

ADVANCES IN PHARMACOGNOSY AND PHYTOMEDICINE

Journal homepage: <http://www.journals.wsrpublishing.com/index.php/APP>

Print ISSN: 2423-706X

Online ISSN: 2423-7078



Original Article

A Scientometric Analysis of Research Papers Published on Pharmacognosy as reflected in the Web of Science

Chandran Velmurugan* and Natarajan Radhakrishnan

Department of Library and Information Science, Periyar University, Salem- 636 011, Tamilnadu, India

ARTICLE INFO

Corresponding Author:

Chandran Velmurugan
vmurugan73@gmail.com

How to Cite this Article

Velmurugan, C., and Radhakrishnan, N. (2015). A Scientometric Analysis of Research Papers Published on Pharmacognosy as reflected in the Web of Science. *Advances in Pharmacognosy and Phytomedicine*, 1(1), 27-40.

Article History:

Received: 18 October 2015

Accepted: 29 October 2015

ABSTRACT

Pharmacognosy is the hoariest conception and study of medicinal drugs. To evaluate and identify the growth pattern of literature output, a total 348 scholarly communications from a sample data has been gathered for the analysis of Pharmacognosy from the Web of Science (WOS) citation database during the period between 1989 and 2014. This paper aim to scrutinize the several elements such as type of document, Language, yearly output, most prolific authors, prolific journals, Institution, country wise production, source titles, research areas and keywords of literature output and also examine various metric analysis such as h-index, g-index, e-index, hc-index, hI-index, hI,norm, hI,annual, hm-index, AW-index, AWCR and AWCRpA and degree of collaboration.

Keywords: Literature Trends, Scientometrics, Bibliometrics, Pharmacognosy, authorship pattern, DC, h-index, g-index, Global Performance.

Copyright © 2015, World Science and Research Publishing. All rights reserved.

INTRODUCTION

Pharmacognosy deals with science of drugs and study with biological origin such as plant, mineral and animal. The term pharmacognosy derived from two Greek words – Pharmakon-means drug or medicine and gnosis means knowledge. The term "pharmacognosy" was used for the first time by the Austrian physician Schmidt in 1811 and 1815 by Crr. Anotheus Seydler in a work titled *Analecta Pharmacognostica*. Pharmacognosy has broad scope in the field of pharmacy such as Isolation

or Analysis of Phytochemical. For example: Strong acting substances such as glycosides from digitalis leaves, Alkaloids from the plants of Belladonna, Hyocyamus, Rauwlofia and Morphine and other alkaloids from the plant opium were isolated and clinical uses studied. According to the American Society of Pharmacognosy defines, Pharmacognosy is the study of the physical, chemical, biochemical and biological properties of drugs, drug substances or potential drugs or drug substances of natural

origin as well as the search for new drugs from natural sources. According the Wikipedia, 'Pharmacognosy is the study of medicinal drugs derived from plants or other natural sources'.

Scientometrics is a division of science which deals with the output qualities in terms of organizational research structure, resource inputs and outputs, develops benchmarks to evaluate the quality of information productivity. Scientometric studies describe the discipline using the growth pattern and other characteristics. These studies have also investigated the particularly in measuring and computing the emerging trust areas. In the present study, this is the first study in the field of Pharmacognosy tasking scientometric analysis. We have chosen to evaluate the research papers published on Pharmacognosy as the growing area in the knowledge world.

Details of Data Sample

It is inferred in the table 1 regarding the information about Pharmacognosy has been retrieved using web science citation database for the publication analysis between 1989 and 2014 (26 years). After gathering data uploaded in the publish or perish (PoP) software on 20th October 2015 and collected whole information in terms of records, local citation score, global citation score, Cites per year, Cites/paper, Cites/author, Cites/author/year, Papers/author, Authors/paper, h-index, g-index, e-index, hc-index, hI-index, hI,norm, hI,annual, hm-index, AW-index, AWCRC and AWCRCpA .

Related Work

A wide-ranging literature review is an indispensable integral part of any research, as it assists to identify the gap in research and aids the investigator in designing and analyzing research work. Further, acquaintances of previous related studies are essential to formulate an appropriate research methodology. For the present study, an attempt has been to review only the significant and the recent literature on the various aspects of scientometric research has been taken though a huge amount of literature available in this filed.

Mallik and Mandal (2013) has evaluated bibliometric study of world literature outputs on microRNA to estimate and visualize the research trends. He analyzed the different parameters such as publication analysis, total citation score,

average citation per paper were used to measure the research performance. The results showed that the average number of articles per author increased in first three years and later it reduced gradually in the next 4-5 years. Shao (2013) reported his analysis on oncology for the year 2001 and 2010. The data was collected from web of science citation database and evaluated co-citation analysis, social network analysis and knowledge domain visualization.

Table 1: details of the Pharmacognosy information

S. No	Details	Description
1	Query date	2015-10-19
2	Search topic	Pharmacognosy
3	Collection span	1989 - 2014 (26 years)
4	Total records	348
5	Local Citation Score	123
6	Global Citation Score	3895
7	Cited References	14109
8	Number of Authors	1259
9	Keywords	1461
10	Cites per year	149.81
11	Cites/paper	11.19/2.0/0 (mean/median/mode)
12	Cites/author	1696.16
13	Cites/author/year	65.23
14	Papers/author	153.37
15	Authors/paper	3.62/3.0/2 (mean/median/mode)
16	h-index	32 (64%)
17	g-index	55 (79%)
18	e-index	38.11
19	hc-index	23
20	hI-index	8.90
21	hI, norm	20
22	hI, annual	0.77
23	hm-index	21.91
24	AW-index	22.87
25	AWCR	522.94
26	AWCRpA	217.52

The study dealt with various factors such as tumor metastasis and angiogenesis, mechanism of abnormal oncogene expression and relationship between cancels and apoptosis. Yu *et al.*, (2012) studied a bibliometric analysis of scholarly communications on photosynthesis during the period from 1992 to 2009 based on the Science Citation Index Expanded (SCI-Expanded) through web of science. The study investigated various feature such as language wise distribution, kinds of document, discipline wise, core journal wise, geographical wise, organization wise and highly cited articles etc. Mendez, Gomez and Bordons (1993) have reported in their work for assessing research

performance without citations and clearly said some indicators could not differentiate between the research published in domestic and foreign journals although they seem that Spanish scientists were more interested in the pharmacological and botanical aspect of the natural products than in their chemical structure.

Some authors earlier studies have taken into consideration for the present study such as bibliometric study on Journal of Intellectual Property rights by Velmurugan (2013, 2014) in Library Philosophy and Practice (e-journal) and Journal of Information Technology and Library Science, Annals of Library and Information Studies for the year 2007-2012 by Velmurugan (2013) in International Journal of Digital Library Services and Bibliometric analysis with special reference to Authorship Pattern and Collaborative Research Output of Annals of Library and Information Studies for the Year 2007 – 2012 by Velmurugan (2013) in International Journal of Digital Library Services, Indian Journal of Pure and Applied Physics for the Year 2009 – 2012 by Velmurugan (2014) in Asian Review of Social Sciences, Technical Review Journal: A Scientometric Study by Velmurugan (2014) in International Journal of Digital Library Services, Research analysis by means of Scientometric techniques on Biotechnology by Velmurugan and Radhakrishnan (2015) in International Journal of Multidisciplinary Consortium, Journal of Information Literacy: A Scientometric Profile by Velmurugan and Radhakrishnan (2015) in *Journal of Information Sciences and Application*, Quantitative Analysis of Scientific Publications Output on Engineering Journal: A Scientometric Study by Velmurugan and Radhakrishnan (2015) in *Journal of Information Sciences and Application*, Literature output of Supply Chain Management: A Scientometric approach by Velmurugan and Radhakrishnan (2015) in *Journal of Organizational Behaviour*, Authorship trends and collaborative research work on Library Herald: a Scientometric analysis by Velmurugan and Radhakrishnan (2015) in Information Science and Digital Libraries.

Objectives of the Study

1. To examine the types of document and to identify the types of language.

2. To assess the year wise publication and growth pattern of literature for a period of study
3. To study the most prolific authors and most prolific journals
4. To describe the Institution wise and country wise production
5. To find out the major themes of research productivity in the field of Pharmacognosy
6. To show the keywords of literature output and determine the degree of collaboration

Hypotheses

There is a significant relationship between Journal articles and other documents

1. There is a significant relationship between single and Collaborative authors
2. There is a significant relationship between institution and country wise production

MATERIALS AND METHODS

From Web of Science Core Collection citation database such as SCI-Expanded, SSCI, A&HCI were used to collect the data as primary source. We select the search option and the search item Pharmacognosy in topic filed with the limitation of 26 years duration from 1989 to 2014. In result, we found a total of number of 348 scholarly communications as a sample for data analysis. The research performance work is done in the month of October 2015. The retrieved data has different categories includes articles, review, editorial material, meeting abstract, proceeding papers, letter, biographical-items, and notes. Moreover, the data has been transferred to Excel spread sheet for further analysis. For sample data and visual representation of author productivity, VOSviewer software and publish and perish (PoP) software have been employed.

ANALYSIS AND RESULTS

1. Document wise research output in the field of Pharmacognosy

Form the web of science database, we retrieved the various types of literature output in the forms of research articles, review, editorial material, meeting abstract, proceeding papers, letter, biographical-items, and notes. Based on the analysis, the results show that out of 348, the majority of 220 (63.2%) articles with 1345 global citations has placed in the first place and

followed by 71 (20.4%) reviews, 24 (6.9%) editorial material, 17 (4.9%) meeting abstract, 11 (3.2%) proceeding papers and the least number of document in the form of biographical-item, book review and note are (each 1, 0.30%) found during the study period. It is interesting that based on the global citation score in the field of Pharmacognosy, review

manuscript has placed in first position with 2008 TGCS, and followed by articles with 1345 TGCS has occupied in the second place. It is noticed that most of the manuscript has cited in the form of reviews globally (Table 2 and Figure 1). In this analysis, compare with documents there is a significant relationship between Journal articles and other documents.

Table 2: Document wise research output

	Document Type	Recs	Percent	TLCS	TGCS
1	Article	220	63.2	43	1345
2	Review	71	20.4	61	2008
3	Editorial Material	24	6.9	3	93
4	Meeting Abstract	17	4.9	0	1
5	Article; Proceedings Paper	11	3.2	16	446
6	Letter	2	0.5	0	0
7	Biographical-Item	1	0.3	0	0
8	Book Review	1	0.3	0	0
9	Note	1	0.3	0	2
	Total	348	100	123	3895

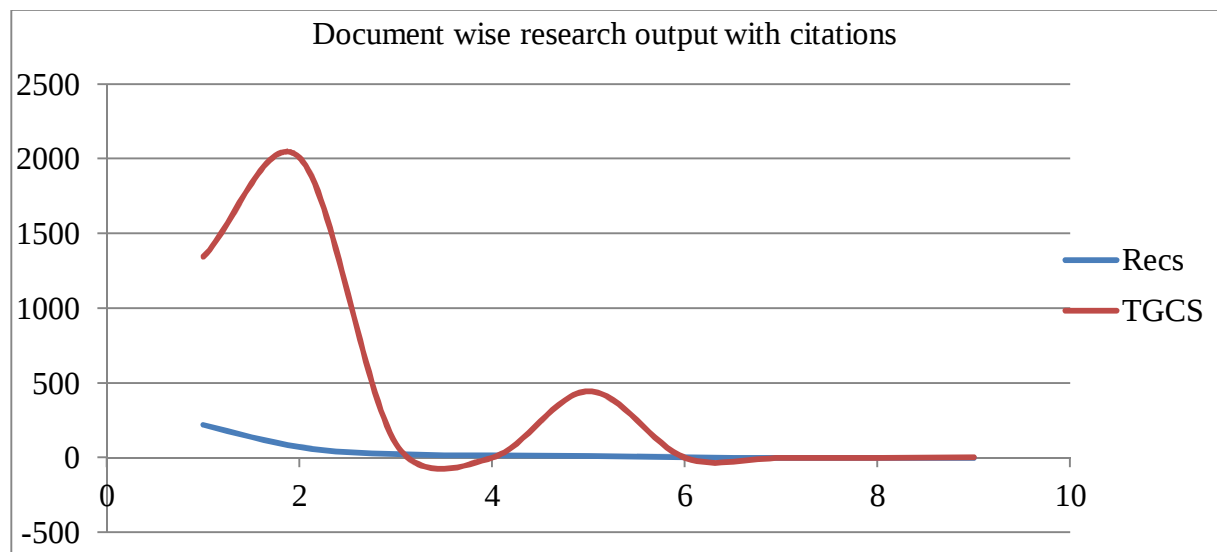


Figure 1: Document wise research output with citations

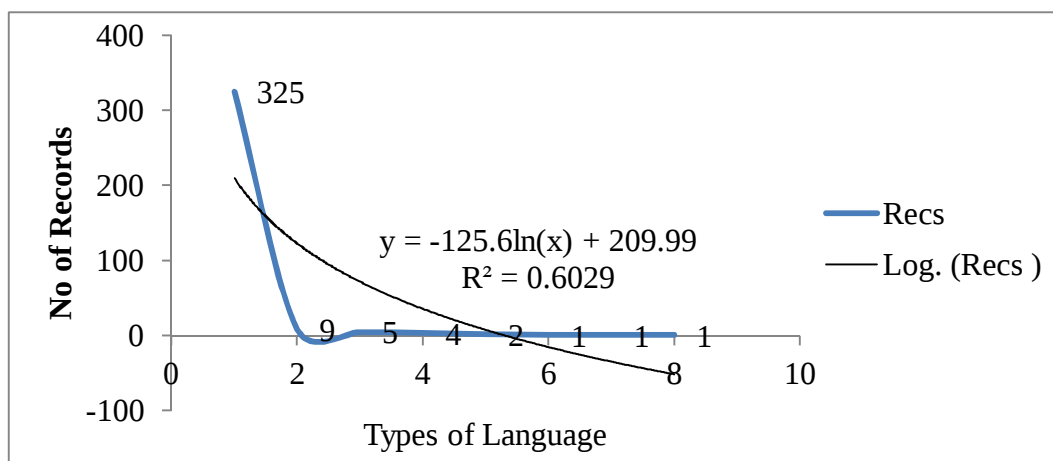


Figure 2: Language wise research output

2. Language Wise Research Output in the Field of Pharmacognosy

It is identified in the figure 2 shows the language wise research output in the field of Pharmacognosy for the present study. The languages such as English, Japanese, Portuguese, Spanish, French, Czech, German and Turkish have involved in which the highest number of 325 (93.4%) articles with 3867 TGCS are written in the English language is the predominant and followed by Japanese articles are in the second position with 9 (2.6%) and the small amount of articles are written in the Czech, German and Turkish (each 1, 0.3%). The figure represents the logarithm value is $y = -125.6\ln(x) + 209.99$, $R^2 = 0.6029$.

3. Publication Wise Research Output in the Field of Pharmacognosy

It is evident from the above table that the publication growth trend from the year 1989 to 2014. Out of 348 literature output, the maximum numbers of 44 (12.6%) articles published in the year 2010 and followed by 40 research papers are published in the next year 2011. It is also noticed that based on the citation score in the global level 549 citations in the year 2004 and followed by 440 global citation score in the year 2008. Based on the citation per paper range from 0.5 to 83.25 and the average citation per paper is 11.19. The findings of the study reveal that after 2006 there is a significant growth and increased trend till 2011 and after that the fluctuation trend towards growth of publications during the period shows in the Table 3 and Figure 3.

It is inferred from the above table and figure represents the growth rate of publication between 1989 and 2014. The majority of research output is 44 (12.6%) in the year 2010 with 352 global citations and 15 local citations in Pharmacognosy and the least number of articles is one (0.3%) in the year 1989 and 1999 respectively. Based on the citations research, the highest number of citation score is in the year 2004 and the maximum number of local citation score is 15 in the year 2007 and 2010 respectively. The exponential growth rate of research articles is $y = 5E-111e^{0.1279x}$, and the R^2 value is 0.6919 during the period of study.

The graph has been plotted based on the HistCite software and the Nodes fixed 30 and Links: 39, top Local Citation Score 30; Minimum number 1 fixed and the Maximum

number 8 has been fixed to make a graph for publication growth pattern indicates the Figure 4.

Table 3: Publication wise research output

	Year	Recs	Percent	TC	ACPP
1	1989	1	0.3	0	0
2	1990	5	1.4	19	3.8
3	1991	2	0.6	3	1.5
4	1992	3	0.9	62	2.07
5	1993	5	1.4	37	7.4
6	1994	4	1.1	57	14.25
7	1995	4	1.1	89	22.25
8	1996	7	2.0	73	10.43
9	1997	6	1.7	83	13.83
10	1998	2	0.6	11	5.5
11	1999	1	0.3	2	2.0
12	2000	4	1.1	333	83.25
13	2001	2	0.6	72	36.0
14	2002	3	0.9	29	9.67
15	2003	4	1.1	34	8.5
16	2004	11	3.2	549	49.91
17	2005	9	2.6	471	52.33
18	2006	12	3.4	277	23.08
19	2007	16	4.6	174	10.88
20	2008	25	7.2	440	17.6
21	2009	26	7.5	351	13.5
22	2010	44	12.6	352	8.0
23	2011	40	11.5	189	4.73
24	2012	35	10.1	130	3.71
25	2013	43	12.4	42	0.98
26	2014	34	9.8	16	0.47
Total		348	100	3895	11.19

4. Degree of Collaboration

Table 4 Figure 5 depicts the degree of collaboration of authors in the field of Pharmacognosy during the period of study between 1989 and 2014. It was statistically calculated using by Subramanian's formula: $C = Nm / (Nm + Ns)$, where C = degree of collaboration, Nm = number of multi-authored works, and Ns = number of single-authored works. It was found that the degree of collaboration ranges from 1.0 to 7.6 in Pharmacognosy and the average degree of collaboration is 4.04. In this context, there is a significant relationship between single and collaborative authors in terms of research productivity.

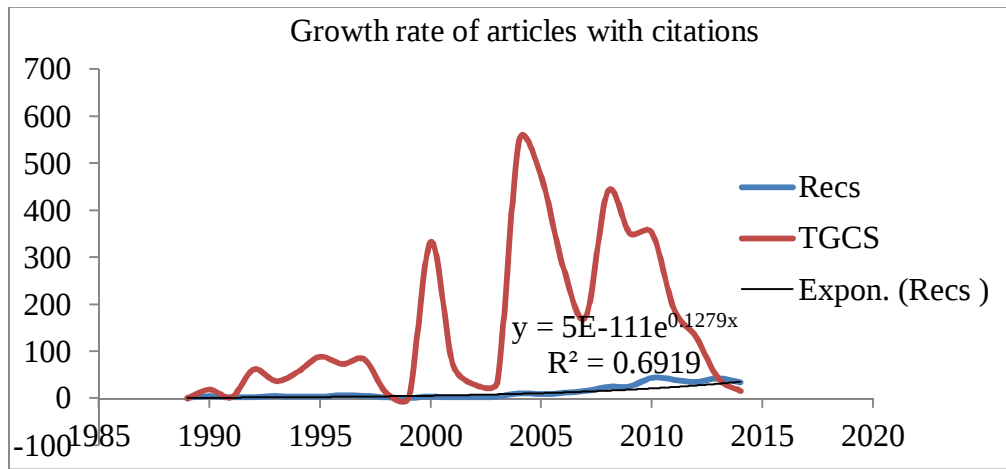


Figure 3: Publication wise research output

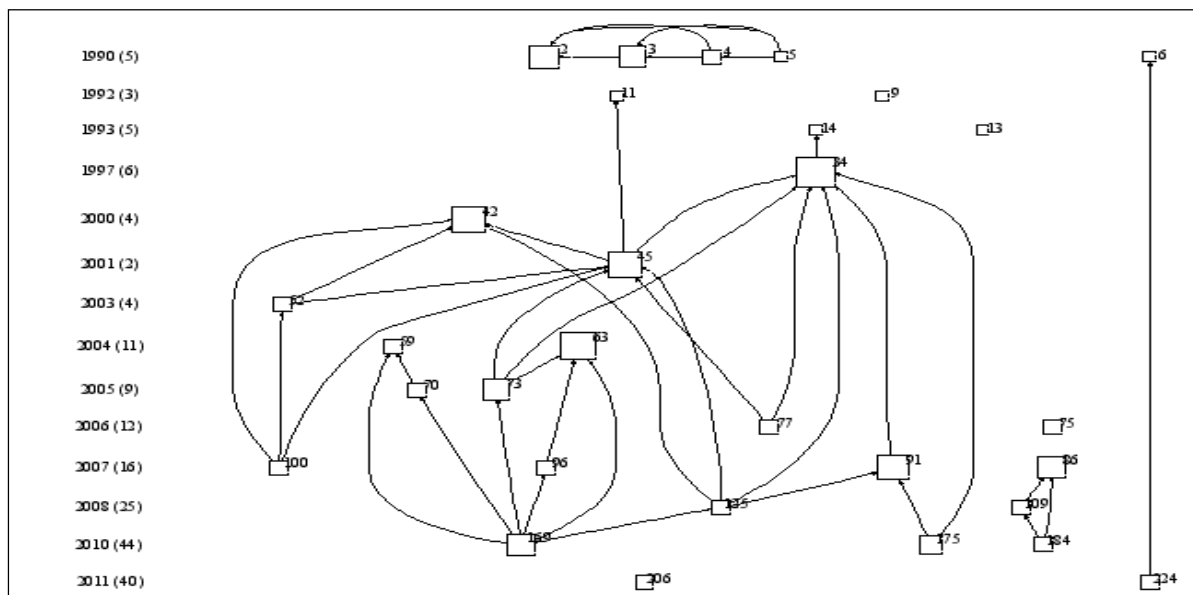


Figure 4: Publication growth pattern

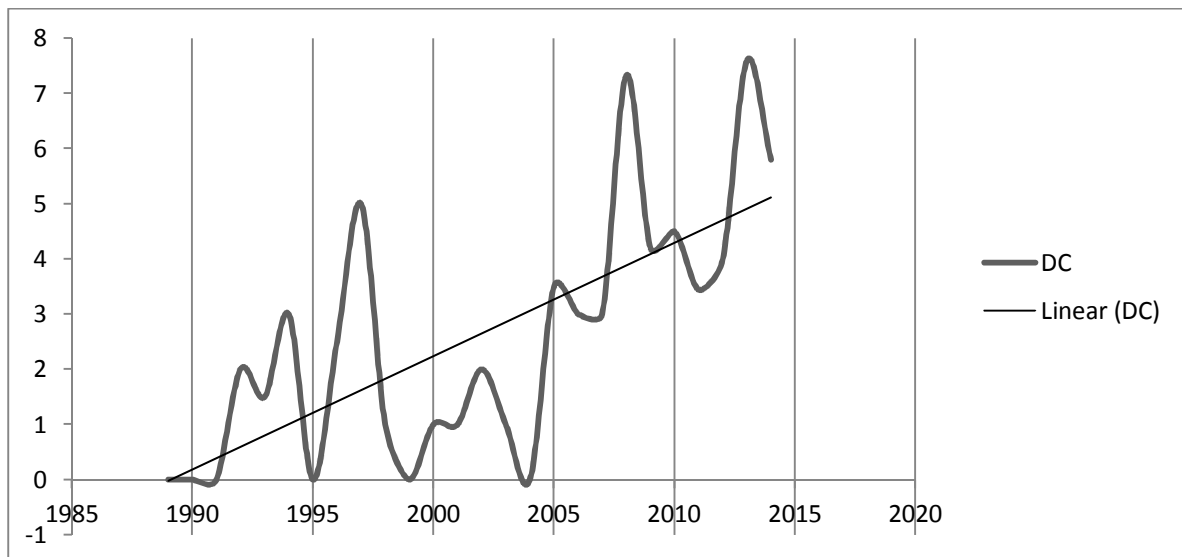


Figure 5: Degree of collaboration

5. Prolific authors in the field of Pharmacognosy

Researchers have analyzed the authors' contribution in the field of Pharmacognosy during the study period. It is inferred in the above table and shows that out of 1259 authors, the most prolific ten authors only selected for the present study. In this context, the maximum number of 20 records are contributed by 'EFFERTH T' with 400 global citations and placed in the first place, and followed by in the second place has 'RAWAT AKS' with 10 records and 74 global citations. The next place has captured by 'KHATOON S' with 8 research articles and 63 citations globally. Out top 10 authors, the least number of 5 record counts with 31 global citations contributed by 'BERNARD P'. The table also indicates that the trend line and exponential growth rate of y value is $210.59e^{-0.353x}$ and R^2 value is 0.5516 (table 5, Figure 6).

Table 4: Degree of collaboration

Year	SA	MA	TA	DC
1989	1	0	1	0
1990	0	5	5	0
1991	2	0	2	0
1992	1	2	3	2.0
1993	2	3	5	1.5
1994	1	3	4	3.0
1995	0	4	4	0
1996	2	5	7	2.5
1997	1	5	6	5.0
1998	1	1	2	1.0
1999	1	0	1	0
2000	2	2	4	1.0
2001	1	1	2	1.0
2002	1	2	3	2.0
2003	2	2	4	1.0
2004	0	11	11	0
2005	2	7	9	3.5
2006	3	9	12	3.0
2007	4	12	16	3.0
2008	3	22	25	7.33
2009	5	21	26	4.2
2010	8	36	44	4.5
2011	9	31	40	3.44
2012	7	28	35	4.0
2013	5	38	43	7.6
2014	5	29	34	5.8
	69	279	348	4.04

SA- Single author, MA- Multi authors, TA- Total authors

6. Institution wise research output in the field of Pharmacognosy

It can be identified from the figure 7 represents that out of 380, researchers have selected only top 25 predominant institutions for the study. To view this, the highest number of 14 (4.0%) literature output with 333 total global citations contributed by German cancer research center and occupied the first position and followed by the same record count contributed by unknown contributors and National Botany Research Institute and University of Fed Parana each contributed 12 articles with different citations such as 114 and 15 respectively.

7. Country wise production in the field of Pharmacognosy

It can be observed from the below table 6 and figure 8 the analysis of country wise production in the field of Pharmacognosy during the period of 26 years. Out of 54 countries, Brazil has placed with 62 research output and the percentage rate is 17.8 and also the global citation score is 83 and has got the first place based on the record count and followed by India has 52 records with 391 global citation score and occupied the second rank, and the next place has got by USA with 46 articles with 1272 citation score, and followed by Germany has 26 records with 442 citation score globally is ranked in the fourth. It is found that the USA has placed in the first place based on the majority of citation score i.e. 1272 and Germany has ranked in the second position with 442 citation score and followed by India has placed in the third position with 391 citation score. Based on the above analysis, there is a significant relationship between institution and country wise production during the period study.

8. Prolific Journals in the field of Pharmacognosy

It is inferred from the below table 7 shows the contribution of core journal in the field of Pharmacognosy. Out of 132 journals, we have selected only top most journals are taken into consideration for analysis. In this connection, the majority of 45 literature count contributed by Brazilian Journal of Pharmaceutical Sciences with 40 global citations and has ranked first position and followed by Revista Brasileira De Farmacognosia-Brazilian Journal of Pharmacognosy journal has occupied in the

second rank with 24 records and 17 citations. Journal of Ethnopharmacology and Planta Medica have got the third position each with 17

articles and the citations are 682 and 142 respectively.

Table 5: Top 10 prolific authors

	Author	Recs	Percent	TLCS	TGCS	TLCR
1	Efferth T	20	5.7	14	400	13
2	Rawat AKS	10	2.9	4	74	1
3	Khatoon S	8	2.3	5	63	3
4	Bohlin L	7	2.0	20	50	12
5	Mehrotra S	7	2.0	4	68	0
6	Van Wyk BE	7	2.0	0	9	0
7	Duarte MD	6	1.7	1	4	0
8	Mino Y	6	1.7	12	22	8
9	Tilney PM	6	1.7	0	4	0
10	Bernard P	5	1.4	14	31	8

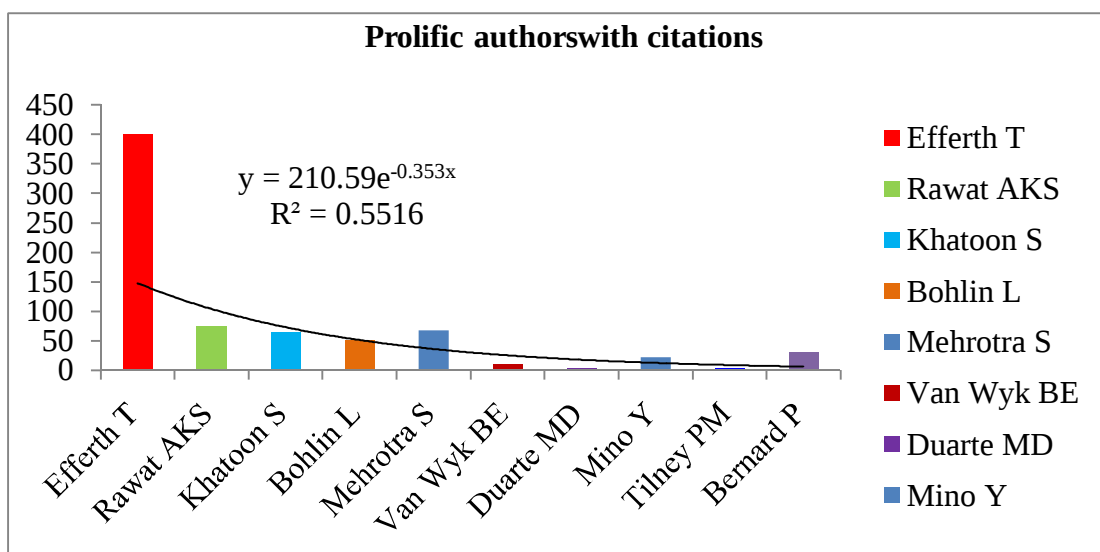
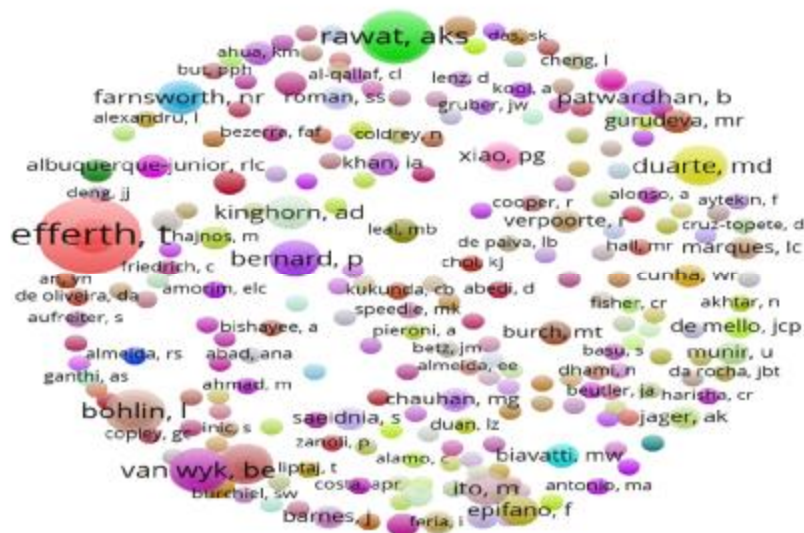
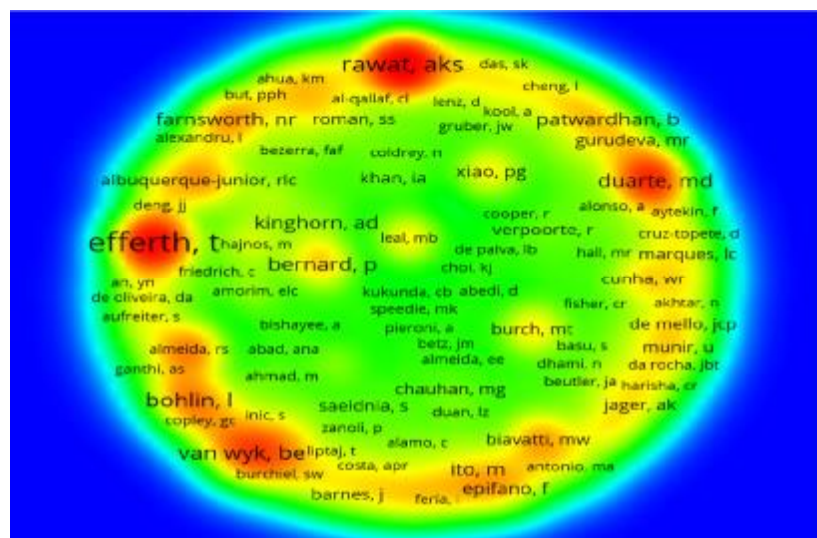


Figure 6: Top 10 Prolific authors



Map.1: Network based VOSviewer of author productivity



Map. 2: Density based VOSviewer of author productivity

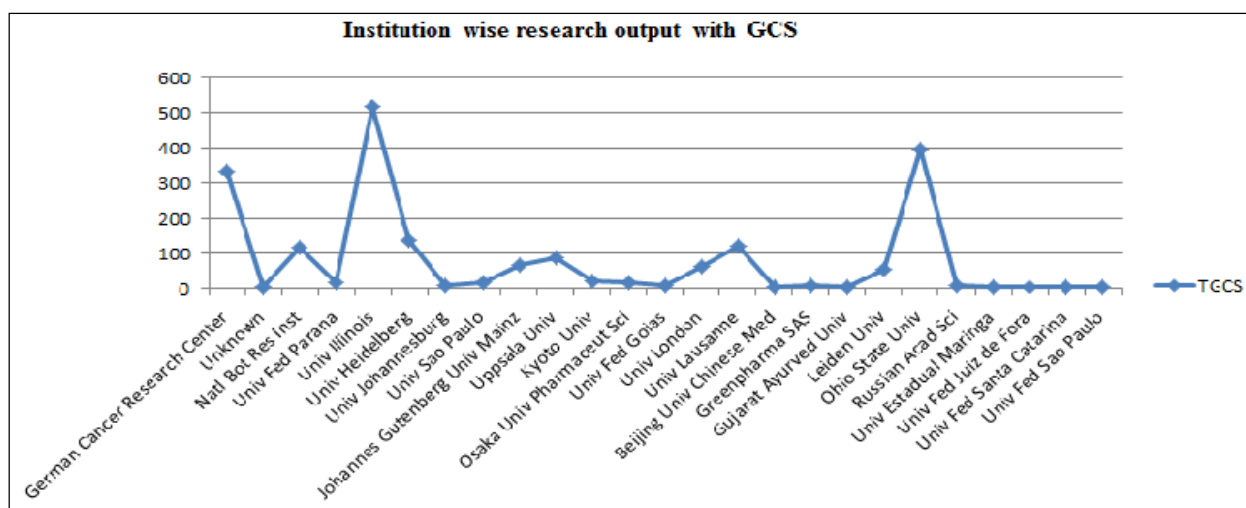


Figure 7: Institution wise research output

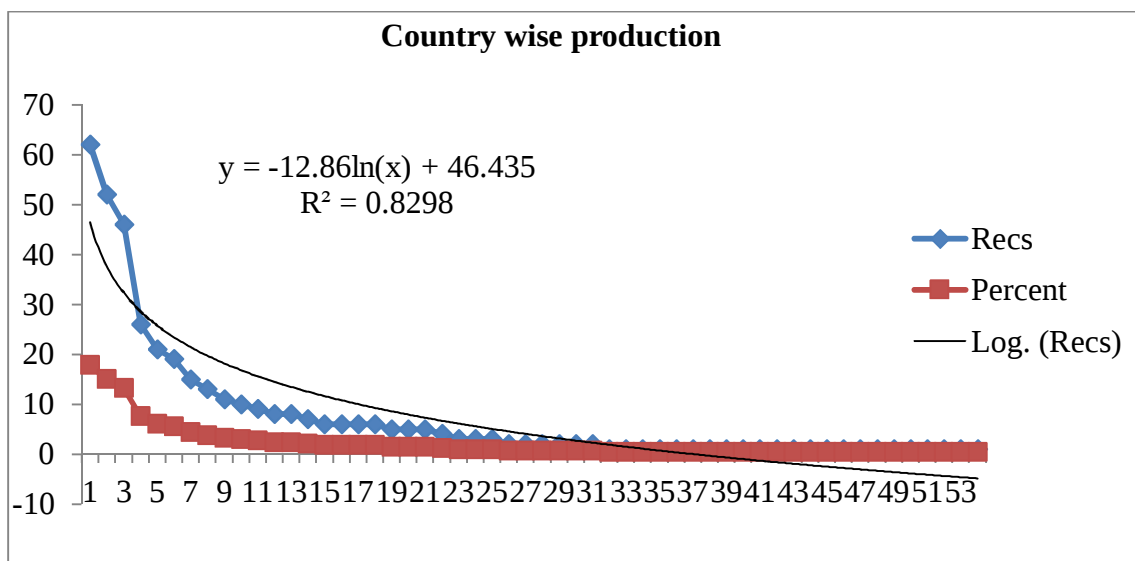


Figure 8: Country wise production

Table 6: Country wise production

	Country	Recs	Percent	TLCS	TGCS
1	Brazil	62	17.8	4	83
2	India	52	14.9	11	391
3	USA	46	13.2	24	1272
4	Germany	26	7.5	15	442
5	Unknown	21	6.0	10	59
6	Japan	19	5.5	17	342
7	Peoples R China	15	4.3	7	166
8	UK	13	3.7	8	178
9	South Africa	11	3.2	0	98
10	Italy	10	2.9	2	354
11	Iran	9	2.6	0	17
12	Sweden	8	2.3	20	100
13	Switzerland	8	2.3	2	217
14	Spain	7	2.0	0	20
15	Belgium	6	1.7	2	149
16	France	6	1.7	5	9
17	Mexico	6	1.7	5	76
18	Pakistan	6	1.7	0	3
19	Austria	5	1.4	1	140
20	Canada	5	1.4	0	67
21	Netherlands	5	1.4	8	344
22	Poland	4	1.1	0	10
23	Australia	3	0.9	0	34
24	Russia	3	0.9	0	6
25	Turkey	3	0.9	0	37
26	Argentina	2	0.6	0	22
27	Hong Kong	2	0.6	0	16
28	Malaysia	2	0.6	0	4
29	Romania	2	0.6	0	0
30	Saudi Arabia	2	0.6	0	1
31	Slovakia	2	0.6	0	9
32	Bosnia & Herceg	1	0.3	0	0
33	Colombia	1	0.3	0	0
34	Croatia	1	0.3	2	4
35	Cuba	1	0.3	0	0
36	Cyprus	1	0.3	0	0
37	Czech Republic	1	0.3	0	0
38	Denmark	1	0.3	0	11
39	Finland	1	0.3	0	17
40	Hungary	1	0.3	0	2
41	Israel	1	0.3	0	17
42	Kuwait	1	0.3	0	4
43	Nepal	1	0.3	0	2
44	Nigeria	1	0.3	0	0
45	Norway	1	0.3	0	5
46	Panama	1	0.3	0	10
47	Peru	1	0.3	0	8
48	Philippines	1	0.3	0	10
49	Portugal	1	0.3	0	4
50	Singapore	1	0.3	0	10
51	Tanzania	1	0.3	0	50
52	U Arab Emirates	1	0.3	0	2
53	Uganda	1	0.3	0	32
54	Vietnam	1	0.3	0	1

Table 7: Top 10 Prolific Journals

	Journal	TR	Percent	TC
1	Brazilian Journal of Pharmaceutical Sciences	45	12.9	40
2	Revista Brasileira De Farmacognosia-Brazilian Journal of Pharmacognosy	24	6.9	17
3	Journal of Ethnopharmacology	17	4.9	682
4	Planta Medica	17	4.9	142
5	Indian Journal of Traditional Knowledge	11	3.2	11
6	Latin American Journal of Pharmacy	10	2.9	17
7	Pharmacognosy Magazine	10	2.9	3
8	Yakugaku Zasshi-Journal of The Pharmaceutical Society of Japan	9	2.6	197
9	Pharmaceutical Biology	8	2.3	36
10	Journal of Scientific & Industrial Research	7	2.0	19

TR – Total records, TC- Total citations

Table 8: Top 10 highly cited papers

	Name of the paper with authors	TC	TCR
1	Drug discovery from medicinal plants by Balunas MJ, Kinghorn AD	356	115
2	The Catharanthus alkaloids: Pharmacognosy and biotechnology by van der Heijden R, et al	213	198
3	A drug over the millennia: Pharmacognosy, chemistry, and pharmacology of licorice by Shibata S	193	63
4	Natural compounds for cancer treatment and prevention by Nobili S, Lippi D, Witort E, Donnini M, Bausi L, et al.,	126	140
5	Pharmacognostic and pharmacological profile of Humulus lupulus by Zanolli P, Zavatti M	117	142
6	Ayurveda and natural products drug discovery by Patwardhan B, Vaidya ADB, Chorghade M	92	94
7	The potential of African plants as a source of drugs by Hostettmann K, Marston A, Ndjoko K, Wolfender JL	89	104
8	Current Evaluation of the Millennium Phytomedicine-Ginseng (I): Etymology, Pharmacognosy, Phytochemistry, Market and Regulations by Jia L, Zhao YQ	86	49
9	Folk pharmaceutical knowledge in the territory of the Dolomiti Lucane, inland southern Italy by Pieroni A, Quave CL, Santoro RF	79	61
10	Molecular markers in herbal drug technology by Joshi K, Chavan P, Warude D, Patwardhan B	72	103

Total Citations, Total Cited References

Table 9: Top 10 Research Area wise literature output

S. No	Research Areas	Record Count	%
1	Pharmacology Pharmacy	227	65.230
2	Plant Sciences	97	27.874
3	Chemistry	37	10.632
4	Integrative Complementary Medicine	32	9.195
5	Biochemistry Molecular Biology	22	6.322
6	Medical Laboratory Technology	9	2.586
7	Engineering	7	2.011
8	Food Science Technology	6	1.724
9	General Internal Medicine	6	1.724
10	Toxicology	6	1.724

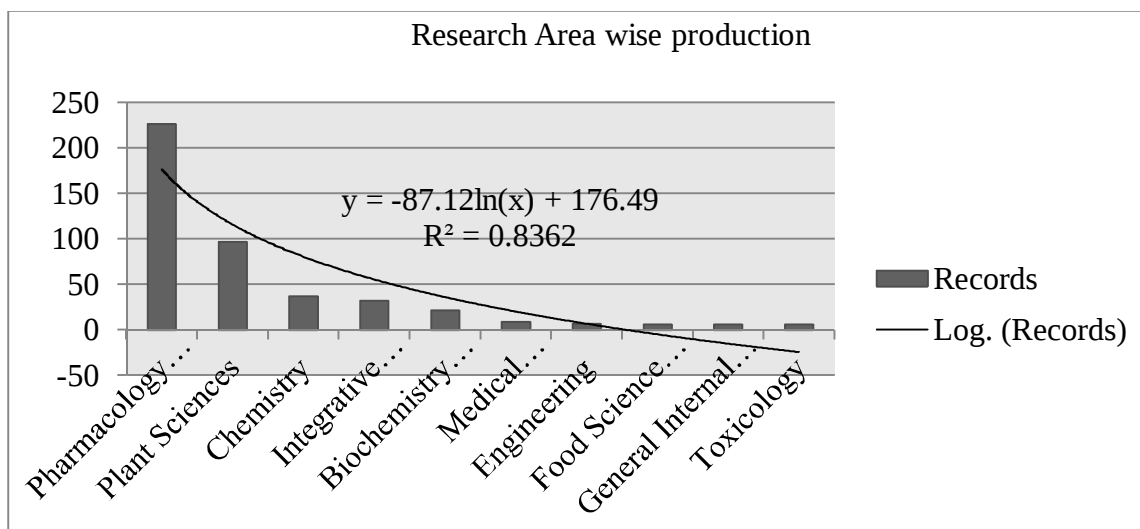


Figure 9: Research Area wise literature output

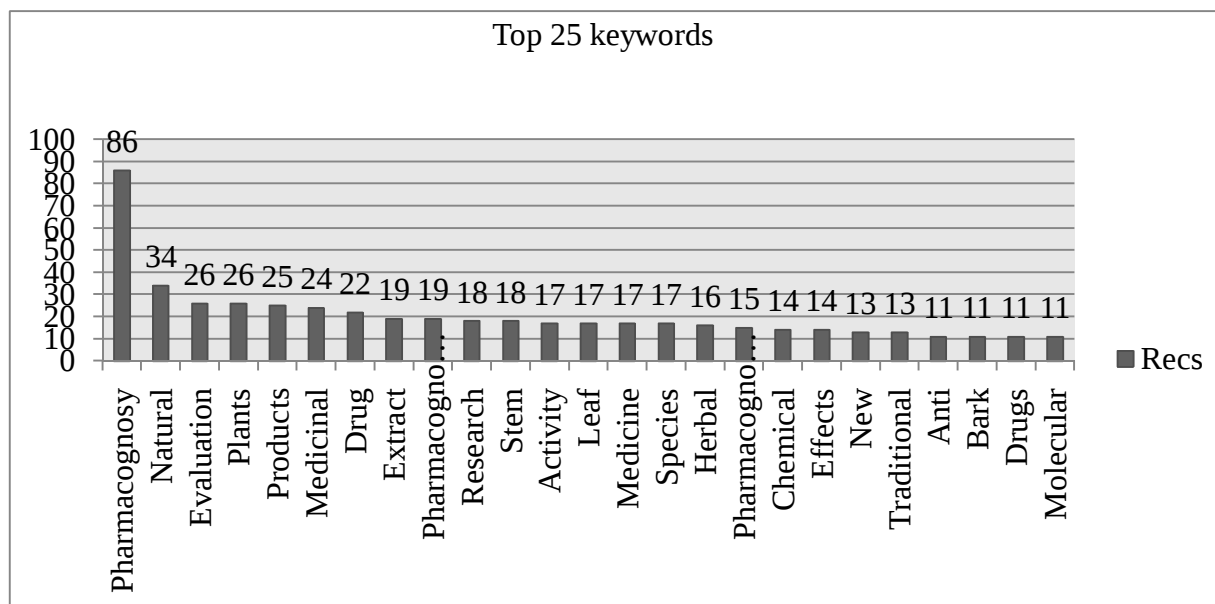


Figure 10: Top 25 keywords

Out of 132 core journals, based on the citations, Journal of Ethnopharmacology has placed in the first rank with 682 citations and followed by Yakugaku Zasshi-Journal of The Pharmaceutical Society of Japan has occupied in the second position with 197 citations and the least number of citations has Pharmacognosy Magazine with 3 citations and placed the least position compare with other core journals.

9. Highly cited papers

It is inferred from the below table 8 that there have been 13007 cited references observed in Pharmacognosy publications during the period

of study and it has been listed only top 10 cited references for the present study. Out of top 10 cited references, the highest number of 356 citations with 115 total cited references cited with the article of 'BALUNAS MJ, KINGHORN AD' in the title namely, Drug discovery from medicinal plants under the journal of 'Life Science' in the year 2005 which is placed in the first rank followed by 213 citations with 198 total cited references cited with the article of 'HEIJDEN R, et al' in the title namely, The Catharanthus alkaloids: Pharmacognosy and biotechnology under the journal of Current Medicinal Chemistry in the

year 2004 and occupied in the second place. The next place has ranked by Yakugaku Zasshi-Journal of the Pharmaceutical Society of Japan in the year 2000 with 193 citations with 63 total cited references cited with the article of 'SHIBATA S' in the title namely, A drug over the millennia: Pharmacognosy, chemistry, and pharmacology of licorice.

10. Research Area wise literature output in the field of Pharmacognosy

Research areas are important in any field of study. In view of present study, a total number of 12 research areas found in the web of science citation database during the period of study between 1989 and 2014. Out of 12, more than 65 percent of articles are from Pharmacology Pharmacy research and has predominant with 227 record count and followed by Plant Sciences has placed in the second position with 97 articles. The third rank has in the research area of Chemistry with 37 literature output (table 9 and figure 9).

11. Keywords of research output in the field of Pharmacognosy

Out of 4107 word count, here we have figured 10 that only top 25 keywords for analysis. Based on the study, the word 'Pharmacognosy' has witnessed the top list as it has the highest number of records 86 record count with 910 global citation scores, and followed by the word 'Natural' is in the next position of 'Pharmacognosy' and the record count is 34 with 598 global citation score. Based on the present study, the small number of record count has the keywords are Anti, Bark, Drugs and Molecular in each 11 articles respectively.

RESULTS AND CONCLUSION

Based on the analysis, the following major findings are revealed:

1. Of the 348, more than 60 percent of the documents are in terms of research articles and the remaining such as reviews, editorial material, meeting abstract, proceeding papers and the least number of document in the form of biographical-item, book review and notes.
2. The greatest number of research output is in the year 2010 with 352 global citations and 15 local citations in Pharmacognosy and the least number of articles is one in the year 1989 and

1999 respectively. The exponential growth rate of research articles is $y = 5E-111e^{0.1279x}$, and the R^2 value is 0.6919 during the period of study.

3. The highest numbers of citation score in the global level 549 citations in the year 2004 and the least number of citation score in 1999 and there is no citation score in the beginning year.

4. It is identified that the degree of collaboration ranges from 1.0 to 7.6 in the filed Pharmacognosy and the average degree of collaboration is 4.04.

5. The majority number of 20 records are contributed by 'EFFERTH T' with 400 global citations and placed in the first place, and the out top 10 authors, the least number of 5 record counts with 31 global citations contributed by 'BERNARD P'.

6. The highest number of literature output contributed by German cancer research center and occupied the first position but based on the citation score found that the University of Illinois has placed in the first rank during the period of study.

7. Out of 54 countries, Brazil has placed the first place based on the record count and followed by India has occupied in the second rank but based on the citation score USA has placed in the first place with highest number of citations and Germany has ranked in the second position.

REFERENCES

- Definition of Pharmacognosy (2015, October 15). Pharmacognosy, Retrieved from: <http://www.pharmacognosy.com/about.htm>
- Definition of Pharmacognosy (2015, October 15). Retrieved from: <http://www.pharmacognosy.us/>
- Introduction and scope of Pharmacognosy (2015, October 15). Retrieved from: <http://www.slideshare.net/USrinivasa/introduction-and-scope-of-pharmacognosy>
- Mallik, A., & Mandel, N. (2013). Bibliometric analysis of global publication output and collaboration structure study in microRNA research. *Scientometrics*, 98, 2011- 2037.
- Mendez, A., Gomez, I., & Bordons, M. (1993). Some indicators for assessing research performance without Citations. *Scientometrics*, 26 (1), 157-167.
- Pharmacognosy (2015, October 15). Retrieved from: <https://en.wikipedia.org/wiki/Pharmacognosy>
- Shao, H., et al. (2013). Analysis of oncology research from 2001 to 2010: a scientometric perspective. *Oncology reports*, 29 (4), 1441-1452.

- Velmurugan, C. (2013). Bibliometric analysis with special reference to Authorship Pattern and Collaborative Research Output of Annals of Library and Information Studies for the Year 2007 – 2012. *International Journal of Digital Library Services*, 3 (3), 13-21.
- Velmurugan, C. (2013). Research Output with Special Reference to Authorship Pattern and Collaborative Research Work of the Journal of Intellectual Property Rights (JIPR) During 2007- 2012. *Journal of Information Technology and Library Science*, 2 (1), 1-8.
- Velmurugan, C. (2013). Research Trends in Journal of Intellectual Property Rights (JIPR): A Bibliometric Study. *Library Philosophy and Practice (e-journal)*, Paper 1043. Retrieved from: <http://digitalcommons.unl.edu/libphilprac/1043>.
- Velmurugan, C. (2013). Scientometric analysis: Annals of Library and Information Studies Publications Output during 2007 – 2012. *International Journal of Library and Information Studies*, 3 (3), 58- 65.
- Velmurugan, C. (2014). Research Trends in Indian Journal of Pure and Applied Physics (IJPAP) for the Year 2009 – 2012. *Asian Review of Social Sciences*, 3 (1), 24-28.
- Velmurugan, C., & Radhakrishnan, N. (2014). Publication Research Trends on Technical Review Journal: A Scientometric Study. *International Journal of Digital Library Services (IJDLS)*, 4 (3), 45-55.
- Velmurugan, C., & Radhakrishnan, N. (2015). Authorship trends and collaborative research work on Library Herald: a Scientometric analysis, In Somvir, (Ed.), *Information Science and Digital Libraries* (pp. 183-197). International Research Publication House, Delhi.
- Velmurugan, C., & Radhakrishnan, N. (2015). Journal of Information Literacy: A Scientometric Profile, *Journal of Information Sciences and Application*, 3 (1), 1-9.
- Velmurugan, C., & Radhakrishnan, N. (2015). Literature output of Supply Chain Management: A Scientometric approach. *Journal of Organizational Behaviour*, 3(2), 31-44.
- Velmurugan, C., & Radhakrishnan, N. (2015). Quantitative Analysis of Scientific Publications Output on Engineering Journal: A Scientometric Study. *Journal of Information Sciences and Application*, 3 (1), 19-30.
- Velmurugan, C., & Radhakrishnan, N. (2015). Research analysis by means of Scientometric techniques on Biotechnology. *International Journal of Multidisciplinary Consortium (IJMC)*, 2(1), 256-265.
- Yu, J.J., Wang, M.H., Xu, M & Ho, Y.S. (2012). A bibliometric analysis of research papers published on photosynthesis: 1992-2009. *Photosynthetica*, 50 (1), 5-14.