

Citation Analysis of Dissertations in Molecular Biology and Biotechnology: A Case Study of G. B. Pant University of Agriculture and Technology, India

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ABSTRACT: Citation analysis and ranking of journals are key aspects of knowledge management and collection development in academic and research libraries. This paper aims to assist the library collection development in order to fulfill the needs of scientists and research scholars. The study covered the period 1998–2010 and used the reference lists of dissertations submitted by the doctoral students of the molecular biology and biotechnology sciences at the G. B. Pant University of Agriculture and Technology, Pantnagar, India. The findings of the study showed that citation analysis is a valid, reliable and practical method to provide reasonably accurate information on the use of molecular biology and biotechnology literature by doctoral students. Publishing research in high-quality journals is an integral part of academic life. Therefore, researchers often refer to journal rankings when making decisions to submit and publish their research findings.

I. Introduction

Molecular biology is the branch of biology that deals with the molecular basis of biological activity. This field overlaps with other areas of biology and chemistry, particularly genetics and biochemistry. Molecular biology chiefly concerns itself with understanding the interactions between the various systems of a cell, including the interactions between the different types of DNA, RNA, and protein biosynthesis as well as learning how these interactions is regulated.

Hari Kumar (2002) defined biotechnology as the science of applied biological process. It is the key technology for future developments in agricultural, industrial, pharmaceutical, public health, environmental protection, bioenergetics and geological explorations in most countries. In

agriculture, it has its multifarious application in micro-propagation, generation of transgenic, molecular characterization of genetic variability, production of disease resistant and pest tolerant plants, and in bio-fertilizers and bio-pesticides production.

G.B. Pant University of Agriculture and Technology, Pantnagar, India has initiated a biotechnology program in 1986 so as to develop suitable biotechnological techniques to complement conventional methods of raising field crops. The biotechnology program started in 1988 with the support of the Department of Biotechnology, Government of India, which served as the nodal department besides imparting training to postgraduate students as part of manpower development program. After initiating the M.Sc. program, the department initiated a Ph.D. program in 1995 and has been offering it as an interdisciplinary program with curricular and faculty inputs from different departments.

Citation analysis is a branch of information science in which the way articles in a scholarly field are accessed and referenced is studied. It was developed to identify core articles, authors, or journals in a field (Meho, 2007). It reveals the relationships between works that are represented by references (Garfield, 2004), and thus can guide collection development in academic libraries (Johnson, 2000).

II. Literature Review

In 2009, Herther studied the research evaluation and citation analysis. Her findings showed that as more sources for citation information have become available and many scholarly databases today offering cited reference data, there is a need to identify access and manage these resources. Information professionals need to become more proactive in their strategies to support these applications and users.

Garfield studied citation indexes for retrieval and research evaluation in 2004. The purpose of his study was to develop, using objective criteria, a statistical procedure to evaluate the importance of scientific journal articles.

In 1998, Sylvia studied citation analysis as an unobtrusive method for journal collection evaluation, using psychology student research bibliographies. She found that the most cost-effective and the most used materials were usually held by the library.

Dutta and Sen analyzed *Indian Journals of Pure and Applied Mathematics* in 2001. They found that the articles involved in their study have been contributed by 59 authors, including 28 foreign authors. This makes the journal really international. The predominance of single author contributions is observed in citations as well.

In 2009, Olatokun and Makinde analyzed dissertations submitted to the Department of Animal Science, University of Ibadan, Nigeria during the period 2000-2007. Their findings showed that journals were the most utilized reference materials in the dissertations.

In 2007, Ravi and Mohan investigated the rates of successful doctorates awarded in the Faculty of Science in Annamalai University. Their study is helpful to promote the research activity at various levels in future.

Verma and Thakur, in their research paper "Citation Analysis of Doctoral Dissertations in Botany Submitted to Pt. Ravishankar Shukla University", studied 35 doctoral dissertations in the area of botany awarded during the period of 1966-2004. The study has been carried out to determine the use pattern of literature in the area. A total of 7,916 references were analyzed for identifying their bibliographic form, authorship pattern, and ranking of journals.

In their citation analysis of 265 Workforce Education and Development (WED) dissertations, theses, and graduate research papers at Southern Illinois University Carbondale (SIUC), Waugh and Ruppel determined the core serials in the discipline, provided the Morris Library with a guide to serials acquisition and maintenance in the discipline, and provided future WED students with a core list of WED journals.

In 2009, Chan and others studied citations from accounting dissertations completed during the period of 1999–2003 to provide a ranking of accounting journals. They found that the ranking of accounting journals was based on specialty areas (auditing, financial, managerial, tax, systems, and others) and research methods (archival, experimental, modeling, survey, and others).

In 2011, Miller studied 25 master's theses to determine citation types, percentages, and ranking of journals. The researcher concluded by discussing implications for library collection development in times of fiscal constraint.

III. Objectives of the Study

The objectives of the study are as follows:

- To identify the chronological distribution of dissertations
- To identify the distribution of dissertations by subject
- To identify the types of documents cited in dissertations
- To identify the frequency of journals used
- To identify the references cited
- To identify the geographical distribution of cited journals
- To identify the top 50 journals by impact factor

IV. Research Methodology

A descriptive method was adopted for the current study. All doctoral dissertations from the Department of Molecular Biology and Biotechnology of the G. B. Pant University of Agriculture and Technology, India from 1998 to 2010 were analyzed. Altogether, there were thirty-five doctoral dissertations.

All citations from each dissertation were included for analysis. Data was manually entered into an Excel spreadsheet, including the author of the dissertation, citation date, and a code to indicate

the format of the citation, such as journal, book, proceeding, series, report, map, newspaper, web site, software, or data set.

V. Data Collection

Citations from the references in each dissertation were extracted for content analysis. The citations were broken into eight categories: journals, books, conference papers, web resources, technical reports and standards, government documents, theses and dissertations, and miscellaneous (e.g., patents, personal communications, product literature, software and software manuals, university extension documents, unpublished materials, and others).

VI. Data Analysis and Discussion

The data extracted were entered into an MS-Excel worksheet to obtain the frequency, distributions, and measures of central tendency like mean, mode, and median.

Table 1: Chronological Distribution of Dissertations

Year	Distribution	%
1998	1	2.85
1999	1	2.85
2000	0	0
2001	1	2.85
2002	5	14.28
2003	3	8.57
2004	3	8.57
2005	3	8.57
2006	3	8.57
2007	1	2.85
2008	3	8.57
2009	8	22.85
2010	3	8.57
Total	35	100

Table 1 shows that the chronological distribution of dissertations was very high in 2009 and very low in 1998, 1999, 2001 and 2007. In year 2000, the distribution rate of dissertations was zero. Except for an increase in 2002, most of years averaged in 3 dissertations annually.

Table 2: Distribution of Dissertations by Subject

Subject	No. of Dissertations	%
Molecular Cell Biology	4	11.42
Immunology	2	5.71
Plant Transgenic Technology	8	22.85
Plant Tissue Culture	2	5.71
Protein Biochemistry and Biotechnology	7	20
Plant Molecular Biology	11	31.42

Signal Transduction	1	2.85
Total	35	100

Table 2 shows the plant molecular biology (31.42%) has the greatest rates of the subject-wise distribution, followed by plant transgenic technology (22.85%), protein biochemistry and biotechnology (20.00%), molecular cell biology (11.42%), immunology (5.71%), plant tissue culture (5.71%), and signal transduction (2.85%).

Table 3: Types of Documents Cited

Types of Documents	No. of Citations	%
Journals	7,473	88.02
Books	658	7.75
Conference Proceedings	166	1.95
Theses	82	0.96
Reports	36	0.42
Websites	34	0.40
Newsletter	15	0.17
Others	25	0.29
Total	8,490	100

Table 3 shows that citations of journals alone accounted for 88.02% of the total citations (8,490), followed remotely by books (7.75%) and conference proceedings (1.95%). The rest types of documents were cited less than 1% respectively. Note: The type of “Others” includes database, databank, manual, unpublished work, patents, commentary, survey and research bulletin, etc. In another word, journals are the primary source of information in the doctoral studies of molecular biology and biotechnology.

Figure 1: Frequency of Journals Cited

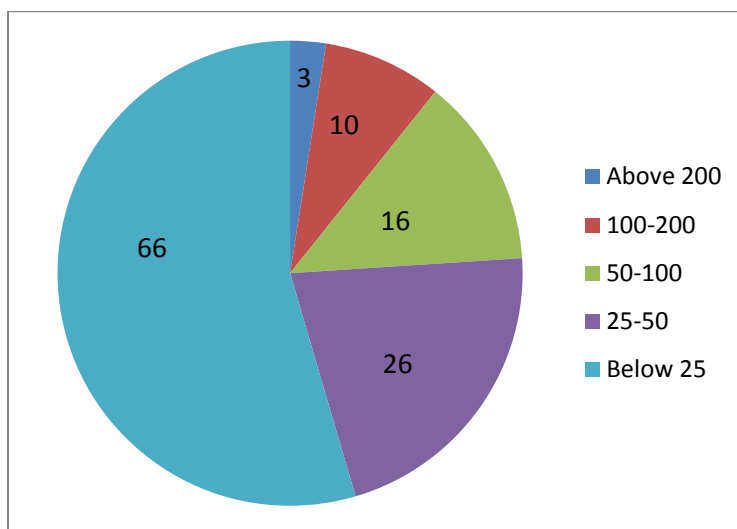


Figure 1 shows the frequency of journals cited in the dissertations.

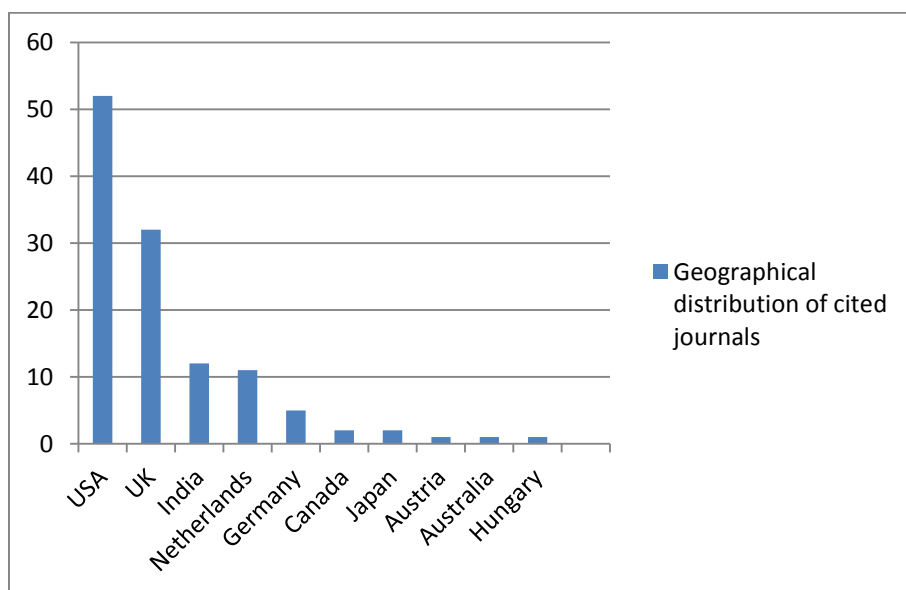
Cited more than 200 times are 3 journals: *Theoretical and Applied Genetics* (293), *Proceedings of the National Academy of Sciences of the United States of America* (273), and *The Plant Cell* (221).

Cited more than 100 times are 10 journals: *Plant Molecular Biology* (175), *Plant Physiology* (172), *Science* (149), *Nature* (146), *Plant Journal* (141), *Journal of Biological Chemistry* (140), *Cereal Chemistry* (127), *Vaccine* (122), *Plant Cell Reports* (119), and *Journal of Virology* (115).

Cited more than 50 times are 16 journals: *Nucleic Acids Research*, *Crop Science*, *Cell*, *Euphytica*, *EMBO Journal*, *Virology*, *Planta*, *Journal of Experimental Botany*, *Current Opinion in Plant Biology*, *Journal of General Virology*, *Plant Science*, *Phytopathology*, *Biochemistry*, *Plant Cell, Tissue and Organ Culture*, and *Animal genetics*.

Cited 25-50 times are 26 journals. And cited 1-24 times are 66 journals.

Figure 2: Geographical Distribution of Cited Journals



Journals cited in the dissertations were published most in United States, followed by United Kingdom, India, Netherlands, Germany, Canada, Japan, Australia, Austria, Hungary, and Kenya.

Figure 3: References Cited by Doctoral Candidates

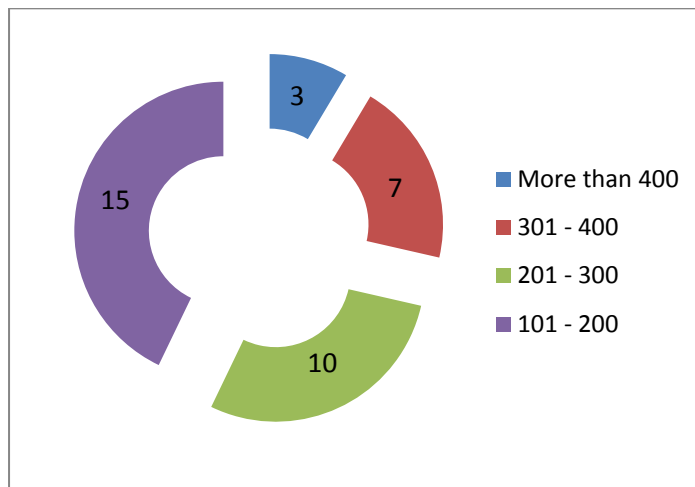


Figure 3 shows that 3 doctoral candidates consulted more than 400 resources, followed by 7 with more than 300 references, 10 with more than 200, and 15 with more than 100. It indicates that doctoral candidates consulted at least 100 documents during their research process.

Table 4: Ranking of Top 50 Journals by Impact Factor

Sl. no.	Name of Journals	Impact Factor*
1	Nature	36.101
2	Cell	34.929
3	Science	31.364
4	Nature Biotechnology	31.1
5	Annual Review of Plant Biology formerly known as Annual Review of Plant Physiology	28.415
6	Annual Review of Genetics	21.774
7	Annual Review of Plant Physiology and Plant Molecular Biology	14.809
8	Molecular Cell	14.194
9	Genes and Development	13.892
10	American Journal of Human Genetics	11.68
11	Current Biology	11.435
12	Plant cell	10.648
13	Annual Review of Phytopathology	10.412
14	Trends in Biochemical Sciences	10.364
15	EMBO Journal	10.124
16	Trends in Plant Science	10.095
17	Current Opinion in Plant Biology	9.933
18	Proceedings Of National Academy of Sciences, USA	9.771
19	Trends in Biotechnology	9.644
20	Journal of Cell Biology	9.58
21	Cancer Research	8.234

22	Nucleic Acids Research	7.836
23	Plant Physiology	7.016
24	Plant Journal	6.948
25	Molecular and Cellular Biology	6.188
26	New Phytologist	6.033
27	Journal of Immunology	5.745
28	Journal of Biological Chemistry	5.328
29	Journal of Virology	5.189
30	Biochimica et Biophysica Acta	5.016
31	Methods in Enzymology	4.596
32	Developmental Biology	4.42
33	Journal of Experimental Botany	4.418
34	Molecular Plant-Microbe Interactions	4.41
35	Plant and Cell Physiology	4.257
36	Plant Molecular Biology	4.149
37	Infection and Immunity	4.098
38	Journal of Molecular Biology	4.008
39	Biology of Reproduction	3.979
40	Genetics	3.889
41	Applied and Environmental Microbiology	3.778
42	Vaccine	3.572
43	Annals of Botany	3.501
44	European Journal of Biochemistry	3.494
45	FEBS Letters	3.399
46	Analytical Biochemistry	3.343
47	Virology	3.305
48	Theoretical and Applied Genetics	3.264
49	Journal of General Virology	3.26
50	Biochemistry	3.226

*Source: Google, Journal's site

Impact factor is one of the quantitative tools for ranking, evaluating, categorizing, and comparing journals. It is a measure of the frequency with which the "average article" in a journal has been cited in a particular year or period. The annual impact factor is a ratio between citations and recent citable items published. Thus, the impact factor of a journal is calculated by dividing the number of current year citations to the source items published in that journal during the previous two years.

Table 4 shows that these 50 journals have impact factor above 3.22. Four journals have impact factor >30. Two journals have impact factor of 20-29. Ten journals have impact factor of 10-19. And 34 journals have impact factor of 3.22-9.

VII. Conclusion

Citation analysis of dissertations and ranking of journals are useful in determining information sources that are vital for doctoral studies in a given subject area. They may also help libraries in their budget planning to judiciously use their budgets and funds to make far reaching decisions on library material collection.

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