

Is COVID-19 Related to the Recent Surge in Research on *Houttuynia cordata* (Thunb)?

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ABSTRACT

Background of the Study: *Houttuynia cordata* is an herbal medicinal plant with a variety of ethnomedicinal properties. The plant extract has potent anti-inflammatory and antioxidant effects, which may help to reduce the complications associated with diabetes. Additionally, it is used as an anti-inflammation, antidote, astringent, anti-bacterial, and anti-viral. **Objectives:** The present study is a scientometric analysis of *Houttuynia cordata* during 1992-2021 as covered in the SCOPUS database to find out the citation impact, growth rate, and research output of *Houttuynia cordata* research during a three-decade period. **Materials and Methods:** SCOPUS database was used to download data for three decades. The information gathered was quantified using bibliometrics; further, VOS viewer was used for visualizing the keyword network. **Results:** The study revealed that from 2005 onwards, there was an increase in *Houttuynia cordata* research and publication. China turns out to be at the top with the maximum number of research publications on *Houttuynia cordata*. Pharmacology, Toxicology, and Pharmaceutics were the top subject areas that constituted the leading publication. Keywords 'Traditional Medicine' and 'Medicinal Plants' were used mainly during the year 1992-2018, however, from 2019-2021 there is a tremendous shift from the keywords such as 'Traditional Medicine', and 'Medicinal Plants' to keywords such as 'Coronavirus', 'COVID-19' and 'Pandemic', indicating that research on *Houttuynia cordata* relating to COVID-19 and Pandemic has become an extensive area of research from 2019 onwards. **Conclusion:** This study concludes that research on *Houttuynia cordata* has been slow since the early years, with a significant surge during the COVID-19 pandemic. The onset of the COVID-19 pandemic has certainly reconfirmed the relevance of *Houttuynia cordata* as a medicinal herb. Additionally, this study will help researchers understand the current state of the *Houttuynia cordata* research and can act as an information road map to further explore research on its medicinal importance which may benefit humanity in the future.

Keywords: Coronavirus, COVID-19, *Houttuynia cordata*, Medicinal Plants, Scientometric Analysis, Traditional Medicine.

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INTRODUCTION

Houttuynia cordata (Thunb) is a herbaceous plant of the Saururaceae family, named after the famous Dutch biologist Maarten Houttuyn. The plant is commonly known as lizard tail, chameleon plant, fish wort, or bishop's weed. It is found mainly in South Asian countries, including India, China, and Japan, and thrives in moist and shady areas. *Houttuynia cordata* is a herbal medicine used to treat various ailments. Herbal medicine is still relevant and widely practiced in many parts of the world, such as Ayurveda, Unani, Traditional Chinese Medicine, Arab Medicine, etc. In 1978, the World Health Organization defined herbal medicine as a finished, labeled medicinal product that contains

an active ingredient, aerial, or underground parts of the plant or other plant material or combinations. Due to its ethnomedicinal uses, it can be consumed internally in a decoction to treat many diseases like cancer, cough, dysentery, enteritis, fever, blood deficiency, cholera, pneumonia, and constipation. It is used to treat various types of skin diseases and snake bites. The leaves of *Houttuynia cordata* can be ground into liquid form and are used as an antidote and astringent. Meghalaya uses *Houttuynia cordata*, natively known as Jamyrdoh, as herbal medicine. It is used as a blood purifier and anti-dysenteric.^[1-3] According to Wang *et al.*, Kumar *et al.*, and Fu *et al.*, *Houttuynia cordata* is reported to have pharmacological activities like antibacterial, anti-viral, anti-tumor, antioxidant, and anti-inflammatory effects. All parts of *Houttuynia cordata* (roots, shoots, leaves) can be consumed either as a vegetable or as herbal medicine.^[2-4] A study conducted by Pakyntein *et al.* stated that *Houttuynia cordata* is traditionally used to manage hyperglycemia. Plant extract shows good antioxidant and anti-inflammatory properties, which might



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result in preventing diabetic complexities that are, for the most part, ascribed to inordinate oxidative and provocative pressure during hyperglycemia.^[5]

Literature Review

Only a few works of literature are available relating to scientometric studies concerning medicinal plants. Some of the literature is *Curcuma longa* (Medicinal Plant) scientometric study; research by Ahmed *et al.* For 20 years, from 1997 to 2016, the study examined global publications on *Curcuma longa* in the Scopus database.^[6] Another bibliometric study was conducted by Manzano *et al.* on worldwide trends in medicinal plants. The Scopus database was used to gather the data. According to the Scopus database, the study found that most of the research on medicinal plants has been carried out in Pharmacology, Toxicology, and Pharmaceutics. Other categories include Medicine, Biochemistry, Genetics, Molecular Biology, Agricultural, Biological Sciences, Chemistry, Environmental Sciences, Microbiology, and Chemical Engineering.^[7] A Scientometric assessment of global publications output during 2007-16 on *Aloe vera* (Medicinal Plant) was conducted by Gupta *et al.* The paper examined global publications on *Aloe vera* in the Scopus database during 2007-2016.^[8] Pereira *et al.* conducted a study to report the main trends and gaps in the Global Scientific Literature about *J. curcas* L, using scientometric analysis. Data were collected using the Thomson Reuters (ISI) Web of Knowledge database from 1991-2015.^[9]

Significance of the Study

In most developing countries, 70-80% of the population relies on traditional medicine for the treatment of various diseases.^[10] People in developing countries, mostly in rural areas, rely on these herbal plants to heal a variety of ailments. Moreover, traditional herbal therapy is both cost-effective and free of adverse effects, which are the main reasons why people, particularly in impoverished countries, prefer it. As previously stated *Houttuynia cordata* is an herbal medicine scientifically proven to be effective in treating diseases like pneumonia, hypertension, constipation, cough, dysentery, enteritis, fever, and blood deficiency^[2,3] and no scientometric study has been done relating to it. Consequently, this paper concentrates on what sorts of scientific advances are being created around *Houttuynia cordata* and its research trends. For this reason, it is proposed to carry out a scientometric study of scientific distributions on this topic. The Scopus database was used for this purpose to assess the performance of research outputs and to discover evolving patterns for the genus *Houttuynia cordata* over three decades.

MATERIALS AND METHODS

In this study, the authors have tried to investigate the *Houttuynia cordata* research output for the last thirty years from 1992 to 2021. For this purpose, the Scopus database was used to download the data. Data were extracted on 16.12.2021 in the CSV excel

sheet. Further, Microsoft excel was used to create the graph and chart and VOS viewer software was used for creating overlay visualization. The keyword used was "*Houttuynia cordata*". The search string applied for searching publications on *Houttuynia cordata* research were:

[TITLE-ABS-KEY ("*Houttuynia cordata*") AND PUBYEAR > 1991 AND PUBYEAR < 2022].

[TITLE-ABS-KEY ("*Houttuynia cordata*") AND PUBYEAR > 1991 AND PUBYEAR < 2022 AND (LIMIT-TO (AFFILCOUNTRY, "India"))].

The first search string resulted in 634 research documents and the second search string resulted in 50 research documents. The data extracted from the research publications were analyzed based on the following objectives:

To study the *Houttuynia cordata* research output for the last thirty years from 1992 to 2021 and to identify the citation impact year-wise of the world and India.

To determine the different sorts of research papers published around the world and in India and to list the top ten countries or territories in terms of productivity.

To identify the Citations received by Indian publications from (1992-2021) in *Houttuynia cordata* research.

To study the distribution of global research output by broad subject areas.

To identify 10 highly cited papers in *c* research worldwide.

To identify the research trend in the world and India through keyword analysis.

Research Question

Is the considerable increase in *Houttuynia cordata* research pertaining to COVID-19?

RESULTS

Contribution and advancement of *Houttuynia cordata* research

Table 1 shows from 1992 till 2004, only a few research papers were published, from 2005 onwards, an upward trend of research on *Houttuynia cordata* was observed. Overall, a total of 634 scientific papers were produced globally from 1992-2021 for 30 years, and India contributed 50 scientific works to this. The number of research publications has increased over a period of 30 years. The citation impact of global publications on *Houttuynia cordata* research in 30 years averaged 15.8 citations per publication. Globally, a paper published in 2005 has received a maximum citation of 817 with an average of 43.00 per publication. In India, the paper published in 2012 has received a full citation of 117, with an average of 39 citations per publication. Figure 1 and

Table 1: World and India research output in *Houttuynia cordata* research from 1992-2021.

Year	World			India		
	TP	TC	ACP	TP	TC	ACP
1992	2	23	11.5	-	-	-
1993	2	10	5	-	-	-
1994	4	25	6.25	-	-	-
1995	2	191	95.5	-	-	-
1996	2	9	4.5	-	-	-
1997	2	10	5	-	-	-
1998	2	7	3.5	-	-	-
1999	3	26	8.7	2	24	12
2000	2	7	3.5	1	1	1
2001	6	197	32.83	-	-	-
2002	6	84	14	-	-	-
2003	7	449	64.14	-	-	-
2004	5	78	15.6	-	-	-
2005	19	817	43.00	-	-	-
2006	17	800	47.06	1	10	10
2007	26	443	17.04	1	-	-
2008	12	472	39.33	1	30	30
2009	32	815	25.5	-	-	-
2010	25	544	21.8	1	8	8
2011	44	719	16.34	5	81	16.2
2012	37	547	14.8	3	117	39
2013	29	524	18.1	1	3	3
2014	42	605	14.404	4	80	20
2015	31	270	8.71	1	1	1
2016	35	765	21.86	3	23	7.7
2017	42	445	10.6	3	22	7.3
2018	33	354	10.73	4	49	12.25
2019	41	206	5.02	2	16	8
2020	54	415	7.69	6	15	2.5
2021	70	155	2.21	11	21	1.9
Total	634	10012	15.8	50	501	10.02

(TP* Total Paper, TC* Total citation, ACP* Average citation per paper).

Figure 2 show the evolution of *Houttuynia cordata* publication and citations in the World and India respectively from 1992-2021.

Table 2 shows that of the total global publication output, 84.2% (534) constitute research article, 10.9% (69) appeared as review paper, 2.7% (17) are conference paper, erratum and note both constitutes 0.8% (5), book chapters, Editorial, Letter and Retracted constitutes only 0.2% (1). India publication output constitute 78.0% (39) research article, 18.0% (9) review paper, conference and note constitute only 2.0% (1). From Figures 3 and 4 it was noticed that the majority of the scientific publication on

Houttuynia cordata are published as research articles followed by review papers both in Global and India.

Table 3 shows a total of 10 countries have published on this subject as per the Scopus database. China, with 316 research publications, South Korea, with 102 research publications, and India, with 50 research publications, are the top three productive countries with an average citation per paper 11.5, 17.64 and 10.02. One of the fascinating discoveries is that the best 7 nations adding to *Houttuynia cordata* research are generally Asian Nations.

Table 2: Types of documents.

Sl. No.	Types of documents	World	India
1.	Article	534(84.2%)	39(78.0%)
2.	Review	69(10.9%)	9(18.0%)
3.	Conference Paper	17(2.7%)	1(2.0%)
4.	Erratum	5(0.8%)	-
5.	Note	5(0.8%)	1(2.0%)
6.	Book Chapter	1(0.2%)	-
7.	Editorial	1(0.2%)	-
8.	Letter	1(0.2%)	-
9.	Retracted	1(0.2%)	-
	Total	634(100%)	50(100%)

Table 3: Contribution and impact of the top 10 productive countries/territories in *Houttuynia cordata* research during 1992-2021.

Sl. No.	Countries/territory name	TP	TC	ACP
1	China	316	3649	11.55
2	South Korea	102	1799	17.64
3	India	50	501	10.02
4	Japan	45	1112	24.72
5	Thailand	39	821	21.05
6	Taiwan	32	1097	34.28
7	Hong Kong	21	825	39.28
8	United States	19	340	17.89
9	Germany	9	89	9.9
10	Iran	8	87	10.87

(TP* Total Paper, TC* Total citation, ACP* Average citation per paper).

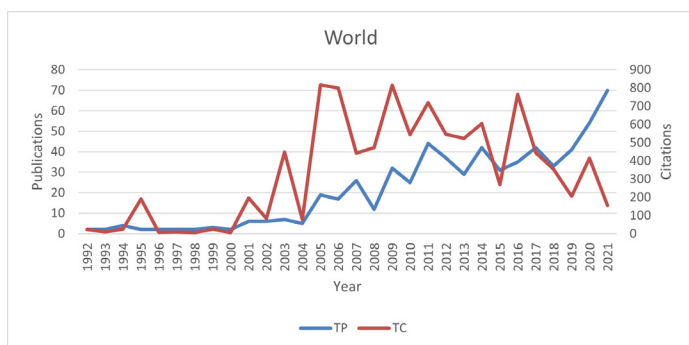
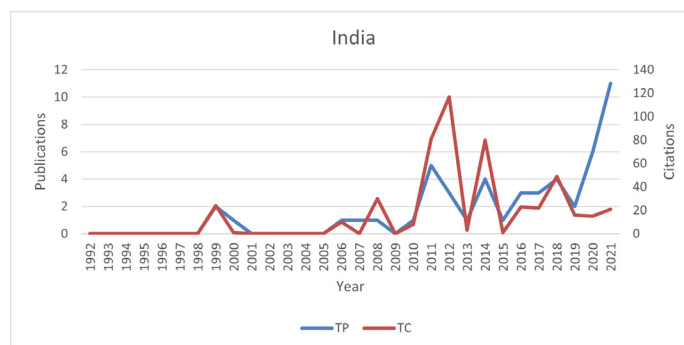
**Figure 1: Evolution of *Houttuynia cordata* publication and citations in the World from 1992-2021.****Figure 2: Evolution of *Houttuynia cordata* publication and citations in India from 1992-2021.**

Figure 5 represents the countries that have published on the topic and the frequency with which they have done so. All these countries together have contributed a total of 634 research publications. The higher the publications, the darker the color of the country, the lighter the color, the lower the publication of a country on *Houttuynia cordata* research. It can be seen that China

has made a significant contribution to the growth of literature, followed by South Korea, India, Japan, and so on (Table 3).

Figure 6 represents the evolution of the top 10 countries over a period of 30 years. In the 90s, research on *Houttuynia cordata* was minimal, where research publications were produced as low

Table 4: Citations received by Indian publication (1992-2021) in *Houttuynia cordata* research.

Citation Received	Publication No.	Total Citations	Publication %	Citation %
0	10	-	20	-
1-10	27	113	54	22.55
11-20	5	86	10	17.17
21-30	4	101	8	20.16
31-40	1	32	2	6.39
>40	3	169	6	1.2
Total	50	501	100	67.47

Table 5: Top 10 Subject-Wise distribution of World Publications in *Houttuynia cordata* Research during 1992-2021.

Sl. No.	Subject	TP	TC	C/P	TP (%)
1.	Pharmacology, Toxicology, and Pharmaceutics	265	4840	18.26	41.80
2.	Medicine	243	3521	14.49	38.34
3.	Biochemistry, Genetics, and Molecular Biology	159	3010	18.93	25.1
4.	Agricultural and Biological Sciences	133	1380	10.38	20.97
5.	Chemistry	109	2314	21.23	17.2
6.	Environmental Science	47	615	13.09	7.41
7.	Immunology and Microbiology	40	660	16.5	6.31
8.	Chemical Engineering	26	289	11.12	4.10
9.	Nursing	25	372	14.9	3.94
10.	Engineering	22	106	4.82	3.47

(TP* Total Paper, TC* Total citation, C/P* Citation per paper).

as 2 publications issued annually. In 2005, the rate of publications started to increase, with China alone publishing 12 research papers annually. As the years passed, this number progressively started to increase. South Korea and India also started to produce more research publications on *Houttuynia cordata* research. In both 2012 and 2014, South Korea produced the maximum number of papers which is 11. In 2021, China produced the leading research publication which is 33, and India produces its maximum research paper, which is 11 in the same year.

Table 4 represents the citations received by Indian publications (1992-2021) in *Houttuynia cordata* research. India has a total number of 50 manuscripts that have received 501 citations. 10 research manuscripts are yet to receive any citation. Of the cited publications, 6% publications (receiving above 40 citations) contributed 1.2% citations, 2% publications (receiving citations from 31 to 40) contributed 6.39% citations, 8% publications (receiving citations from 21 to 30) contributed 20.2% citations, 10% publications (receiving citations from 11 to 20) contributed 17.17% citations and 54% publications (receiving citations from 1 to 10) contributed 22.55% citations.

Table 5 shows the top 10 subject-wise distribution of publications in *Houttuynia cordata* research in the world during 1992-2021. Pharmacology, Toxicology, and Pharmaceutics subject categories constitute (41.80%) of the leading publication out of the lot, followed by Medicine which constitutes 38.34% of the publication, and subsequently followed by Biochemistry, Genetics, and Molecular Biology subject category with 25.1%. The subject areas stated in the top three subject categories are where the most study on *Houttuynia cordata* is done. Research is also being carried out in other subject categories as depicted in Table 5 and Figure 7.

Table 6 represents the top 10 highly cited publications. "Role of Antioxidants and Natural Products in Inflammation," authored by Arulselvan, P. *et al.* have received the highest citation, i.e., 279,^[11] followed by "Study on the inhibitory effects of Korean medicinal plants and their main compounds on the 1,1-diphenyl-2-picrylhydrazyl" authored by Cho E.J. *et al.* which received 215 citations.^[12] In third comes "Study on the inhibitory effects of Korean medicinal plants and their main compounds on the 1,1-diphenyl-2-picrylhydrazyl Anti-microbial effects of Thai

Table 6: Top 10 highly cited papers in *Houttuynia cordata* research during 1992-2021.

Sl. No.	Article name	PY	Author Name	Affiliation	TC
1.	Role of Antioxidants and Natural Products in Inflammation.	2016	Arulselvan, P. <i>et al.</i>	Universiti Putra Malaysia.	279
2.	Study on the inhibitory effects of Korean medicinal plants and their main compounds on the 1,1-diphenyl-2-picrylhydrazyl.	2003	Cho E.J. <i>et al.</i>	Institute of Natural Medicine, Toyama Medical and Pharmaceutical University, Japan; Department of Oriental Medicine Resources, Sunchon National University, South Korea.	215
3.	Anti-microbial effects of Thai medicinal plants against acne-inducing bacteria.	2005	Chomnawang, M.T. <i>et al.</i>	Mahidol University, Bangkok, Thailand.	204
4.	The role of traditional Chinese herbal medicines in cancer therapy from TCM theory to mechanistic insights.	2010	Hsiao, W.L.W., Liu, L.	Hong Kong Baptist University, Hong Kong.	201
5.	Immunomodulatory and anti-SARS activities of <i>Houttuynia cordata</i> .	2008	Lau, K.M. <i>et al.</i>	The Chinese University of Hong Kong, Hong Kong.	197
6.	Virucidal effects of the steam distillate from <i>Houttuynia cordata</i> and its components on HSV-1, Influenza Virus, and HIV.	1995	Hayashi, K. <i>et al.</i>	Department of Virology, Toyama Medical/Pharmaceutical Univ., Japan.	173
7.	Cosmetic applications of selected traditional Chinese herbal medicines.	2006	Wang, K.H. <i>et al.</i>	Taipei Medical University, Taipei, Taiwan.	155
8.	Inhibitory effects of quercetin 3-rhamnoside on influenza A virus replication.	2009	Choi, H.J. <i>et al.</i>	Korea Research Institute of Bioscience and Biotechnology; Wonkwang University, Iksan; Chungcheongnam-Do Health and Environment Research Institute, Daejeon, South Korea.	127
9.	Evaluation of antiviral activities of <i>Houttuynia cordata</i> Thunb. extract, quercetin, quercetrin and cinanserin on murine coronavirus and dengue virus infection.	2016	Chiew, K.H. <i>et al.</i>	The National University of Singapore, Kent Ridge, Singapore.	124
10.	Anti-inflammatory effect of <i>Houttuynia cordata</i> injection.	2006	Lu, H.M. <i>et al.</i>	Central South University; Huaihua College, China.	121

medicinal plants against acne-inducing bacteria," authored by Chomnawang, M.T. *et al.* which received 204 citations.^[13]

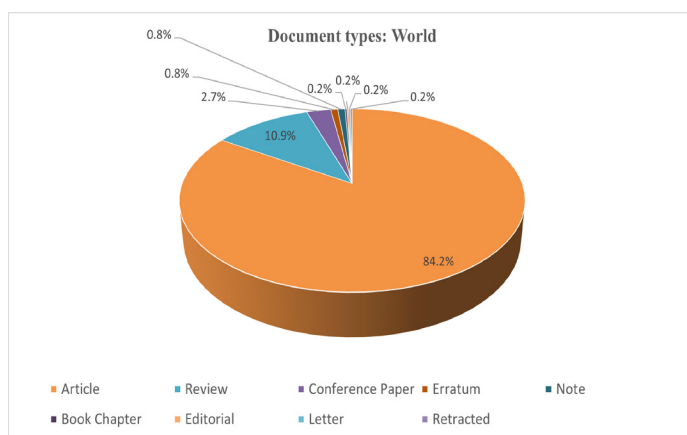
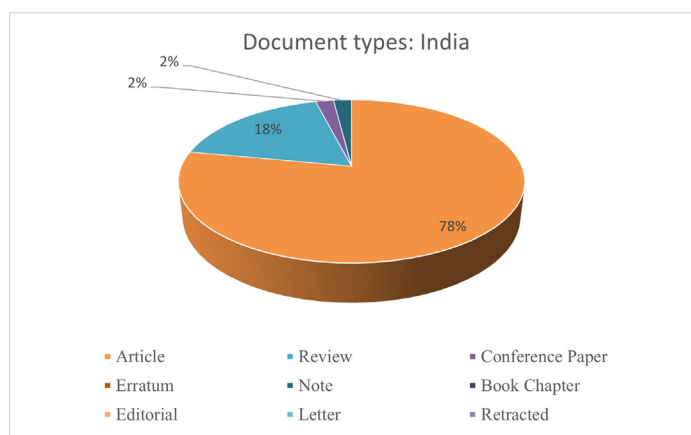
Research Trend and Ethnomedicinal relevance of *Houttuynia cordata*

Significant keywords identified from the scientific articles using VOS viewer shed light on research trends on *Houttuynia cordata* around the world, including their pharmacological properties and medicinal uses. The fifty topmost recurring words from the scientific articles are listed in Table 7. It can be seen that the terms are directed toward research related to the extracts of the *Houttuynia cordata* plant. Significant pharmacological activities reported include antiviral, anti-inflammatory, and antioxidant

activity and research have mainly focused on investigating them. Keyword analysis revealed that the research is also focused on flavonoids, a natural compound found in *Houttuynia cordata* that has anti-inflammatory effects to treat inflammation-related diseases, especially in the lungs. Animal experimentation has also been one of the axes of research, in particular on rats and mice, to study the therapeutic and pharmacological benefits of *Houttuynia cordata* in the treatment of various diseases such as diabetes. Further exploration revealed that *Houttuynia cordata* has been identified as the most potential herbal medicinal plant in China^[14] which is evident from recurring keywords like 'Chinese Herbal' and China.

Table 7: Top 50 significant keywords in the literature on Global *Houttuynia cordata* research during 1992-2021.

Sl. No.	Keyword	Frequency	Sl. No.	Keyword	Frequency
1	<i>Houttuynia cordata</i>	413	26	Female	61
2	Article	359	27	Human cell	53
3	Non-human	277	28	Quercetin	53
4	<i>Houttuynia cordata</i> extract	226	29	Anti-inflammatory activity	50
5	Unclassified drug	223	30	Protein expression	49
6	Controlled study	216	31	<i>In vitro</i> study	47
7	Human	193	32	Animal tissue	46
8	Plant extract	148	33	Drug efficacy	46
9	Medicinal plant	135	34	Animal cell	45
10	<i>Houttuynia</i>	129	35	Anti-viral activity	45
11	Humans	128	36	Herbal medicine	43
12	Herbaceous agent	113	37	Drug mechanism	42
13	Animals	104	38	Antioxidant activity	41
14	Chemistry	99	39	Flavonoid	41
15	Chinese herbal	99	40	Plant Leaf	41
16	Priority journal	94	41	Saururaceae	41
17	Male	90	42	Anti-virus agent	40
18	Drug effect	89	43	Drug isolation	38
19	Animal experiment	88	44	Unindexed drug	37
20	Mouse	68	45	China	36
21	Review	68	46	Antiviral agents	35
22	Metabolism	67	47	Interleukin-6	35
23	Plant extracts	67	48	Adult	33
24	Animal model	66	49	Apoptosis	33
25	Chinese medicine	62	50	Drug structure	33

**Figure 3:** Distribution of scientific publications based on document types by world.**Figure 4:** Distribution of scientific publications based on document types in India.

Significant keywords in the literature highlight the research course on *Houttuynia cordata* in India between 1992 and 2021 as depicted in Table 8. Analysis of the keywords shows that research on *Houttuynia cordata* (Saururaceae) in India is mainly

focused on its plant extracts which exhibit good antioxidant and anti-inflammatory properties in preventing diabetic complications. *Houttuynia cordata*, as traditional medicine, is another area of research. Research on its antiviral, antimicrobial,

Table 8: Top 50 significant keywords in the literature on *Houttuynia cordata* research in India during 1992-2021.

Sl. No.	Keyword	Frequency	Sl. No.	Keyword	Frequency
1	<i>Houttuynia cordata</i>	34	26	Drug effect	5
2	Article	20	27	Herbaceous agent	5
3	Non-human	20	28	<i>In vitro</i> study	5
4	<i>Houttuynia cordata</i> extract	16	29	Oxidative stress	5
5	Human	15	30	Plant extracts	5
6	Unclassified drug	14	31	Quercetin	5
7	Plant extract	13	32	Antioxidant	4
8	Medicinal plant	12	33	Anti-virus agent	4
9	Priority journal	12	34	<i>Centella asiatica</i>	4
10	Humans	9	35	Chemistry	4
11	Controlled study	8	36	Coronavirus disease 2019	4
12	Flavonoid	8	37	Herbal medicine	4
13	India	8	38	Medicinal plants	4
14	Review	8	39	Metabolism	4
15	Unindexed drug	8	40	Physical chemistry	4
16	Drug efficacy	7	41	Phytochemicals	4
17	Plant leaf	7	42	Plant root	4
18	Traditional medicine	7	43	SARS-CoV-2	4
19	Antioxidant activity	6	44	Antibacterial activity	3
20	Anti-viral activity	6	45	Anti-inflammatory activity	3
21	Herb	6	46	Antiviral agents	3
22	Phytochemistry	6	47	Ascorbic acid	3
23	Animal	5	48	<i>Carica papaya</i> extract	3
24	Antimicrobial activity	5	49	<i>Chenopodium album</i>	3
25	COVID-19	5	50	Coughing	3

immune-stimulant, anti-cancer, and anti-inflammatory effects is also prevalent. Keywords also emphasize research on *Houttuynia cordata* and its medicinal properties to tackle SARS Coronavirus, as it is conventionally used to treat pneumonia.

Figure 8 shows VOS viewer visualization of keyword-occurrence of the world with a timespan. In the visualization presented each circle represents a keyword. Large circles represent a keyword that has been frequently used. Small circles represent keywords that have been used fewer times in research publications. Colors indicate clusters of keywords that are relatively strongly related to each other. There are four clusters in the represented visualization. A color bar is indicated at the bottom right corner of visualization, indicating the cluster of keywords that have been most frequently used further the color bar indicates how keyword frequency is mapped to color. Lines indicate the link between the keywords. The keywords in blue color are the most frequently

used keywords whereas the keywords in yellow color represent the emerging keywords. Keyword co-occurrence analysis reveals the most frequently used keywords are *Houttuynia cordata*, Controlled study, Unclassified Drug, Herb, Traditional Medicine, etc. Keywords such as medicinal plant, and traditional medicine related to *Houttuynia cordata* also suggest that much research has been done on these areas implying that researchers prefer to write mostly on these areas. The yellow cluster reveals *Houttuynia cordata* research related to COVID 19 is the emerging research area.

Figure 9 shows VOS viewer visualization of keyword-co-occurrence of India with a timespan. India's most frequently used keywords are *Houttuynia cordata*, medicinal plants, COVID-19, pandemic, and so on. Researchers in India are generally exploring these areas for research. In India *Houttuynia cordata*, research in relation to coronavirus turns out to be an emerging area.



Figure 5: Worldwide publication on *Houttuynia cordata* by countries/territory.

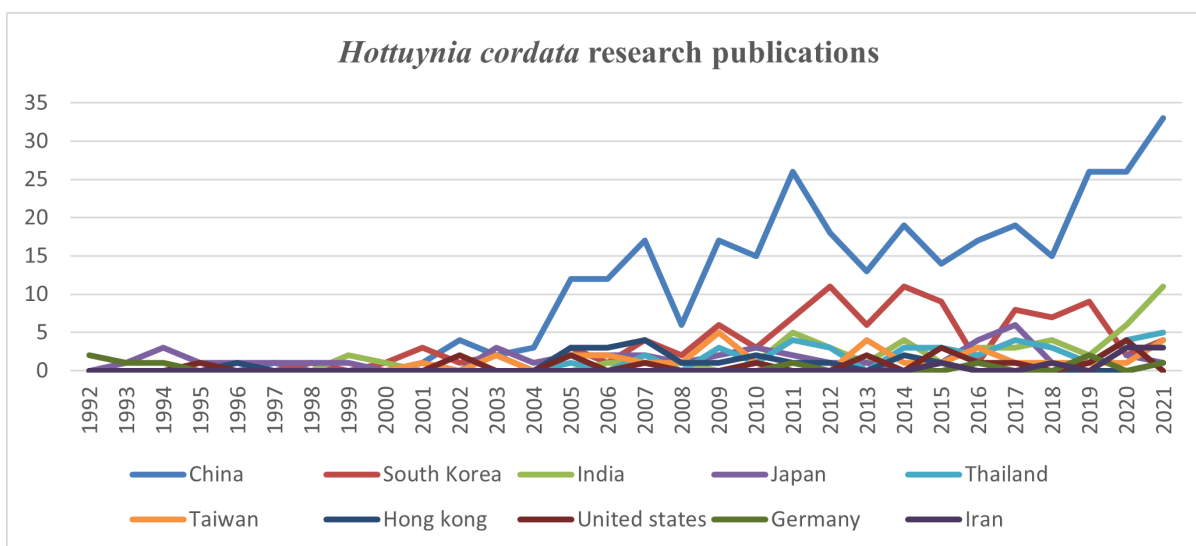


Figure 6: Evolution of research publication on *Houttuynia cordata* in the top 10 countries/territories from 1992 to 2021.

DISCUSSION

An analysis of the scientific publications listed in the Scopus database concerning *Houttuynia cordata* shows less research, over the last 30 years (1992-2021). Globally a total of 634 scientific publications are published in the SCOPUS database. India contributed 50 scientific publications to this. Among the top 10 countries, China globally dominated the publication contribution on *Houttuynia cordata* with a total of 316 publications. This might be because this perennial herb is native to Asian nations like China and India.^[14] Globally, the average citation per paper is 15.8. India has an average citation of 10.02 per paper. Global publication output reveals that most of the papers written on *Houttuynia cordata* were written as research articles (84.2%), and India's contribution is 78.0%. China dominates the publication

distribution as the top productive country, publishing around 316 papers with 3649 total citations and 11.55% ACP. South Korea follows it with 102 papers, 1799 total citations, and 17.64% ACP. India is the third most productive country in publication distribution with 50 publications, 501 total citations, and 10.02% ACP. Of the cited publication in India, 20% of publication has not received any citations, and 54% of publications (receiving citations from 1-10) together contributed the maximum citations, i.e., 22.55%. On subject-wise, Pharmacology, Toxicology, and Pharmaceutics constitute the leading publication with 41.80% of the total publication. The study's findings are significant because they provide an overview of the studies that researchers have done on '*Houttuynia cordata*', both globally and in India. The highest cited paper is the "Role of Antioxidants and Natural products in Inflammation" by "Arulselvan P. et al.", with a total of 279 citations

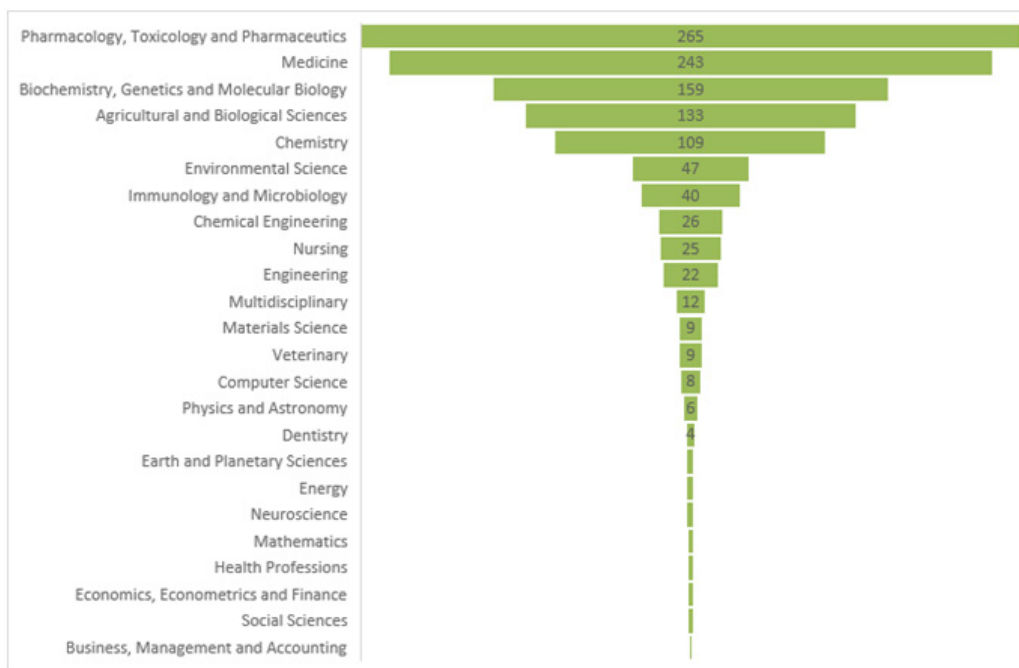


Figure 7: *Houttuynia cordata* research publication by different subject categories globally.

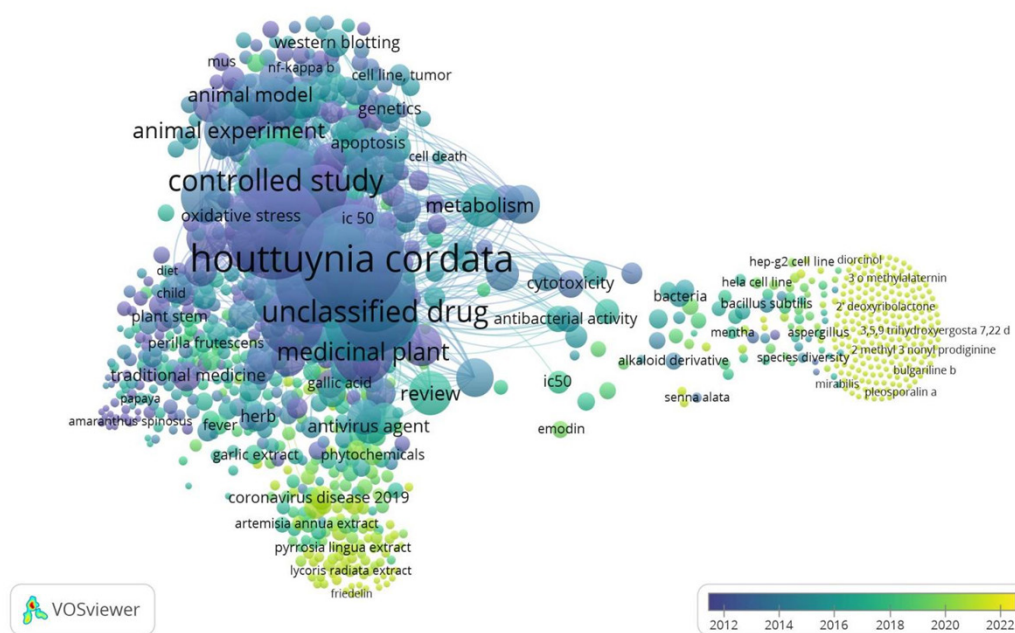


Figure 8: Global Keyword occurrence analysis: Overlay Visualization.

Items-1000, Clusters-4, links-126495, Total link strength-222892.

affiliated to University Putra, Malaysia. This highly referred work emphasizes the significant research area of '*Houttuynia cordata*', and the reoccurrence of keywords like antioxidants and anti-inflammatory further supported it (Tables 7 and 8). The most frequently used keywords in global publications are '*Houttuynia cordata*' 'Unclassified Drug', 'Traditional Medicine', 'Chinese herbal', 'China', 'Interleukin-6', etc. The most frequently

used keywords in India are '*Houttuynia cordata*', 'Medicinal Plants', 'Plant extract', 'Traditional Medicine', 'COVID-19' etc. Furthermore, overlay visualization of keywords revealed both in India and worldwide, *Houttuynia cordata* research related to COVID-19 is an emerging research area. The reasoning may be *Houttuynia cordata* has reportedly been shown to have pharmacological activity, including anti-bacterial, anti-viral,

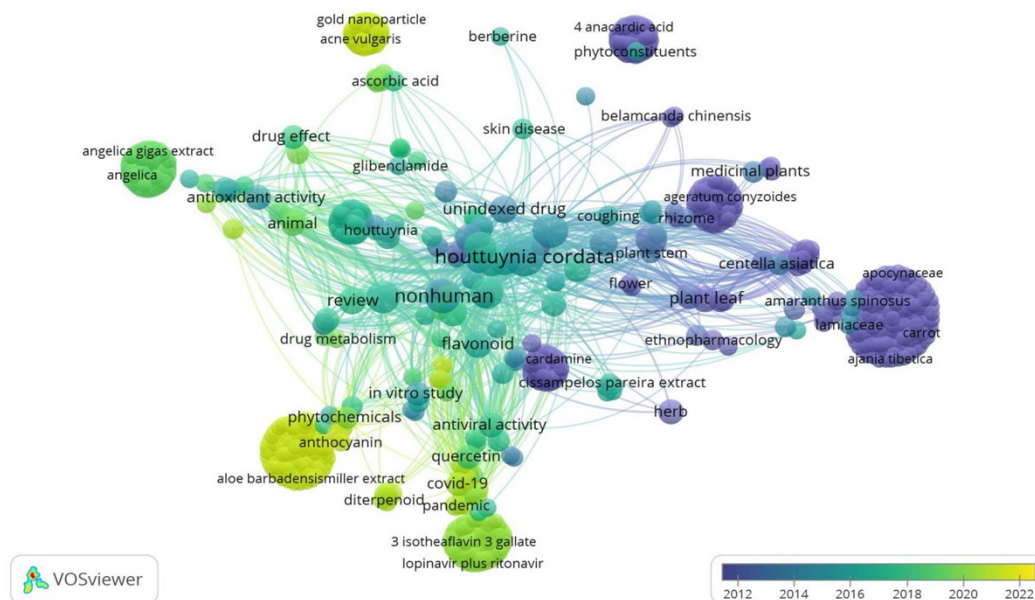


Figure 9: VOSviewer visualization of keyword-co-occurrence of India.

Items-1000, Clusters-9, Links-77461, Total Link Strength-80136.

antitumor, antioxidant, and anti-inflammatory properties. It has also been shown to reduce nasal congestion and swelling by decreasing the activation of Interleukin-6 and is used to fight COVID-19. An important chronic allergic rhinitis mediator, interleukin-6 is crucial for COVID-19 inflammation.^[15]

CONCLUSION

The study of '*Houttuynia cordata*' research from the SCOPUS database for a time period of 30 years presumed that the development of both publications and citations has happened moderately over the years. Asian nations turn out to be doing more research connected with *Houttuynia cordata* in contrast with European nations. China turns out to be the leading contributor to *Houttuynia cordata* research. Keywords analysis likewise demonstrates, for the most part, the significance of *Houttuynia cordata* as a medicinal plant, especially during the COVID-19 pandemic. It was found out that research on *Houttuynia cordata* was slow and torpid throughout the years, then a spike of critical distribution happened lately during the COVID-19 pandemic. Our findings revealed the recent rise in interest in *Houttuynia cordata* research is due to COVID-19. The possible reasoning behind this is in addition to being used to treat pneumonia, this particular genus, as was previously stated, offers medicinal relevance in the fight against the SARS Coronavirus. The results of the study are limited exclusively to the SCOPUS database.

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CONFLICT INTEREST

The authors declare there is no conflict of interest.

ABBREVIATIONS

COVID-19: Coronavirus disease of 2019; **SARS:** Coronavirus - severe acute respiratory syndrome coronavirus.

SUMMARY

The present study is a Scientometric Analysis on *Houttuynia cordata* during 1992-2021 as covered in SCOPUS Database to find out the citation impact, growth rate and research output on research done about *Houttuynia cordata*. *Houttuynia cordata* is a herbal medicinal plant with a variety of medicinal properties. It is used as an anti-inflammation, antidote, astringent, anti-bacterial and anti-viral. The study found out that from 2005 onwards, there was an increase in *Houttuynia cordata* research and publication. Among the top 10 countries, China is the top productive country with the maximum number of publications on *Houttuynia cordata* with 316 publications, followed by South Korea and India respectively. Pharmacology, Toxicology, and Pharmaceutics were the top subject areas that constituted the leading publication, resulting in 41.80% of the total publication. The most common keywords used are '*Houttuynia cordata*', 'Traditional Medicine', 'Medicinal Plants', 'Corona Virus', 'COVID-19' and 'Pandemic'. From 2019-2021 there is a tremendous shift from the keywords such as 'Traditional Medicine', 'Medicinal Plants' to keywords such as 'Corona Virus', 'COVID-19' and 'Pandemic', indicating that research on *Houttuynia cordata* relating to Coronavirus,

COVID-19 and Pandemic has become has an extensive area of research from 2019 onwards.

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