

Bibliometrics Validation of Local Plant Species in Burkina Faso for the Management of Endometriosis from 2014 to 2024

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Abstract

Endometriosis is a chronic gynecological condition characterized by the presence of endometrial-like tissue outside the uterus, causing inflammatory reactions, severe pelvic pain, and fertility problems. Although hormonal and surgical treatments exist, they are often palliative, costly, and difficult to access in low-resource countries. Faced with these limitations, many women turn to traditional medicine, which uses plants with anti-inflammatory, antioxidant, and analgesic properties. However, there is a lack of rigorous scientific data validating these uses, particularly in Burkina Faso. This study aims to catalog the medicinal plants reported in the literature from 2014 to 2024 and to identify the chemical groups responsible for their biological activities. Data for the study were collected via the Dimensions AI platform, using the primary keyword “endometriosis and medicinal plants.” The VOSviewer software was used to map citation networks of authors and journals. The analysis identified 2162 articles published in PubMed during the period, with exponential growth observed between 2019 and 2021, peaking at 400 articles in 2024. The predominant research fields were biomedical and clinical sciences (67.53%). The most represented families in this study were Fabaceae (13%), Asteraceae (10%), and Cannabaceae (8.7%). Essential oils (24.7%), leaves (19.6%), and flowers (19.6%) were the most studied parts. From a phytochemical perspective, flavonoids constituted the most abundant group (26.3%), followed by terpenes (17.8%). Six local species were identified in Burkina Faso, including *Entada africana* and *Phyllanthus niruri*. This study suggests the therapeutic potential of me-

dicinal plants in the management of endometriosis, supported by some biological mechanisms of action.

Keywords

Bibliometrics, Medicinal Plants, Endometriosis, Burkina Faso

1. Introduction

Endometriosis is a common and multifaceted condition characterized by the presence of endometrial-like tissue outside the uterus, which is often asymptomatic. However, it can sometimes cause chronic, severe, and debilitating pain, particularly during menstruation or sexual intercourse. Endometriosis is often a cause of infertility and has significant consequences on quality of life [1] [2]. Approximately 10% of women and girls of reproductive age worldwide suffer from this condition [3]. Despite the global prevalence of endometriosis, little to no data exists in Burkina Faso. Treatments include medical and surgical options but remain largely palliative, offering only temporary pain relief without addressing the underlying causes of the disease [4]. Surgery is associated with a high recurrence rate [2]. Furthermore, the high cost of medical and surgical treatments is a major barrier to their accessibility, particularly in low-resource countries [5]. This situation forces women to turn to traditional medicine for their care. This traditional medicine draws on a variety of resources, including the use of medicinal plants. These plants are believed to contain bioactive compounds that underlie their anti-inflammatory, antioxidant, anti-angiogenic, and analgesic effects [6]. While studies have been conducted worldwide [7], little data is available in Burkina Faso on the medicinal plants used to treat endometriosis. This study aims to: (i) describe the scientific impact of studies related to medicinal plants; (ii) identify the medicinal plants present in Burkina Faso for the management of endometriosis; and (iii) determine the phytochemical groups and their biological activities against endometriosis.

2. Method

This was a descriptive, cross-sectional retrospective study. The scientific literature on medicinal plants used in the management of endometriosis was analysed using bibliometrics, followed by a structured analysis of the high-impact publications that were selected following the FCR and RCR indicators. Bibliometric data were collected via the Dimensions AI platform (developed by Digital Science), using the term “endometriosis AND medicinal plants”. This study was carried out by two operators. Disagreements were resolved by taking the highest figures reported by the operator to ensure that no relevant publications had been omitted. Given that we are in the biomedical field, a filter has been applied to retain only those publications available on PubMed (Figure 1).

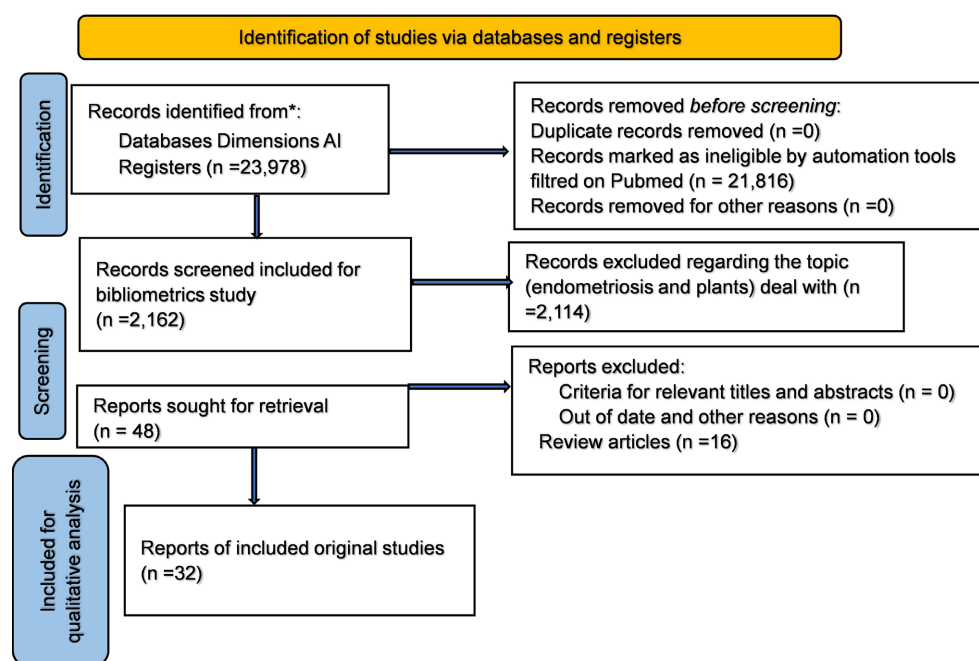


Figure 1. PRISMA 2020 flow diagram for new systematic reviews that included search databases and registry only.

Quantitative analysis was conducted in the Dimension AI platform (analytical view) to measure trends in the number of publications, their citations, and research fields, supplemented by the measurement of scientific and bibliometric impact indicators such as the Field Citation Ratio (FCR) and the Relative Citation Ratio (RCR). The FCR compares the average number of citations for articles in the topic area to the average for all articles in the research field, while the RCR compares it to the average number of citations for a benchmark article in the field during the study period. Values greater than 1 indicate that the topic of interest has had a significant impact in the field of study. The VOSviewer 1.6.20 software (Leiden University, Netherlands) was used to map networks based on the similarity of citations, co-citations, authors, and journals based on all the publications exported to an Excel file from Dimension AI via email. Quantitative data were presented in terms of sample size, frequency, and number of citations.

The qualitative analysis was carried out based on original research articles that explicitly mention the keywords (endometriosis, plants, herbals...) in their title and abstract, whose full versions are available for free on PubMed, Google Scholar, ScienceDirect, and ResearchGate, excluding systematic reviews. Eligibility criteria included articles published from January 2014 to December 2024 in PubMed, dealing exclusively with the treatment of endometriosis using plants and available as open access in databases on the Dimensions AI platform. After reading the articles, the following data (the plant species by its scientific name, the botanical family, the parts used, the biological activities, and the phytochemical groups related to endometriosis) were entered into Excel, which was then used to generate the graphs.

The local species described were selected based on their inclusion in the catalog

of vascular plants and the fact that an herbarium specimen is registered at the “Herbier National du Burkina Faso, HNBU”.

3. Results

3.1. Scientific Impact

3.1.1. Trends in Publications from 2014 to 2024

Data collection identified 23,978 publications in total and 2162 articles published in PubMed regarding the keywords entered in the platform Dimension AI between 2014 and 2024. **Figure 2** shows a steady increase, with a dip between 2019 and 2021. The annual average of 196.54 publications over this period indicates a steady increase, reflecting growing interest among researchers in the study of medicinal plants for the management of endometriosis.

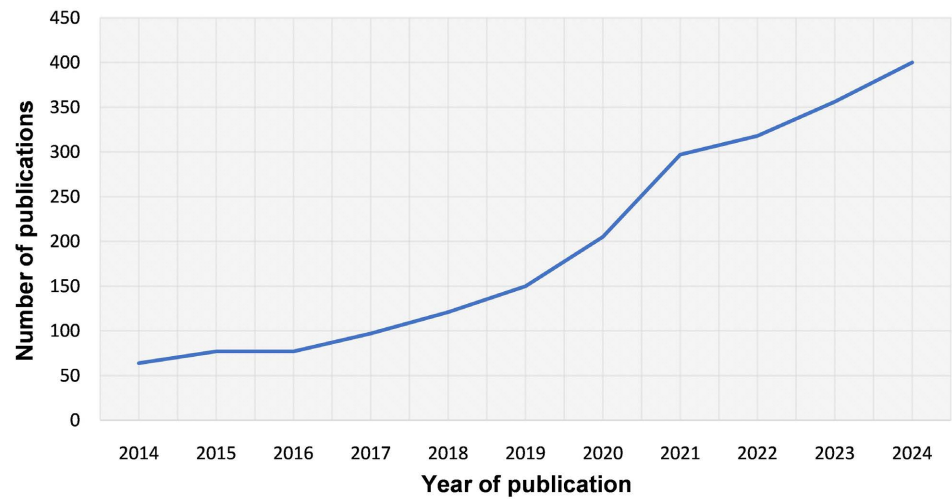


Figure 2. Trends in publications between 2014 and 2024.

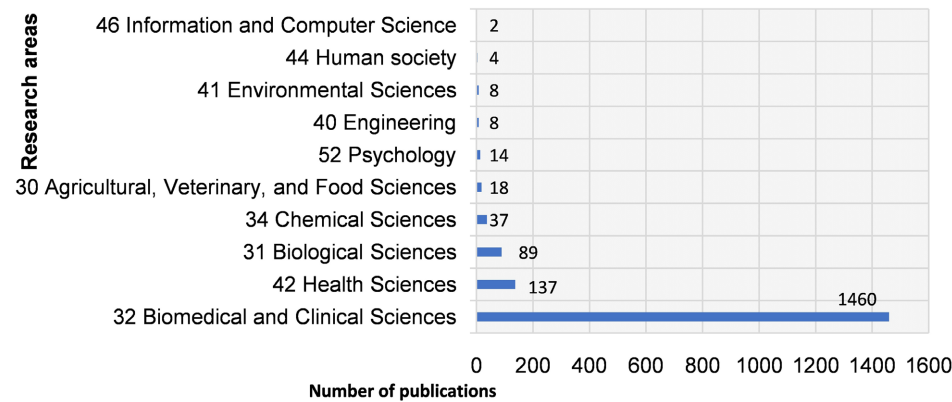


Figure 3. Research areas (ANZSRC 2020).

3.1.2. Classification by Research Field

Figure 3 shows the distribution of publications by research field and reveals that during the study period, biomedical and clinical sciences were the most represented fields, with 1460 publications, followed by pharmaceutical sciences with

412 publications, and “reproductive medicine” and “clinical sciences” with 294 and 253 publications, respectively.

3.1.3. Scientific Impact Indicators

Figure 4 shows the trends in the FCR and RCR scientific impact indicators. An average FCR of 4.4 and an RCR of 2.7 indicate that publications on medicinal plants used in the management of endometriosis have received more citations than the average for publications in the relevant research field. The highest FCR (5.67) and RCR (5.86) values were reached in 2020, reflecting a high scientific impact.

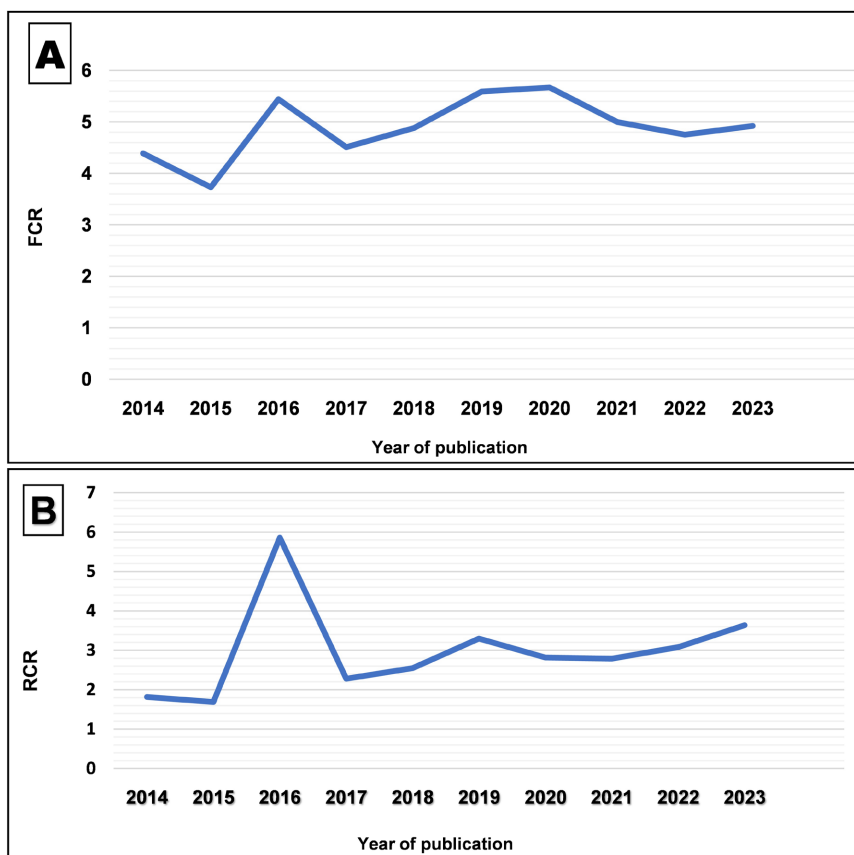


Figure 4. Impact indicator FCR (A) and RCR (B).

3.1.4. Connection Mapping

➤ Network of researchers and countries of affiliation

The network map of connected researchers shows 48 researchers who have published at least five papers on the treatment of endometriosis using plants. They are divided into five distinct collaborative groups and account for a total of 268 co-citation links (**Figure 5(A)**). The countries where researchers are interested in this topic are mainly represented by China (671 publications), the United States (265 publications), Iran (209 publications) and India (193). However, African countries are less well represented, with Egypt (50 publications) leading the way, followed by South Africa (22 publications), Nigeria (20 publications) and Cameroon (13 publications) (**Figure 5(B)**).

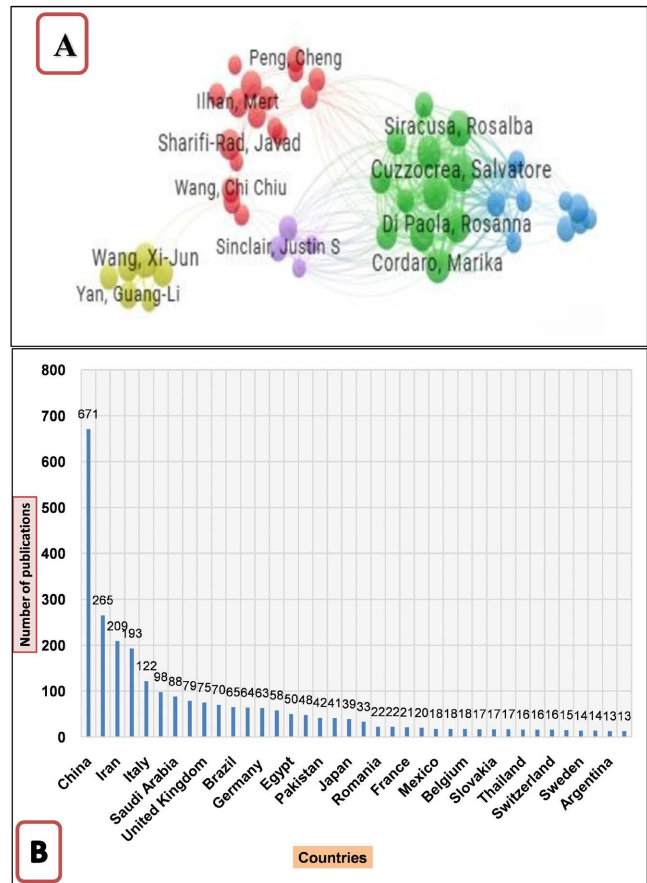


Figure 5. Network of researchers and countries of affiliation.

➤ **Mapping the journal network**

The bibliometric analysis identifies 20 scientific journals that have published at least 15 articles on medicinal plants in the management of endometriosis.

Table 1 shows the number of articles published by each journal and their 2024 impact factor (IF). This bibliometric indicator measures the average reputation of a scientific journal. It calculates the average number of citations received by articles published in that journal over the previous two years. The “Journal of Ethnopharmacology” was the journal with the highest number of published articles and an impact factor of 6.54, while “Phytomedicine” had the highest impact factor of 8.81 and 20 published articles.

Table 1. Journals and their impact factors (IF).

Revue	Documents	IF 2024
Journal of Ethnopharmacology	85	6.54
Frontiers in pharmacology	81	4.65
Molecules	62	4.9
International journal of molecular science	59	7.5
Evidence-based complementary and alternative medicine	50	4.6
Biomedicine & pharmacotherapy	40	2.13

Continued

Nutrients	34	4.8
Pharmaceutics	29	6.6
phytotherapy research	27	6.3
Heliyon	25	3.6
Antioxidants	22	6.6
european journal of medicinal chemist	21	5.9
Phytomedicine	20	8.81
BMC Complementary Medicine and th.....	19	3.4
critical reviews in food science and nutrition	18	8.8
plos one	17	2.6
scientific reports	16	3.9
Pharmaceutics	15	4.8
Przegląd epidemiologiczny	15	0.45

3.2. Structured Analysis of the Selected Publications**3.2.1. Botanical Species and Families Identified**

A total of 48 articles meeting the selection criteria were critically reviewed and subjected to a structured analysis to identify data on the botanical species and families of medicinal plants described for the management of endometriosis in high-impact scientific publications.

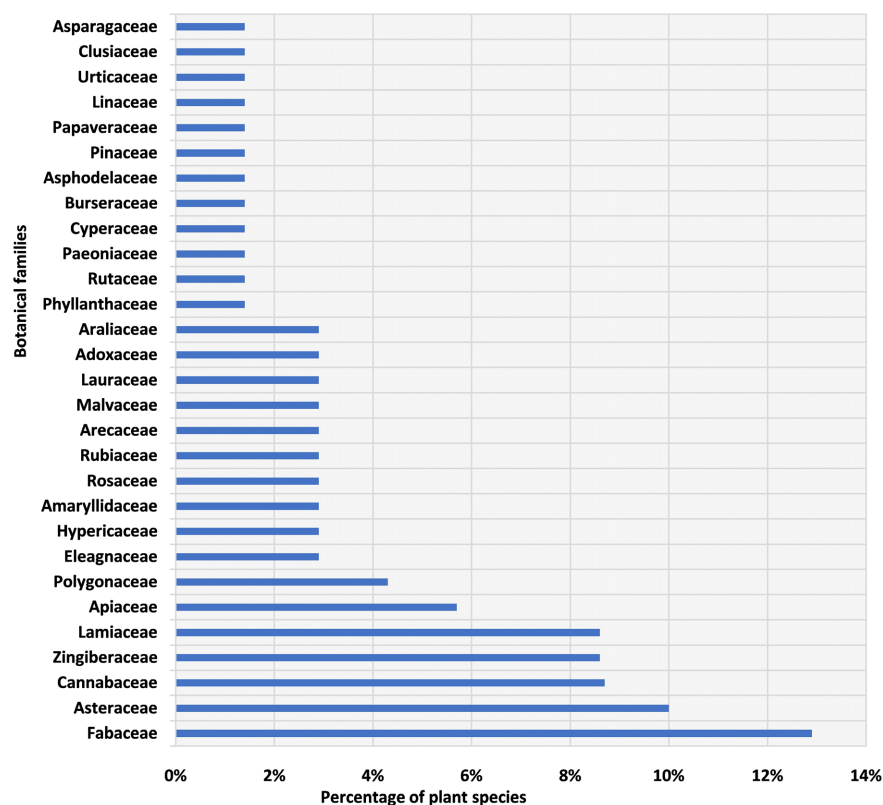


Figure 6. Percentage distribution of plant species by botanical family.

Figure 6 shows the distribution of species by botanical family. A total of sixty-one (61) plant species were identified, belonging to 29 botanical families, with the Fabaceae being the most represented at 13% of plant species, followed by the Asteraceae at 10%. Among these identified species, eight (08) are local species found in Burkina Faso.

3.2.2. Plant Parts and Phytochemical Groups

Figure 7 shows the distribution of phytochemical groups (**Figure 7(A)**) and the plant parts used (**Figure 7(B)**) identified in this study. The data show that essential oils were the most commonly used, at 24.7%, followed by leaves and flowers at 19.6% each, and roots at 12.5%. Among the various phytochemical groups of medicinal plants used in the management of endometriosis, flavonoids were the most common at 26.3%, followed by terpenes at 17.8% and phenolic acids at 9.87%.

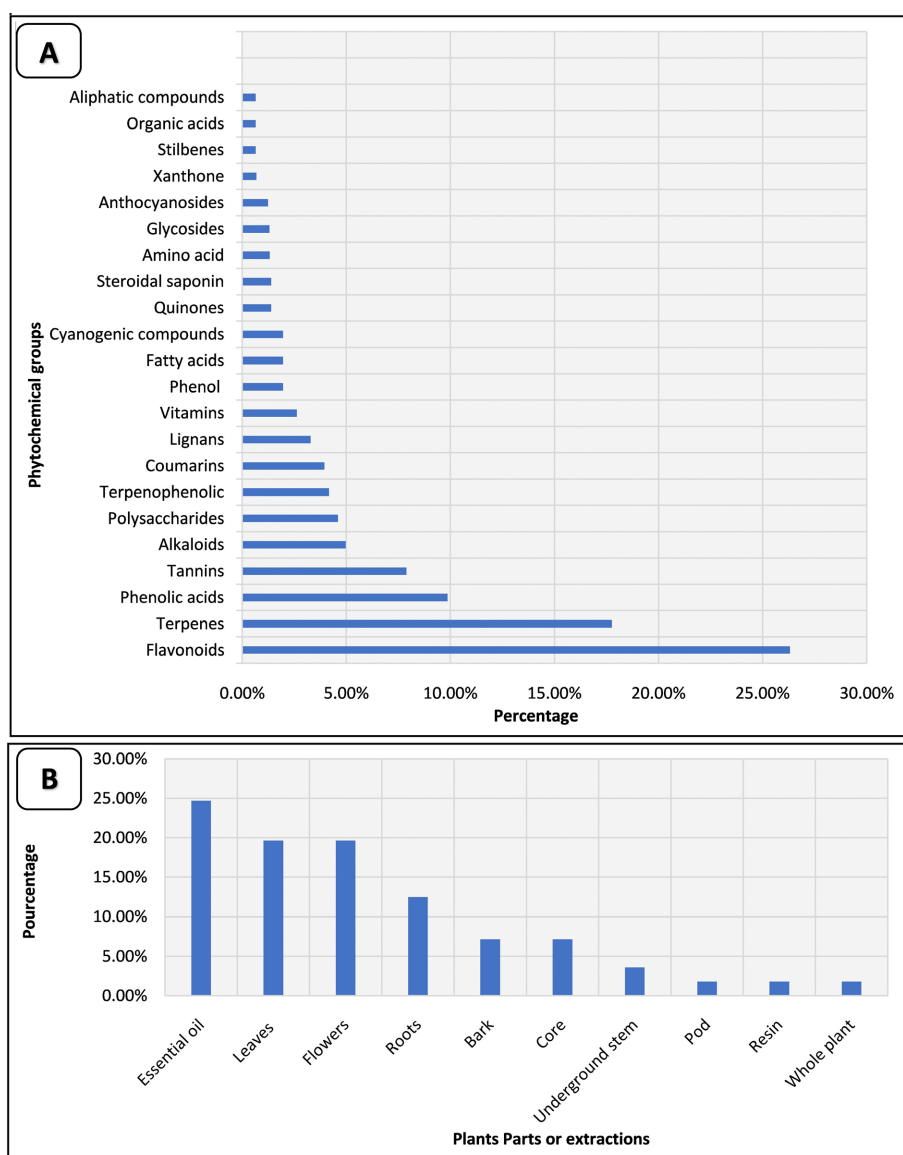


Figure 7. Parts used or extractions (B) and phytochemical groups (A).

3.2.3. Biological Activities and Local Species in Burkina Faso

An analysis of the various biological activities described in the publications indicates that anti-inflammatory activity was the most commonly reported, at 29.9%, followed by analgesic and antioxidant activities, each at 15.3%, as well as anti-angiogenic activity at 10.2%. Furthermore, six species were found in the catalog of vascular plants and have an herbarium specimen registered at the National Herbarium of the National Center for Research in Science and Technology (CNRST). **Table 2** and **Figure 8** present the biological activities associated with the six (06) local species and the mechanisms of action described in high-impact scientific publications.

Table 2. Biological activities and mechanisms of action of phytochemical groups.

Plant species	Common names	Biological activities	Mechanisms of action	References
<i>Entada africana</i>	“Seôneo or sapâarga” in Mooré and “sama nere, mbatari or dali kâba” in Bambara	Anti-inflammatory	Inhibition of NO production Increases the production of immunomodulatory cytokines Partial inhibition of p38 MAPK kinase	[47]-[49]
		Analgesic	Not documented	[50]
		Hormonal regulator	Inhibition of the oestradiol-mediated signalling pathway	[50]
		Cell proliferation	Inhibition of ectopic endometrial lesions through a transient increase in oxidative stress, which is known to cause cell necrosis	[49] [50]
		Psychotropic	Antidepressant	[51]
<i>Pyllanthus niruri</i>	“Tinguin-garga” in Mooré	Anti-inflammatory	Inhibition of pro-inflammatory markers	[52] [53]
		Analgesic	Not documented	[54]
		Antispasmodic	Reduction in ureteral contraction	[55] [56]
		Cell proliferation	Inhibition of MMP-9, an enzyme involved in the spread of endometrial lesions	[53] [57] [58]
		Psychotropic	Stimulation of the central nervous system	[59]
<i>Aloe vera</i>	“Aloe” in Mooré and Lyele; and “aloverayiri” in Dioula	Anti-inflammatory	Inhibition of cytokine production, the production of reactive oxygen species and the cytokine signalling pathway	[60]-[62]
		Analgesic	Reduces the perception of pain	[63]
		Cell proliferation	Reduces cell viability, induces apoptosis, and alters the expression of genes related to the cell cycle	[64]-[66]
<i>Cyperus rotundus</i>	“Ka-pin-ba” in Mooré	Anti-inflammatory	Inhibition of COX-2	[67]-[69]
		Analgesic	Not documented	[67] [68]
		Psychotropic	Neuroprotective	[70] [71]
<i>Ocimum basilicum</i>	“Yulin-gnuuga” in Mooré	Anti-inflammatory	Inhibition of inflammatory markers	[72]-[75]
		Analgesic	Not documented	[76]

Continued

<i>Clitoria ternatea. L</i> “Clitorie” in Mooré	Antispasmodic	Not documented	[77]
	Cell proliferation	Not described	[78]
	Anti-inflammatory	Not documented	[79]
	Analgesic	Not documented	[79] [80]
	Psychotropic	Neuroprotective	[81]
	Cell proliferation	Not described	[82]

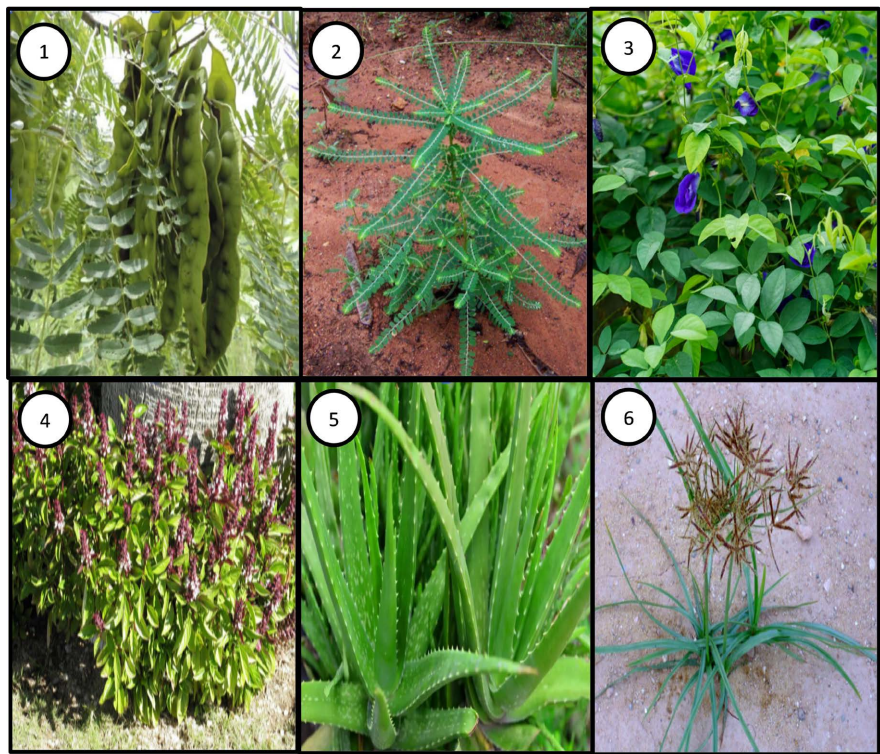


Figure 8. Illustrative photos of plants found in Burkina Faso. 1: *Entada africana*; 2: *Phyllanthus niruri*; 3: *Clitoria ternatea*; 4: *Ocimum basilicum*; 5: *Aloe vera*; 6: *Cyperus rotundus*.

4. Discussions

4.1. Limits of the Study

An analysis of the study’s results highlights a number of biases, such as selection bias. In fact, the period excludes data other than the most recent; FCR and RCR were calculated with a 2-year lag, and the PubMed index excludes journals with low readership, including studies from resource-limited countries. We merely described scientific impact, without evaluating the data content quality, and some journals require a subscription fee. Furthermore, linguistic bias excludes articles in Chinese, even though China is a leader in phytotherapy and medicinal plants in the world. However, this in no way diminishes the relevance of the descriptive information we obtained, which points to research trends and opens up avenues for original verification and confirmation studies.

4.2. Scientific Impact of the Study

The objective of this study was to examine trends in scientific publications on medicinal plants used in the treatment of endometriosis using bibliometrics between 2014 and 2024. Bibliometrics, like other research methods on medicinal plants such as ethnobotany or ethnopharmacology, relies on already validated scientific data (experimental studies *in vivo* and *in vitro*, standardized models and randomized trials) and saves time and resources. Bibliometrics makes it possible to map research pathways and identify the most promising plants or plant families for combating a disease but does not measure clinical relevance. Its main limitation is the accessibility of certain scientific studies. The analysis conducted using the Dimensions AI database revealed an exponential growth in research data over the years regarding the use of medicinal plants for endometriosis. This is evident in the total of 2162 articles on the topic during the study period and reflects a scientific interest in phytotherapeutic approaches to endometriosis, with a peak of 400 articles in 2024. The topic is of interest to health fields such as biomedical and clinical sciences, pharmaceutical sciences, biological sciences, and chemical sciences. This growing trend underscores the recognition of the therapeutic potential of medicinal plants as a promising therapeutic alternative in the management of endometriosis [7]-[10]. This interest among researchers may be explained by the fact that the treatment of endometriosis is often relegated to palliative care and offers only temporary relief. The formula has been demonstrated to reduce the growth of endometriotic lesions, oestrogen levels and suppress inflammation and angiogenesis in rats [11] and the predominance of clinical trials [7].

The FCR (Field Citation Ratio) and RCR (Relative Citation Ratio) indicators reveal the scientific impact of the publications. The variations observed over the years, meanwhile, reflect fluctuating research activity. The average values of 4.4 and 2.7 are above expected standards. This indicates a positive citation impact and, by extension, that the published work has had a remarkable scientific resonance. This assessment of these compelling results is justified by the relevance of the topic, grounded in a methodological approach focused on therapeutic solutions based on medicinal plants for the treatment of endometriosis.

4.3. Contribution to the State of Knowledge

Our study led to the selection of 61 plant species deemed relevant and 6 species found in Burkina Faso. Data analysis reveals a strong concentration of research on a limited number of plants showing a significant correlation with endometriosis. These species have the highest citation frequencies, reflecting a marked scientific interest in their anti-inflammatory, hormone-regulating, and analgesic properties, which mechanism of action pave the way for the management of endometriosis. Thus, cannabis has been linked in several studies to anti-inflammatory and analgesic properties [12]-[19]. An analysis of the distribution of botanical families indicates a strong concentration of research around two dominant families, namely the Fabaceae (13%) and Asteraceae (10%). Overall, this distribution

reflects a research focus on certain families recognized for their pharmacological efficacy, while highlighting the need to expand investigations to other plant families that may contain compounds of therapeutic interest for endometriosis—compounds recognized as possessing bioactive properties with anti-inflammatory, antioxidant, and hormone-regulating properties. Several ethnopharmacological studies have been conducted worldwide for the management of gynecological and obstetric conditions [20]-[24]. Furthermore, the Fabaceae family has been cited in several studies as one of the botanical families containing species with various therapeutic properties, including for endometriosis [25]-[30]. A review of the use of medicinal plants for the management of gynecological conditions showed that the Fabaceae family was the most commonly represented. The most frequently cited conditions were those related to menopause. The plant species used in the preparation of medicinal recipes differed from those found in our study [22]. Another ethnobotanical study conducted in Pakistan showed a predominance of the Rosaceae, Amaranthaceae, and Brassicaceae families, contrary to our results [31]. The predominance of essential oils (24.7%), followed by leaves (19.6%) and flowers (19.6%), is a notable finding of this study. In fact, most ethnopharmacological studies demonstrate that leaves were the most commonly used plant parts [32]-[37]. These results indicate a preference for plant parts rich in volatile and bioactive compounds known for their anti-inflammatory and antioxidant properties, which are relevant for the treatment of endometriosis. Furthermore, the oils would be well-suited for use in vapor form. An analysis of the distribution of phytochemicals reveals that flavonoids are the most abundant (27.78%), followed by terpenes (18.75%) and phenolic acids (10.42%). These three groups account for more than half of the identified compounds. Flavonoids (27.78%) are known for their potent antioxidant and anti-inflammatory properties [38]. In the context of endometriosis, they reduce oxidative stress and inhibit the production of pro-inflammatory cytokines, such as TNF- α and IL-6. Certain flavonoids, such as quercetin and apigenin, exert an antiangiogenic effect, limiting the abnormal growth of endometrial tissue [39]. They can also modulate estrogenic activity, contributing to better hormonal balance [38]. Terpenes (18.75%) possess anti-inflammatory, analgesic, and immunomodulatory effects. They act specifically on the COX-2 pathway, reducing pelvic pain and cramps associated with endometriosis [40]. Certain terpenes, such as β -caryophyllene, bind to cannabinoid receptors, thereby modulating the inflammatory response and pain [41]. Phenolic acids (10.42%), such as caffeic acid, are powerful antioxidants that protect endometrial cells from oxidative stress. They have demonstrated beneficial effects in preventing the progression of endometriosis [42].

4.4. Biological Activities and Mechanism of Action of Plants in Burkina Faso

Of the 61 plant species identified for the treatment of endometriosis, only six (06) species—*Entada africana*, *Phyllanthus niruri*, *Cyperus rotundus*, *Ocimum basilicum*, *Aloe vera*, and *Clitoria ternatea*—have been studied. However, studies in Burkina Faso do not suggest the use of these plants in the management of endo-

metriosis [43] [44]. This observation indicates that research on medicinal plants in Burkina Faso remains in its infancy and could be of interest to Burkinabé researchers. This is justified by the lack of research data on medicinal plants, which is still very limited in international scientific databases. The plants cited in Burkina Faso cover five major areas of biological activity, including anti-inflammatory, analgesic, antispasmodic, hormonal regulatory, cell proliferation inhibitory, and nervous system modulatory effects, all of which are necessary for the management of endometriosis [45].

All of these mechanisms correspond to current therapeutic targets for endometriosis: suppression of local inflammation, reduction of nociception, correction of hormone-induced growth, and limitation of the proliferation and vascularization of ectopic tissues. In fact, the formation and survival of endometriotic lesions at eutopic sites is crucially dependent on fundamental biological processes, including proliferation, apoptosis, inflammation and angiogenesis [46]. The local use of the identified plants in Burkina Faso for the management of endometriosis has not been documented. Given these promising pharmacodynamic profiles, systematic pharmacological screening (*in vitro* antiproliferative and anti-angiogenic tests, profiling of anti-inflammatory cytokines), followed by *in vivo* efficacy and safety studies, would constitute future steps for the development of these local species.

5. Conclusion

This study has highlighted the scientific community's growing interest in the study of plants used in the management of endometriosis, as well as examined the variety of medicinal species identified and the plant parts employed. The results show that plant extracts primarily act on several key pathophysiological processes in endometriosis, namely pain, hormonal regulation, and the nervous system. Furthermore, the effect of traditional treatments is based on the presence of bioactive compounds such as phenolic compounds or terpenoids. These molecules, recognized for their anti-inflammatory, antioxidant, and regulatory properties, provide a scientific basis for the empirical use of these plants in the management of endometriosis. The integration of ethnobotanical surveys, phytochemical characterizations, and mechanism-oriented preclinical models will accelerate the identification of candidate species and active compounds from Burkina Faso for their development as complementary or novel therapies against endometriosis.

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Author Contributions

All the authors have actively contributed to the completion of this work. Conceptualization: Aminata P. Nacoulma, Sié Paul Kambou; Methodology: Aminata P.

Nacoulma, Lassané Ouedraogo, Jean Sakande; Formal analysis and investigation: Sié Paul Kambou, Pierrette Rachidatou Lankouande, Lassané Ouedraogo; Original draft preparation: Aminata P. Nacoulma, Sié Paul Kambou, Naamwin-So-Bawfu R Meda; Review and editing: Sié Paul Kambou, Lassané Ouedraogo; Supervision: Aminata P. Nacoulma, Jean Sakande.

Ethics Statement

Our work was a structured analysis in the form of a systematic review, so there were no ethical issues.

Data Sharing

The corresponding author is available to provide any further information or data relative to the manuscript.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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