Growth and Development of Indian Plant Science Research: A Scientometric Analysis

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Abstract

The study examined the Indian plant science research on several parameters including growth, research communication in core journals, and geographical distribution of publications, share of international collaborative publications at the national level as well as across subjects and characteristics of high productivity institutions and authors.Materialsand Methods: The study focuses on the articles published by India indexed in Web of Science for the period 2008 to 2017. Results: India has produced 14,137papers, the study suggests the need to increase the pace of Indian scientific research and also improve their quality compared with other developed and developing countries. It also suggests tobuild up the scientific capacity, competence and knowledge base to help bridging the scientific andtechnological gap with leading countries.

Keywords

Scientometrics, Plant Science research, Publication output, Scientometric Analysis, Growth and Collaboration,

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1. Introduction

The strong connections with Economics and Sociology of Science as well as Science policy. The development of Scientometrics as an operational Activity- A Response to the pressing demand for the 'measuring of Science', Especially in Russia and the USA in 1970. Amongst the founding fathers of the discipline were De Solla Price (1963), Garfield (1955) and Narin (1976) in the US, NalimovandMulczenko (1969) in Russia and Braun and Bujdoso (1975) in Hungary. Scientometrics indicators can be classified to the number the aim of Scientometrics is to provide characterizations of scientific activity. Because of the particular importance of publication in scientific communities, it largely overlaps with Bibliometrics, which is the quantitative analysis of media in any written form.

In addition to disciplines of measurement (informetrics/data-mining, statistics and mathematical modelling), Scientometricsof Scientometrics sets they represent and the application of reference standards. Scientometrics indicators referring to the measure of a single scientometrics aspect of scientometrics system represented by a single scientometrics set with a single hierarchical level are termed gross indicators. Those indicators which consist of several gross or complex indicators, preferably with weighting factors and each representing a special aspect of a scientometrics system are composite or compound indexes.

2.Plant Science

Botany is a mother science which has given birth to several branches, each being pursued as a specialty. The study of botany has undergone a tremendous change in the past 50 years and is presently called Plant Sciences to cover its wide scope. Early contributions to botanical knowledge were mainly made in colleges and universities by eminent individuals, who were fired by a spirit of nationalism. By talent and devotion they built schools of botanical learning. Undoubtedly, India has worldwide recognition in embryology, palaeobotany, taxonomy, cytology, cytogenetics, plant breeding, plant tissue culture and morphogenesis, and ecology. I.H. Burkill (1965) has compiled Chapters on History of Botany in India. B.M. Johri (1994) has edited two volumes on Botany in India: History and Progress, sponsored by the INSA.

3. Objectives of the study

The main objective of the study is to present the growth and progress of plant science research during 2008 to 2017, as per the web of science database and make the quantitative and qualitative assessment by way of analyzing various features of research such as,

1. Year wise growth and distribution of publications
2. Document type of distribution
3. Research areas wise contribution of publications
4. The publications productivity and impact of leading institutions of India.
5. The pattern of research communication in most in most productive journals.
6. The most prolific author contributions.

4.Methodology of the study

This study uses web of science (www.isiknowledge.com) database to extract relevant publications data of plant science research for the 10 year period (2008-2017). For analyzing the data, excel has been used.

5.Analysis of the study

Table 1 shows that out of 14137 research papers, the highest number of papers i.e. 1821 (12.88%) scholarly publications with 6569 citations with 3.61 average citations per papers and h index is 25 in the year 2016. Followed by 1774 (12.55%) publications with 10104 citations and 5.7 average citations per paper and h index 33 in the year 2015. The lowest number, i.e. 1051 (7.43%) research output with 15514 citations with 14.76 average citations per paper and h – index 55 in the year 2009.

5.1 Year wise growth on Plant Sciences

Years	TP	TC	ACCP	H Index	%
2008	1156	16023	13.86	56	8.18
2009	1051	15514	14.76	55	7.43
2010	1188	19884	16.74	55	8.4
2011	1202	16159	13.44	52	8.5
2012	1303	14200	10.9	48	9.22
2013	1463	13629	9.32	44	10.35
2014	1427	10379	7.27	35	10.09
2015	1774	10104	5.7	33	12.55
2016	1821	6569	3.61	25	12.88
2017	1752	2588	1.48	15	12.39
Total	**14137**	**125049**			**100**

Distribution of research output in different sub-fields in Indian Plant science

Table 2 indicates that the top ten sub-fields in Indian Plant science. Among the selected top ten publications contribution according to the highest research output from Agriculture (1796 publications, 19.454 % share),followed by Pharmacology Pharmacy(1750 publications 18.956% share), Genetics heredity (1271 publications 13.767% share), Integrative Complementary Medicine (1051 publications 11.384% share), Biochemistry Molecular Biology (965 publications 10.453% share), Biotechnology Applied Microbiology (588 publications 6.369% share), Chemistry (549 publications 5.947% share),Cell Biology(447 publications 4.842% share),Medical Laboratory Technology(447 publications 4.842% share), these two sub fields are same in publication output and Environmental Sciences Ecology(368 publications 3.986% share).

Table –5.2: Distribution of research output in different sub-fields in Indian Plant science

Sl. No.	Research Areas	Records	%
1	Agriculture	1796	19.454
2	Pharmacology Pharmacy	1750	18.956
3	Genetics Heredity	1271	13.767
4	Integrative Complementary Medicine	1051	11.384
5	Biochemistry Molecular Biology	965	10.453
6	Biotechnology Applied Microbiology	588	6.369
7	Chemistry	549	5.947
8	Cell Biology	447	4.842
9	Medical Laboratory Technology	447	4.842
10	Environmental Sciences Ecology	368	3.986
	Total	**9232**	**100**

Most preferred journals and their impact in the field of plant science

Impact of the plant sciences journals of Indian contributors with more than 100 publications in Plant Science has been shown in the table 3. The important leading journals preferred by the Scientists are *Indian Journal of Genetics and Plant Breeding* (published from India) with (839 publications 16.532% share), followed by *Indian Journal of Traditional Knowledge* (India) with (835 publications 16.453% share),*Journal of Ethnopharmacology* (Irland) with (567 publications 11.172% share),Frontiers In Plant Science, Switzerland with (458 publications 9.025% share),*Pharmaceutical Biology* (United Kingdom) with (447 publications 8.808% share),*ActaPhysiologiaePlantarum* (Poland) with(439 publications 8.65% share),*Vegetos* (India) with(402 publications 7.921% share),*Communications In Soil Science and Plant Analysis* (USA)with(380 publications 7.488% share,*Phytotaxa* (New Zealand) with364 publications 7.172% share)*Journal of Plant Biochemistry and Biotechnology* (India)with (344 publications 6.778% share).

Table –5.3: Most preferred journals and their impact in the field of plant science

Sl. No.	Source Title	Countries	Records	%
1	Indian Journal of Genetics And Plant Breeding	India	839	16.532
2	Indian Journal of Traditional Knowledge	India	835	16.453
3	Journal of Ethnopharmacology	Ireland	567	11.172
4	Frontiers In Plant Science	Switzerland	458	9.025
5	Pharmaceutical Biology	United Kingdom	447	8.808
6	ActaPhysiologiaePlantarum	Poland	439	8.65
7	Vegetos	India	402	7.921
8	Communications In Soil Science And Plant Analysis	USA	380	7.488
9	Phytotaxa	New Zealand	364	7.172
10	Journal of Plant Biochemistry And Biotechnology	India	344	6.778

Most prolific research institutions in the field of Plant Sciences

Table 4 shows the most prolific research institutions of India. Council Of Scientific Industrial Research(CSIR), Dehli contributed the highest i.e. 750 (20.080%) publications, followed by International Crops Research Institution Semi Arid Tropical with 524 (14.029%) publications, Banaras Hindu University, Varanasi with 414 (11.084%) publications, Council Of Scientific Industrial Research(CSIR), Dehli 405 (10.843%) publications, University of Delhi, Dehli 370 (9.906%) publications, Punjab Agriculture University,Chandigarh, 334 (8.942%) publications, Botanical Survey India, Kolkata, 295 (7.898%) publications, Aligarh Muslim University, Uttar Pradesh223 (5.971%)publications, National Botanical

Research Institute India,Lucknow, 211 (5.649%) publications and Tamil Nadu Agriculture University, Tamil Nadu, 209 (5.596%) publications.

Table – 5.4: Indian Institutions Contributions and Other Indices of Plant Sciences

Sl. No.	Organizations	Records	%
1	Indian Agriculture Research Institution	750	20.080
2	International Crops Research Institution Semi Arid Tropical	524	14.029
3	Banaras Hindu University	414	11.084
4	CSIR	405	10.843
5	University Delhi	370	9.906
6	Punjab Agriculture University	334	8.942
7	Botonical Survey of India	295	7.898
8	Aligarh Muslim University	223	5.971
9	National Botonical Research Institution	211	5.649
10	Tamil Nadu Agriculture University	209	5.596
	Total	**3735**	**100**

Highly Productive Scientists in Indian Plant Sciences

The table 5 shows the highly productive scientists based on their highest publications, irrespective of their disciplines during 2008-2017 appeared in Web of Science. Kumar, A.contributed the highest publications to the field of plant sciences, i.e. 346 publications with 15.642%, followed byKumar, S. 340 publications with 15.371 %, Singh S, 253 publications with 11.438%, Singh, A. K., 215 publications with 9.72%, Kumar, V., 185 publications with 8.363%, Kumar, R., 183 publications with 8.273%, Sharma S., 179 publications with 8.092%, Singh, R., 168 publications with 7.595%, and Varshney,R. K., 167 publications with 7.55%.

Table –5.5: Most prolific Indian authors in plant sciences

Sl. No.	Authors	Records	%
1	Kumar A	346	15.642
2	Kumar S	340	15.371
3	Singh S	253	11.438
4	Singh AK	215	9.72
5	Kumar V	185	8.363
6	Kumar R	183	8.273
7	Sharma S	179	8.092
8	Singh A	176	7.957
9	Singh R	168	7.595
10	Varshney RK	167	7.55
	Total	**2212**	**100**

Countries Contributions in Plant Sciences

Table 6 depicts the international collaborative papers of India with the top 10 countries during 2008-2017. These countries published 14317 articles with India in the field of plant science. The largest number of collaborative publications (746 articles) of India in this research output was with United States with 29.42% share, followed byGermany, (272articles with 10.73% share), Peoples R China,(272articles with 10.73%share), Australia,(248articles with 9.78% share), South Korea,(198articles 7.81%share), Japan, (190 articles with 7.49%share), Saudi Arabia,(186articles with 7.33%share), England, (166articles with 6.55%share), France, (133articles with 5.24%share) and Italy, (125articles with 4.93%share).

Table -5.6: Countries Contributions in Plant Sciences

Sl. No.	Countries	Records	%
1	USA	746	29.42
2	Germany	272	10.73
3	Peoples R China	272	10.73
4	Australia	248	9.78
5	South Korea	198	7.81
6	Japan	190	7.49
7	Saudi Arabia	186	7.33
8	England	166	6.55
9	France	133	5.24
10	Italy	125	4.93
	Total	**2536**	**100**

Distribution of publications among document types

The sources of plant sciences research include articles published in the journals, reviews, conference

and seminars proceedings, editorial materials, corrections and book chapters (Table 7). This study has observed a total of 14317 publications in plant sciences from India over a period of five years from 2008-2017. Out of them, articles appeared in the journals have shown a predominant contribution 12370 publications with 87.162%share.from countries. And followed by the other research outputs falls in the review 739 publications with 5.207%share, meeting abstract 359 publications with 2.530%share,editorial material 297 publications with 2.093% share, news item 264 publications with 1.860%share, correction 58 publications with 0.409%share, proceedings paper 53 publications with 0.373%share,letter 29 publications with 0.204%share, book chapter 12 publications with 0.085%share and the final retracted publication 11 publications with 0.078%share.

Table -5.7: Distribution of publications among document types

Sl. No.	Document Types	Records	%
1	Article	12370	87.162
2	Review	739	5.207
3	Meeting Abstract	359	2.530
4	Editorial Material	297	2.093
5	News Item	264	1.860
6	Correction	58	0.409
7	Proceedings Paper	53	0.373
8	Letter	29	0.204
9	Book Chapter	12	0.085
10	Retracted Publication	11	0.078

Language wise Distribution

The Table 8 reveals the language wise distributions, the scientists researchers from Indian Plant Science research are published in different language i,e English, German and Portuguese. It is observed that 14135 articles with 99.986% share in English, 1 article with 0.007% share in german and 1 article with 0.007% share in Portuguese.

Table- 5.8. Language Wise Distribution on Plant Sciences

Sl. No.	Languages	Records	%
1	English	14135	99.986
2	German	1	0.007
3	Portuguese	1	0.007

Conclusion

Thisstudy reveals the India had contributed papers in Plant Sciences during the period of 2008 to 2017 as show in web of science international database. This study presented a summary of scientometric research in the Plant Sciences. Using publication of literature, an overview of scientometric efforts have been presented to trace the emergence of this new technological area. The paper has also presented data that gives an idea about which courtiers are the most active in terms of scientific publications in plant sciences. Finally it is concluded that the result of a scientometric study that focuses on the field of plant sciences and the collaboration among authors, institutions of Indian plant sciences literature has been gradually increased year by year.

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