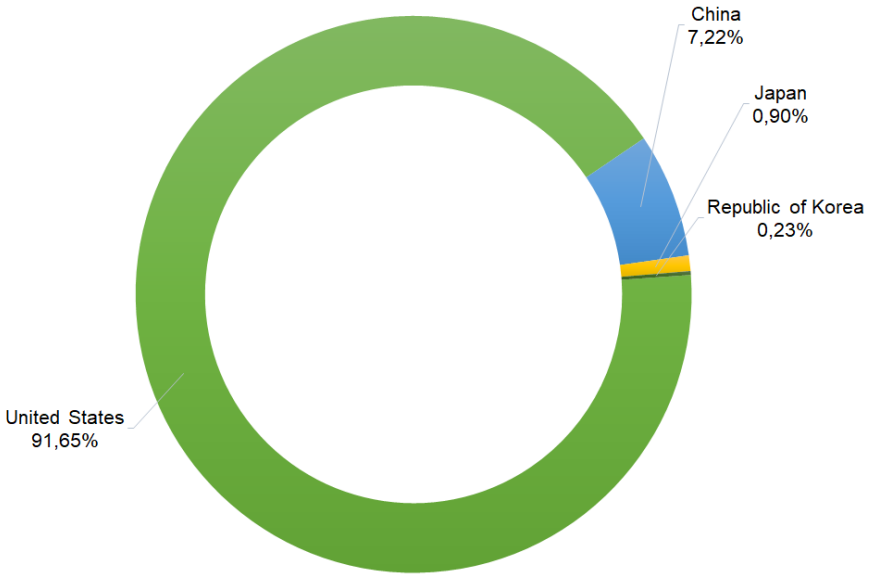

Figure 4. Jurisdictions (%) of patent documents (i.e., granted patents and plant pa-tents) related to the IPC code A01H6/50 (*Lamiaceae*) until 2023.

In the first place, the United States is represented by the "United States Patent and Trademark Office" in 406 patent documents (10 granted patents and 396 plant patents), with a high patent contribution of 91.65%. Secondly, China, through the "China National

Intellectual Property Administration", encapsulates 32 patent documents (all of which are granted patents) with a low patent contribution of 7.22%. Next, Japan, through the "Japan Patent Office", recoded four patent documents (all of which are granted patents), with a very low patent contribution (0.9%). Finally, in fourth place, the Republic of Korea is represented by the "Korean Intellectual Property Office" in only one patent document considered granted patent, with a very low patent contribution (0.23%).

As the United States encompasses all plant patents in this area (i.e., 396), it is considered the leading jurisdiction. However, considering the granted patents, China led the way with 32 granted patents, followed by the United States with only 10 granted patents.

3.5. Scientific overview: Lamiaceae genera and inventive purpose

As seen above, the subclass IPC code A01H concerns new plants or processes to obtain and reproduce them by tissue culture techniques, and more specifically, the subgroup A01H6/50 concerns the *Lamiaceae* family. According to the findings of this study, it is primordial to analyze which *Lamiaceae* genus has been most invented or discovered as a new and distinct variety of asexually reproduced plant.

Figure 5 presents *Lamiaceae* genera concerned with the legal protection of new plant varieties until 2023. In total, there are 23 genera of *Lamiaceae* concerned with discovering and innovating on distinct varieties of asexually reproduced plants. In summary, the most claimed plant in the invention-related patents is dedicated to the *Plectranthus* genus. Also known as spurflower, it is a genus of about 85 species of flowering plants. This genus is included in 110 patent documents and represents 25.82% of the total. Next, the *Salvia* genus, also known as sage, is presented in 73 documents (17.14%). It is the largest genus of plants in the *Lamiaceae* family, with nearly 1000 species of shrubs, herbaceous perennials, and annuals. Thirdly, the *Lavandula* genus, also known as lavender, is presented in 53 patent documents (12.44%). This is a genus of 47 known species of flowering plants in the *Lamiaceae* family. It is important to note that these three genera present 55.4% of total patent documents concerned with the legal protection of new plant varieties of *Lamiaceae*.

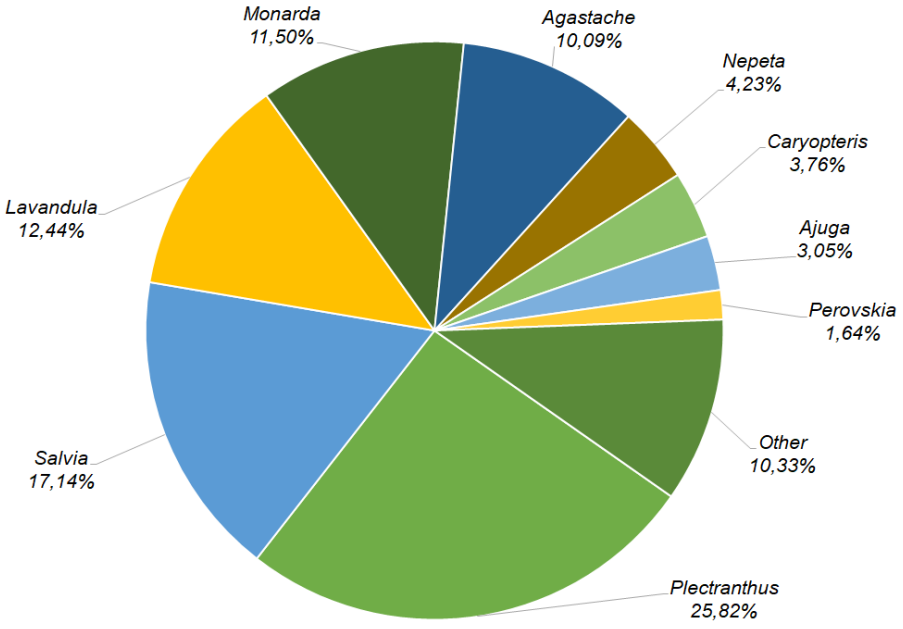

Figure 5. *Lamiaceae* genus (%) concerned with the legal protection of new *Lamiaceae* plant varieties until 2023.

The essential objective claimed by the majority of patent documents analyzed in this study is ornamental. It means that inventors are interested in the *Lamiaceae* plant grown for its attractive appearance. As inventive purpose, the ornamental concerned 85.62% of

the total patent documents. This is essentially the case with plant patents. Furthermore, other inventive purposes are also claimed in the patent documents, but with a low percentage. The other patent documents claimed innovations in genetic engineering (7.3%) or plant breeding (3%) that seek a better yield of proteins or other compounds of interest. The rest of the patent documents claimed plants that are more tolerant of climate effects (2.15%), plants resistant to powdery mildew (1.5%), and suitable substrates for the cultivation of certain *Lamiaceae* species (0.43%) (Figure 6).

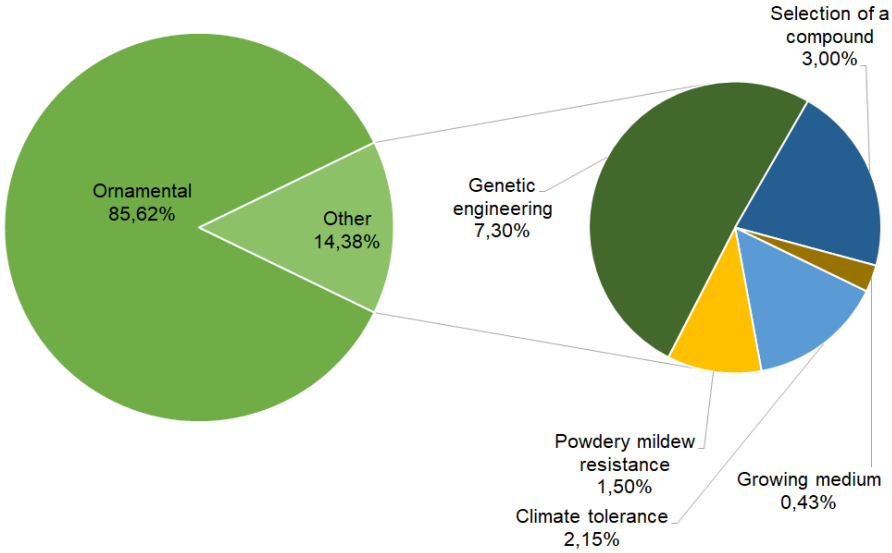

Figure 6. Inventive purposes related to the legal protection of new plant varieties of the *Lamiaceae* family until 2023.

3. Conclusions

This study clearly accomplished a patent analysis using 443 patent documents relevant to the legal protection of new *Lamiaceae* plant types. The search was carried out using International Patent Classification, which is a system for categorizing patents into technical fields that include all aspects of technology. The majority of found patent documents are considered plant patents (i.e., a record of 396). They are a specific type of patent granted to individuals or entities who have invented or discovered a new and distinct variety of asexually reproduced plant. Among the jurisdictions interested in this area, the United States encompasses all plant patents, and it is considered the leading jurisdiction. The *Lamiaceae* genera concerned with the legal protection of new plant varieties comprise, among others, *Plectranthus*, *Salvia*, and *Lavandula*, which present 55.4% of total patent documents in this area. The essential objective claimed by the majority of patent documents analyzed in this study is primarily ornamental, where inventors are interested in the *Lamiaceae* plant grown for its attractive appearance.

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References

1. Rabbinge, R.; Bindraban, P.S. Making More Food Available: Promoting Sustainable Agricultural Production. *Journal of Integrative Agriculture* **2012**, *11*, 1-8, doi:10.1016/S1671-2927(12)60777-9.
2. Sumberg, J.; Giller, K.E. What is 'conventional' agriculture? *Global Food Security* **2022**, *32*, 100617, doi:10.1016/j.gfs.2022.100617.
3. Popp, J.; Lakner, Z.; Harangi-Rákos, M.; Fári, M. The effect of bioenergy expansion: Food, energy, and environment. *Renewable and Sustainable Energy Reviews* **2014**, *32*, 559-578, doi:10.1016/j.rser.2014.01.056.
4. Jiang, L.; Chen, Y.; Wang, X.; Guo, W.; Bi, Y.; Zhang, C.; Wang, J.; Li, M. New insights explain that organic agriculture as sustainable agriculture enhances the sustainable development of medicinal plants. *Frontiers in Plant Science* **2022**, *13*, doi:10.3389/fpls.2022.959810.
5. Greff, B.; Sáhó, A.; Lakatos, E.; Varga, L. Biocontrol Activity of Aromatic and Medicinal Plants and Their Bioactive Components against Soil-Borne Pathogens. *Plants* **2023**, *12*, 706, doi:10.3390/plants12040706.
6. Kock, M.A. Open Intellectual Property Models for Plant Innovations in the Context of New Breeding Technologies. *Agronomy* **2021**, *11*, 1218, doi:10.3390/agronomy11061218.
7. Yu, J.-K.; Chung, Y.-S. Plant Variety Protection: Current Practices and Insights. *Genes* **2021**, *12*, 1127, doi:10.3390/genes12081127.
8. Pottage, A.; Sherman, B. Organisms and manufactures: On the history of plant inventions. *Melbourne University Law Review* **2007**, *31*, 539-568.
9. World Intellectual Property Organization. IPC Publication. Available online: www.wipo.int/classifications/ipc/ipcpub (accessed on June 11, 2023).
10. European Patent Office. Espacenet Glossary. Available online: https://worldwide.espacenet.com/patent/help/espacenet-glossary (accessed on August 25, 2023).
11. World Intellectual Property Organization. *Guide to the International Patent Classification (IPC)*; WIPO: Geneva, Switzerland, 2020; p. 51.
12. El Boukhari, R.; Fatimi, A. A review of the patentability of rosemary-derived drugs and bioactive compounds. *Drugs and Drug Candidates* **2023**, *2*, 172-188, doi:10.3390/ddc2010011.
13. El Boukhari, R.; Fatimi, A. Patent analysis of four *Lamiaceae*-derived plants: A medicinally active resource against new health challenges. *Medical Sciences Forum* **2023**, *21*, 1, doi:10.3390/ECB2023-14093.
14. El Boukhari, R.; Fatimi, A. Analysis of lavender-related patent documents. *Journal of Analytical Sciences and Applied Biotechnology* **2023**, *5*, 20-28, doi:10.48402/IMIST.PRSM/jasab-v5i1.39312.
15. Cambia Institute. The Lens Patent Data Set. Available online: www.lens.org (accessed on June 11, 2023).
16. Ross, H.A. *Ajuga* reptans Variety named 'Arctic Fox' Plant Patent: USPP008395P, United States, September 28, 1993.
17. Narasimhamoorthy, B.; Greaves, J.A.; Zhao, L.; Qui, Z.; Cloud, N. Oregano clonal line having high levels of thymol. Granted Patent: US9839193B2, United States, December 12, 2017.
18. Wyse, J.; Luria, G. Trends in intellectual property rights protection for medical cannabis and related products. *Journal of Cannabis Research* **2021**, *3*, 1, doi:10.1186/s42238-020-00057-7.
19. Fatimi, A. A patent data analysis of the innovation trends in biological control agent formulations. *Recent Advances in Food, Nutrition & Agriculture* **2022**, *13*, 59-69, doi:10.2174/2772574X13666220831122154.
20. Fatimi, A. Exploring the patent landscape and innovation of hydrogel-based bioinks used for 3D bioprinting. *Recent Advances in Drug Delivery and Formulation* **2022**, *16*, 145-163, doi:10.2174/2667387816666220429095834.