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Phyllanthus emblica (Medicinal Plant) Research: A Scientometric Analysis during 2011-2021

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ABSTRACT

The current study examines Phyllanthus emblica *(Medicinal Plant) Scientometrics from 2011 to 2021. Scientometrics techniques are being used for a variety of purposes, including the determination of various scientific indicators, the evolution of scientific output, the selection of journals for libraries, and even stating the potential of a specific field. The acceptance of Scientometrics techniques in various disciplines has resulted in a significant increase in the literature on Scientometrics and related areas. In this field had published 1077articles in eleven years. In year 2021 maximum papers was published that is 172(15.97%), 97% publications are multiauthored. Out of total 1077 literature published, 0.98%of them or published under the joint author of publications and Majority of scientists published their research output in English, 906 records are research Articles. India is at the top, with publishing maximum records 652, followed by China with 122Records.Chiang Mai University, Chinese Academy of Sciences and Indian Council are at top rank by publishing 17 articles.*

KEYWORDS: *Scientometric, Authorship Pattern, Doubling Time, Degree of Collaborations, Phyllanthus emblica, Medicinal plant.*

INTRODUCTION

Phyllanthus emblica (Medicinal Plant) is a traditional system that cures various diseases and its origin in India is thousands years ago. Good health depends on the balance of mind, body, and spirit. More than 600 formulae's are based on herbal treatment. 250 plants remedies are used in Ayurvedic treatments. Ayurveda therapies are based on the health benefits, such as pain relief or increased vitality (energy) can be treated with the help of plant leaves, fruits etc.

Phyllanthus emblica is a fruit that has been used as a natural remedy by Ayurvedic practitioners. According to Ayurvedic, *Phyllanthus emblica* (Amalaki) is beneficial for a various health

related issues associated with liver, heart, brain, and lungs. It's also found in Triphala, which can boost our immunity and treat a variety of health issues. In Sanskrit, Amalaki means "the sustainer". With the help of, *Phyllanthus emblica* (medicine) are using to treat Anemia, Diarrhea, Inflammation, Jaundice, Diabetes etc.

This study is being conducted to assess the growth rate of *Phyllanthus emblica* literature and to discover the statistical and standard improved performance of publication, particularly in *Phyllanthus emblica*. Many studies on its benefits have been conducted, opening the door to further research and development in this area. As a result, relevant investigators of understanding must evaluate quantitative growth in *Phyllanthus emblica* literature research using scientometric tools and techniques.

Scientometrics is concerned with the quantitative aspects of science and scientific research. It is a branch of statistics concerned with measuring and analysing scholarly literature. In this work, author is analysing and measuring the scholarly literature on *Phyllanthus emblica*. Many studies on its benefits have been conducted, opening the door to further research and development in this area. As a result, relevant investigators of understanding must evaluate quantitative growth in *Phyllanthus emblica* literature research using scientometric tools and techniques.

LITERATURE REVIEW

B.M Gupta et al. (2019) have studied quantitative and qualitative assessment of *Aegle marmelos* from the period 2004 to 2018. This study is performed on 962 publications. 36.37%annual growth rate registered and average citation per paper was 16.0. India is at top with 82.30% of the global publication. Researchers have concluded that Aegle marmelos is an important plant used in treatment in various disease.

Naheem et al. (2017) analysed research publications on "chronic liver disease" The data was taken from Scopus and this research was mainly belong to SAARC Countries and there countries contributed 2312 publications. India is at top position in term of publication share. Collaborative research is highly maintained within the SAARC members as well as outside the SAARC Members.

Bhardwaj (2016) analysed the research work took place on the Hemorrhagic fever spread due to Ebola virus. This research included data from database. Total 159 journals were under study with 2446 publications with 69960 citations. Top ten countries are mainly involving research work on the Ebola virus and their research output is 86.8%. USA is alone at top with 46.9% research publications and majority of work published in this field in English Language (87.9%)

Alvarado et al. (2015) examined the expansion of Brazilian metrics literature in metrics research. Their investigation concentrated on the expansion of the literature on bibliometrics, informatics, and scientometrics produced in Brazil by Brazilian and international writers in the form of journal articles, book chapters, and conference papers. Almost 2300 documents were released between 1973 and December 2012. This literature doubles in size every 3.2 years and grows at a rate of 24 percent per year.

H.N.K. Dissanayakea (2015) conducted a scientometrics study on medicinal plant research in Sri Lanka. Sri Lankan scientists' research on medicinal plants was studied using the Scopus database. The search results were analysed based on the numerous sorts of research, plant endemism, and biological activity demonstrated by various plants. According to the findings, activity-related research is more popular than generic physicochemical investigations. Universities have published more papers than research institutions and other institutes. The year with the most publications was 2012.

Arya (2013) worked on the bibliometric study on the research output on "Plant Pathology Research" from the period 2008 to 2012. Total 4302 articles from different journals are taken from CeRA (Consortium for e-Resources in Agriculture) database. After data analysis it was concluded that 95.99% of the article showed multiple authorship. University of California got

first rank with 222 publications, followed by 143 by India.

Jeyshonkar & Ramesh Babu (2013) have studied research on Leukaemia publications researcher did their work on Indian authors from the period 1960 to 2011. The data under study was from Scopus database. After analysis it was concluded that overall growth rate of publication, authorship pattern, degree of collaboration took a positive node and on this field interest of researchers are increasing day by day. In this field major focusing is done on collaborative research and degree of collaboration is 0.96.

Dutt and Nikam (2013) assessed the research done on the solar cell in India between time periods of 1991 to 2010. Most prolific institution is "Indian Association for the Cultivation".

There is a good connection between researches on the solar cell done by Indian researchers with international researchers. This collaboration trend of research is increasing day by day with local to global researchers More focusing is given to research on the materials of solar cells, How the solar cell works if silicon as replaced by the other materials.

Bala & Gupta (2012) analysed globally publications on “Meals research” during the time 2001 to 2010. Data source was Scopus. USA and UK were the main collaborative countries publications followed by USA and Switzerland (112). USA and Canada (70). This studies mainly revealed on the strategies of measles vaccine in developing countries.

OBJECTIVES OF THE STUDY

This study has the following objectives:

1. To study year -wise distribution of the articles published during 2011 to 2022.
2. To find annual growth rate of articles.
3. To reveal authorship pattern and author productivity.
4. To examine Relative Growth Rates and Doubling Time of articles.
5. To classify the Degree of authors collaboration.
6. To study country wise and subject -wise distribution of publications.
7. To study the document wise and language wise distribution of publications.
8. To study the institute wise and funding Sponsor wise distribution of publications.
9. To identify and prepare the Ranked List of Source Title.
10. To identify and prepare the ranked list of authors.
11. To study the distribution publications output by broad subject areas.

RESEARCH METHODOLOGY

The data as a sample is directly retrieved from SCOPUS database. Data ispresented with the help of Microsoft Excel Sheet, in the form of tables. By using different formulae of Scientriometric and its tools data is analysed and various parameters has been calculated. Results are more visualised by the different bar graphs.

RESULTS AND DISCUSSIONS

Year-Wise Distribution of Articles & Annual Growth Rate

Table 1: Year-Wise Distribution of Articles & Annual Growth Rate

S. No	Year	No. of Articles	%	Cumulative	AGR (%)
1	2011	108	10.02	108	-
2	2012	105	9.74	213	- 2.85
3	2013	91	8.44	304	-13.33
4	2014	77	7.14	381	-15.38
5	2015	88	8.17	469	14.28
6	2016	58	5.39	527	-34.09
7	2017	59	5.47	586	1.72
8	2018	75	6.96	661	27.11
9	2019	97	9.00	758	29.33
10	2020	147	13.65	905	51.54
11	2021	172	15.97	1077	17.00
Total		**1077**	**100**		

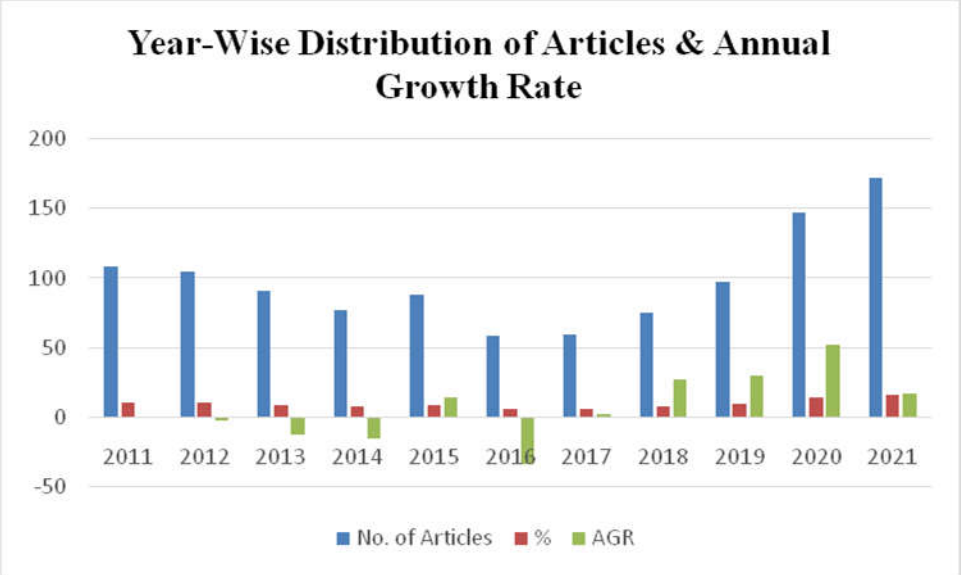

Figure 1: Year-Wise Distribution of Articles & Annual Growth Rate

It is shown in Table - 1, yearly publications of research work on the medicinal plant *Phyllanthus emblica* (Amalaki) from the period 2011 to 2021.The table clearly shows that researchers' *in this field had published 1077articles in eleven years. In year 2021 maximum pape*rs was published that is 172(15.97%), followed by 2020 with 147(13.65%) and minimum publication was in 2016(5.39%). From the table has been concluded that overall publication growth is oscillatory. For 2012 to 2017 its trend is decreasing and then it is taking an abrupt growth in 2020 and till 2021 it is showing increasing trend

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$$Annual\ Growth\ Rate = \frac{(Suceeding\ Value - Previous\ Value)}{Previous\ Value}$$

Authorship Pattern

Table 2: Authorship Pattern

Year	Single Author	Two Authors	Three Authors	Four Authors	Five Authors	Six Authors	More than Six Authors	No. of Publications
2011	3	19	28	25	15	9	9	**108**
2012	6	24	15	23	9	11	17	**105**
2013	2	14	23	19	11	10	12	**91**
2014	2	15	24	12	7	3	14	**77**
2015	3	17	16	12	17	11	12	**88**
2016	0	12	16	8	5	7	10	**58**
2017	2	12	6	15	9	4	11	**59**
2018	0	10	13	13	8	13	18	**75**
2019	1	16	19	14	9	16	22	**97**
2020	5	18	20	28	32	11	33	**147**
2021	3	16	32	26	31	25	39	**172**
Total	**27**	**173**	**212**	**195**	**153**	**120**	**197**	**1077**
Percentage	2.50	16.06	19.68	18.10	14.20	11.14	18.29	100

In authorship pattern it is revealed that authors had contributed total of 1077 Records and out of which 97% publications are multiauthored. Highest Records 19.68% are written by three, followed by 195 by four authors, 173 by two authors, 153by five authors, 120(11.14%) by six authors. Only 27 publications are of single author that reflects in the field of Amalaki more emphasis is given to collaborative research.

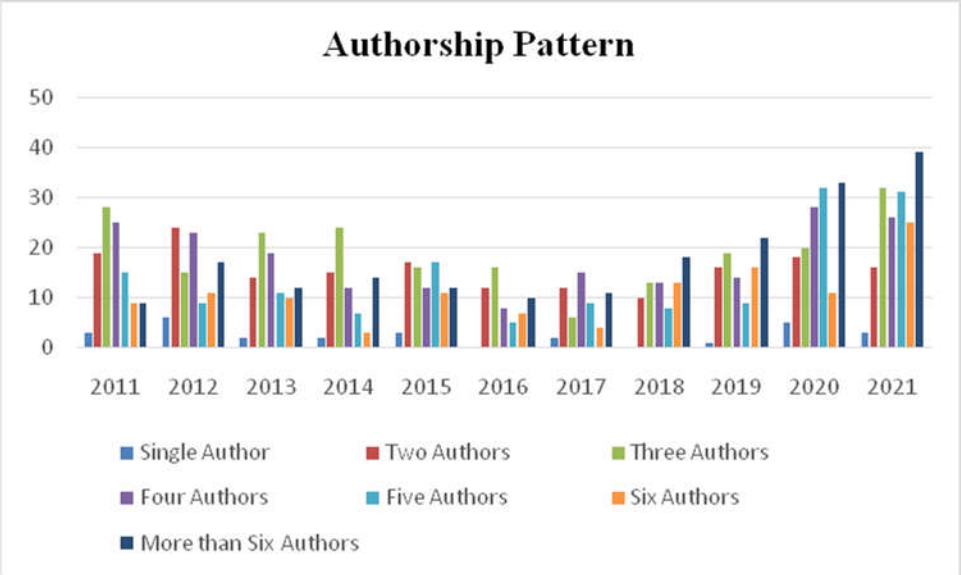

Figure 2: Authorship Pattern

Author Productivity

Table 3: Author Productivity

Year	Number of Authors	Number of Articles	APA	AAPP
2011	435	108	0.25	4.00
2012	437	105	0.24	4.16
2013	383	91	0.23	4.20
2014	319	77	0.24	4.16
2015	380	88	0.23	4.34
2016	269	58	0.215	4.76
2017	282	59	0.21	4.76
2018	369	75	0.20	5.00
2019	478	97	0.20	5.00
2020	715	147	0.20	5.00
2021	893	172	0.19	5.26
Total	4960	**1077**	**0.21**	**4.76**

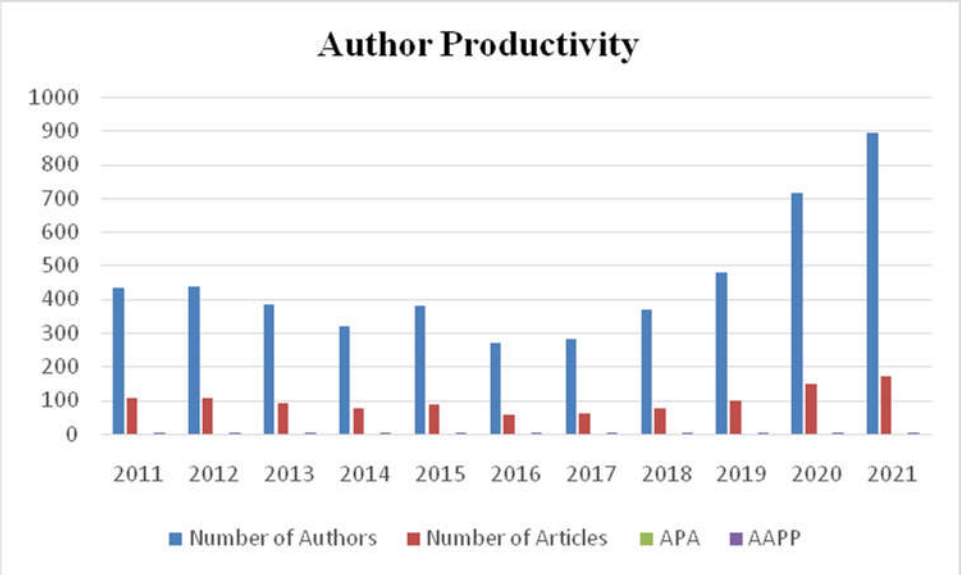

Figure 3: Author Productivity

The *Productivity per author* and *Average Authors Per Paper* are calculated by the following formulae

$$Productivity\ Per\ Author = \frac{Number\ of\ Articles}{Number\ of\ Authors} = 0.21$$

$$Average\ Authors\ Per\ Papers = \frac{Number\ of\ Authors}{Number\ of\ Articles} = 4.76$$

Relative Growth Rates (RGR) and Doubling Time (DT)

Table 4: Relative Growth Rates (RGR) and Doubling Time (DT)

S. No	Year	No. of Articles	Cumulative Total	$LogW_1$	$LogW_2$	RGR	Doubling Time (DT=0.693/RGR)	Mean RGR= ΣR/N	Mean ΣDt/N
1	2011	108	108	2.033	2.033	-	-		
2	2012	105	213	2.02	2.32	0.30	2.31		
3	2013	91	304	1.95	2.48	0.53	1.30		
4	2014	77	381	1.88	2.58	0.70	0.99		
5	2015	88	469	1.944	2.67	0.73	0.94		
6	2016	58	527	1.76	2.72	0.96	0.72	0.69	0.92
7	2017	59	586	1.77	2.76	0.99	0.70		
8	2018	75	661	1.87	2.82	0.95	0.73		
9	2019	97	758	1.98	2.87	0.89	0.77		
10	2020	147	905	2.16	2.95	0.79	0.87		
11	2021	172	1077	2.23	3.03	0.80	0.86		
Total		**1077**				7.64	10.19		

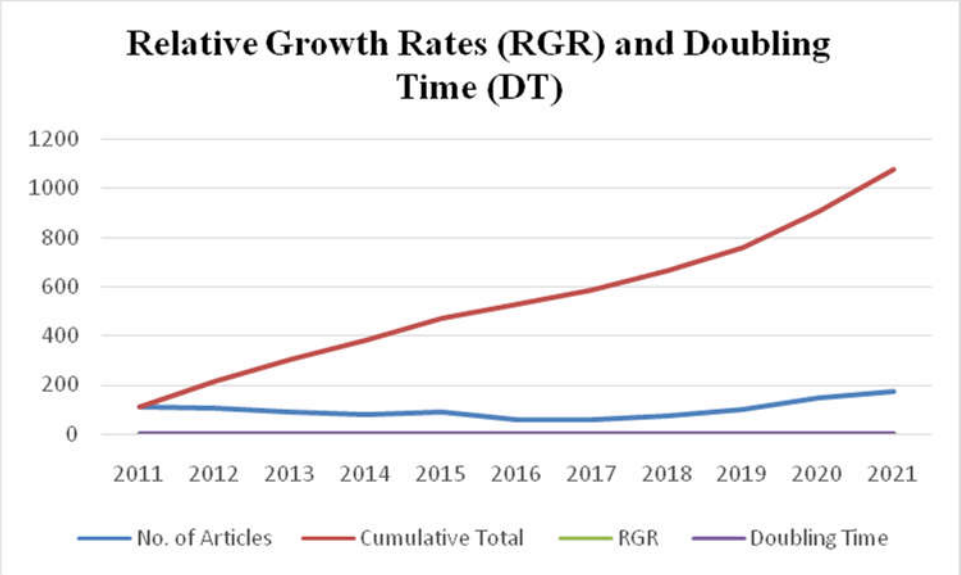

Figure 4: Relative Growth Rates (RGR) and Doubling Time (DT)

Table 4 shows that the relative growth rate of total published articles and also their doubling time. The Doubling time is directly related to RGR. If the numbers of publications or pages of subject double during a given period, then the difference in the logarithms of numbers at the beginning and end of this period must be logarithms of number 2. If natural logarithm is used, this difference has a value of 0.693 in 2012, the growth rate was 0.30.

During the entire study period, the average Relative Growth Rate was 0.69
Relative Growth Rate (RGR) = $Log_e w_2 - Log_e w_1 = 2.303(Log_e w_2 - Log_e w_1)$
Doubling Time $= \frac{0.693}{RGR} = 0.92$

Degree of Collaboration

Table 5: Degree of Collaboration

Year	Single Author Publications (Ns)	Multiple Author Publications (Nm)	Nm+Ns	Degree of Collaboration DC=Nm/(Nm+Ns)
2011	3	105	108	0.97
2012	6	99	105	0.94
2013	2	89	91	0.97
2014	2	75	77	0.97
2015	3	85	88	0.96
2016	0	58	58	1.00
2017	2	57	59	0.96
2018	0	75	75	1.00
2019	1	96	97	0.99
2020	5	142	147	0.96
2021	3	169	172	0.98
Total	**27**	**1050**	**1077**	**0.98**

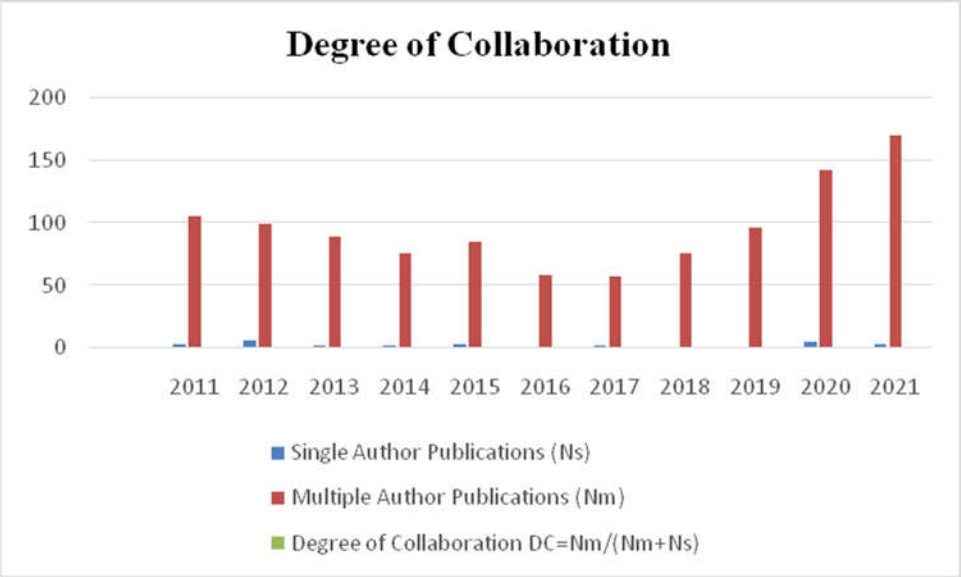

Figure 5: Degree of Collaboration

It could be noted that out of the total 1077 publications, only 27 of them have single authored distribution and the rest of them are multi authored. Compared with the single author works, multi authored contributions are superlatively high.

It is inferred from the table 5 that at the aggregate level, the degree of collaboration is of

0.98 during the study period 2011 to2021, i.e., out of total 1077 literature published, 0.98%of them or published under the joint author of publications. This brings out clearly the high level of prevalence of collaborative research in this field.

$$\textit{Degree of Collaboration (DC)} = \frac{Nm}{(Nm+Ns)} = 0.92$$

Language Wise Distributions of publications

Table 6: Language Wise Distributions of publications

Rank	Language	Number of Publications
1	English	1038
2	Chinese	34
3	Korean	3
4	French	1
4	German	1
4	Persian	1
4	Portuguese	1
	Total	**1077**

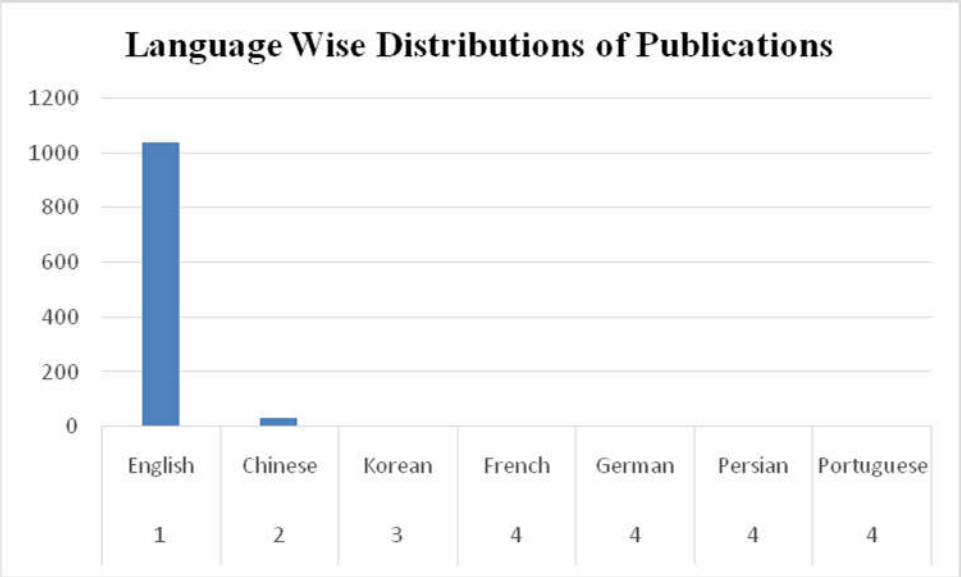

Figure 6: Language Wise Distributions of publications

Table 6 highlights the language-wise distribution of *Phyllanthus emblica* research output. Majority of scientists published their research output in English. 1038 (96.20%) publications out of 1077 are written in English only, followed by Chinese 34.3 in Korean and one-one are in German, Persian and Portuguese.

Document Type distributions of publications

Table 7: Document Type distributions of publications

Document Type	**Number of Publications**
Article	906
Review	100
Conference Paper	42
Book Chapter	12
Data Paper	5
Letter	4
Note	4
Conference Review	3
Editorial	1
Total	**1077**

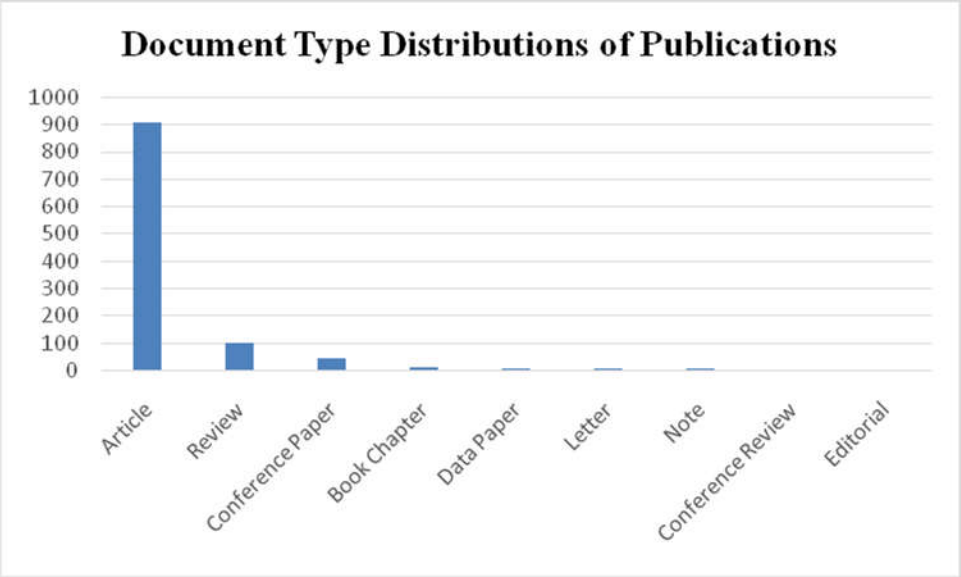

Figure 7: Document Type distributions of publications

Table 7 shows the distribution of 1077 research output. 906 publications are research Articles, 100are Reviews papers, 42 are Conference Papers, 12 are Book Chapters, 5 are Data Papers. Letters and Notes have 4-4 publications each. The contribution of Conference Review and Editorial are 3 and 1 respectively. From the Table, it has been observed that the researchers prefer Journal Articles as compare to others.

Country wise distributions of publications

Table 8: Country wise distribution of publications (Top 10)

Rank	Country	Number of Publications
1	India	652
2	China	122
3	Thailand	94
4	United States	46
5	Pakistan	38
6	Bangladesh	25
7	South Korea	22
8	Saudi Arabia	21
9	Iran	20
9	Japan	20
10	Malaysia	17
10	Sri Lanka	17

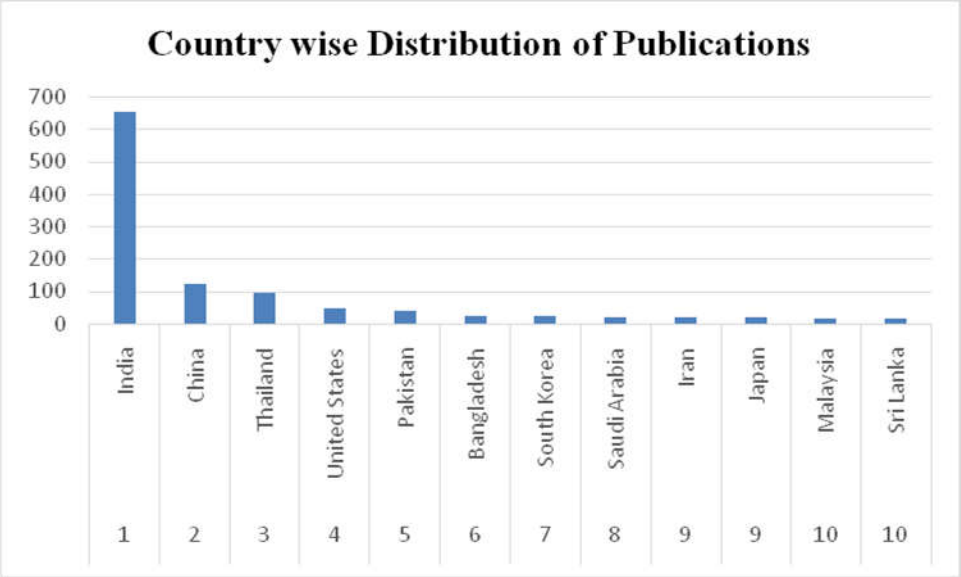

Table 8: Country wise distribution of publications (Top 10)

Table 8 In the field of *Phyllanthus emblica* 68 countries are carrying out their research. Table represents research output of 16 top countries who published maximum publications. India is at the top, with publishing maximum records 652, followed by China with 122 publications, Thailand with 94 publications, United States 46, Pakistan 38 and so on. From the data it is cleared that 90% work on *Phyllanthus emblica* is associated with Asian countries only and Indian researchers are showing more interest in this field.

Subject Area Wise Distribution of Publications

Table 9: Subject Area Wise Distribution of Publications (Top 15)

Rank	Subject Area	Number of Publications
1	Pharmacology, Toxicology and Pharmaceutics	371
2	Medicine	330
3	Agricultural and Biological Sciences	294
4	Biochemistry, Genetics and Molecular Biology	232
5	Environmental Science	104
6	Chemistry	98
7	Chemical Engineering	57
8	Immunology and Microbiology	54
9	Engineering	38
10	Nursing	36
11	Veterinary	33
12	Multidisciplinary	29
13	Materials Science	25
14	Energy	23
15	Physics and Astronomy	21

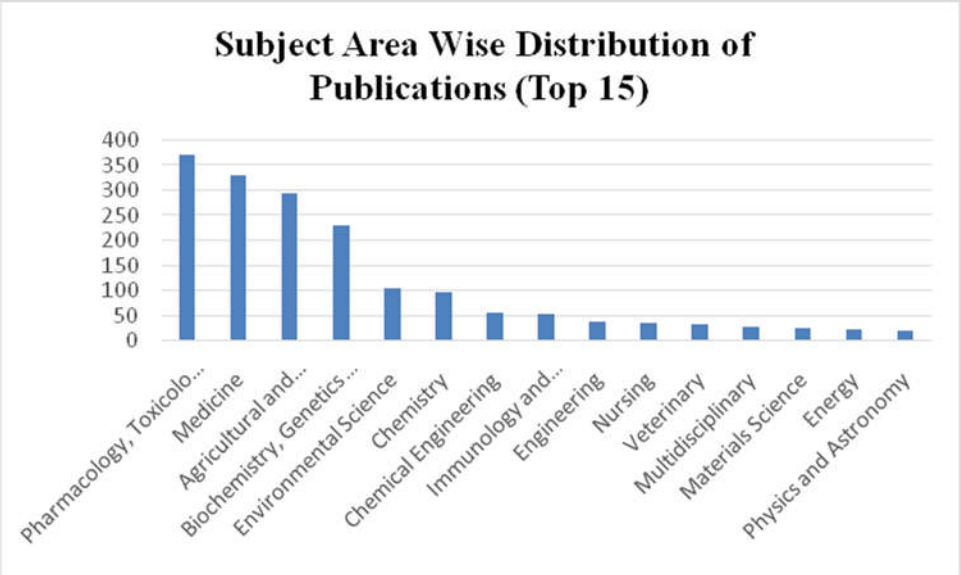

Figure 9: Subject Area Wise Distribution of Publications (Top 15)

From Table 9, It has been found that the total no of records is counted 1077 out of which Pharmacology, Toxicology and Pharmaceuticshave maximum contribution (371), followed by Medicine (330), Agricultural and Biological Sciences (294), Biochemistry, Genetics and Molecular Biology (232), Environmental Science (104) and Chemistry (98) and so on. From the data it is cleared that more than 60% records are associated with only three fields 1) Pharmacology, Toxicology and Pharmaceutics, 2) Medicine and 3) Agricultural and Biological Sciences. Hence from the observations it has been concluded that *Phyllanthus emblica* is used in the treatment of different diseases.

Ranked List of Prolific Authors (Top 5)

Table 10: Ranked List of Prolific Authors (Top 5)

Rank	Name of Author	Number of Publications
1	Keeta, I.	10
1	Potduang, B.	10
2	Baliga, M.S.	9
3	Chaiyasut, C.	6
3	Mirunalini, S.	6
3	Niwaspragrit, C.	6
3	Rajeshkumar, S.	6
3	Soradech, S.	6
4	Ahmad, S.	5
4	Asmilia, N.	5
4	Fungsin, B.	5
4	Hara, K.	5
4	Kamra, D.N.	5
4	Kumar, A.	5
4	Sachdanandam, P.	5
4	Sagane, Y.	5
4	Sivamaruthi, B.S.	5
4	Someya, T.	5
4	Sripanidkulchai, B.	5
4	Wang, D.	5
4	Watanabe, T.	5
4	Wijesekara, R.G.S.	5
4	Yang, C.R.	5
4	Zhang, H.	5
4	Zhang, Y.J.	5
5	Abrar, M.	4
5	Agarwal, N.	4
5	Arya, D.S.	4
5	Bobby, Z.	4
5	Chaudhary, L.C.	4
5	Cheng, R.R.	4
5	Fahrimal, Y.	4
5	Golechha, M.	4
5	Han, L.	4
5	Ketmanee, N.	4
5	Krishnaveni, M.	4
5	Li, Y.	4
5	Manhas, R.K.	4
5	Palatty, P.L.	4
5	Patel, S.S.	4
5	Sano, K.	4
5	Singh, K.	4
5	Tantrawong, A.	4

5	Vijayakumar, S.	4
5	Wang, X.	4
5	Xu, M.	4
5	Zhang, L.Z.	4
5	Zhu, H.T.	4

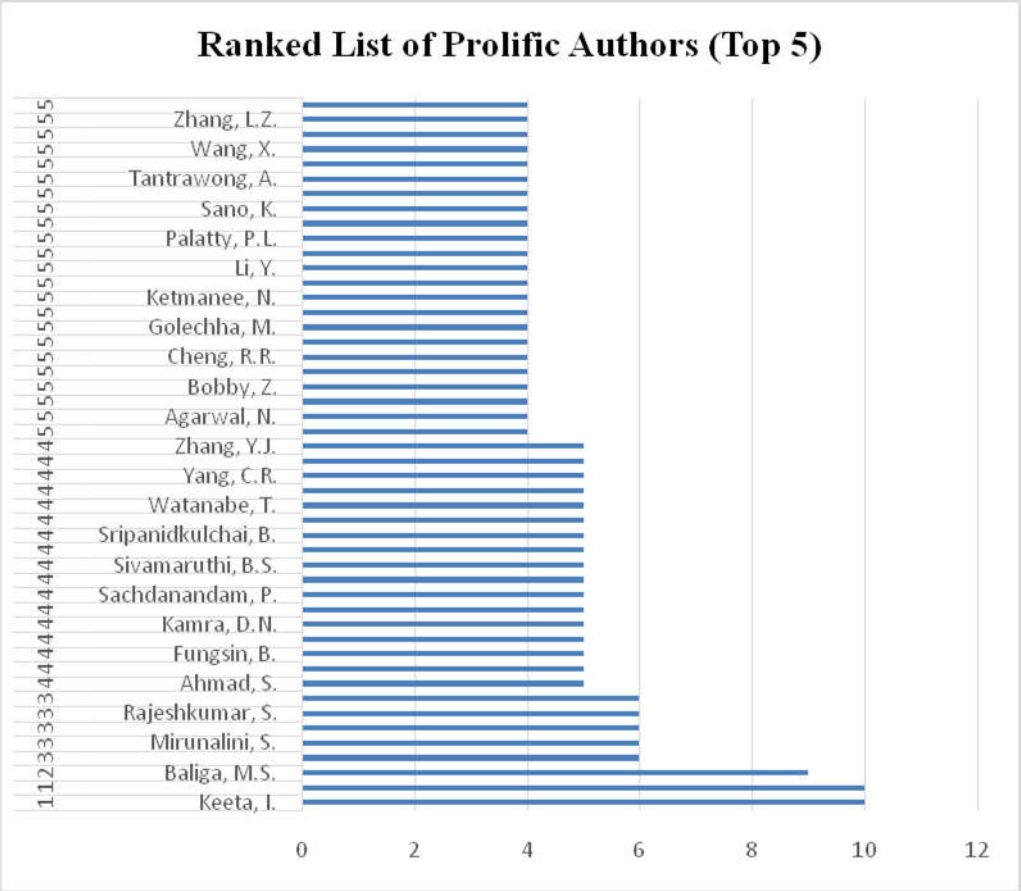

Figure 10: Ranked List of Prolific Authors (Top 5)

Table 10 presents rank list of authors who have contributed four or more articles in the different issues of JFR during the period of study. Most of the fifth ranked authors have published four papers followed by 4th rank has published five papers, rank 3rd authors have six papers, 2nd have nine papers and Keeta, I. and Potduang, B. are at rank first by publishing maximum ten articles. The authors having same number of contributions have been given the same rank. Ranking of authors has great importance in Scientometric research.

Institution Wise Distribution of publications (Top 5)

Table 11: Institution Wise Distribution of publications (Top 5)

Rank	Name of Institution	Number of Publications
1	Chiang Mai University	17
1	Chinese Academy of Sciences	17
1	Indian Council of Agricultural Research	17
2	ICAR - Indian Agricultural Research Institute, New Delhi	14
2	CCS Haryana Agricultural University	14
3	Indian Veterinary Research Institute	13
3	Vellore Institute of Technology	13
3	Saveetha Institute of Medical and Technical Sciences	13
4	Mahasarakham University	12
4	Annamalai University	12
5	Thailand Institute of Scientific and Technological Research TISTR	11
5	Kunming Institute of Botany Chinese Academy of Sciences	11
5	Saveetha Dental College And Hospitals	11

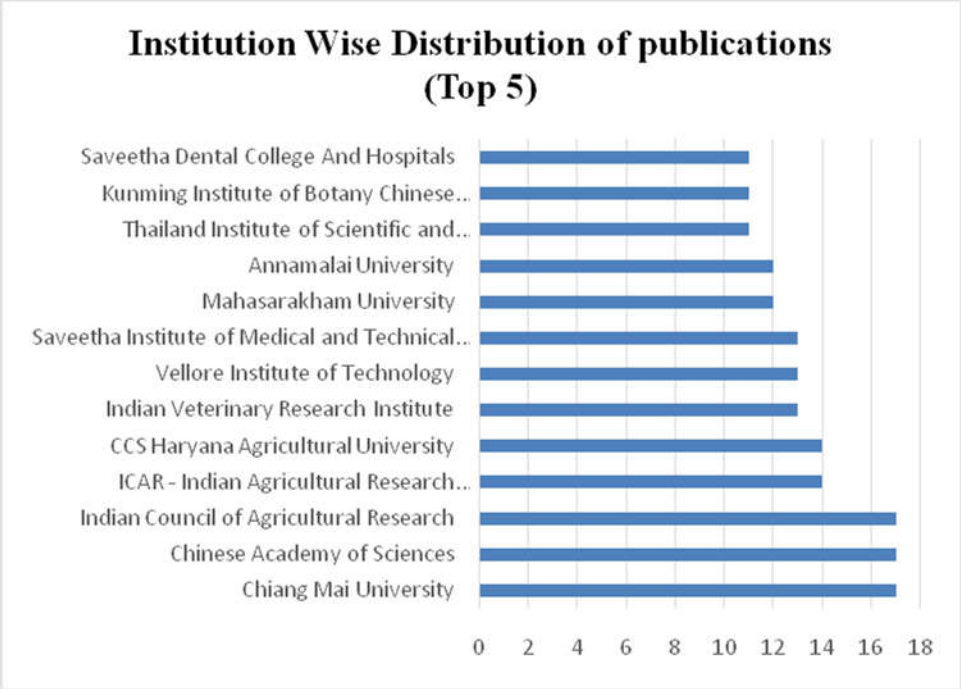

Table 11: Institution Wise Distribution of publications (Top 5)

Table 11 shows that this research output is being contributed by different types of institutions. In this study, an analysis has been made to find out the production of *Phyllanthus emblica* research output according to the categories of the institutions. Accordingly, five major categories of institutions were identified namely Chiang Mai University, Chinese Academy of Sciences, Indian Council of Agricultural Research at first rank by publishing 17 publications. ICAR - Indian Agricultural Research Institute, New Delhi and CCS Haryana Agricultural University at second rank by publishing 14 publications and so on.

Funding Sponsor Wise Distribution of publications (Top 5)

Table 12: Funding Sponsor Wise Distribution of publications (Top 5)

Rank	Name of Funding Sponsor	Number of Publication
1	National Natural Science Foundation of China	36
2	University Grants Commission	24
3	Department of Science and Technology, Ministry of Science and Technology, India	18
4	Chiang Mai University	11
4	Science and Engineering Research Board	11
5	Council of Scientific and Industrial Research, India	9
5	Indian Council of Medical Research	9

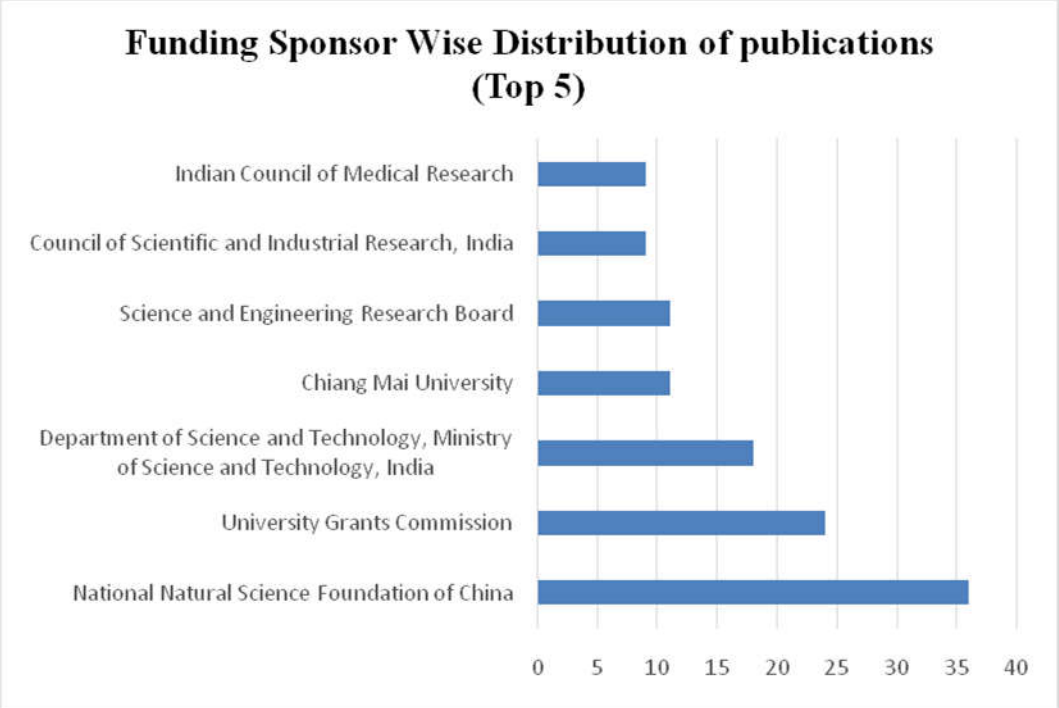

Figure 12: Funding Sponsor Wise Distribution of publications (Top 5)

The table-12 indicates top 5 funding agencies with publications. It is found from the analysis that there are large numbers of funding agencies were acknowledged by the research publications in this field chemistry across the globe. It is revealed that National Natural Science Foundation of China has the largest number of publication output (36) from this sponsored research, while University Grants Commission is at the second position that has sponsored the research for 24 publications, Department of Science and Technology, Ministry of Science and Technology, India sponsored with 18 publications.

Ranked List of Source Title (Top 5)

Table 13: Ranked List of Source Title (Top 5)

Rank	Source Title	Number of Publication
1	Journal of Ethnopharmacology	30
2	Research Journal of Pharmacy and Technology	19
3	International Journal of Pharma and Bio Sciences	17
4	Evidence Based Complementary and Alternative Medicine	14
4	Thai Journal of Pharmaceutical Sciences	14
5	International Journal of Pharmacy and Pharmaceutical Sciences	13

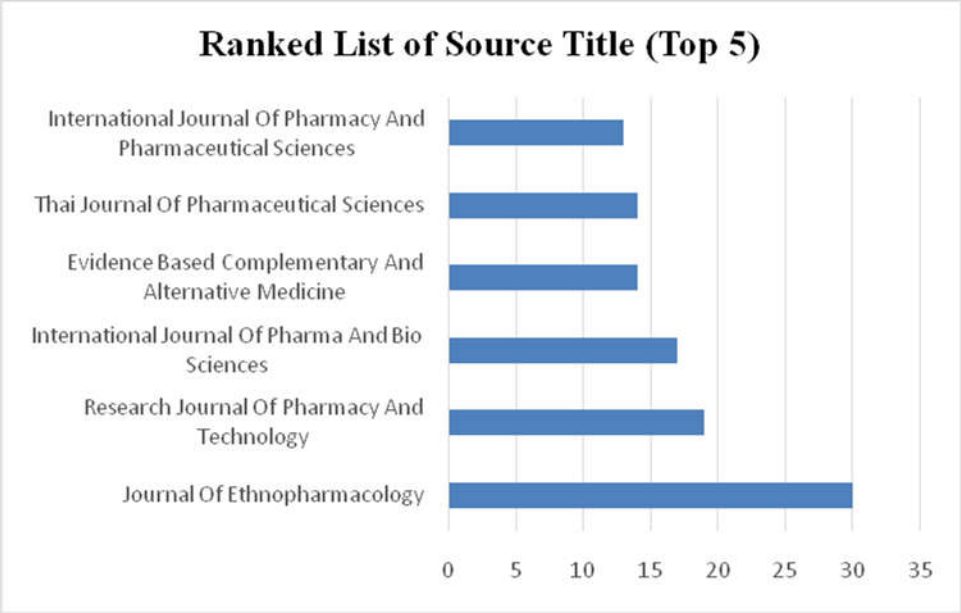

Figure 13: Ranked List of Source Title (Top 5)

Table 13 shows that the impact factor best available to measure the quality of a journal reflects the frequency with which the journal's articles are cited. Both the number of citations and the prestige of the citing journals should be considered for a better scientometrics measure of journal quality.

The scientists have published the highest number of publications (30) in Journal of Ethnopharmacology and at top rank followed by Research Journal of Pharmacy and Technology 17 and at second rank, so on.

CONCLUSION

Scientometrics studies are widely used technique to evaluate research publications and generate data that policymakers and experts can use. This study has proven to be a useful tool in assessing Research output on *Phyllanthus emblica* from 2011 to 2021: A Scientometric Analysis. This study highlighted the Scientometrics analysis to measure various factors such as article growth, year of publication, relative growth rates, and doubling time for citations, authorship pattern, language wise distributions, document type, country wise records, time serious, and source wise distributions, which can be used to understand the nature and characteristics of the journal globally. A

Scientometric Analysis of *Phyllanthus emblica* Research Output from 2011 to 2021.

- In this field had published 1077articles in eleven years. In year 2021 maximum papers was published that is 172(15.97%)
- 97% publications are multiauthored.
- Out of total 1077 literature published, 0.98%of them or published under the joint author of publications.
- Majority of scientists published their research output in English
- 906 records are research Articles.
- India is at the top, with publishing maximum records 652, followed by China with 122Records
- Chiang Mai University, Chinese Academy of Sciences and Indian Council are at top rank by publishing 17 articles.

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