Indian Contribution to Biotechnology Research: Scientometric Analysis

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Abstract

This paper analyses the growth pattern of Biotechnology literature in India during 2002-2016 (15 years). The Scopus international multidisciplinary bibliographical database has been used to identify the Indian contributions on the field of Biotechnology. The study measures the performance based on several parameters, publishing trend, authorship pattern, degree of collaboration, preferred journals by the scientists and citations. *The number of articles published in online Scopus database during the period 2002-2016 is 5514. There is an upward trend in number of collaborated papers.*

Keywords

Biotechnology Research-India, Scientometric analysis

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1. INTRODUCTION

Scientometrics is a well known branch of science that explains the output traits in the case of organizational research structure, resource input and output, develops benchmarks to evaluate the quality of information output. It helps to assess the scientific production. According to Sangam et al (2010) explains the increasing trend in literature over specific period may be growth of literature. In the present study; we did the Scientometric analysis of Biotechnology Research in India with special reference to Scopus database for the period of 2002-2016 .

2. DEFINITIONS

Scientometrics is the quantitative study of the disciplines of science based on published literature and communication. This could include identifying emerging areas of scientific research, examining the development of research over time, or geographic and organizational distributions of research. Tague-Sutcliffe (1992) defines Scientometrics as "the study of the quantitative aspects of science as a discipline or economic activity. It is part of the sociology of science and has application to science policy-making. It involves quantitative studies of scientific activities, including, among others, publication, and so overlaps bibliometrics to some extent".

3.REVIEW OF LITERATURE

Ashok Kumar et. al. (2013), evaluated the research output of Biotechnology in India , during the period 1999-2012. Result of this study shows that Indian researchers of Biotechnology research contribution increased during the year 2005, contribution of single author and double author is dominating moreover the journal current science dominates the top journal with highest publication.

Amsaveni and Vasanthi (2012) in a survey entitled "Mapping of Green Biotechnology: A Scientometic Analysis" came to the conclusion that numbers of published articles have significantly increased during the year 2011 to 2010. Most of the articles were published by Stewart, CN and Yoshizaki G .

3. SCOPE AND METHODOLOGY

The data was collected from the SCOPUS Database. Scopus database is one of the very comprehensive citation databases covering all the aspects of science. The present study attempts to find out the publication

pattern of Indian researchers in the field of Biotechnology. The study aims to analyse quantitatively the growth and development of Biotechnology Research in India in terms of publication output as reflected in Scopus database during the period 2002-2016.

4. OBJECTIVES OF THIS STUDY

The following objectives were formulated for the present study:

- To sketch the year wise distribution
- To examine the authorship pattern of the contribution.
- To find out the degree of collaboration
- To measure the source wise publications
- To find out the research productivity in institution wise
- To observe the citations of publications.

5. METHODOLOGY

This information about the publications has been downloaded from the online SCOPUS database. In all 5514 records were obtained for the period of (2002-2016). Ms Excel 2010 was used for analysing data.

The following Scientometric indicators have been used in the study:

Degree of collaboration:

Subramaniyam's 13 formulas below have been adopted to examine the degree of collaboration in this study.

C=Nm/(Nm+Ns)

Where ,

C= degree of collaboration in a subject.

Nm =number of multiple authored papers

Ns=number of single authored papers

6. ANALYSIS AND DISCUSSION

6.1 Growth of Biotechnology research output:

Table 1 indicates the growth of Biotechnology research during 2002-2016. The highest output during the 15 year period was in the year 2013 (9.55%) and the lowest (2.54%) in 2002. Further the year wise distribution during the years 2012(8.87%), 2015 (8.69%), 2016 (8.64%) indicates that these years were relatively more productive in relation to total number of publications in Biotechnology. Now the trend of publication is increasing gradually with good number of articles.

Table 1: Year wise Distribution

Year-wise	No. of Articles Published	Percentage
2013	598	9.55
2012	555	8.87
2015	544	8.69
2016	541	8.64
2011	529	8.45
2014	507	8.10
2010	389	6.21
2009	340	5.43
2008	282	4.50
2006	253	4.04
2007	230	3.67
2005	211	3.37
2004	202	3.23
2003	163	2.60
2002	159	2.54

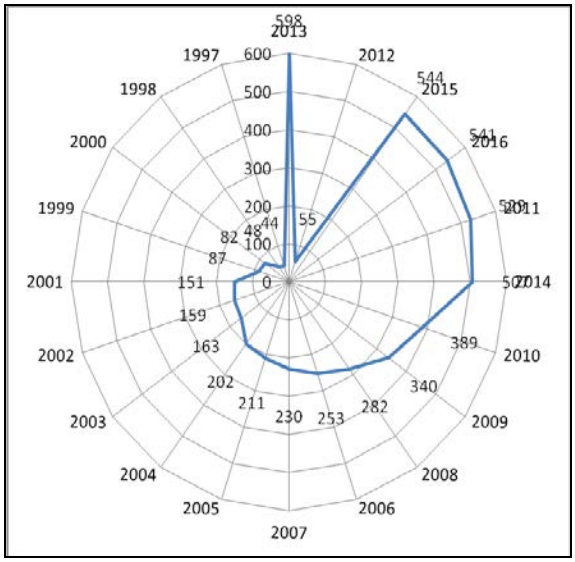


Figure 1 - Year wise Distribution

6.2 Authorship Pattern

To find the authorship pattern, entire data was divided in to seven blocks as single, two, three, four, five, six and more than six authored publications as shown in Table 2. The results presented in Table -2 shows that Two authored publications were maximum at 1274 (24.65%) and six authored papers at 293 (5.67%) were the lowest.

Table 2: Author wise Distribution

Sl. No	Author wise Pattern	No of records	Percentage of 5169(%)
1.	Single Author	623	12.05
2.	Two Authors	1274	24.65
3.	Three Authors	1220	23.60
4.	Four Authors	864	16.72
5.	Five Authors	500	9.67
6.	Six Authors	293	5.67
7.	More than Six Authors	395	7.64
8.	Total	5169	100

6.3 Degree of Collaboration

The Degree of collaboration of authors by year wise is shown in Table 3. The extent of Degree of Collaboration by year wise has been calculated. Accordingly, the degree of collaboration has been calculated for the years 2002-2016. The year wise Degree of collaboration falls between 0.83 and 0.94. The degree of freedom of the authorship pattern of the current study is 0.87

Table 3- Degree of Collaboration

Sl.No	Year	Single Author	Two Authors	Three Authors	More than Three Authors	Degree of Collaboration	Total
1.	2002	10	39	45	43	0.93	137
2.	2003	24	45	42	46	0.85	157
3.	2004	36	60	48	62	0.83	206
4.	2005	29	60	55	66	0.86	210
5.	2006	32	62	76	84	0.87	254
6.	2007	41	61	50	83	0.83	235
7.	2008	46	79	67	100	0.84	292
8.	2009	54	78	90	126	0.84	348
9.	2010	63	111	80	151	0.84	405
10.	2011	46	122	136	251	0.92	555
11.	2012	42	119	131	267	0.92	559
12.	2013	34	148	154	250	0.94	586
13.	2014	52	92	128	264	0.90	536
14.	2015	59	119	131	258	0.90	567
15.	2016	65	143	117	243	0.89	568

6.4 Preferred Journals by the Scientists of Biotechnology

Table 4 reveals the highly preferred journals by the researchers of Biotechnology is “Journal of Bioresource Technology” in which publication output is 435”, 227 in “Journal of Plant Biochemistry and Biotechnology” and also 208 in “IIOAB Journal”and so on.

Table 4-: Source wise Distribution

Sl.No	Source	Publication	%
1.	Bioresource Technology	435	10.24
2.	Journal of Plant Biochemistry And Biotechnology	227	5.35
3.	IIOAB Journal	208	4.90
4.	Plant Cell Biotechnology And Molecular Biology	204	4.80
5.	Journal of Microbiology And Biotechnology	125	2.94
6.	Applied Microbiology And Biotechnology	124	2.92
7.	Biotechnology And Bioprocess Engineering	112	2.64
8.	Current Science	83	1.95
9.	Journal of Bioscience And Bioengineering	83	1.95
10.	Applied Biochemistry And Biotechnology	82	1.93
11.	Critical Reviews In Biotechnology	69	1.63
12.	Biotechnology Advances	68	1.60
13.	Journal of Industrial Microbiology And Biotechnology	65	1.53
14.	Agricultural And Biological Chemistry	64	1.51
15.	Plant Biotechnology Reports	63	1.48
16.	Biotechnology Progress	59	1.39
17.	Indian Journal of Biotechnology	55	1.30
18.	Current Trends In Biotechnology And Pharmacy	54	1.27
19.	Asian Journal of Microbiology Biotechnology And Environmental Sciences	52	1.22
20.	Journal of Biotechnology	47	1.11

6.5 Institution wise Distribution

During the period (2016-2002) India has produced a total of 5514 publications. The highest output was given by Indian Institute of Technology Delhi (220), Indian Agricultural Research Institute (142), Indian Institute of Technology, Kharagpur (111) and Central Food Technological Research Institute India (109), University of Delhi (108) Banaras Hindu University (101) and so on. It implies that IIT and IARI are the predominant publishers of biotechnology articles in India.

Table 5: Institution wise Distribution

Sl. No	Institution Title	No.of Articles	%
1	Indian Institute of Technology Delhi	182	0.033
2	Indian Agricultural Research Institute	117	0.021
3	Indian Institute of Technology, Kharagpur	101	0.018
4	Vellore Institute of Technology	98	0.018
5	University of Delhi	95	0.017
6	Banaras Hindu University	87	0.016
7	National Institute for Interdisciplinary Science and Technology	82	0.015
8	Indian Institute of Chemical Technology	81	0.015
9	Bhabha Atomic Research Centre	74	0.013
10	Central Food Technological Research Institute India	67	0.012
11	Indian Institute of Technology, Bombay	63	0.011
12	Aligarh Muslim University	63	0.011
13	Osmania University	60	0.011
14	Indian Institute of Science	55	0.010
15	Indian Institute of Technology, Madras	55	0.010

6.7 Citation analysis

During the 15 years period (2002-2016) India has produced a total of 5515 articles. The highest number of citation was (2160) in Reactive and Functional Polymers, (1115) Microbiology and Molecular Biotechnology, (826) Applied Microbiology and Biotechnology, (798) Biotechnology Advances Journal and respectively so on. Journal of Reactive and Functional Polymers has highest number of citations compared with all other Journals.

Table 6: Citation Analysis

Sl. No	Name of the Journals	No of Citations
1.	Reactive and Functional Polymers	2160
2.	Microbiology and Molecular Biotechnology	1115
3.	Applied Microbiology and Biotechnology	826
4.	Biotechnology Advances	798
5.	Biotechnology and Applied Biochemistry	594
6.	FEMS Microbiology Reviews	557
7.	Bio Resource Technology	528
8.	Biotechnology Progress	518
9.	Current Science	505
10.	Journal of Industrial Microbiology and Biotechnology	504

7. DISCUSSIONS

Analysis shows that the researchers of Biotechnology published highest number of publications in the year 2013 and also it is shows that the growth rate of publication has increased during the period of 2011-2016. The authorship pattern reveals that two authored papers are more than three authored papers. Most of the papers were written by two or three authors.

Authors from Indian Institute of Technology Delhi, Indian Agricultural Research Institute; Indian Institute of Technology, Kharagpur; Central Food Technological Research Institute India etc. contributed most number of articles.

8. CONCLUSION

Biotechnology is the one of the most important discipline with respect to Indian agriculture where the researchers can implement their techniques to develop the food industries, medicine and agriculture. Moreover India is the one of the predominant Asian countries which involves more in biotechnology research and for the past decade our researchers are producing more significant research papers in terms of biotechnology.

It is essential that pure and applied research in fusion disciplines always yields a good result to the societal development. Biotechnology is one among the subject which keen on development of society and industries and also it requires more employment opportunities and income to our nation.

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