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A SCIENTOMETRIC GLIMPSE OF TULSI PLANT FROM 1989-2016

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ABSTRACT

Scientometrics, is an efficient tool for effective evaluation of research performance on any topic, subject and country, it has been widely adopted for the analysis of the research output globally. Tulsi holds a great medicinal significance in the history of world and India in particular, it holds a religious significance as well. In view of thepopularity of tulsi over the centuries, the study is an attempt to map out research output on "Tulsi" from all over the world during 1989-2016.The purpose was to provide a idea about the periodic growth of literature,authorship patterns,prolific authors, top contributing sources, language dispersal, geographic origin, top cited articles and nature of articles on Tulsi.

Keywords:Open Access,Research Output, Scientometrics, Tulsi, Growth.

I. INTRODUCTION

Plants have been a rich source of energy from the ages as they have the natural capacity of fixing the sunlight and converting it to the food required by living organisms mostly humans and animals, plants have served as a rich source of many valuable products necessary for the sustenance of life . Besidesproviding food plants have a great medicinal value as the Hippocrates (460-377 B.C.), Greek physician strongly believed that medicines derived from plants are useful to treat many human diseases. Theophrastus (371-297 B.C.), the first botanist wrote Dioscorides (first century, A.D.) "gathered a short to the point information about utility, usage and properties of about six hundred medicinal plants" [1].The availability of written records regarding medicinal plants can be traced back to 1500 B.C in Egypt. And about 800-400 B.C in India and in China about 500 B.C. [2].India is home land of many medicinal plants like Tulsi (Ocimum tenuiflorum), Basil(Ocimum basilicum), etc.

Bibliometrics is technique used to understand the features or characteristics of a particular body of knowledge or subject. It can be used to analyse and understand the research trends and development of information in various knowledge areas and to predict the future trends of publishing.In the subject field of Science the written information rotates around objectivity providing a high capability to study, analyse the facts, criticising the existing truth and citing the relevant information. Bibliometrics / Scientometrics serves as an important tool in

assessing the intellectual contribution embedded in any publication be it a book, research article. The present study is an attempt to analyse the research output of Tulsi from bibliometric point of view. As Tulsi serves one of the most important place in Indian culture. Tulsi is cultivated for religious and medicinal purposes, and for its essential oil. It is widely known across the Indian sub-continent as a medicinal plant and a herbal tea commonly used in Ayurveda, and has an important role within hindu tradition in which devotees perform worship involving holy basil plants and leaves.Tulsi is derived from a Sanskrit word which means "matchless". The plant has been accredited for many medicinal properties not only in Indian system of medicine (Ayurveda and Sidh) but in other systems of medicines like Greek, Roman and Unani systems [3]. This plant is a member of family Lamiaceae, and genusOcimum. Tulsi is known as Ocimum sanctum. It has two varieties i.e. black (Krishna Tulsi) and green (Rama Tulsi). It has great medicinal value[4].Some of its medical uses are it is used against gastrointestinal disorders , Ocular disorders ,Cardiovascular disorders ,Respiratory diseases, toothache , inflammatory disorders ,antifertility effect, anti tumor effect and anti-carcinogenic effect as well [5]. It has a great value in serving many gynaecological problems.

II. OBJECTIVES

The objectives of the study are:

- To determine annual publication trends, and the different types of sources ,the types of publications as well;
- To identify the country of publications, highly cited publications along with the total number of citations
- To reveal authorship pattern and author productivity;
- To determine the language diversity of the publications;
- To identify the nature of access

III.METHODOLOGY

The study is an attempt to analyse the global research output on Tulsi .The data was extracted from Web of Science, one of the leading indexing and abstracting database. The records were retrieved by entering a search query "Tulsi'', and data was retrieved for the time span of 27 years (1989-2016) the data was downloaded in the excel form and then tabulated for analysis necessary statistical operations were applied.

IV.REVIEW OF LITERATURE

A good number of bibliometric studies have been carried out on different aspects of plants like chemical, biological and medical. Some of the studies cover citations from only one database while as others include combination of specialised database. An over view of such studies is given below:

[6] studied the nature of citations taking into consideration two bibliographies on cowpea in the time from 1888 to 1973. Interestingly it was revealed that the literature growed twice in every 20 years. English language

dominated the intellectual output as 87% of literature was published in English language.[7] analysed about 1,373 citations pertaining to Indian grape during the period from 1901-1981 taking into consideration an exhaustivebibliography results signified that there was increase in collaborative research and journals are the main source used for publishing and contain the core information. A similar type of study was carried out by [8] in which they collected 8,401 citations from 68 doctoral theses submitted to another university geographically located in India from 1996 to 2000 concerning to agriculture. A study conducted by[9] on the literature of Neem (Azadirachta Indica) published during the time from 1989 to 1999 extracted fromBiological Abstracts it was revealed that authors like to work in collaboration with other authors as about 89.02% of 1,111 papers were written by multiple authors and only about 27.4% of the papers followed single authorship. There is a positive sign that India contributed to about 56% of the total literature and regarding language it was found that English was the main language used in about 96.4% of papers .About 28 (9.3%) titles were identified as core journal titles by them. [10] carried out bibliometric study of the research output of Embelia ribes (Black Pepper) the study rotated around 332 articles derived from PubMed .This study highlighted the growth of literature, pattern of authorship, most productive authors, main journals of the subject, institutes and countries which contribute more to this type of publishing.[11] observed the research performance in stem cell researchfor a period of 10 years (1999 to 2008) with a total of 54,373publications extracted from MEDLINE database.USA contributed a lot to the publications and ranked first while as United Kingdom and Netherlands stood at second and third positions respectively. It was further revealed that 88.52% of total research output was published in English language followed by Chinese and Japanese with 2.86% and 0.94% contribution respectively. Out of developing nations India contributes comparatively less to Stem Cell Research.[12] examined the content of the journal Economic Botany from 1994-2003 and it was revealed that literature was dominated by subject clusters like ethnobotany, traditional and folk medicine, plant products, and photochemistry. The single authorship pattern was less evident and large number of papers were co-authored; most primary authors were affiliated with educational institutions, United States stood on top among 45 countries from which articles originated with United Kingdom on the second number. However, [13] studied references of 343 articles indexed under the MeSH topic medicine-Chinese-traditional in the Medline database, from 1974 to 1992 it was evident from the study that most of the publications were outcome of China and the United States. Chinese and English language dominated the scene and among the document type there were large number of articles in comparatively small number of journals. [14]carried out a bibliometric study of Black seed (Nigella sativa) he analysed the periodic growth, author patterns, subject focus, and geographic origin of it. He studied 530 citations it was revealed that major part of literature was contributed by medical sciences and chemistry with India and Egypt as major nations of contribution and a great number of publications followed co-authorship pattern with English language as main medium of communication. In the other study carried out by [15] studied date palm (Phoenix dactylifera L.),literature by using bibliometric techniques and about 2,465 citations were identified by him he recognised most of the literature was contributed by Iraq and Egypt, and mostly used language was English and a small fraction of authors contributed to one-third of the publications. This literature

wasalso interdisciplinary in nature mainly covering the fields of agriculture, biological sciences, andchemistry. However, [16] carried out the bibliometric study of Lavender from year 2008 to 2012 using two renowed indexing and abstracting databases—Thomson Reuter's Web of Science and Elsevier's SciVerse Scopus and their study revealed that during the study period no uniform development in research of Lavender is observed. A good difference in research productivity was evident among developed and developing nations. Most of the articles were published in the journals belonging to United States, United Kingdom, Netherlands and Germany. Collaborative authorship (tree authors) was preferred by authors and that too within the same institution. Authors belonging to 60 different countries were identified working on this very area; most of them belonged to Iran, Spain and Portugal. Most monstrously, studied species are 'Lavandula angustifolia', 'Lavandula stoechas', and 'Lavandula _ intermedia'. English was the mostly used language for publication by authors.

V.DATA ANALYSIS AND INTERPRETATION

YEARLY DISTRIBUTION OF RESEARCH OUTPUT

The countries all over the world contribute a total of 173 publications as retrieved for the period of 27 years (1989-2016).There is no uniformity in the growth of literature, although compound annual growth rate of 11.51 % is observed during the period. The highest number of growth publications comes in between 2009 to 2013 with 66,followed by 2014 to 2016 that is 58.There is a almost nil growth of publication from 1989 to 2000 only 10 publications comes from this decade (Table 1).

TABLE 1: YEARLY DISTRIBUTION OF RESEARCH OUTPUT

Year	No. of Publications	Growth Rate	Compound Annual Growth Rate
1989-1993	4	-	11.51%
1994-1998	6	50%	
1999-2003	12	100%	
2004-2008	27	125%	
2009-2013	66	144%	
2014-2016	58	-12.12%	

VI.SOURCES USED

Choice of source is very important for the purpose of communicating the research. Different people use different criteria for selection of source as there is a direct contact between reputation of source and research publication. More reputed the source is more authentic the research work is considered. Journal of Ethnopharmacology

singly contributes a major portion to the research of tulsi as 8 publications are from it (4.62%) while as 8 sources contribute 3 publications each(13.8%) and 31 sources 2 publications each and single(45.66%) publications are contributed by 79 sources as shown in Table2

TABLE -2: SOURCES USED

S. No.	Source Publication	Publications	Percentage
1	Journal of Ethnopharmacology	8	4.62
2	8 sources published three publications each	24	13.8
3	31sources published two publications each	62	35.83
4	79 sources published single publication each	79	45.66
Total		173	100

VII.AUTHORSHIP PATTERN

Authors like to publish in a collaborative manner. It is evident from the results that 98 (56.64%) of publications are having more than three authors, followed by authors which like to work in a group of three 32(18.49%),then double authors 31 (17.91%) and later single author (6.93%)publications respectively. The trend of multiauthored publications is quite evident in this study as high proportion of papers is having more than three authors (Table 3).Statistically, it is observed that distribution in authorship pattern is not uniform. It means authors prefer to work jointly.

TABLE 3: AUTHORSHIP PATTERN

Authorship	Papers	Percentage	P-value
Single	12	6.93	<0.05
Double	31	17.91	
Triple	32	18.49	
More than Three authors	98	56.64	

VIII.TOP TEN NATIONS THAT CONTRIBUTE TO THE RESEARCH PRODUCTIVITY

A country's research output helps to assess its intellectual level to a greater extent. Top ten nations were identified on the basis of their research contribution to tulsi it is evident that India is leading with 141 publications (81.5%) followed by USA with 13 publications (7.5%) then other nations including Pakistan,Germany, Saudi Arabia,Canada, Uruguay, South Korea, Libya, Brazil which contribute less than 10 publications (Table 4).

TABLE 4: TOP TEN NATIONS

Rank	Country	No. of Publications	Percentage
1	India	141	81.5
2	USA	13	7.5
3	England	5	2.9
4	Pakistan	4	2.3
5	Germany	4	2.3
6	Saudi Arabia	3	1.7
6	Canada	3	1.7
7	Uruguay	2	1.2
7	South Korea	2	1.2
7	Libya	2	1.2
7	Brazil	2	1.2

IX.PROLIFIC AUTHOR'S CONTRIBUTION

A total of 826 authors had contributed in a total of 173 publication on Tulsi. It is evident from the Table 5, in the context of number of publications, the most prolific authors are Singh SP and Grover JK with a record of four publications each, followed by five authors with three publications each. The rest of all authors are having only two publications each.

TABLE 5: PROLIFIC AUTHORS

Rank	Author	Country of Affiliation	No. of Publications	Percentage
1	Singh SP	India	4	6.77
1	Grover JK	India	4	6.77
2	Vats V	India	3	5.08
2	Varma S	India	3	5.08

2	Singh S	India	3	5.08
2	Kohli K	India	3	5.08
2	Kikani K	India	3	5.08
3	Yadav SP	India	2	3.38
3	Tuteja FC	India	2	3.38
3	Thacker NP	India	2	3.38
3	Slater A	England	2	3.38
3	Singh Y	India	2	3.38
3	Singh R	India	2	3.38
3	Shukla SK	India	2	3.38
3	Sharma S	India	2	3.38
3	Sharma P	India	2	3.38
3	Rudra A	India	2	3.38
3	Ravindra KB	India	2	3.38
3	Rao S	India	2	3.38
3	Rahman,Z	India	2	3.38
3	Portugal ,R	South Korea	2	3.38
3	Pillai,KK	India	2	3.38
3	Pandit,MK	India	2	3.38
3	Padhi,M.M	Canada	2	3.38
3	Naik,S.N	India	2	3.38

X.PUBLICATION TYPE

A total of 173 publications were identified globally in which major document type was article contributing about 156 (90.2%) publications , followed by Meeting Abstract with 7(4%) and review 5(2.9%), Editorial material, Book review only 2 (1.2%) each and Proceeding paper only 1 (0.6%). It is clear that majority of the authors like to publish their work as research articles instead of any other publication type (Table 6).

TABLE 6: PUBLICATION TYPE

Type	No. of Publication	Percentage
Article	156	90.2
Meeting Abstract	7	4

Review	5	2.9
Editorial Material	2	1.2
Book Review	2	1.2
Proceedings Paper	1	0.6
Total	173	100

XI.ANALYSIS OF HIGHLY CITED ARTICLES

The highly cited articles along with total citation and average citation per pear are shown in Table-5.It is worth to mention that most of the research articles are highly nascent, so that high citation rate shall not be expected. Nevertheless, the highly cited article on Tulsi plant is "*Evaluation of anti-hyperglycemic and hypoglycemic effect of Trigonellafoenum-graecum Linn, Ocimum sanctum Linn and Pterocarpus marsupium Linn in normal and alloxanized diabetic rats"* published in Journal of Ethnopharmacology with total citations is 130 and average citations per year is 8.12, followed by *Biosynthesis of silver nanoparticles using Ocimum sanctum (Tulsi) leaf extract and screening its antimicrobial activity* with total citations is 116 and 16.57 is average citations per year. It is also mentioned that the citation rate and average citations are poor in under developing nations like India as compared to the developed nations.

TABLE 7: HIGHLY CITED ARTICLES

Title	**Total Citations**	**Average Citation Per year**
Evaluation of anti-hyperglycemic and hypoglycemic effect of Trigonellafoenum-graecum Linn, Ocimum sanctum Linn and Pterocarpus marsupium Linn in normal and alloxanized diabetic rats	130	8.12
Biosynthesis of silver nanoparticles using Ocimum sanctum (Tulsi) leaf extract and screening its antimicrobial activity	116	16.57
Extracellular biosynthesis of gold and silver nanoparticles using Krishna tulsi (Ocimum sanctum) leaf	93	13.29
Ethanolic extract of Ocimum sanctum leaves partially attenuates streptozotocin-induced alterations in glycogen content and carbohydrate metabolism in rats	89	6.36
Antioxidative defense system in an upland rice cultivar subjected to increasing intensity of water stress followed by recovery	83	5.53

Antifungal Activities of Ocimum sanctum Essential Oil and its Lead Molecules	47	5.88
PCR-based DNA markers linked to a gall midge resistance gene, Gm4t, has potential for marker-aided selection in rice	47	2.14
Anti-cancer effects of novel flavonoid vicenin-2 as a single agent and in synergistic combination with docetaxel in prostate cancer	43	6.14
Antibacterial finish for cotton fabric from herbal products	42	5.25
Biological activities of Ocimum sanctum L. fixed oil - An overview	34	3.09

XII.LANGUAGE OF PUBLICATIONS

Linguistic analysis of the publications revealed that only three languages were used for publication that is English, French and Serbian. English is the parent language of majority of publications 171(98.84%)while one publication(0.57%) each is published in French and Serbian. As the plant holds a great significance in Indian system of medicine,not a single record pertaining to Tulsi published in "Hindi "was retrieved (Table 8)

TABLE 8: LANGUAGE DIVERSITY

Language	No. of Publications	Percentage
English	171	98.84
French	1	0.57
Serbian	1	0.57

XIII.NATURE OF ACCESS

Accessibility enhances the availability of literature in any field of knowledge .Open access is a highly acknowledged concept in Library and Information Science as it enhances the availability of information and breaks the traditional concept of chaining of information. Very discouraging result was revealed after analysing the nature of access of research material as majority of the publications on Tulsi plant were subscription based /closed access journals 156(90.17%) however , only 17 (9.82%) publications are open access (Table 9).

TABLE 9: NATURE OF ACCESS

Access	No. of Publication	Percentage
Open Access	17	9.82
Closed Access	156	90.17

XIV. LIMITATIONS

The study is based on the data gathered through Web of Science and that too against the search query "Tulsi". It is possible that further articles have been published that are not indexed in the database. Numbers of publications are used as a measure of research activity and this is not a true representation of extent of research carried out in this particular research topic.

XV.CONCLUSION

It is clear from the study that the growth of literature pertaining to this plant is inconsistent, authors like to work in collaborative manner. India contributes highest number of publications. English language dominates the scene and majority of articles are subscription based. Global research output pertaining to Tulsi indexed by Web of Science is not upto the expectations. Various steps need to be taken to promote research in this particular dimension .National language of India needs to be promoted for publication because no record published in Hindi was retrieved .However, funding the research can also play a vital role in making publications openly accessible.

REFERENCES

[1]Sumner, J. S. The natural history of medicinal plants. *Eukaryon*,1(10) (2005). Retrieved from: http://legacy.lakeforest.edu/images/userImages/vaidyt/Page_5422/Jessica%20Abruzzo.pdf

[2] Chadwick, A. and Craker, L. E. The scientific literature on herbs. *Science and Technology Libraries*, 9 (1), 71-103 (1988).Doi.org/10.1300/J122v09n01_09

[3] Mondal S., Miranda R. B., and Mahapatra, S. C . The Science behind Sacredness of Tulsi (Ocimum sanctum LINN.).*Indian Journal of Physiology Pharmacology*, 53(4), 291-306 , (2009).

[4] Kumar V., Andola H.C., Lohani H. and Chauhan N. Pharmacological Review on Ocimum sanctum Linnaeus: A Queen of herbs. *Journal of Pharmacy Research*, 4, 366- 368. (2001).Retrieved from:http://jprsolutions.info/files/final-file-57a37165c81e30.97516847.pdf

[5]Sumit, B and Geetika,A.Therapeutic benefits of holy basil (tulsi) in general and oral medicine: A review. *International Journal of Research in Ayurveda and Pharmacy*,3 (6), 1-4(2012).Retrieved from:http://www.ijrap.net/admin/php/uploads/894_pdf.pdf

[6] Adenaike, B. O. Bibliometric studies on a protein-rich crop: The cowpea. *Journal of Information Science*, 4 (2-3), 117-121(1982).Doi:/10.1177/016555158200400208

[7]Subbaiah, R. Eighty years of grape research in India (1901-1981): A bibliometric study. *Annals of Library Science and Documentation*, 31(1-2), 18-26(1984) .Retrieved from:http://nopr.niscair.res.in/bitstream/123456789/27976/1/ALIS%2031(1-2)%2018-26.pdf

[8] Krishna, K.M. and Kumar, S. Authorship trends in agricultural research: Abibliometric analysis. *SRELS Journal of Information Management*, 41(2), 229-234 (2004).Retrieved from:http://www.i-scholar.in/index.php/sjim/article/view/44472>

[9]Vijayakumar, M., Shehbaz, H. and Naqvi, S.H. Authorship trends in AzadirachtaIndica literature: A bibliometric study. *SRELS Journal ofInformation Management*,39(4), 445-455(2002).Retrievedfrom: http://www.informaticsjournals.com/index.php/srels/article/view/5555

[10] Singh, G., Ahmad, M and Nazim, M. A Bibliometric study of Embelia. Ribes, *Library Review*, 57 (4), 289-297(2008).Doi.org/10.1108/00242530810868724

[11] Thirumagal, A. Stem Cell Research: A Bibliometric Analysis from 1999-2008, *Library Philosophy and Practice*. (2012).Retrieved from:http://digitalcommons.unl.edu/libphilprac/791.

[12] Biswas, B. C., Roy, A., and Sen, B. K. Economic Botany: a bibliometric study.*Malaysian Journal of Library & Information Science*, 12(1), 23-33(2007).Retrieved from:http://mjs.um.edu.my/index.php/MJLIS/article/view/6985>

[13] Haiqi, Z. A bibliometric study on medicine Chinese traditional in Medline database.*Scientometrics*, 31(3), 241-250. (1994)Doi:10.1007/BF02016874

[14] Anwar, M. A. (2005). Nigella sativa: A bibliometric study of the literature on Habbat Al-Barakah. *Malaysian Journal of Library & Information Science*, 10 (1), 1-18.(2005).Retrieved from: http://www.citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.608.9576&rep=rep1...

[15] Anwar, M. A. (2006). Phoenix Dactylifera L: A bibliometric study of the literature on Data Palm. *Malaysian Journal of Library & Information Science*, 11 (2), 41-60.(2006).Retrieved from:https://jice.um.edu.my/index.php/MJLIS/article/download/7831/5386

[16] Gul, S., Nisa, N.T., Shah, T.A., Shah, M.U.A and Wani, A. B.Research output on Lavender,2008-2012.*European Journal of Integrative Medicine*, 7(5),460-466.(2015).Doi.org/10.1016/j.eujim.2015.05.004