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AUTHORSHIP PATTERN AND RESEARCH COLLABORATION OF JOURNALS OF BOTANY

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ABSTRACT

The study highlights the authorship pattern and research collaboration in the area of Biology based on 1183 scholarly communication appeared in the Botany during 2005-2014. Study illustrates various significant aspects like types and trends of authorship, author productivity, degree of collaboration, collaborative index, Growth rate of the articles, Relative growth rate and Doubling time, geographical wise distribution. Multiple author papers are more popular among Botany literature. USA is the highest Contributor Country in the field of Botany literature, finally verified through Kolmogorov Simonov test. Finally it can be concluded that Botany literature does not follow the Lotka's law of author productivity and found that there is a negative Co-relation in botany literature.

KEYWORDS: Growth Rate, Relative Growth Rate, Doubling Time, Authorship Pattern, Lotka's Law, KS Test, Botany Literature.

INTRODUCTION

Concept of authorship actually emanated from the anonymity of scholarly communications as, research communications were validate based on the merit of the content and positioned within an anonymous and coherent conceptual system of established truths. In today's highly competitive market place authorship attribution has become even more significant as it is the currency of research credit and primary basis for academic evaluation and reward system like promotions, tenure and salary determination. Study of authorship across the disciple, thus becomes an issue that has frequently been persuaded in bibliometrics.

The Present study is a bibliometric analysis of Botany Literature over the period of 2005-2014. An attempt has been made in this study to find out the various characteristics of Botany literature such as average growth rate of literature, relative growth rate and Geographical distribution, authorship pattern and Collaborative research etc.

About Web of Science

The *Web of Science* is a part of *Web of Knowledge* Online Database; it was launched by Thomson Reuters, and focuses on research published in journals, conferences and books on science, medicine, arts, humanities and social sciences. The *Web of Science* was created as an awareness and information retrieval tool, but it has acquired an important secondary use as a tool for research evaluation, using citation analysis and bibliometrics. Data coverage is both current and retrospective in the sciences, social sciences, arts and humanities, in some cases back to 1900. Within the research

community this data source is often referred by the acronym 'ISI'. Unlike other databases, the *Web of Science* and underlying databases are selective, that is the journals abstracted are selected using rigorous editorial and quality criteria.

REVIEW OF RELATED LITERATURE

Mahapatra (1985) assessed the Relative Growth Rates (RGR) is a measure to study the increase in number of articles/pages per unit of articles/pages per unit of time. Gururaj S Hadagali and Gavisiddappa an a dhalli (2015) demonstrates the growth of neurology literature for the period 1961-2010. A total of 291,702 records were extracted from the Science Direct Database for fifty years. The Relative Growth Rate (RGR) and Doubling time (Dt.) of neurology literature have been calculated, supplementing with different growth patterns to check whether neurology literature fits exponential, or logistic model. In the study of Das, P.K. (2015) highlights the authorship pattern and research collaboration in the area of in for metrics based on 420 scholarly communications appeared in the journal of in for metrics during 2007-2013. Study illustrates various significant aspects like trends of authorship, degree of collaboration, collaborative index, relative growth rate. Findings suggest tangible growth of in for metrics literature over the years with predominantly multi-authored contributions. Nattar (2009) has conducted scientometric analysis of 829 articles published in Indian Journal of Physics during 2004-2008. Results indicated that the highest numbers of papers have been written by co-authors. The contributions in this journal from India were slightly more than those from the other countries. Gavisiddappa Anadahalli (2014) an attempthas been made to test the validity of Lotka's law in the domain of library and information science (LIS) published in the LISTA database considers only the Authors of the Articles that appear in 2008 to 2012 as the base for the study which included 1012 articles contributed by 2022 authors. Lotkas law is one of the most basic laws of bibliometric and it deals with frequency of publication by authors in any given field. The study reveals three method namely Sen's Method Pao's Method and Maximum Likelihood Method are used and tested and finally verified through Kolmogorov smirnov test. Finally it can be concluded that Lotka's law by and large holds good for the authorship pattern in the field of library and information science. The results shows the data: one pending equal a '-2,75', the obtained is lower in the work of Voos (1974), as in the Sen, Taib e Hassan (1996), in this camp; percentage of authors, executors of one work only, it is equal to 79% and a excellent adjust of the Lotka Law, to be applied at the Kolmogorov-Smirnov. Kanungo, T. (1995) conducted a study on citing patterns of Indian political scientists in Indian Journal of political science for the period 1990-93. 3509 citations were cited for 119 articles. The analysis revealed that 88.37% authors were Indian; only 111.63% belong to Foreign Countries. There were 89.08% single authors and 10.92% had two or more authors. The score of self- citation constituted to 1.82% and author self-citation, 24.03%. Periodicals as source of Information were 18.97%. Out of which 41.86 were Indian and 58.14% were Foreign.

Objectives

The major objectives of the study are to find out the following:

- The No. of papers published, average growth rate of literature in the Botany Literature over the study period of ten years (2005-2014).
- To study the Relative Growth Rate (RGR) of articles;
- To find out the Doubling Time (Dt) for the articles to become double of the existing amount;
- Authorship pattern and degree of Collaboration of research in the field of Botany Literature.

- To determine whether the n value confirms to Lotka's Law through K-S Test.

Methodology

Keeping view of the aforesaid objectives, primary data for the study has been extracted from the Web of Science is indexing online database published by Thomson Reuters (2005-2014). Necessary data was collected in the form of bibliometric components, such as the average growth rate of literature, Relative growth Rate and Doubling Time of article, authorship pattern, degree of collaboration of research, Most Prolific authors. Lotka's law and K S test applied for the present study. Finally given data set was organized, tabulated and analysed with the help of in Ms-Excel and SPSS and presented in the form of tables and graphs for the purpose of interpretation and discussion in the following way.

Data Analysis and Interpretation

Analysis of collected data has revealed many interesting findings which signify the authorship and collaborative attributes of the botany literature.

Table 1: Year Wise Contribution and Average Growth Rate of Articles

SI. No	Publication Year	Recs	%Age	Cumulative	Cum%	Growth Rate	Statistical Results	
1	2005	146	12.342	146	12.342		Max	151
2	2006	91	7.692	237	20.034	1.604	Min	74
3	2007	74	6.255	311	26.289	1.230	Mean	118.3
4	2008	81	6.847	392	33.136	0.914	$\bar{x}$	
5	2009	126	10.651	518	43.787	0.643	SD	28.40
6	2010	139	11.750	657	55.537	0.906	R	77
7	2011	119	10.059	776	65.596	1.168		
8	2012	110	9.298	886	74.894	1.082		
9	2013	151	12.764	1037	87.658	0.728		
10	2014	146	12.342	1183	100.000	1.034		
		1183	**100.000**	**6143**		1.034		

Table- 1 depicts the year wise contribution and average growth rate of articles in the Botany literature from 2005-2014. It is evident from the table- that 1183 articles were published during the study period (2005-2014). It is observed that highest numbers of articles (N=151, 12.76%) were published in the year 2013. The second highest number of articles (N=146, 12.34%) was published in the year 2005 and 2014, while lowest numbers of article were contributed in the year 2007 (N=74, 6.25%). Further, it is found that the average growth rate of the article found to be 1.034. It can be concluded that on an average 118 articles were published during the each year with deviation of 28 articles.

Relative Growth Rate

The relative growth rate (RGR) is the increase in the number of articles/pages per unit of time. This definition is derived from definition of relative growth rates in the study of growth analysis of individual plants and is effectively applied in the field of botany (Hunt R 1978). The mean relative growth over specific period of interval can be calculated from the following equation:

$$RGR=\frac{LogX_eW2-LogX_eW1}{T^2-T1}$$

Where as

RGR= mean relative growth rate over the specific period of interval

$Logx_eW1$ = log of initial number of articles

Logx_eW2 = Log of final number of articles after a specific period of interval

T_2-T_1 = the unit difference between the initial time and the final time

Doubling Time (DT)

There exists a direct equivalence between the relative growth rate and the doubling (Bradford, 1934). if the number of articles/pages of a subject double during a given period then the difference between 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. thus, the corresponding doubling time for each specific period of interval and for both articles and pages can be calculated by the formula;

Doubling time (Dt.) = $\frac{0.693}{\bar{R}}$

Where $\bar{R}$ =Relative Growth Rate

Table 2: Relative Growth Rate and Doubling Time of the Research Output by Year Wise

Year	Quantum of Output	Cumulative Output	W1	W2	Rt (P)	Mean RP(P)	Dt (P)	Mean Dt (P)
2005	146	146	4.984	4.984	0.000		0.000	
2006	91	237	4.511	5.468	0.484		1.430	
2007	74	311	4.304	5.740	0.272	0.253	2.550	1.892
2008	81	392	4.394	5.971	0.231		2.994	
2009	126	518	4.836	6.250	0.279		2.486	
2010	139	657	4.934	6.488	0.238		2.915	
2011	119	776	4.779	6.654	0.166		4.163	
2012	110	886	4.700	6.787	0.133	0.165	5.228	4.394
2013	151	1037	5.017	6.944	0.157		4.404	
2014	146	1183	4.984	7.076	0.132		5.261	
Total	**1183**							

Table 2 clearly indicates, the value of an average RGR of articles Rt(P) The year wise analysis of the growth of articles output shows that growth is high in the year 2005-2009 and then there is a sudden decreasing in productivity during the year 2010-2014. Furthermore, mean Dt.(P) for the first five year was and increased to in the latter five year, i.e. from 2010 to 2014. It shows that the mean relative growth of Botany Literature has shown an increasing trend.

Table 3: Authorship Pattern

Year	No. of Articles	No of Papers / Author (S)						Multiple	Total No of Authors	TA
		Single	Double	Three	Four	Five	>Five			
2005	146	44	30	24	21	13	14	102	365	409
2006	91	43	19	11	10	3	5	48	156	199
2007	74	30	16	15	5	3	5	44	142	172
2008	81	31	21	14	7	3	5	50	157	188
2009	126	62	22	13	14	7	8	64	222	284
2010	139	60	19	19	14	15	12	79	298	358
2011	119	40	15	21	16	13	14	79	306	346
2012	110	41	19	22	11	8	9	69	242	283
2013	151	51	37	20	9	6	28	100	368	419
2014	146	50	27	27	15	7	20	96	350	400
Total	**1183**	**452**	**225**	**186**	**122**	**78**	**120**	**731**	**2606**	**3058**
		38.208	**19.019**	**15.723**	**10.313**	**6.593**	**10.144**	**61.792**	**2.203**	

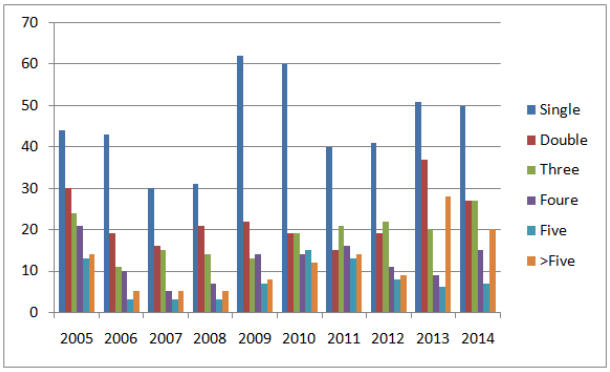

Figure 1

Average author per paper $= \frac{\text{Total no.of authors}}{\text{Total number of papers}} = \frac{3058}{1183} = 2.585$

It is observed from the table 3 that 3058 authors have contributed 1183 articles and average of authors per paper is 2.585. Single authored research articles constitute 38.208%, whereas multiple authored research papers contribute maximum i.e., 61.792% of the total number of research articles. It shows that multiple authored research articles have made major contribution to the field of Botany.

Table 4: Collaborative Research in Botany

Collaborative Research in Botany								
Year	**Single Authors Papers**	**Multiple Authors Papers**	**Total Paper**	**TA**	**DC**	**CC**	**MC**	**CI**
2005	44	102	146	453	0.69863	0.834768	0.836615	3.10274
2006	43	48	91	242	0.527473	0.755096	0.75823	2.659341
2007	30	44	74	202	0.594595	0.77797	0.781841	2.72973
2008	31	50	81	219	0.617284	0.778463	0.782034	2.703704
2009	62	64	126	346	0.507937	0.762331	0.764541	2.746032
2010	60	79	139	418	0.568345	0.80303	0.804956	3.007194
2011	40	79	119	386	0.663866	0.84171	0.843896	3.243697
2012	41	69	110	324	0.627273	0.808076	0.810578	2.945455
2013	51	100	151	470	0.662252	0.830603	0.832374	3.112583
2014	50	96	146	450	0.657534	0.827444	0.829287	3.082192
	452	**731**	**1183**	**3510**	0.617921	0.920523	0.942663	0.005039

TA = Total authors DC= Degree of Collaboration CC = Collaborative coefficient

CI= Collaborative index MC= Modified coefficient

Degree of Collaboration (DC)

$$DC = \frac{N_m}{N_{m+}N_s} = \frac{731}{731+452} = \frac{731}{1183} = 0.617$$

Where N_m refers to the multiple author and N_s denote the number of single-authored communications published in a particular communication channel during certain period of time.

Collaborative Coefficient (CC)

$$CC = 1 - \sum_{J=1}^{J=K}(1=J)\frac{F_j}{N}$$

Modified Coefficient (MC)

$$MC=\frac{A}{A-1}\left\{\frac{\sum_{j=1}^{A}(1|j)f_j}{N}\right\}$$

Collaborative Index (CI)

$$CI=\sum_{j}^{A}=1^{j}f_j$$

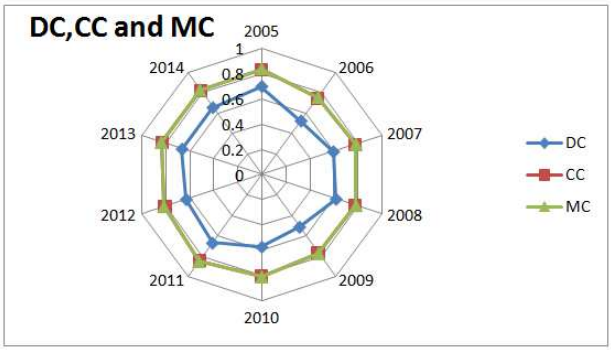

Figure 2

R= -0.470 Negative co-relation

Table- shows the Collaborative coefficient research in Botany Literature for 2005-2014. The analysis of the table shows that out of 1183 articles published, single author share is 452 and multiple paper author shares is 731. This indicates that multiple paper contribution is more than single author papers. Moderate degree of collaboration is observed (0.612), while 0.801 Collaboration coefficient,. 0.804, Modified coefficient and 2.933 Collaborative index is observed in the Botany literature. It can be summarized from the above discussion that very High collaborative research activities are observed in Botany literature.

Table 5: Most Prolific Authors

Rank	Author	No of Articles
1	[Anonymous]	14
2	Knapp S	8
3	Green TGA	7
4.5	Lee WJ	6
4.5	McNeill J	6
4.5	Turl and NJ	6
7	Chaffey N	5
7.5	Coyle HM	5
7.5	Sancho LG	5
10	Bennett MD	4

Table presents the most prolific authors who have contributed to Botany Literature. It is observed that [Anonymous] has made the highest contribution by publishing 14 research articles during the study period (2005-2014). The next highest contribution is made by Knapp S with a publication of 8 research articles. On the other hand researcher like Green TGA and Lee WJ, McNeill J, Turl and NJ have also made significance contribution by contributing 7 and 6 research articles to Botany Literature. However, other authors namely Chaffey N, Coyle HM, Sancho LG and Bennett MD have also made moderate contributions.

Lotka's Law

Lotka's Law is one of the most basic Law of Bibliometrics, which deals with the frequency of publication by authors in any given field. The generalized form of Lotka's law can be expressed as

$X^n Y=(C)$

Where y is the number of authors with x articles, the exponent n and constant C are parameters to be estimated from a given set of author productivity data.

Lotka's law describes the frequency of publication by authors in a given filed. It states that "the number of authors making n contribution is about $1/n^2$on those making one and the proportion of all contributions that make a single contributions, is about 60 percent (Lotka 1926, cited in potter1988). This means that out of all the authors in a given filed, 60 percent will have just one publication and 15 percent will have two publications. 7 percent of authors will have three publications and so on. According to Lotka's law of scientific productivity only a six percent the authors in a field will produce more than 10 articles

Table 6: KS Test of Observed and Expected Distribution of Authors

# of Pub x	# of Authors y_x	% of Authors $f_o(yx)=y_x/\sum y_x$	Cumulative % of Authors $\sum f_o(y_x)$	Expected % of Authors $Fe(y_x)=C/(1/x^n)$	Cumulative Expected % of Authors $\sum F_e(y_x)$	$D=\sum f_o(y_x)- \sum Fe(y_x)$
1	2739	0.913	0.913	0.913	0.913	0
2	202	0.067333	0.980333	0.014565	0.927565	0.052768
3	34	0.011333	0.991667	0.001294	0.92886	0.062807
4	16	0.005333	0.997	0.000232	0.929092	0.067908
5	3	0.001	0.998	6.13E-05	0.929153	0.068847
6	3	0.001	0.999	2.06E-05	0.929174	0.069826
7	1	0.000333	0.999333	8.23E-06	0.929182	0.070151
8	1	0.000333	0.999667	3.71E-06	0.929186	0.070481
14	1	0.000333	1	1.31E-07	0.929186	0.070814
Total	**3000**					

D_{max}= 0.913 critical value = 10.022

Distribution does not follow the Lotka's law. Dmax value is 0.070814 and Critical value is 0.022. Since the critical value is less than Dmax (0.022 > 0.070814). So we must fail to reject the null hypothesis by using the formula:

$X^n Y=C$

We concluded that Botany literature does not follow the Lotka's law of author productivity.

FINDINGS AND CONCLUSIONS

Present study demonstrated some general inferences on the basic bibliometric attributes like authorship pattern, research collaboration of the botany literature. Steady increase of publications over the years. With respect to author productivity, present study does not follow the Lotka's generalized inverse square law with K. S test.

Relative Growth Rate (RT(P)) of an articles gradually Decreases Correspondingly the values of Doubling time of the articles Dt(P) gradually increases. The degree of collaboration was estimated to 0.617, of which double and triple authored contribution were prominent. Average collaboration index (CI) 0.005, Collaboration Coefficient 0.920, Moderate

Collaboration 0.942 and Average author per paper 2.585. USA and UK Country has produced maximum number of articles in the field of Botany. It may be concluded that findings of the study would certainly provide the-state-of-the-art of botany research, thus helping the researchers and policy makers to have the panorama of this speciality.

REFERENCES

1. Bonilla-Calero, A.I. (2008) Scientometric Analysis of a Sample of Physics-related research output held in the Publication repository strathprints (2000-2005). *Library Review*. 57(9), 700-721.
2. Cronin, blaise; Shaw, Debora & Barre, Kathryn La. (2001). A cast of thousand: co authorship and sub authorship collaboration in the 20th century s manifested in the scholarly journal literature of psychology and philosophy. JASIST, 54(9), 855-871.
3. Das, P. k. (2015). Authorship pattern and Research Collaboration of Journal of In formetrics. *International Journal of Information Dissemination and Technology*. 5(1), 53-62.
4. Gavisiddappa, Anadahalli (2014) An Examination of Lotka's Law ICT Components in LIS Research at the Third National Conference on Scientometrics, Big Data Analytics(BDA) and Libraries. Kuvempu University, Shankaragatta, May 31st, 2014.
5. Hadagali, Gururaj S. and Anadhalli, Gavisiddappa (2015).Modeling the growth of Neurology Literature.*Journal of Information Science Theory and Practice*, 3(3), 45-63. Accessed on 08/December/2015.www.jistop.org.
6. Hunt, R. (1978). Plant growth analysis. London: Edward Arnold.
7. Hunt, R. (1982). Plant growth analysis: second derivates and compounded second derivates of splined plant growth curves. *Annals of Botany*. 50, 317-328.
8. Kanungo, N.T. (1995) Citing pattern of Indian Political Scientists: A case study of the Indian Journal of Political Science. Journal of Library and Information Science, 20(1-2), 56-65.
9. Lotka, A. J. (1926) The frequency distribution of scientific productivity. *Journal of the Washington Academy of Sciences*, 16(12), 317-324.
10. Mahapatra, M. (1985) on the validity of the theory of exponential growth of scientific literature. In 15th IASLIC conference proceedings, Bangalore, IASLIC, 61–70.
11. Mamdapur, Ghouse Modin N., Rajgoli, Iqbalahmad, u., Chavan, Santosh M. and Khamitkar, Kiran S. (2014).Bibliometric portrait of SRELS Journal of Information Management for the period 2004-2013. Library philosophy and practice (e-journal), paper 1166. Accessed on 02/December/2015(http://digitalcommons.unl.edu/libphilprac/1166).
12. Nattar, S. (2009) Indian journal of physics: A Scientometric analysis. International Journal of Library and Information Science, 1(4), 055-061.
13. Neelamma & Gavisiddappa Anandhalli (2015). Research Trends in Crystallography: A study of Scientometric Analysis**.** *International Journal of Information Sources and Services*, 2(2), 71-83.
14. Nicholls, P. T. (1989) Bibliometric modeling processes and the empirical validity of Lotka's law. *Journal of the*

American Society for Information Science. 40(6), 379-385.

15. Pao, M. L. (1986) An Empirical examination of Lotka's Law.*Journal of American Society for Information Science*, 37, 26-33.
16. Potter, W. G. (1988) of making many books there is no end: Bibliometrics and libraries. *Journal of Academic Librarianship*, 14: 238a-238c.
17. Rana, M. S. and Agarwal, S. (1994). Authorship trends in Indian wildlife and fisheries literature: a bibliometric study. *Annals of Library Science and Documentation*, 41(1), 13-18.
18. Sen, B. K. (2010) Lotka's Law: A View point. *Annals of Library and Information Studies*, 57, 166-167.
19. Venkateshan, M.; Gopalakrishnan, S. and Gnanasekara, D. (2013). Growth of Literature on climate change research: A Scientometric study. *Journal of Advances in Library and Information Science*, 2(4), 236-242.
20. Voos, H. (1974) Lotka and Information Science. *Journal of the American Society for Information Science*, 25(4), 270-272.