Scientometric Analysis of Black Pepper Research Publications from 2011 – 2020

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ABSTRACT

Scientometric analysis of black pepper research publications from Scopus Database from 2011 – 2020 with 2076 research publications During the study period maximum of 316 (15.22%) research publications are contributed in the year of 2020. average research publications per year is 207.6 and CAGR is 7.31 related growth rate is 0.28 in the year 2012 and 0.06 in the year of 2019 at same time doubling time is 2.44 in the year 2012 and 11.08 in the year 2019. out of 2076 research publications 122 research publications are single author's and remaining 1954 research publications are multi author's maximum of 1735 (83.57%) research publications are contributed by articles. Bhat, A.I was the most productive author with 17 (0.81%). Maximum of 33(1.59%) research publications are contributed by Food Chemistry and maximum of 57(2.75%) publications are funded by National Natural Science Foundation of China. India is the most productive country with 712 (34.30%) contributions followed by China.

KEYWORDS: Scientometric, Spices, Black Pepper, Relative growth Rate and doubling time.

INTRODUCTION

Scientometric analysis research publications is an important aspect of black pepper research publication in recent year. Black Pepper is rightly called the King of Spices, and its positions is supreme among spices. This spice with its characteristic pungency and flavor is an ingredient in many food preparations, and at the dining table it is the only spice invariably served. It was used for different purposes by different people in the past and in future. The black pepper of commerce is the dried, mature fruits (commonly called berries) of the tropical, perennial climbing plant Piper nigrum L., which belongs to the family *Piperaceae*. Black pepper is woody climber, grown in the South Western region of India, comprising of the states of Kerala, Karnataka, Tamil Nadu and Goa, the entire region once known as Malabar a name now used restrictively to mean only the northern part of Kerala. Pepper is popular the uses are mainly as a food in ingredient and as a preservative. Besides, almost all the traditional systems of medicine- Ayurvedic, Homoeopathy, Unani and Aromatherapy as well as Chinese and African systems- regularly use pepper in various forms, both as a preventive and cure for an astonishing number of ailments with remarkable success.

REVIEW OF LITERATURE

Research Publications are clearly one of the quantitative measures for the basic research activity in a country. It must be added, however, that what excites the common man, as well as the scientific community, are the peaks of scientific and technological achievement, are the peaks of scientific and technological achievement, not just the statistics on publications. **Liu & shu** have studied the distribution of Astronomy papers by Chinese authors for the period 1986-1990 across various subfields of Astronomy and ranked different institutes by their productivity. The performance of Indian Organic Chemistry research in India was assessed by **Karki & Garg.** The study established that Organic Chemistry performed in India had improved slightly when compared to the previous period. The high and low activity areas of Spices amongst 36 Asian countries have been identified by **Amudhavalli & Senthilkumaran** in their paper Cross National Comparison of Spices Research amongst the Asian Countries. This analysis is spread over a period of three decades (1968-2002). A Scientometric study of Black Pepper literature published form 1999-2013 with respect to India using Horticultural Science Data base identified by **Senthilkumaran and Abdul Jaseem.** This paper investigates the most prolific authors, primary institutions and key journals in black pepper are critically examined for its features.

OBJECTIVE OF THE STUDY

A Scientometric study in the area of black pepper will help the scientist to know the research and development in this area and to progress further study. The main objectives of the study are

1. To find out year wise growth of Publications.

2. To find out Relative Growth Rate and Dubling time.

3. To Identify the document type.

4. To Analysis top 10 Author's contributors.

5. To analysis the author patron.

METHODOLOGY

The ''Black Pepper'' research publications are identified from the Scopus multidisciplinary Online database from 2011 to 2020. Using the following research keyword: title-ABS-Key ''Black Pepper'' AND PUB YEAR- 2010 AND PUB YEAR-2021. The data was collected for this study is for ten years. The collected data is were analysed using micro soft excel work sheet.

ANALYSIS AND INTERPRETATION

Year Wise Growth of Publications

Table -1 Year wise Growth of Black Pepper Research Publication.

S. No	Year	No of Publications	%	Cum.	%	Growth Ratio
1	2011	156	7.51	156	7.51	
2	2012	144	6.94	300	14.45	0.92
3	2013	179	8.62	479	23.07	1.24
4	2014	185	8.91	664	31.98	1.03
5	2015	194	9.34	858	41.33	1.05
6	2016	206	9.92	1064	51.25	1.06
7	2017	231	11.13	1295	62.38	1.12

8	2018	229	11.03	1524	73.41	0.99
9	2019	236	11.37	1760	84.78	1.03
10	2020	316	15.22	2076	100.00	1.34
Total		**2076**	**100.00**			
CAGR		**7.31**				

Table 1 shows that year wise growth of black pepper related research publications from Scopus database from 2011 – 2020. It is identified from the study a total number of 2076 research Publications are contributed during the study period out of that, Maximum of 316 (15.22%) research publication are contributed in the year of 2020. followed by 236 (11.37%) research publication in the year of 2019. An average research publication per year is 207.06. During the study period it is identified that, Compound annual growth rate is 7.31 and also this study found that, maximum annual growth rate is 1.34 in the year 2020. followed by 1.24 in the year 2013 minimum growth rate during the study period is 0.92 in the year 2012

Relative Growth Rate and Doubling Time

Table - 2 Relative Growth Rate and Doubling Time

S. No	Year	No of Publications	Cum.	W1	W2	RGR=(W2-W1)	Dt=0.693/RGR
1	2011	156	156		2.193		
2	2012	144	300	2.193	2.477	0.28	2.44
3	2013	179	479	2.477	2.680	0.20	3.41
4	2014	185	664	2.680	2.822	0.14	4.89
5	2015	194	858	2.822	2.933	0.11	6.23
6	2016	206	1064	2.933	3.027	0.09	7.42
7	2017	231	1295	3.027	3.112	0.09	8.12
8	2018	229	1524	3.112	3.183	0.07	9.80
9	2019	236	1760	3.183	3.246	0.06	11.08
10	2020	316	2076	3.246	3.317	0.07	9.66
Total		**2076**					

Table – 2 The growth of Publication was analyzed by using two parameters namely Relative Growth Rate and Doubling time Mahapatra (1985) 16 RGR is a measure to study the increases in number of articles in a period of time. It is calculated as

$$R(a) = \frac{(W_2 - W_1)}{(T_2 - T_1)}$$

Where as

Explain w1, w2, t1 and t2

R(a) = RGR = the mean relative growth rate over the specific period of interval

W1 = the logarithm of beginning number of publications/pages

W2 = the logarithm of ending number of publications/pages after a specific period of interval

$T2 – T1$ = the unit difference between the beginning time and the ending time.

The doubling time is the time taken for the doubling of the number of records actually published within a stipulated period. The doubling time is calculated from the relative growth rate and the natural logarithm number is used, the difference has a value of 0.693. Thus, the corresponding doubling time can be calculated by the following formula.

$$Dt = \frac{0.693}{R\,(a)}$$

The relative growth rate and the doubling time (Dt) was calculated and the result are present in table 2. The study it is identified from the table 2, the relative growth rate is 0.28 in the of year 2012 and 0.06 in the year of 2019. This study found that relative growth rate is decreasing trend. At the same time doubling time found that 2.44 in the year of 2012 and 11.08 in the year of 2019. It is found that doubling time is in increasing trend.

Document Type Distribution

Table - 3 Document Type distribution

S.No	Document Type	No of Publications	%	Cum.	Cum.%
1	Article	1735	83.57	1735	83.57
2	Review	168	8.09	1903	91.67
3	Conference Paper	76	3.66	1979	95.33
4	Book Chapter	57	2.75	2036	98.07
5	Letter	11	0.53	2047	98.60
6	Editorial	6	0.29	2053	98.89
7	Book	5	0.24	2058	99.13
8	Erratum	5	0.24	2063	99.37
9	Note	4	0.19	2067	99.57
10	Short Survey	4	0.19	2071	99.76
11	Conference Review	3	0.14	2074	99.90
12	Data Paper	2	0.10	2076	100.00
	Total	2076	100.00		

Table 3 depict the category published with percentage. It shows that most of the literature published in the form of articles which consist of 83.57% of the total publication. Review 8.09 % and third place in conference paper with 3.66% research publications. This study confirmed that more than 95.32 % of research publication are contributed by articles, Review and conference papers Remaining nearby 4.68% of research publications are identified in other form of publication.

Author wise Distribution

Table – 4 Author wise Distribution

S.No	Author	No of Publications	% of 2076	Rank
1	Bhat, A.I.	17	0.81	1
2	Anandaraj, M.	15	0.72	2
3	Goswami, T.K.	14	0.67	3
4	Eapen, S.J.	13	0.62	4
5	Kumar, A.	12	0.57	5
6	Umadevi, P.	11	0.52	6
7	Kirubakaran, A.	10	0.48	7
8	Wu, H.	9	0.43	8
9	Alara, O.R.	8	0.38	9
10	Fan, R.	7	0.33	10
Total		104	5.53	

From the above table – 4, it can be seen that from the among top 10 authors Bhat, A.I is the most productive author with 17 (0.81%) publications out of total output of 2076 publications followed by Anandraj. M contributing with 15 (0.72%) research publications. Goswami T.K. with 14 (0.67%) research publication. The least productive authors in top 10 are Alara, O.R with 8 (0.38%) and Fan, R. with 7 (0.33) publication.

Authorship Pattern

Table – 5 Authorship Pattern

S.No	Authorship	No of Publication	%	Cum.	%
1	Single Author	122	5.88	122	5.88
2	Two Authors	313	15.08	435	20.95
3	Three Authors	373	17.97	808	38.92
4	Four Authors	351	16.91	1159	55.83
5	Five Authors	326	15.70	1485	71.53
6	Six Authors	206	9.92	1691	81.45
7	Seven Authors	146	7.03	1837	88.49
8	Eight Authors	97	4.67	1934	93.16
9	Nine Authors	53	2.55	1987	95.71
10	Ten Authors	31	1.49	2018	97.21
11	More than ten Authors	58	2.79	2076	100.00
Total Publications		2076	100.00		

Table- 5 identified that author pattern in the field of black pepper research publication during the ten-year of study period. From the study it is identified that, out of 2076 research publication. 122 research publication are contributed by single authors and remaining 1354 research publication are multi authors contributions. From the multi authors

publication maximum 313 research publication are contributed two authors followed by 373 publications are contributed by three authors, 351 publications are four authors. During the ten-year study period more than ten authors are contributed 58 publications. Highest collaborative efforts have been observed in this study.

Top 10 Funding Agency

Table – 6 Top 10 Funding Agency

S. No	Name of the Funding Agency	No of Publications	% of 2076
1	National Natural Science Foundation of China	57	2.75
2	Conselho Nacional de Desenvolvimento Científico e Tecnológico	28	1.35
3	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior	28	1.35
4	University Grants Commission	24	1.16
5	Indian Council of Agricultural Research	20	0.96
6	Department of Biotechnology, Government of West Bengal	18	0.87
7	National Research Foundation of Korea	18	0.87
8	National Institutes of Health	16	0.77
9	Universiti Putra Malaysia	16	0.77
10	Bangladesh Council of Scientific and Industrial Research	13	0.63
Total		238	11.46

Table – 6 shows that top 10 Funding Agency contributed are identified from above table. The maximum of 57 (2.75%) publication are funded by National Natureal Science Foundation of China, followed by Conselho Nacional de Desenvolvimento Científico e Tecnológico and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior with 28 (1.35%) research publication Top 10 funding Agencies are contributed by 238 (11.46%) research publication.

Top 10 Journals of Publication

Table – 7 Top 10 Journals Contributions

S.No	Name of the Journal	No of Publications	% of 2076
1	Food Chemistry	33	1.59
2	Journal Of Ethnopharmacology	31	1.49
3	Food Control	24	1.16
4	International Journal Of Pharma And Bio Sciences	22	1.06
5	International Journal Of Pharmacy And Pharmaceutical Sciences	19	0.92
6	Iop Conference Series Earth And Environmental Science	19	0.92
7	Plos One	19	0.92
8	Phytotherapy Research	15	0.72
9	Asian Journal Of Pharmaceutical And Clinical Research	14	0.67
10	International Journal Of Research In Pharmaceutical Sciences	14	0.67
		210	10.12

Table – 7 shows that top 10 journals contribute in the field of black pepper research publication. Form the table-7 it is identified that maximum of 33 (1.59%) research publications are contributed by Food Chemistry. Followed by Journal Of Ethnopharmacology 31 (1.49%) research publication in second place Third place is Food Control with

24 (1.16%) research publication. During the ten years study period top 10 journals are contributed by 210 (10.12%) research publication.

Country wise Contributions

Table – 8 Top fifteen Countries Contributions

S.No	Country	No of Publications	% Of 2076
1	India	712	34.30
2	United States	166	8.00
3	China	164	7.90
4	Brazil	112	5.39
5	Malaysia	108	5.20
6	Iran	73	3.52
7	South Korea	72	3.47
8	Pakistan	71	3.42
9	Thailand	67	3.23
10	Germany	48	2.31
11	Japan	48	2.31
12	Indonesia	47	2.26
13	Saudi Arabia	44	2.12
14	Turkey	44	2.12
15	Italy	43	2.07
Total		1819	87.62

Table – 8 shows countries that mark a place in the top fifteen countries with 2076 publications that is 87.62% of the total papers published in the year range of 2011-2020. India seems to be the most predominant country with 34.30 % of the total publication followed by the United States.

Language wise contribution

Table – 9 Language wise contribution

S. No	Language	No of Publications	%
1	English	2021	97.35
2	Chinese	14	0.67
3	Portuguese	14	0.67
4	Persian	7	0.34
5	Spanish	6	0.29
6	Korean	5	0.24
7	French	4	0.19
8	Arabic	2	0.10
9	Japanese	2	0.10
10	Polish	2	0.10
11	Turkish	2	0.10
12	Ukrainian	2	0.10

13	Malay	1	0.05
14	Russian	1	0.05
15	Serbian	1	0.05

Table – 9 lists all the languages in which pepper records have been published from 2011-2020. The pepper literature seems to be distributed amongst Oriental and European languages. The maximum of 2021 (97.35%) research publication contributed by in English language. Chinese get the 2nd position. Malay, Russian and Serbian with 1 (0.05%) research publication.

CONCLUSION

The total research publication on Pepper is 2076 records (2011-2020). The study attempted to identify the growth and development of black pepper research and found that publications are contributed maximum of 316 (15.22%) research publications in the year of 2020. Average research publications per year is 207.6 and compound annual growth rate is 7.31. Relative growth rate is 0.28 in the year 2012. and 0.06 in the year2019. This study depicts that relative growth rate is decreasing trend. At the same time doubling time 2.44 in the year 2012 and 11.08 in the year 2019 and it is conformed that doubling time is in ordinary trend. Out of 2076 research publications during the study period. During the study period maximum of 1735 (83.57%) research publications are contributed by article, maximum of 91 (2.92%) research publications are contributed by Bhat. A.I. maximum of 33(1.59%) research publications are contributed by Food Chemistry and maximum of 57(2.75) publications are funded by National Natural Science Foundation of China. Maximum of 712 (34.30%) research publications are countries and maximum of 2021 (97.35%) research publications are language wise contributed.

REFERENCES

[1] Amudhavalli, A., and P. Senthilkumaran, "Cross-National Comparison of Spices Research amongst the Asian Countries". International Workshop on Webometrics, Informetrics and Scientometrics, Indian Institute of Technology, Roorkee, 2-5 March 2004. Ed. Hidrun Kretschmer, Yogendra Singh and Ramesh Kundra. Roorkee: IIT, 2004, 1-9.

[2] Karki, M.M.S., and K.C. Garg. "Scientometircs of Indian Organic Chemistry Research". Scientometrics 45.1 (1990): 363-373.

[3] Liu, J., and S. Shu. "Statistical Analysis of Astronomical Papers of China During 1986-1990". Scientometrics 32 (1995): 237-245.

[4] Senthilkumaran, P and Abdul Jaseem. "Scientometric Analysis of Black Pepper Research in India". International Journal of Research in Library Science 2.2 (2016): 116-122.

[5] Singh, J. "Spices and Plantation Crops". Aaishkar Publishers, News Delhi (2008): 1-23

[6] Zamani G.R.; Shadi S.; Mohammadi M.; Mahmodi Garaie J.; Rezaei N. "A survey of quality of life in adolescents with epilepsy in Iran". 33 69-72.

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