

CHAPTER 5

Data Analysis and Interpretation

5.0. INTRODUCTION

The data collected for any research investigation need to be processed scientifically to get the required result. The processing of data with statistical method may be termed as data analysis. The analysis refers to the computation of certain measures along with searching for patterns of relationship that exist among data-group. Giles (1974), states that “in the process of analysis, relationship or difference supporting or conflicting with original or new hypotheses should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions.” In other words, analysis of data in a general way involve a number of closely related operations which are performed with the purpose of summarising the collected data and organizing thesis in such a manner that they solve the research questions.

This chapter aims to examine the data collected from Doctoral Theses in Life Science, Assam University, Silchar. The present study is undertaken for bibliometric investigation of research trend in the field of Life Sciences through citation study of the theses submitted in the School of Life Sciences, Assam University. It is necessary to analyse different source of literature published in various domain for exploring the knowledge exertion. In this study, 40 numbers of theses in the domain Life Sciences were analysed which were submitted

during 1996 to 2012. As the department was established in the year 1996 and started its research journey in the year 1998. Record shows that the first thesis was submitted in the year 2001.

In this study, an attempt has been taken to examine the major forms of literature, ranking of journals, books, authors, and to identify the degree of collaboration and distribution of citation according to period, country etc. In this context an investigation was done and data were analysed through different parameters of bibliometrics.

5.1. DISTRIBUTION OF CITATION BY FORMS

The academic communication results from the research output by the scholars in different fields in variety of document forms. Table 5.1. represents the cited documents which are grouped into ten forms/types of documents i.e., journals, books, edited books, reports (including government, project, research, technical and annual reports), conference & seminar proceedings, theses/dissertation, reference book, unpublished documents and web resources and miscellaneous. The form-wise distribution of citations has been done in order to know the most dominant forms cited by the researchers.

Table 5.1. Frequency Distribution of Different Forms of Literature

Rank	Forms/Document Type	No. of Citations	Percentage of Citations	Cumulative Percentage of Citations
1	Journals	8064	80.54	80.54
2	Books	962	9.61	90.15
3	Edited Books	303	3.03	93.18
4	Conference/Seminar Proceedings	252	2.52	95.70
5	Reports	174	1.74	97.43
6	Web Resources	85	0.85	98.28
7	Theses/Dissertations	83	0.83	99.11
8	Reference Books	15	0.15	99.26
9	Unpublished Document	5	0.05	99.31
10	Miscellaneous	69	0.69	100.00
	Total	10012	100	

Table 5.1 gives a form-wise distribution of citations and shows that 8064 citations were from Journals accounting for about 80.54% of the total number of 10012 citations. This was followed by other forms contributed such as Books with 962 (9.61%) citations, Edited book with 303 (3.03%) citations, Conference Proceedings with 252 (2.52%) citations, Reports with 174 (1.74%) citations and others contributed 257 (2.57%) of citations. This result clearly shows that most of the studies were being conducted by consulting journals, the most dominant form of document. In other words, journal is the most inspiring source of

information among the scientist and researchers engaged in the field of life sciences.

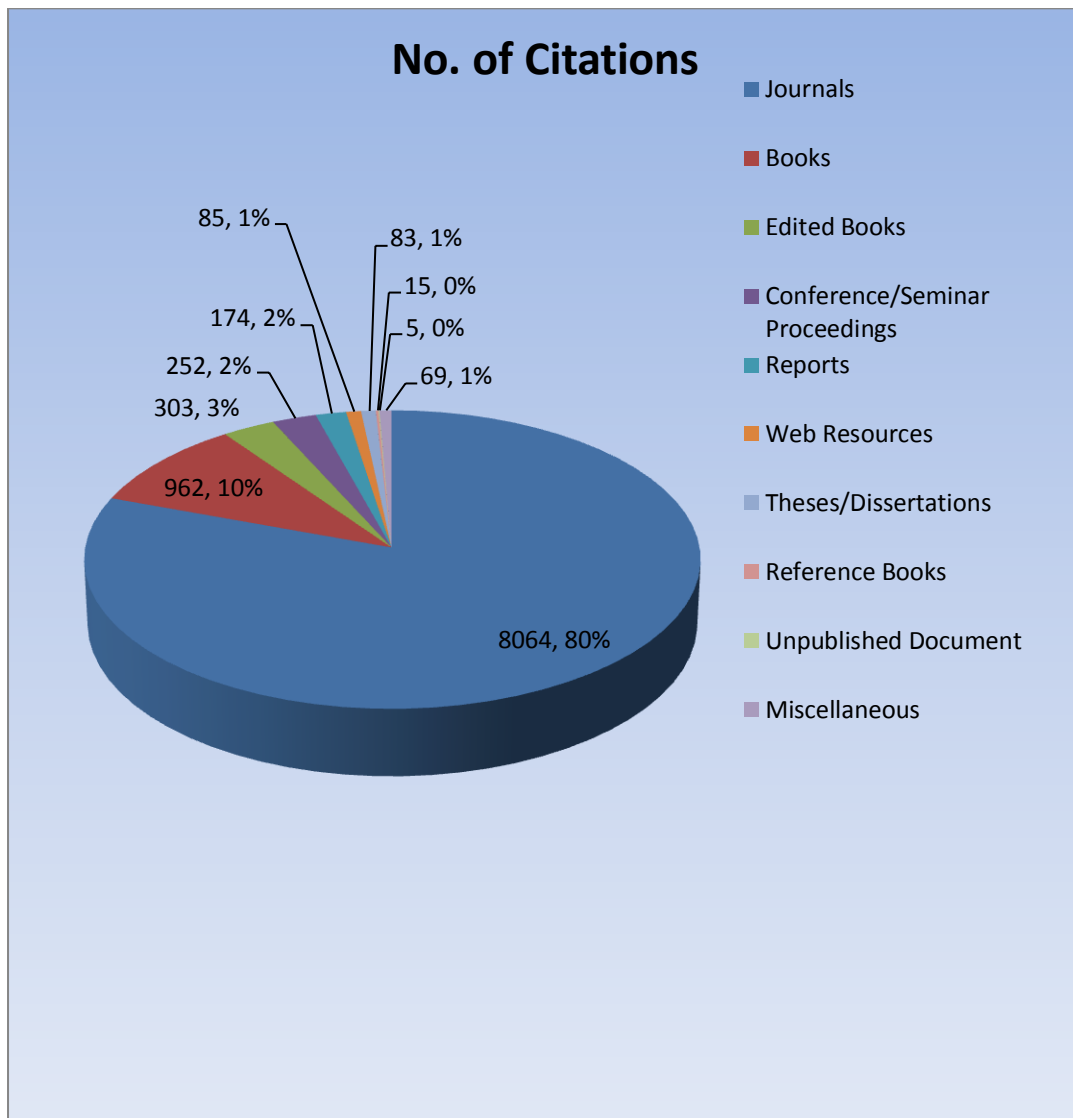


Figure 5.1: Different Forms of Cited Documents

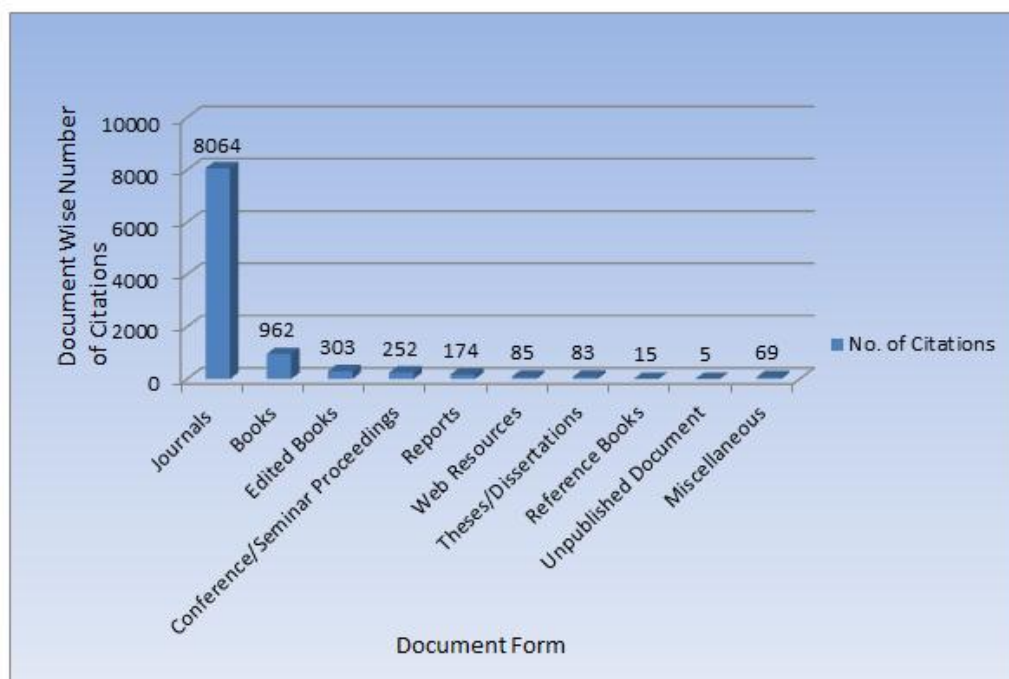


Figure 5.2: Different Forms of Documents

The Figure 5.1 and Figure 5.2 represent the distribution of citation in different document forms. Figure revealed that unpublished documents occupy the last rank with 5 (0.05%) citations followed by reference books with 15 (0.15%) citations.

5.2. THESIS WISE FREQUENCY DISTRIBUTION OF DIFFERENT FORMS OF LITERATURE

There were 40 theses submitted in the School of Life Sciences. All the theses were numbered serially in a sequence such as T01, T02, T03.....T40 on the basis of their year of submission. Table 5.2 represents the thesis wise form of document citations used by the researchers in the School of Life Sciences. This table shows that Thesis no. 1(T01) contributed 294 nos. of

journal articles citations, 41 nos. of books citation, 1 no. of edited books, 4 nos. of proceedings, 11 nos. of reports, 1 no. of web resource and 3 nos. of miscellaneous source of citation. Contributions of different document forms of different theses have been shown in the Table 5.2.

Table 5.2. Thesis Wise Frequency Distribution of Different Forms of Documents

Thesis No.	Forms/Documents													Total	Cumulative No
	Journal Articles	Book	Edited Books	Conference/Seminar/Proceedings	Reports	Web Resource	Thesis/Dissemination	Reference Book	Unpublished	Miscellaneous					
T01	294	41	1	4	11	1	0	0	0	0	0	0	3	355	355
T02	201	16	0	2	1	0	0	0	0	0	0	0	1	221	576
T03	199	69	22	14	11	0	4	2	0	0	0	0	4	325	901
T04	642	49	0	5	1	1	0	0	0	0	0	0	5	703	1604
T05	219	70	0	11	1	0	1	0	0	0	0	0	2	304	1908
T06	223	12	0	7	2	0	0	0	0	0	0	0	1	245	2153
T07	184	59	0	3	1	0	1	0	0	0	0	0	0	248	2401
T08	226	3	15	4	1	2	0	0	0	0	0	0	2	253	2654
T09	63	65	0	11	4	1	5	0	0	0	0	0	2	151	2805
T10	126	10	0	4	0	0	0	0	0	0	0	0	0	140	2945
T11	119	34	0	1	0	1	0	0	0	0	0	0	2	157	3102
T12	240	6	0	2	2	0	10	0	3	4	0	0	4	267	3369
T13	136	4	11	1	0	0	0	0	0	0	0	0	0	152	3521
T14	75	10	2	2	0	10	2	1	0	0	0	0	0	102	3623
T15	53	6	2	0	0	0	0	0	0	0	0	0	0	63	3686
T16	75	18	13	52	14	3	14	1	0	14	0	0	14	204	3890
T17	197	61	34	37	14	4	13	0	1	3	0	0	3	364	4254
T18	215	14	12	1	0	0	0	0	0	0	0	0	0	242	4496
T19	67	21	3	0	1	1	1	1	0	1	0	0	1	96	4592
T20	152	34	13	2	1	0	1	1	0	2	0	0	2	206	4798
T21	246	1	7	2	2	6	0	1	0	9	0	0	9	274	5072
T22	212	2	3	3	1	0	0	1	0	0	0	0	0	222	5294
T23	100	14	2	0	0	4	2	0	0	0	0	0	0	122	5416
T24	215	5	6	4	1	0	0	0	0	0	0	0	1	232	5648
T25	175	12	18	1	4	1	0	0	0	0	0	0	0	214	5862
T26	111	49	12	7	3	0	3	1	0	0	0	0	0	186	6048
T27	212	16	0	1	0	0	6	0	0	0	0	0	0	235	6283
T28	373	41	54	12	6	13	0	0	0	5	0	0	5	504	6787
T29	149	13	27	4	5	10	3	1	0	0	0	0	0	212	6999
T30	281	7	12	4	21	11	0	0	0	0	0	0	0	336	7335
T31	203	13	4	0	0	0	0	0	0	0	0	0	0	220	7555
T32	142	17	9	13	5	4	3	0	1	2	0	0	2	196	7751
T33	183	5	5	0	1	3	0	0	0	0	0	0	0	197	7948
T34	233	33	11	5	2	1	1	0	0	0	0	0	0	286	8234
T35	100	12	4	3	3	0	2	0	0	1	0	0	1	125	8359
T36	133	5	1	1	0	0	0	0	0	0	0	0	0	140	8499
T37	311	26	0	11	7	3	6	0	0	1	0	0	1	365	8864
T38	429	35	0	5	28	0	1	2	0	0	0	0	0	500	9364
T39	390	17	0	10	6	4	0	0	0	2	0	0	2	429	9793
T40	160	37	0	3	14	1	2	0	0	0	0	0	2	219	10012
Total	8064	962	303	252	174	85	83	15	5	69	0	0	69	10012	10012

Above Table 5.2 clearly shows that 642 numbers of journal citations were cited by research scholar of thesis no. T04 which is highest followed by 429 numbers of journal citations cited by research scholar of thesis no. T38. 53 nos. of journal citation were cited in thesis no. T15 which is the least.

The Table 5.2 reveals that 70 numbers of book citations were cited by research scholar of thesis no. T05 which is highest followed by 69 numbers of book citations cited by research scholar of thesis no. T03. 1 nos. of book citation was cited in thesis no. T21 which is the least. In the same way highest numbers of 54 no. citations of edited book was cited in thesis no. T28 and least number of citations were cited by T01 and T36 with only 1 no. of citation. In the same way, Citations of all forms along with the thesis number have been reflected in the Table No. 5.2. The Table 5.2 also revealed that the research scholar of T09 cited more citations of books than journals in his thesis which shows a significant difference among all other theses and the form of cited documents.

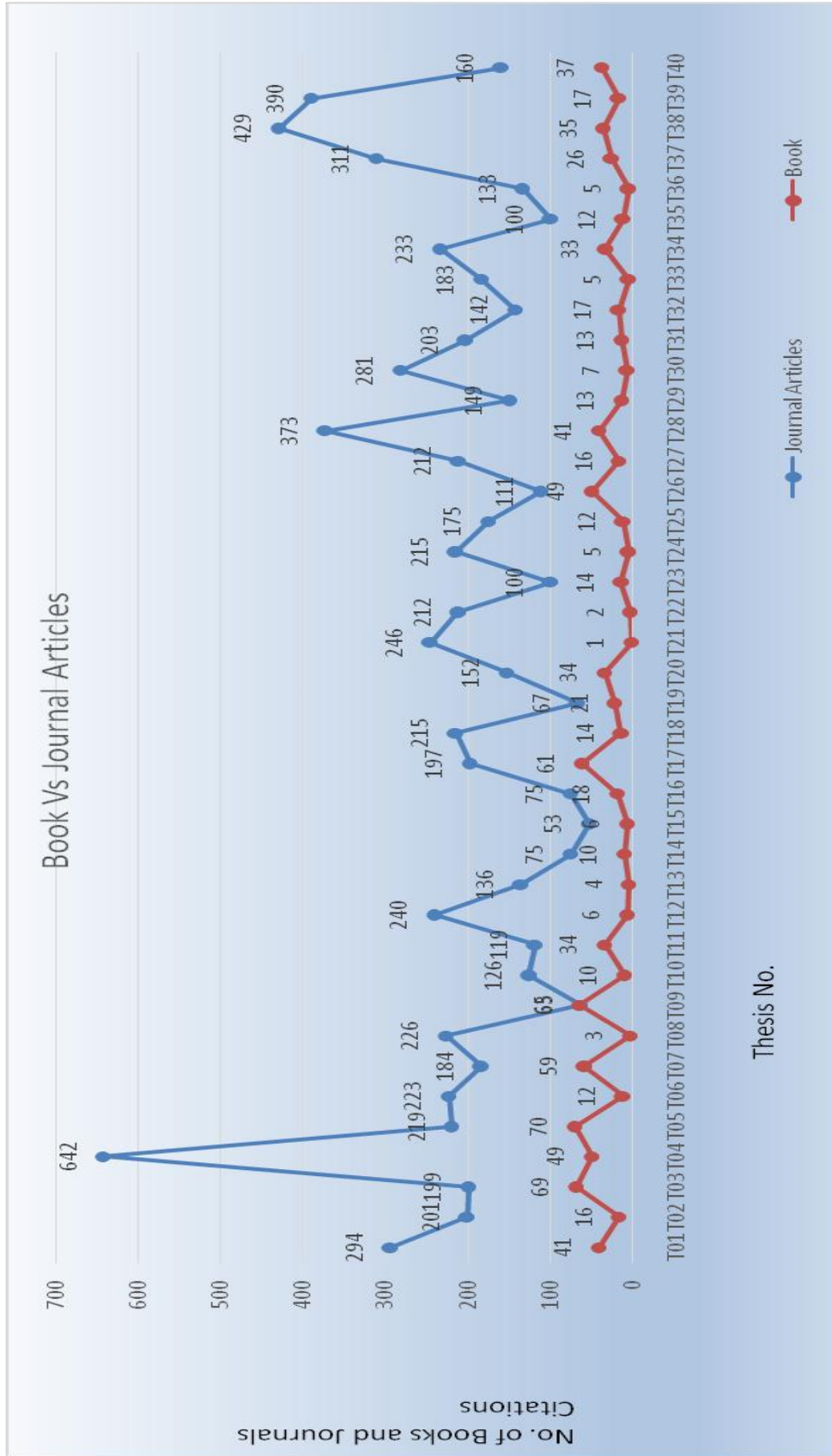


Figure 5.3: Book Vs Journal

Figure 5.3 clearly indicates the citations of the number of books and journals per thesis. It is observed that numbers of book citations is less corresponding to numbers of journals citation. It is evident that researchers in the filed of life sciences prefer to use journal articles as a major source of information. The books are found to be the second most significant form of document used by life science researchers in their research outputs.

Figure 5.3. also clearly indicates that number of book citations is relatively more constant than journal citations. This may also be shown in the following way:

	Journal Citation	Book Citation
Maximum Citation	642	70
Minimum Citation	53	01
Difference /Range	589	69

5.3. RANKING OF JOURNALS MADE ON THE BASIS OF CITATIONS

Information boom has made it impossible for libraries to acquire all the documents being published in the world. It becomes essential to select only that material which is useful to meet the users' satisfaction. There are some journals which are very close to the subject and the area of research work and these are being most frequently cited by the researchers. These highly cited journals are called core journals of the field. The core journals always publish relevant articles on a particular subject and rests of the journals publish the articles from various fields in a haphazard manner. So the librarian should procure the core

journals for the collection development. The ranking of core journals used by the researcher were shown in Table 5.3.

Table5.3: Ranking of Journals made on the basis of Citations

Sl. No.	Rank	Name of the Journal	No. of Citations	Cumulative No. of Citations	Percentages	Cumulative Percentages
1	1	Mutation Research	287	287	3.56	3.56
2	2	Plant Physiology	228	515	2.83	6.39
3	3	Journal of Economic and Taxonomic Botany	142	657	1.76	8.15
4	4	Plant and Soil	79	736	0.98	9.13
5	5	Oryza	76	812	0.94	10.07
6	6	Economic Botany	71	883	0.88	10.95
7	6	Physiologia Plantarum	71	954	0.88	11.83
8	7	Plant Science	66	1020	0.82	12.65
9	8	Nature	56	1076	0.69	13.34
10	9	Science	55	1131	0.68	14.03
11	10	Journal of Ethnopharmacol	54	1185	0.67	14.69
12	11	Environment Health Perspect	52	1237	0.64	15.34
13	12	Bulletin of the Botanical Survey of India	50	1287	0.62	15.96
14	12	Current science	50	1337	0.62	16.58
15	12	Journal of Experimental Botany	50	1387	0.62	17.20
16	12	Plant Cell Reports	50	1437	0.62	17.82
17	13	Experimental Botany	49	1486	0.61	18.43
18	13	Plant Cell Environment	49	1535	0.61	19.04
19	14	Indian Fern Journal	46	1581	0.57	19.61
20	15	Applied Biochemistry and Microbiology	44	1625	0.55	20.15
21	15	The Journal of the Bombay Natural History Society	44	1669	0.55	20.70

Sl. No.	Rank	Name of the Journal	No. of Citations	Cumulative No. of Citations	Percentages	Cumulative Percentages
22	16	Ethnobotany	43	1712	0.53	21.23
23	16	Phytochemistry	43	1755	0.53	21.76
24	17	Cancer Reasearch	41	1796	0.51	22.27
25	17	Carcinogenesis	41	1837	0.51	22.78
26	17	New Phytologist	41	1878	0.51	23.29
27	18	Journal of Clinical Microbiology	40	1918	0.50	23.78
28	19	Planta	38	1956	0.47	24.26
29	19	Indian Journal of Animal Science	38	1994	0.47	24.73
30	20	Infection and Immunity	37	2031	0.46	25.19
31	20	Mutagenesis	37	2068	0.46	25.64
32	21	Plant Molecular Biology	35	2103	0.43	26.08
33	21	Toxicology	35	2138	0.43	26.51
34	22	Journal of Bacteriology	32	2170	0.40	26.91
35	22	Journal of Plant Physiology	32	2202	0.40	27.31
36	23	Journal of Biological Chemistry	30	2232	0.37	27.68
37	24	African Journal of Biotechnology	28	2260	0.35	28.03
38	24	Ancient Science of Life	28	2288	0.35	28.37
39	24	Archives of Toxicology	28	2316	0.35	28.72
40	24	Plant Growth Regulation	28	2344	0.35	29.07
41	24	Toxicology and Applied Pharmacology	28	2372	0.35	29.41
42	24	Toxicology Letters	28	2400	0.35	29.76
43	25	Plant cell Tissue and Organ Culture	27	2427	0.33	30.10
44	26	Bulletin of medico-ethnobotanical research	26	2453	0.32	30.42
45	26	Theoretical and Applied Genetics	26	2479	0.32	30.74

Sl. No.	Rank	Name of the Journal	No. of Citations	Cumulative No. of Citations	Percentages	Cumulative Percentages
46	27	Environmental and Molecular Mutagenesis	25	2504	0.31	31.05
47	27	Indian Journal of Genetics	25	2529	0.31	31.36
48	28	Clinical Infectious Diseases	24	2553	0.30	31.66
49	28	Crop Science	24	2577	0.30	31.96
50	28	Fitoterapia	24	2601	0.30	32.25
51	28	Journal of Oral Pathology & Medicine	24	2625	0.30	32.55
52	28	Reportual Review Plant Physiology	24	2649	0.30	32.85
53	28	The Lancet	24	2673	0.30	33.15
54	28	Trends in Plant Science	24	2697	0.30	33.44
55	29	Canadian Journal of Microbiology	23	2720	0.29	33.73
56	29	Fertility and Sterility	23	2743	0.29	34.02
57	29	Journal of Natural Products	23	2766	0.29	34.30
58	29	Plant Physiological Biochemistry	23	2789	0.29	34.59
59	30	Field Crops Research	22	2811	0.27	34.86
60	30	Plant Biology	22	2833	0.27	35.13
61	31	Environmental and Experimental Botany	21	2854	0.26	35.39
62	31	International Journal of Cancer	21	2875	0.26	35.65
63	32	Free Radical Biology & Medicine.	20	2895	0.25	35.90
64	32	The New England Journal of Medicine	20	2915	0.25	36.15
65	33	Acta Physiologiae Plantarum	19	2934	0.24	36.38
66	33	Biochem Biophys Acta	19	2953	0.24	36.62
67	33	Environmental Research	19	2972	0.24	36.86
68	33	Nucleic Acids Research	19	2991	0.24	37.09

Sl. No.	Rank	Name of the Journal	No. of Citations	Cumulative No. of Citations	Percentages	Cumulative Percentages
69	33	World Journal of Microbiology & Biotechnology	19	3010	0.24	37.33
70	34	Anal Biochemistry	18	3028	0.22	37.55
71	34	Indian Journal of Medical Microbiology	18	3046	0.22	37.77
72	34	Indian Journal of Plant Physiology	18	3064	0.22	38.00
73	34	Plant Cell Physiology	18	3082	0.22	38.22
74	35	Biologia Bratislava.	17	3099	0.21	38.43
75	35	Indian Journal of Traditional Knowledge	17	3116	0.21	38.64
76	35	The Plant Cell	17	3133	0.21	38.85
77	35	Veterinary Microbiology	17	3150	0.21	39.06
78	36	Chemical Research Toxicology	16	3166	0.20	39.26
79	36	FEBS Letters	16	3182	0.20	39.46
80	36	Folklore	16	3198	0.20	39.66
81	36	Food and Chemical Toxicology	16	3214	0.20	39.86
82	36	Indian Journal of Pharmacology	16	3230	0.20	40.05
83	36	Journal of Infectious Disease	16	3246	0.20	40.25
84	36	Journal of Inland Fisheries Society of India.	16	3262	0.20	40.45
85	36	Phytotherapy Research	16	3278	0.20	40.65
86	36	Soil Science Society of America Journal	16	3294	0.20	40.85
87	37	Archives of Environmental & Occupational Health	15	3309	0.19	41.03
88	37	Archives of Biochemistry and Biophysics	15	3324	0.19	41.22

Sl. No.	Rank	Name of the Journal	No. of Citations	Cumulative No. of Citations	Percentages	Cumulative Percentages
89	37	Biologia Plantarum	15	3339	0.19	41.41
90	37	British Journal of Cancer	15	3354	0.19	41.59
91	37	British Medical Journal	15	3369	0.19	41.78
92	37	Cancer	15	3384	0.19	41.96
93	37	Indian Journal of Agricultural Science	15	3399	0.19	42.15
94	37	Indian Journal of experimental Biology	15	3414	0.19	42.34
95	37	Journal of Ethnopharmacology	15	3429	0.19	42.52
96	37	Oral Oncology	15	3444	0.19	42.71
97	37	Plant	15	3459	0.19	42.89
98	38	Critical Review in plant Science	14	3473	0.17	43.07
99	38	Journal of Medica-Ethnobotanical Research	14	3487	0.17	43.24
100	38	Methods in Enzymology	14	3501	0.17	43.42
101	39	American Journal of Veterinary Research	13	3514	0.16	43.58
102	39	Biochemistry & Pharmacology	13	3527	0.16	43.74
103	39	Bioresource Technology	13	3540	0.16	43.90
104	39	Euphytica	13	3553	0.16	44.06
105	39	FEMS Microbiology Letters	13	3566	0.16	44.22
106	39	International Journal of Pharmacognosy	13	3579	0.16	44.38
107	39	Journal of Medical Microbiology	13	3592	0.16	44.54
108	39	Journal of Toxicology and Environmental Health	13	3605	0.16	44.70
109	39	Microbiological Research	13	3618	0.16	44.87
110	39	Phytopathology	13	3631	0.16	45.03

Sl. No.	Rank	Name of the Journal	No. of Citations	Cumulative No. of Citations	Percentages	Cumulative Percentages
111	40	Biochemistry	12	3643	0.15	45.18
112	40	Biology and Fertility of Soils	12	3655	0.15	45.32
113	40	British Journal of Industrial Medicine	12	3667	0.15	45.47
114	40	Cancer Letters	12	3679	0.15	45.62
115	40	Hydrobiologia	12	3691	0.15	45.77
116	40	Journal of Microbiol Biotechnol.	12	3703	0.15	45.92
117	40	Journal of Plant Nutrition	12	3715	0.15	46.07
118	40	Journal of Toxicology and Environmental Health	12	3727	0.15	46.22
119	40	Reportual Review of Plant Biology	12	3739	0.15	46.37
120	41	Agronomy Journal	11	3750	0.14	46.50
121	41	Anticancer Research	11	3761	0.14	46.64
122	41	Applied Microbiology Biotechnology	11	3772	0.14	46.78
123	41	Biochemical Journal	11	3783	0.14	46.91
124	41	Botanical Bulletin of Academia Sinica	11	3794	0.14	47.05
125	41	Chemical and pharmaceutical Bulletin	11	3805	0.14	47.19
126	41	Ecotoxicology and Environmental Safety	11	3816	0.14	47.32
127	41	Environmental Mutagenesis	11	3827	0.14	47.46
128	41	Indian Journal of Medical Research	11	3838	0.14	47.59
129	41	Indian photo-pathology	11	3849	0.14	47.73
130	41	Journal of Antimicrobial Chemotherapy	11	3860	0.14	47.87
131	41	Journal of Sci. Res. Pl. Med	11	3871	0.14	48.00
132	41	Letter in Applied Microbiology	11	3882	0.14	48.14

Sl. No.	Rank	Name of the Journal	No. of Citations	Cumulative No. of Citations	Percentages	Cumulative Percentages
133	41	Madras Agricultural Journal	11	3893	0.14	48.28
134	41	Molecular Breeding	11	3904	0.14	48.41
135	41	Soil Science	11	3915	0.14	48.55
136	41	Teratogenesis, carcinogenesis, and mutagenesis	11	3926	0.14	48.69
137	42	Biochemical and Biophysical Research Communications	10	3936	0.12	48.81
138	42	Biological chemistry	10	3946	0.12	48.93
139	42	Botanical review	10	3956	0.12	49.06
140	42	Clinical Microbiology Reviews	10	3966	0.12	49.18
141	42	Current Opinion in Microbiology	10	3976	0.12	49.31
142	42	EMBO Journal	10	3986	0.12	49.43
143	42	Food Chemistry	10	3996	0.12	49.55
144	42	Functional Plant Biology	10	4006	0.12	49.68
145	42	Human Reproduction	10	4016	0.12	49.80
146	42	Indian Journal of Fisheries	10	4026	0.12	49.93
147	42	International Journal Andrology	10	4036	0.12	50.05
148	42	International Journal Crude Drug Research	10	4046	0.12	50.17
149	42	Journal of Agronomy & Crop Science	10	4056	0.12	50.30
150	42	Journal of Immunology	10	4066	0.12	50.42
151	42	Molecular Microbiology	10	4076	0.12	50.55
152	42	Plant Biotechnology Journal	10	4086	0.12	50.67
153	42	Toxicological Sciences	10	4096	0.12	50.79
154	43	American Journal of Chinese Medicine	9	4105	0.11	50.91
155	43	Current Microbiology	9	4114	0.11	51.02

Sl. No.	Rank	Name of the Journal	No. of Citations	Cumulative No. of Citations	Percentages	Cumulative Percentages
156	43	Current Opinion Plant Biology	9	4123	0.11	51.13
157	43	Environmental Ecology	9	4132	0.11	51.24
158	43	Environmental monitoring and Assessment	9	4141	0.11	51.35
159	43	Environmental Pollution	9	4150	0.11	51.46
160	43	Botanical Review	9	4159	0.11	51.57
161	43	Indian Forester	9	4168	0.11	51.69
162	43	Indian Journal of Physiology and Pharmacology	9	4177	0.11	51.80
163	43	International Journal of Syst. Bacterial	9	4186	0.11	51.91
164	43	Journal of Agriculture and Food Chemistry	9	4195	0.11	52.02
165	43	Journal of Applied Bacteriology	9	4204	0.11	52.13
166	43	Journal of Econ. Tax. Bot. Addl. Ser.	9	4213	0.11	52.24
167	43	Journal of Environmental Biology	9	4222	0.11	52.36
168	43	Journal of the National Cancer Institute	9	4231	0.11	52.47
169	43	Life Sciences	9	4240	0.11	52.58
170	43	Lloydia	9	4249	0.11	52.69
171	43	Natural Product Reports	9	4258	0.11	52.80
172	43	Plant Production Science	9	4267	0.11	52.91
173	43	Planta Medica	9	4276	0.11	53.03
174	43	Reportals of Botany	9	4285	0.11	53.14
175	43	Science of The Total Environment	9	4294	0.11	53.25
176	43	Soil Biology and Biochemistry	9	4303	0.11	53.36

Sl. No.	Rank	Name of the Journal	No. of Citations	Cumulative No. of Citations	Percentages	Cumulative Percentages
177	43	Soil Science and Plant Nutrition	9	4312	0.11	53.47
178	43	Veterinary Research	9	4321	0.11	53.58
179	43	Water Science and Technology	9	4330	0.11	53.70
180	44	23 Journal cited eight times each	184	4514	2.28	55.98
181	45	29 Journal cited seven times each	203	4717	2.52	58.49
182	46	27 Journal cited six times each	162	4879	2.01	60.50
183	47	38 Journal cited five times each	190	5069	2.36	62.86
184	48	83 Journal cited four times each	332	5401	4.12	66.98
185	49	117 Journal cited three times each	351	5752	4.35	71.33
186	50	291 Journal cited two times each	582	6334	7.22	78.55
187	51	1730 Journal cited one time each	1730	8064	21.45	100.00
Total			8064			

Table 5.3 shows the rank list prepared among all the 2518 number of journals and it is observed that about 50% of citations cover by only 147 numbers of journals which ranked up to 42. The journal named “Mutation Research” has got the first rank, contributing 287 citations, accounting for 3.56% followed by “Plant Physiology” contributing 228 citations, accounting for 2.83% and the third rank is occupied by “Journal of Economic and Taxonomic Botany” contributing 142 citations accounting for 1.76% out of total 8064 journal citations. It is also found that 25% of journal citation contributed by 30 number of journals.

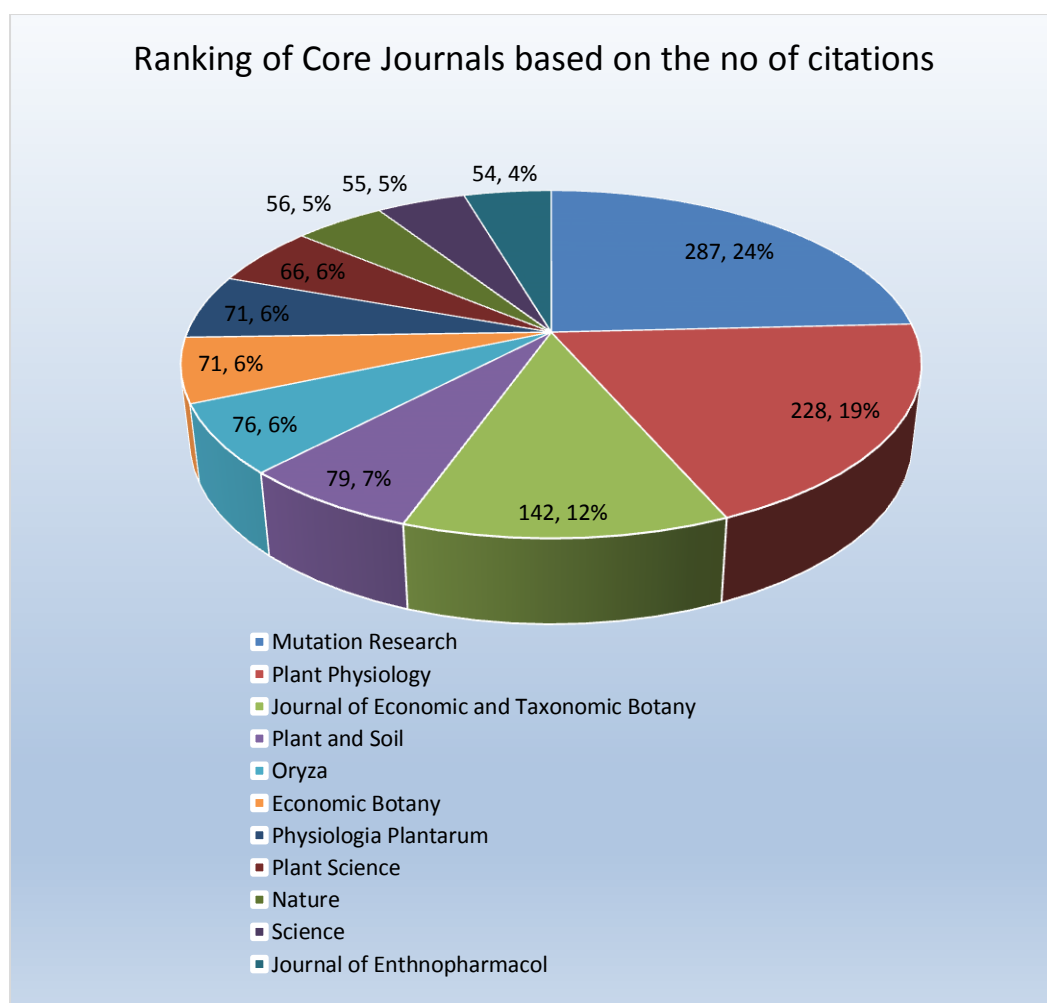


Figure 5.4: Core Journals Based on Frequency Distribution of Citations

Figure 5.4 represents the core journals based on their citation distribution where only 10 journals contribute 14.69% of total journal citation. Among these ten journals only 'Mutation Research' occupies 24% followed by 'Plant Physiology' 19% and 'Journal of Economics' and Taxonomic Botany' with 19% and 12% respectively.

5.4. RANKING OF BOOKS MADE ON THE BASIS OF CITATIONS

The Table 5.4 depicts the ranking list of books according to their frequency of citations. Out of 10012 total citations, books contribute 962 numbers of citations. The title of the book which have been included in the ranking list may be said as relatively more important in researchers view point. The analysis shows that the book "Flora of Assam" contributes highest numbers of citations 18(1.87%) has got first rank followed by second rank by "Indian Medicinal Plants" with 10(1.04%) citations and in the third rank is occupied by "Medicinal Plants" accounting for 9(0.9%) citations. 15 nos. of books cited 3 times, 60 nos. of books cited 2 times and 670 nos. of books cited only for one time.

Table 5.4: Ranking of Books Made on the Basis of Citations

Sl. No.	Rank	Title of the Books	No. of Citations	Cumulative No. of citations	%age of citations	Cumulative %age of citations
1	1	Flora of Assam	18	18	1.87	1.87
2	2	Indian Medicinal plants	10	28	1.04	2.91
3	3	Medicinal Plants	9	37	0.94	3.85
4	4	Bergey's Manual of Determinative Bacteriology	8	45	0.83	4.68
5	5	Flora of India	7	52	0.73	5.41
6	5	Text Book of Medical Physiology	7	59	0.73	6.13
7	5	Indian Materia Medica	7	66	0.73	6.86
8	5	Supplement to Glossary of Indian Medicinal Plants	7	73	0.73	7.59
9	6	Economic plants of India	6	79	0.62	8.21
10	6	Ethno-medico botany of Arunachal Pradesh (Nishi and Apatani tribes)	6	85	0.62	8.84
11	6	The useful plants of India	6	91	0.62	9.46
12	7	Fish and Fisheries of India	5	96	0.52	9.98
13	7	Flora of Jowai	5	101	0.52	10.50
14	7	Methods and approaches in Ethnobotany	5	106	0.52	11.02
15	7	Wealth of India	5	111	0.52	11.54

Sl. No.	Rank	Title of the Books	No. of Citations	Cumulative No. of citations	%age of citations	Cumulative %age of citations
16	8	Indegeneous drugs of India	4	115	0.42	11.95
17	8	Medicinal Plants of India and Pakistan	4	119	0.42	12.37
18	8	Responses of plants to Environmental stress.	4	123	0.42	12.79
19	8	The Flora of British India	4	127	0.42	13.20
20	9	15 no of book cited 3 times	45	172	4.68	17.88
21	10	60 no of book cited 2 times	120	292	12.47	30.35
22	11	670 no of book cited 1 times	670	962	69.65	100.00
Grand Total			962			

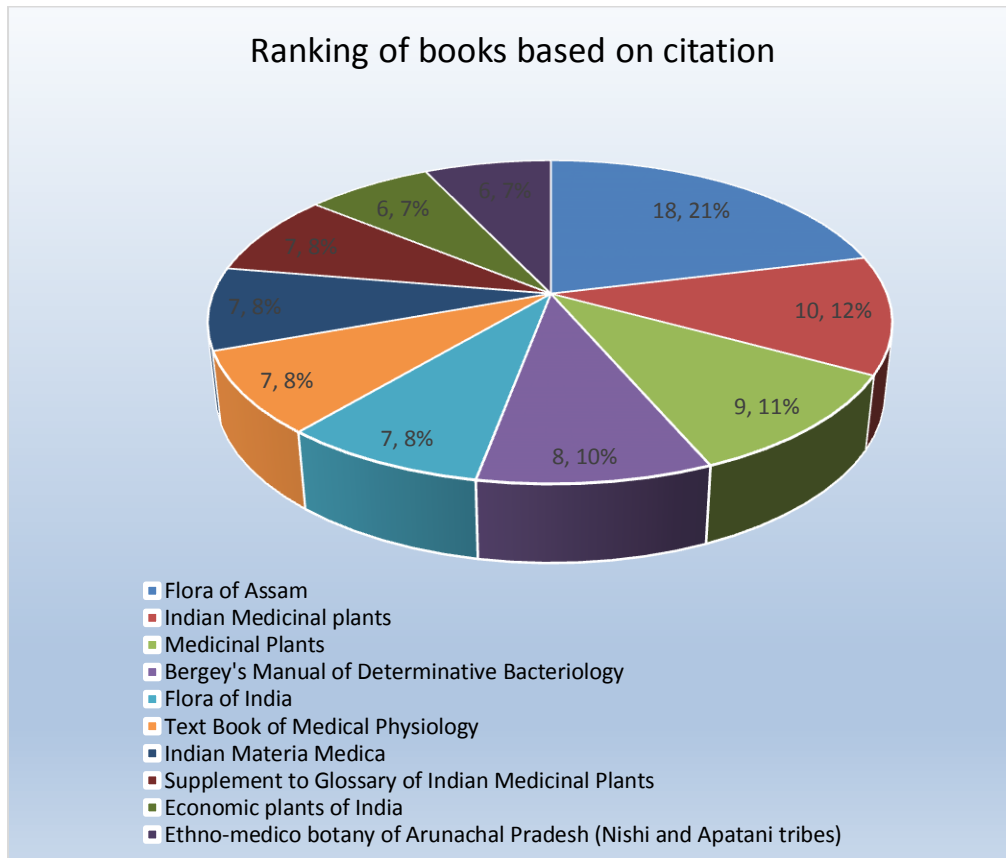


Figure 5.5. Ranking of Books Based on the Frequency Distribution of Citations

Figure 5.5 represents the ranking of ten books based on their citation distribution. Among ten books which reveals that book ‘Flora of Assam’ occupies 21% followed by ‘Indian Medicinal Plants’ and ‘Medicinal Plants’ with 12% and 11% citations respectively

5.5. DISTRIBUTION OF AUTHORSHIP PATTERN

The Table 5.5 deals with the authorship pattern in the different periods of journal citations. This section is depicted to identify the authorship pattern, degree of collaboration in the field of life science research. The present table revealed that more citations were from multiple authors than single authors in the field of Life Science. Single authors contributed 1443 citations, while two authors contributed

2092 citations and three or more than three authors contributed 4529 numbers of citations out of the total numbers of citations. It is also revealed that there was a tremendous growth rate in collaborative research pattern in the latest decades starting from 1980s. So, the scientific literatures are more collaborative than sole authorship. In this study, it was also found that, authors' names were not mentioned in five citations and year of publication was not found in one citation.

All the decades in the present study fall under three centuries i.e., 19th, 20th and 21st century. The total numbers of journal citations were 20, 5822 and 2216 in the 19th, 20th and 21st century respectively. It is also observed from the Table 5.5 that there is a remarkable increase in collaborative authorship pattern from the last part of 20th century.

Table 5.5. Distribution of Authorship Pattern and Degree of Collaboration in Journals

Sl. No.	Decade	Single Authored journal Citation	Two Authored Journal Citation	Three or more than three Authored journal Citation	Total	Century
1	1813-1822	1	0	0	1	19 th Century (20)
2	1823-1832	0	0	0	0	
3	1833-1842	1	0	0	1	
4	1843-1852	0	0	0	0	
5	1853-1862	0	0	0	0	
6	1863-1872	1	0	2	3	
7	1873-1882	2	0	2	2	
8	1883-1892	2	1	0	3	
9	1893-1902	5	1	4	10	
10	1903-1912	8	1	0	9	
11	1913-1922	8	1	3	12	
12	1923-1932	13	4	1	18	
13	1933-1942	25	10	11	46	
14	1943-1952	32	14	21	67	
15	1953-1962	58	34	55	147	
16	1963-1972	137	78	52	267	
17	1973-1982	189	222	384	795	
18	1983-1992	323	484	789	1596	
19	1993-2002	369	647	1854	2870	
20	2003-2012	264	584	1368	2216	21 th Century (2216)
21	Year not mentioned	0	0	1	1	
22	Author name not mentioned	5	0	0	5	
	Total	1443	2092	4529	8064	
	% of Collaboration	17.89	25.94	56.16	100	
	% of Collaboration (Round Off)	18	26	56	100	
	Degree of Collaboration			0.82		

5.6. SINGLE VS MULTIPLE AUTHORS

The above Table 5.5 clearly shows that the predominance of multiple author is more in life science than single author. Only 17.89% of total citations were contributed by single author while 25.94% and 56.16% were the contributions of citations by two authors and three or more than three authors respectively. So, the total 82.1% are the collaborative research outputs. It is evident that multi-authorship pattern is more dominant in this field. It is also observed that the collaboration in research activity is more with three and more than three authors.

5.7. DEGREE OF COLLABORATION

The author's productivity is calculated with their active role in research activity in a particular field. The degree of collaboration is determined in quantitative term with author's collaboration in research publication. Degree of collaboration is needed to identify the author productivity and research trend.

Degree of collaboration is tested by formula suggested by K. Subramanym. The above table shows the degree of collaboration during the period under study. The degree of collaboration can be calculated as below:

$$C = N_m / N_s + N_m$$

Where, C= Degree of collaboration

$$C = 6621 / 8064$$

N_m =No. of Multi author=6621

$$= 0.82 \text{ (Degree of Collaboration)}$$

N_s = No. of Single author=1443

It is identified that research activity usually done collectively in the field of Life Sciences. So, it is very true that collaboration in research is essential in the present digital age in any area. This observation clearly states that the

participative research outputs are very useful as they are quantitatively and qualitatively produced by the scientists in a particular field.

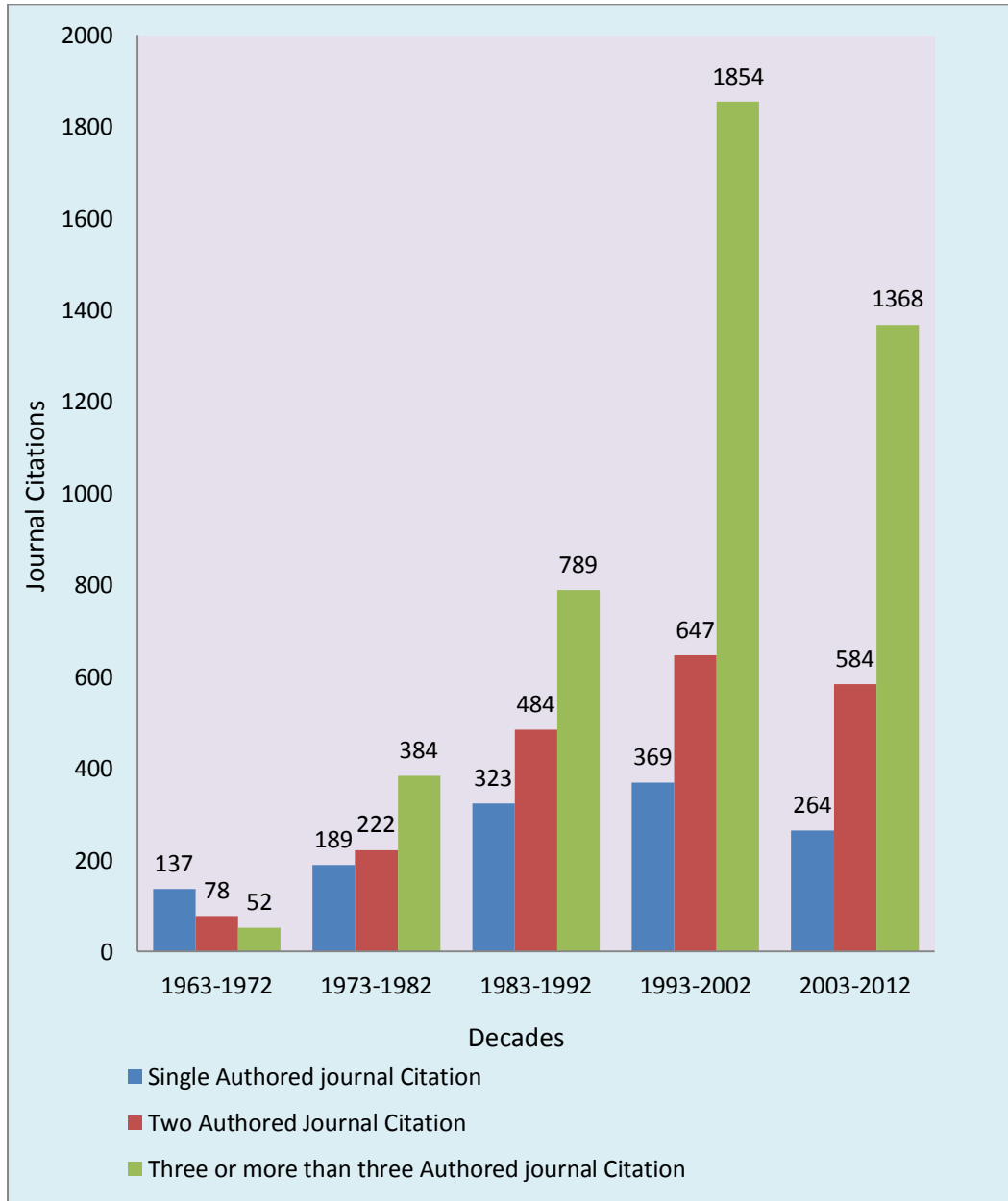


Figure 5.6. Distribution of Authorship Pattern

The Figure 5.6 shows the authorship pattern in Life Sciences in recent 50 years. It is very clear from the figure that multi authored literature is in increasing trend and single authorship trend is declining rapidly in the field of Life Sciences research. The figure depicts that the multi-authors research output is dominant over the solo authorship. It is revealed from the study that the research trend in this field is reaching towards multiple authorship pattern. It is very much evident that there is a need of collaborative authorship pattern in literature of different subjects.

5.8. AUTHOR'S PRODUCTIVITY

The Table 5.6 represents the pattern of one time and more than one time contributions to the citations under study. This table is prepared only to investigate the contributions of first author of every citation undertaken for this study. The Table 5.6. shows that productivity of author is from one to maximum of the 55 citations, but 5291 authors contributed only once, 607 authors contributed two citations, 154 authors contributed for three citations. It is found that there are also highly prolific authors who have contributed maximum number of citations. This study clearly identifies that S. K. Jain and C. R. Tarafdar are the two highly prolific authors in the field of Life Sciences research production contributing 55 and 28 citations respectively.

Table 5.6. Contribution of First Author in Journal (Author's Productivity)

No. of Author Contributed as 1st Author	No. of Citations Contributed by 1st Author	Total No. of Citation	Percentage of Citations	Cumulative Percentage
5291	1	5291	65.61	65.61
607	2	1214	15.05	80.67
154	3	462	5.73	86.40
71	4	284	3.52	89.92
32	5	160	1.98	91.90
15	6	90	1.12	93.02
11	7	77	0.95	93.97
9	8	72	0.89	94.87
8	9	72	0.89	95.76
3	10	30	0.37	96.13
6	11	66	0.82	96.95
4	12	48	0.60	97.54
1	13	13	0.16	97.71
1	14	14	0.17	97.88
1	16	16	0.20	98.08
1	23	23	0.29	98.36
1	24	24	0.30	98.66
1	25	25	0.31	98.97
1	28	28	0.35	99.32
1	55	55	0.68	100.00
6219		8064	100	

5.9. PERIOD WISE AND DOCUMENT WISE DISTRIBUTION OF CITATION

All the document forms and their year of publication are tabulated in the Table 5.7. From this table it is observed that journal is the highest useful source of information for citation in life science research followed by books ranked second, conference/ seminar proceeding ranked third and web resource stands fourth rank. From the Table 5.7, it is observed that highest percentage 34.94% in the decade 1993 to 2002 followed by 25.15% in the decade 2003 to 2012 and lowest percentage in the decade 1843 to 1952. The nascent sources in all document forms are most dominant.

Table 5.7: Period wise and Document wise distribution of Citations

Sl. No.	Year	Forms/Documents										Total	Percentages		
		Journal Articles	Book	Conference/Seminar Proceedings	Edited book	Report	Thesis/Dissertation	Unpublished	Web Resource	Reference Book	Others				
1	1813-1822	1	3	0	0	0	0	0	0	0	0	0	0	4	0.04%
2	1823-1832	0	1	0	0	0	0	0	0	0	0	0	0	1	0.01%
3	1833-1842	1	3	0	0	1	0	0	0	0	0	0	0	5	0.05%
4	1843-1852	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
5	1853-1862	0	5	0	0	0	0	0	0	0	0	0	0	5	0.05%
6	1863-1872	3	9	0	0	0	0	0	0	0	0	0	0	12	0.12%
7	1873-1882	2	8	1	0	0	0	0	0	0	0	0	0	11	0.11%
8	1883-1892	3	4	0	0	0	0	0	0	0	0	0	0	7	0.07%
9	1893-1902	10	9	0	0	0	0	0	0	0	0	0	1	22	0.22%
10	1903-1912	9	6	0	0	0	0	0	0	0	0	0	0	15	0.15%
11	1913-1922	12	1	0	1	0	1	0	0	0	0	0	0	14	0.14%
12	1923-1932	18	3	0	0	0	0	1	0	0	0	0	0	22	0.22%
13	1933-1942	46	27	2	0	2	0	2	0	0	0	0	0	77	0.77%
14	1943-1952	67	14	4	0	2	0	2	0	0	0	0	0	87	0.87%
15	1953-1962	147	36	14	2	1	1	1	1	1	1	0	2	204	2.04%
16	1963-1972	267	54	11	17	11	0	1	0	0	0	0	1	362	3.62%
17	1973-1982	795	150	31	42	23	8	0	0	0	0	0	7	1058	10.57%
18	1983-1992	1596	248	55	72	42	19	2	0	5	21	2060	20.58%		
19	1993-2002	2870	275	90	134	51	34	0	24	5	15	3498	34.94%		
20	2003-2012	2216	105	43	33	37	21	1	39	2	21	2518	25.15%		
22	year not mentioned	1	1	1	2	3	0	0	22	0	0	30	0	30	0.30%
	Total	8064	962	252	303	174	83	5	85	15	69	10012	100.00%		

5.10. PERIOD WISE DISTRIBUTIONS OF CITATIONS

The Table 5.8 represents the year wise presentation of citations. In the present study a total 10012 citations were found where 9982 citations were with year and 30 citations were without year. Table 5.8 illustrates the chronological distribution of total citations within the period from 1813 to 2012. The present analysis reveals that there is an increasing trend in the research productivity from the time period 1813-2012. There was a rapid growth from the period 1973-2012 which

shows increasing trend in the research publications in the field of life science research.

Table 5.8: Period Wise Distributions of Citations

SL NO	Period	No of Citations	Percentage of Citations	Cumulative Percentage of citation
1	1813-1822	4	0.04	0.04
2	1823-1832	1	0.01	0.05
3	1833-1842	5	0.05	0.10
4	1843-1852	0	0.00	0.10
5	1853-1862	5	0.05	0.15
6	1863-1872	12	0.12	0.27
7	1873-1882	11	0.11	0.38
8	1883-1892	7	0.07	0.45
9	1893-1902	22	0.22	0.67
10	1903-1912	15	0.15	0.82
11	1913-1922	14	0.14	0.96
12	1923-1932	22	0.22	1.18
13	1933-1942	77	0.77	1.95
14	1943-1952	87	0.87	2.82
15	1953-1962	204	2.04	4.85
16	1963-1972	362	3.62	8.47
17	1973-1982	1058	10.57	19.04
18	1983-1992	2060	20.58	39.61
19	1993-2002	3498	34.94	74.55
20	2003-2012	2518	25.15	99.70
21	year not mentioned	30	0.30	100.00
Total		10012	100.00	

The aging of literature in life sciences can be seen in the Table 5.8 above. It is clearly evident that there is a tremendous use of current literature by the researchers in Life Sciences. 92.25% of the references cited by the researchers in Life Sciences are current i.e. from 1973 to 2012. So, it can be said that the

researchers prefer to use current sources of information for their research activities. They used very few percentages of old citations in their research purpose. The Figure 5.7 shows that there is an increasing trend from the period 1963-1972. The highest percentage of citations was cited from the recent period.

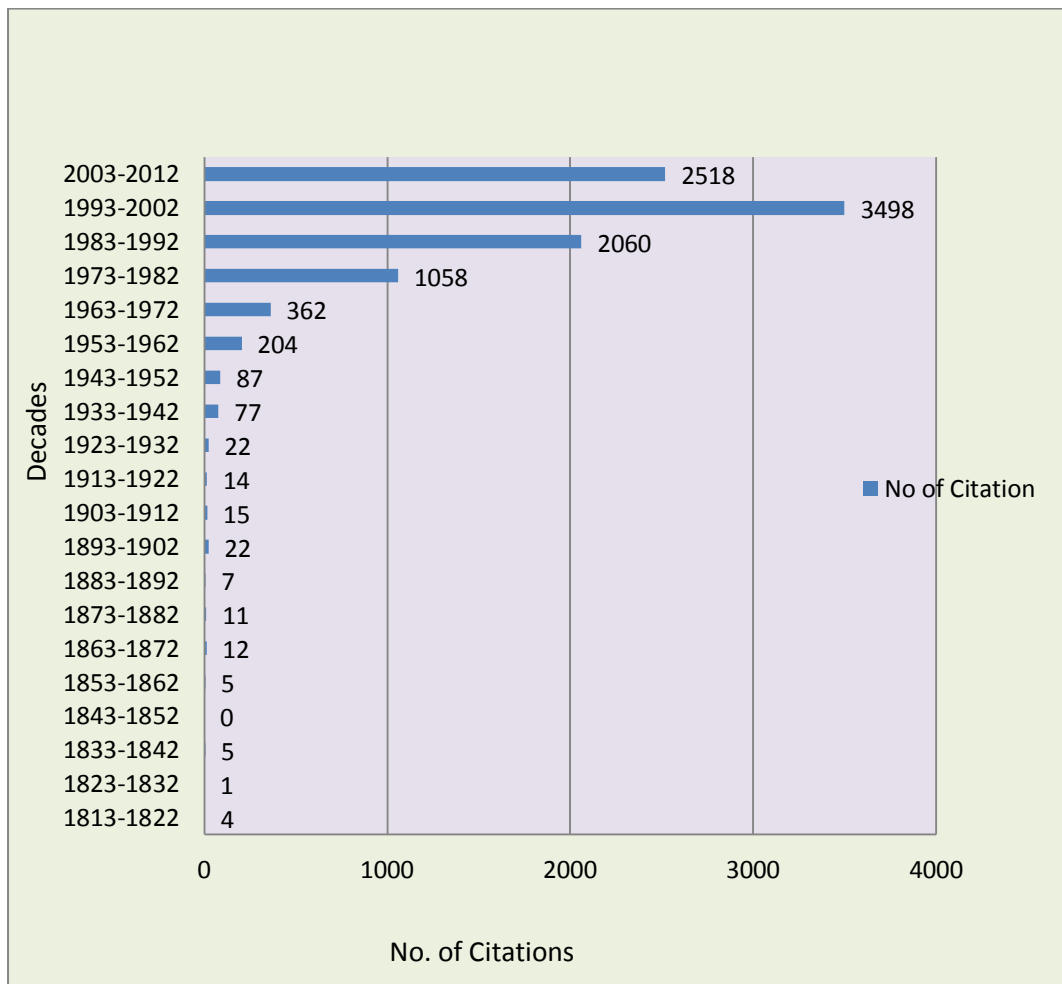


Figure 5.7: Period Wise Distributions of Citations

The figure also shows that the more concentration of citation found from the period 1973-2012

5.11. PERIOD WISE DISTRIBUTION OF CITATIONS TO JOURNAL

Table 5.9 represents the year wise representation of journal citations. In this study a total 8064 journal citations were arranged according to their year of publications including one number of journal citation without year of publication. 35.59% during the period 1993 to 2002 is having highest numbers of citations followed by 27.48% of journal citation during the period 2003 to 2012.

Table 5.9. Period Wise Distributions of Citations to Journal

Sl. No.	Period	No of Citation	Percentage of Citations	Cumulative percentage of citation
1	1813-1822	1	0.01	0.01
2	1823-1832	0	0.00	0.01
3	1833-1842	1	0.01	0.02
4	1843-1852	0	0.00	0.02
5	1853-1862	0	0.00	0.02
6	1863-1872	3	0.04	0.06
7	1873-1882	2	0.02	0.09
8	1883-1892	3	0.04	0.12
9	1893-1902	10	0.12	0.25
10	1903-1912	9	0.11	0.36
11	1913-1922	12	0.15	0.51
12	1923-1932	18	0.22	0.73
13	1933-1942	46	0.57	1.30
14	1943-1952	67	0.83	2.13
15	1953-1962	147	1.82	3.96
16	1963-1972	267	3.31	7.27
17	1973-1982	795	9.86	17.13
18	1983-1992	1596	19.79	36.92
19	1993-2002	2870	35.59	72.51
20	2003-2012	2216	27.48	99.99
21	year not mentioned	1	0.01	100.00
Total		8064	100.00	100.00

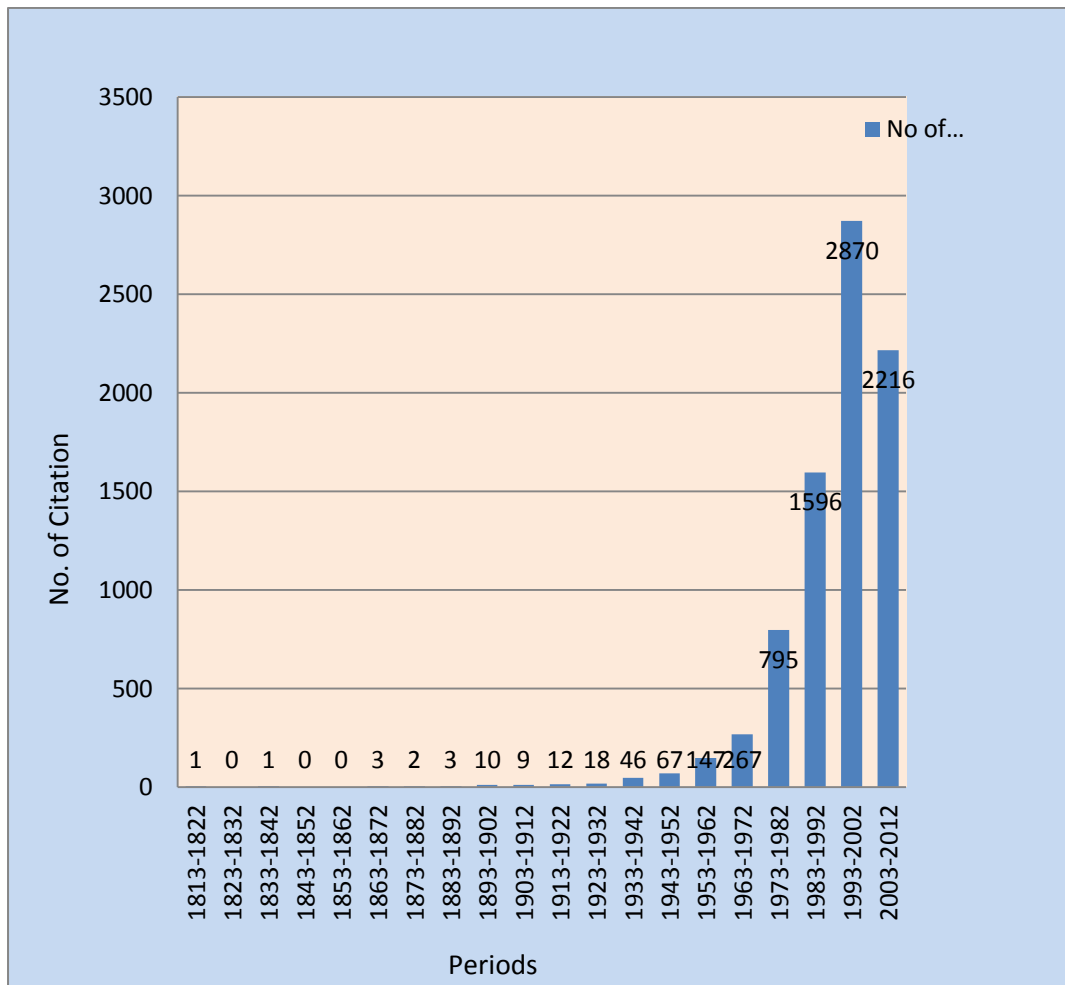


Figure 5.8 Period Wise Distributions of Journals

The above Figure 5.8 indicates the numbers of journal citations according to their year of publications and it is seen that there is a remarkable use of journals in the recent years.

5.12. PERIOD WISE DISTRIBUTION OF CITATIONS TO BOOKS

This Table 5.10 and Figure 5.9 represent the year wise representation of citations of books. In this study, a total 962 book citations were arranged according to their year of publications including one book citation without year of publication. 28.59% during the period from 1993 to 2002 is having highest numbers of

citations followed by 25.78% of book citations during the period from 1983 to 1992.

Table5.10 Period Wise Distributions of Citations to Books

Sl. No.	Period	No of Citation	Percentage of Citations	Cumulative percentage of citation
1	1813-1822	3	0.31	0.31
2	1823-1832	1	0.10	0.42
3	1833-1842	3	0.31	0.73
4	1843-1852	0	0.00	0.73
5	1853-1862	5	0.52	1.25
6	1863-1872	9	0.94	2.18
7	1873-1882	8	0.83	3.01
8	1883-1892	4	0.42	3.43
9	1893-1902	9	0.94	4.37
10	1903-1912	6	0.62	4.99
11	1913-1922	1	0.10	5.09
12	1923-1932	3	0.31	5.41
13	1933-1942	27	2.81	8.21
14	1943-1952	14	1.46	9.67
15	1953-1962	36	3.74	13.41
16	1963-1972	54	5.61	19.02
17	1973-1982	150	15.59	34.62
18	1983-1992	248	25.78	60.40
19	1993-2002	275	28.59	88.98
20	2003-2012	105	10.91	99.90
21	year not mentioned	1	0.10	100.00
Total		962	100.00	100.00

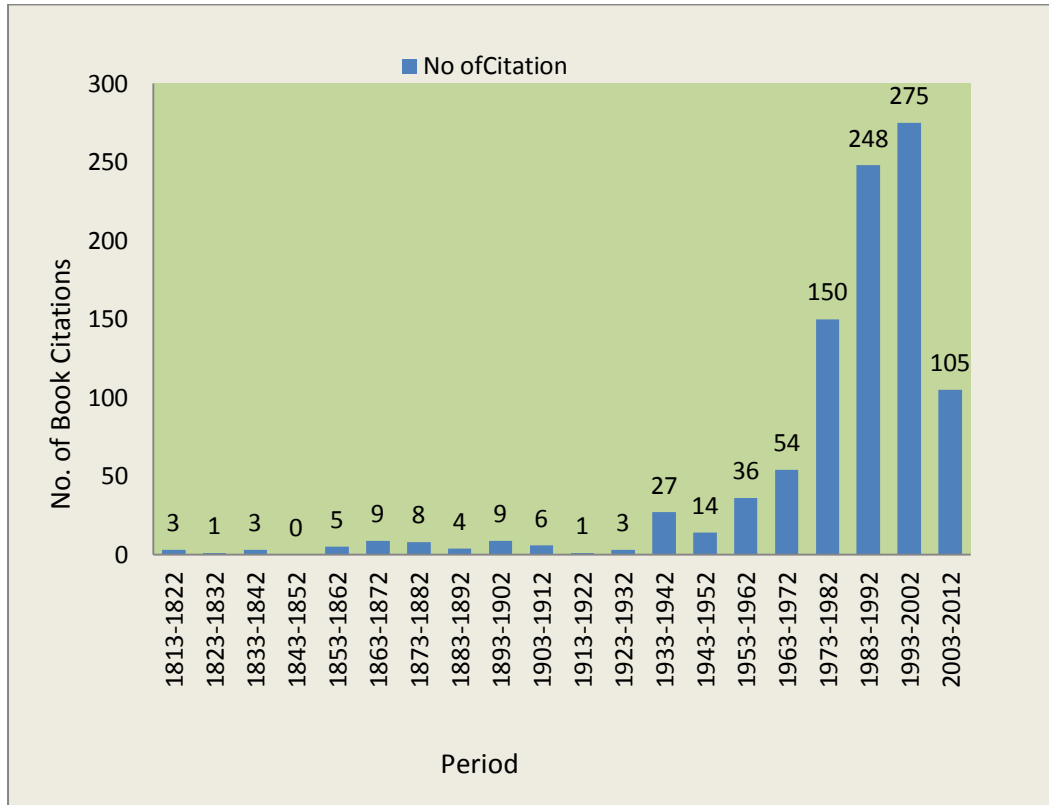


Figure5.9: Period Wise Distributions of Citations to Books

So, from both the study of journals and books citation, it is observed that researchers used recent journal citations more compared to book citations.

5.13. YEAR WISE DISTRIBUTION OF CITATIONS IN RECENT TWENTY YEARS

All the 10012 citations were arranged according to their year of publication and it was found that first year of publication was 1813 and last year of publication was 2012 i.e. there were 200 years. Out of these 200 years, recent twenty years get more concentration of citations. The same has been shown for the recent twenty years in Table 5.11

Table 5.11. Year Wise Distribution of Citations for Recent 20 years

Sl. No.	Year	No. of Citation
1	1993	253
2	1994	278
3	1995	291
4	1996	332
5	1997	359
6	1998	362
7	1999	393
8	2000	432
9	2001	379
10	2002	419
11	2003	438
12	2004	360
13	2005	392
14	2006	326
15	2007	284
16	2008	284
17	2009	219
18	2010	126
19	2011	71
20	2012	18
Recent 20 years total		6016

The Table 5.11 shows the year wise distribution of citations where there are total 6016 numbers of citations cited by scholars from 1993 to 2012. The year wise distribution of citations clearly indicates that more concentration of citations was found in the period from 1996 to 2006 and there after there is a decreasing trend from the year 2007. From the above table a line graph may be drawn which is shown in Figure 5.10.

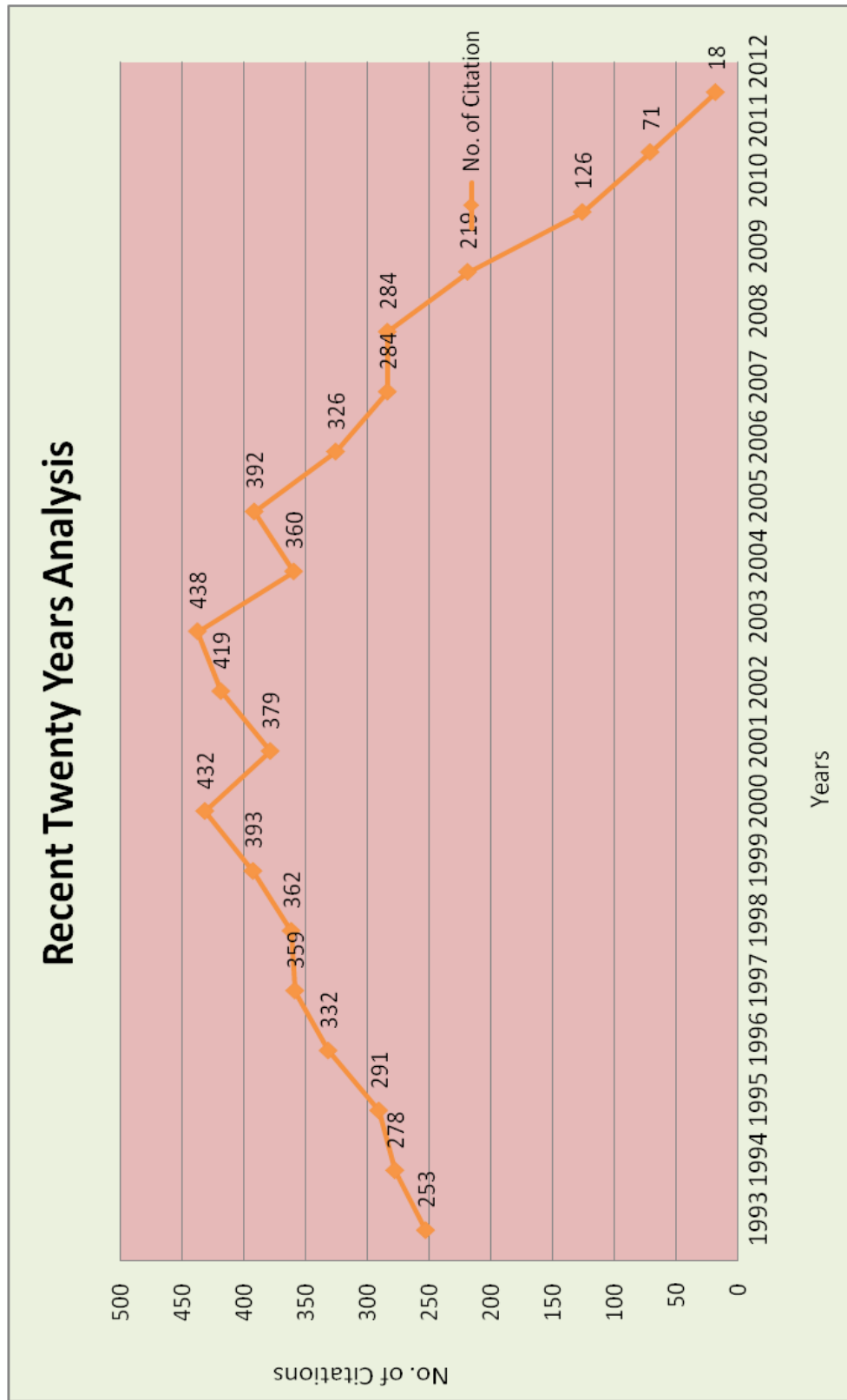


Figure 5.10: Year Wise Distribution of Citations for Recent 20 years

The above Figure 5.10 clearly indicates that 438 citations were cited by scholars which was maximum in number in the year 2003 followed by 432 citations in the year 2000. In the year 2012, least number of citations were cited with a total of 18 citations.

5.14. YEAR WISE AND DOCUMENT WISE DISTRIBUTION OF CITATION FOR RECENT 20 YEARS

Table 5.12 shows the year wise breakup of all the document forms from 1993 to 2012. In between this period web resource gets importance in comparison to earlier period i.e., contribution of web resource was zero up to 1994 and it was increased to 24 up to year 2002 and again it was increased to 39 from 2003 to 2012. So, it reveals that now a days the researchers are using more and more online resources for their research purpose due to innovative development of information communication technology and web technology.

Table 5.12 Year Wise and Document wise Distribution of Citation for Recent 20 years

Sl. No.	Year	Forms/Documents										Total			
		Journals	Books	Conference/ Seminar proceedings	Edited book	Report	Thesis/Dissertation	Unpublished	Web Resource	Reference Book	Others				
1	1993	197	27	10	11	6	1	0	0	0	1	0	0	1	253
2	1994	202	34	3	33	3	0	0	0	0	0	0	0	3	278
3	1995	242	25	3	9	8	2	0	1	0	1	0	0	1	291
4	1996	282	19	12	5	5	5	0	2	1	1	0	1	1	332
5	1997	298	21	7	23	3	4	0	2	0	1	0	0	1	359
6	1998	301	34	6	12	5	1	0	2	0	1	0	0	1	362
7	1999	328	29	8	9	7	8	0	3	0	1	0	0	1	393
8	2000	347	34	12	18	7	7	0	5	1	1	0	0	1	432
9	2001	324	21	10	3	6	3	0	6	1	5	0	0	0	379
10	2002	349	31	19	11	1	3	0	3	2	0	0	0	0	419
11	1993-2002 , 10 years	2870	275	90	134	51	34	0	24	5	15	0	5	15	3498
12	2003	366	30	7	13	6	4	0	5	0	7	0	0	7	438
13	2004	306	21	13	1	9	3	0	4	0	3	0	0	3	360
14	2005	357	13	5	5	4	4	0	4	0	0	0	0	0	392
15	2006	295	13	4	3	1	5	0	4	1	0	0	0	0	326
16	2007	258	7	7	4	5	3	0	0	0	0	0	0	0	284
17	2008	259	6	3	4	0	1	1	4	0	6	0	0	6	284
18	2009	189	6	2	1	6	1	0	11	0	3	0	0	3	219
19	2010	112	5	2	1	2	0	0	3	0	1	0	0	1	126
20	2011	59	4	0	1	3	0	0	2	1	1	0	0	1	71
21	2012	15	0	0	0	1	0	0	2	0	0	0	0	0	18
22	2003-2012 , 10 years	2216	105	43	33	37	21	1	39	2	21	1	39	2	2518
23	1993-2012 20 years	5086	380	133	167	88	55	1	63	7	36	1	63	7	6016

5.15. BLOCK WISE DISTRIBUTIONS OF CITATIONS

The whole period of study has been grouped in twenty decades consisting of 10 year duration. All the citations are arranged according to their respective decades and again all these decade are grouped in four periods comprising 5 decades (Block of years) and all the citations are grouped according to their respective block of 50 years which may be shown in column no. 4 excluding 30 numbers of citations without mentioning year of publication in the Table 5.13. It is clear from the column no. 4 that, fourth block gets more concentration and first three blocks get negligible importance for citations. So, the first two block of the years i.e., year up to 1912 may be declared as obsolete and from 1913 to 1962 may be declared as partially obsolete.

Table 5.13 : Block Wise Distribution of Citations

SL No	Decade	Total	No. of Citations	Block
1	2	3	4	5
1	1813-1822	4		1
2	1823-1832	1		2
3	1833-1842	5	15	3
4	1843-1852	0		4
5	1853-1862	5		5
6	1863-1872	12		1
7	1873-1882	11		2
8	1883-1892	7	67	3
9	1893-1902	22		4
10	1903-1912	15		5
11	1913-1922	14		1
12	1923-1932	22		2
13	1933-1942	27	404	3
14	1943-1952	87		4
15	1953-1962	204		5
16	1963-1972	362		1
17	1973-1982	1058		2
18	1983-1992	2061	9496	3
19	1993-2002	3498		4
20	2003-2012	2518		5
21	Year N.A. (0)	30	30	
	Total	10012	10012	

5.16. BRADFORDS ZONE FOR LIFE SCIENCE

It is revealed from the Table 5.14 that there are 55(2.18%) journals found in the nucleus and they are most significant journals in the subject life sciences contributing 2697 (33.44%) citations out of total 8064 citations placed in the first zone. In the second zone, 321 journals contributing 2688 (33.33%) citations and in the third zone consisting of 2142 journals accounting for 2679 (33.44%) citations. The analysis clearly indicated that each zone contributed approximately equal percentage of citations i.e. one third of total citations. Hence, with the application of Bradfords Law of Scattering the ratio of each journal in each zone stand as 55: 321: 2142.

Table 5.14.Distributions of Journals in Life Science Based on Bradfords Law of Scattering

Zone	No. of Journal	Percentage of Journal	Cumulative No. of Journal	Cumulative Percentage Of Journal	No. of Citations	Percentage Of Citation	Cumulative No. of Citations	Cumulative Percentage of Citation
1	2	3	4	5	6	7	8	9
1	55	2.18	55	2.18	2697	33.44	2697	33.44
2	321	12.75	376	14.93	2688	33.33	5385	66.78
3	2142	85.07	2518	100	2679	33.22	8064	100

In the above Table 5.14. all the journals are divided into three zones contributing equal percentage of citations which may be seen as column no. 7 and it is also observed that few numbers of journals contributed more citations while large number of journals contributed less numbers of citations. The table above illustrates the fact that there is an increasing trend of journals in each zone having low productivity of citations. This perview of decreasing productivity implies the extent of scattering of material in the field of life science research.

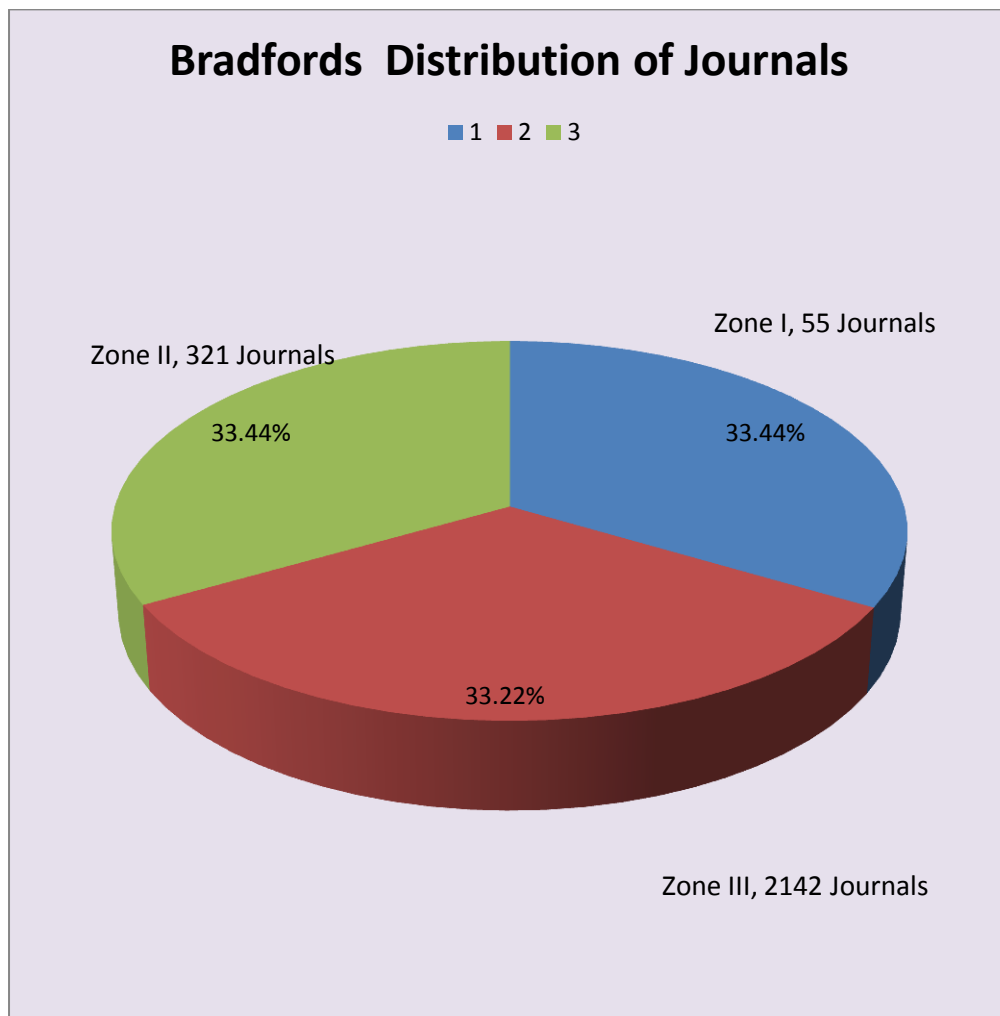


Figure 5.11: Bradford's Distribution of Journals

5.17. PRODUCTIVITY OF JOURNALS IN LIFE SCIENCE

It is very clear from the Table 5.15 below that the percentage of journals increases i.e. 1.19, 4.69, 19.86 and 74.27 but their percentage of production of citation remain constant as 25.02%, 25.02%, 25.02% and 24.93% respectively. It is also observed from the table that the average productivity of citation is declining from 67.26 in the first zone to 1.57 in the fourth zone as shown in coloumn no. 10. In other words, it can be said that the concentration of more numbers of citations contributed by few number of journals.

Table 5.15. Productivity of Journals in Life Sciences

Zone	No. Of Journal	Percentage of Journal	Cumulative No. of Journal	Cumulative Percentage of Journal	No. Of Citations	Percentage of Citation	Cumulative No. of Citations	Cumulative Percentage of Citation	Average production of Citations
1	2	3	4	5	6	7	8	9	10
1	30	1.19	30	1.19	2018	25.02	2018	25.02	67.27
2	118	4.69	148	5.88	2018	25.02	4036	50.05	17.1
3	500	19.86	648	25.73	2018	25.02	6054	75.07	4.04
4	1870	74.27	2518	100.00	2010	24.93	8064	100.00	1.07

5.18. RANKING OF AUTHOR FOR CORE JOURNAL

Research outputs of authors enrich a subject which can be identified by the bibliometric studies in a particular subject. Contributions are made by different

authors in the field of life sciences through articles published in the different journals. A rank list has been prepared among the different authors of journals which were used by research scholar of life sciences of Assam University, Silchar from 1996 to 2012. The same has been shown below in Table 5.16

Table 5.16 Rank List of Author for Journal

Sl. No	Rank	Name of Author	No. of Citation	Cumulative No. of Citation	%age of Citations	%age of Cumulative citation
1	1	Jain, S. K.	55	55	0.68	0.68
2	2	Tarafdar, C. R.	28	83	0.35	1.03
3	3	Rao, R. R.	25	108	0.31	1.34
4	4	Kar, D	24	132	0.30	1.64
5	5	Khan, M. A.	23	155	0.29	1.92
6	6	Hora, S.L	16	171	0.20	2.12
7	7	Panigrahi, G.	14	185	0.17	2.29
8	8	Hemadri, K.	13	198	0.16	2.46
9	9	Tiwari, K. C.	12	210	0.15	2.60
10	9	Mittler, R.	12	222	0.15	2.75
11	9	Foyer C. H.	12	234	0.15	2.90
12	9	Borthakur, S. K.	12	246	0.15	3.05
13	10	Stich, H. F.	11	257	0.14	3.19
14	10	Singh, K. K.	11	268	0.14	3.32
15	10	Rao, A.S.	11	279	0.14	3.46
16	10	Pfalle, M. A.	11	290	0.14	3.60
17	10	Panda, S. K.	11	301	0.14	3.73
18	10	Dutta Choudhury, M.	11	312	0.14	3.87
19	11	Schultes, R.E.	10	322	0.12	3.99
20	11	Dobereiner, J.	10	332	0.12	4.12

Sl. No	Rank	Name of Author	No of Citation	Cumulative No. of Citation	%age of Citations	%age of Cumulative citation
21	11	Deb Roy, B.	10	342	0.12	4.24
22	12	Smirnoff, N.	9	351	0.11	4.35
23	12	Singh, S.	9	360	0.11	4.46
24	12	Nautiyal, P.	9	369	0.11	4.58
25	12	Kumar, Y.	9	378	0.11	4.69
26	12	Kumar, S	9	387	0.11	4.80
27	12	Krishna, G.	9	396	0.11	4.91
28	12	Dey, S. C.	9	405	0.11	5.02
29	12	Bhattacharjee, M.K.	9	414	0.11	5.13
30	13	Zhang, J.	8	422	0.10	5.23
31	13	Sairam, R. K.	8	430	0.10	5.33
32	13	Noctor, G.	8	438	0.10	5.43
33	13	Nayar, B. K.	8	446	0.10	5.53
34	13	Kanjilal, U. N.	8	454	0.10	5.63
35	13	Hernandez, J. A.	8	462	0.10	5.73
36	13	Halliwell, B.	8	470	0.10	5.83
37	13	Cakmak, I.	8	478	0.10	5.93
38	13	Bir, S.S.	8	486	0.10	6.03
39	14	MacDonald, A. St. J.	7	493	0.09	6.11
40	14	Ladha, J.K.	7	500	0.09	6.20
41	14	Joshi, M. C.	7	507	0.09	6.29
42	14	Hope, C.W.	7	514	0.09	6.37
43	14	Holdsworth, D.K.	7	521	0.09	6.46
44	14	Goel, A.K.	7	528	0.09	6.55

Sl. No	Rank	Name of Author	No of Citation	Cumulative No. of Citation	%age of Citations	%age of Cumulative citation
45	14	Dagar, H.S.	7	535	0.09	6.63
46	14	Chowdhury, S.	7	542	0.09	6.72
47	14	Bashan, Y.	7	549	0.09	6.81
48	14	Barman, R. C.	7	556	0.09	6.89
49	14	Asada K.	7	563	0.09	6.98
50	15	Singh, V.	6	569	0.07	7.06
51	15	Simon, J. W.	6	575	0.07	7.13
52	15	Saitou, N.	6	581	0.07	7.20
53	15	Roy, G. P.	6	587	0.07	7.28
54	15	Preston, R. J.	6	593	0.07	7.35

In the above Table 5.16 it is seen that author S. K. Jain contributed 55 citations which is highest among all and ranked first. Four authors namely C. R. Tarafdar, R. R. Rao, D. Kar and M. A. Khan contributed more than 20 citations i.e., 28, 25, 24 and 25 respectively and ranked second, third, fourth and fifth but less than the contributions of S. K. Jain. Ten to sixteen contributions were made by 16 numbers of authors. Fifteenth ranked has been obtained by 5 authors namely V. Singh, J.W. Simon, N. Saitou, g. P. Roy and R. J. Preston with 6 citations each.

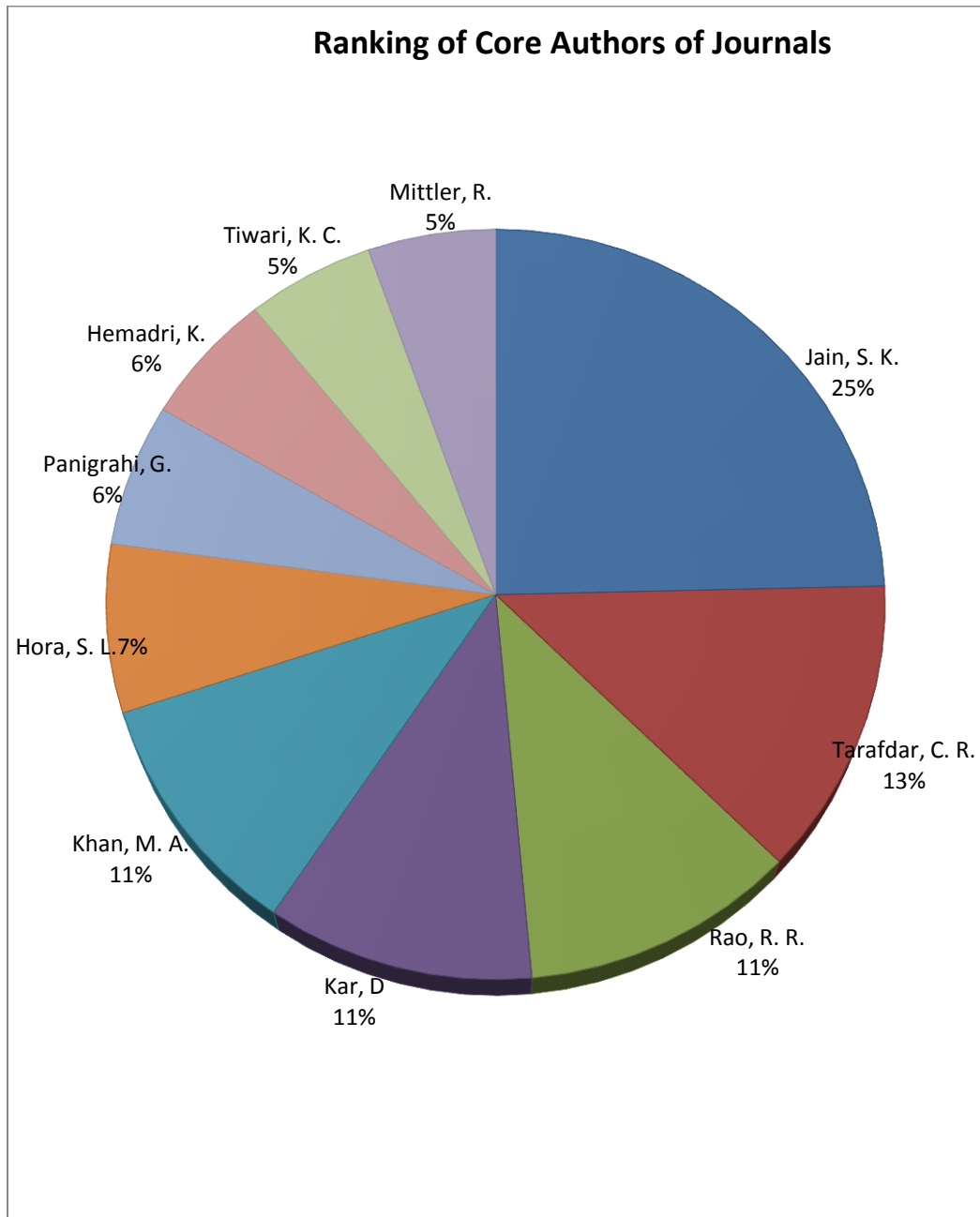


Figure 5.12. Ranking of Authors of Journals

This Figure 5.12 clearly shows the contribution of citations by authors in the journals based on distribution of citations.

5.19. RANKING OF AUTHORS FOR BOOK

Rank list of authors contribution in book citation are presented in the Table 5.17 below:

Table 5.17. Rank List of Author for Book

Sl No.	Rank	Name of Author	No of Citation	Cumulative No. of Citation	%age of Citations	%age of Cumulative citation
1	1	Jain, S. K.	25	25	0.31	0.31
2	2	Chopra, R. N.	17	42	0.21	0.52
3	3	Kanjilal, U. N.	13	55	0.16	0.68
4	4	Beddome, R.H.	9	64	0.11	0.79
5	5	Dey, K. L.	7	71	0.09	0.88
6	5	Kirtikar, K.R.	7	78	0.09	0.97
7	5	Nayar, M. P.	7	85	0.09	1.05
8	6	Hajra, P.K.	6	91	0.07	1.13
9	6	Nadkarni, A.K.	6	97	0.07	1.20
10	7	Dixit, R.D.	5	102	0.06	1.26
11	7	Jhingran, V. G.	5	107	0.06	1.33
12	7	Levitt, J.	5	112	0.06	1.39
13	7	Sharma, B.D.	5	117	0.06	1.45
14	7	Watt, G.	5	122	0.06	1.51
15	8	Asolkar, I. V.	4	126	0.05	1.56

It is observed from the above table that S. K. Jain gets first rank in book citations contributed 25 nos. of citations and R. N. Chopra gets second rank with a contribution of 17 nos. of citations. U. N. Kanjilal contributed 13 numbers of citations and got third rank.

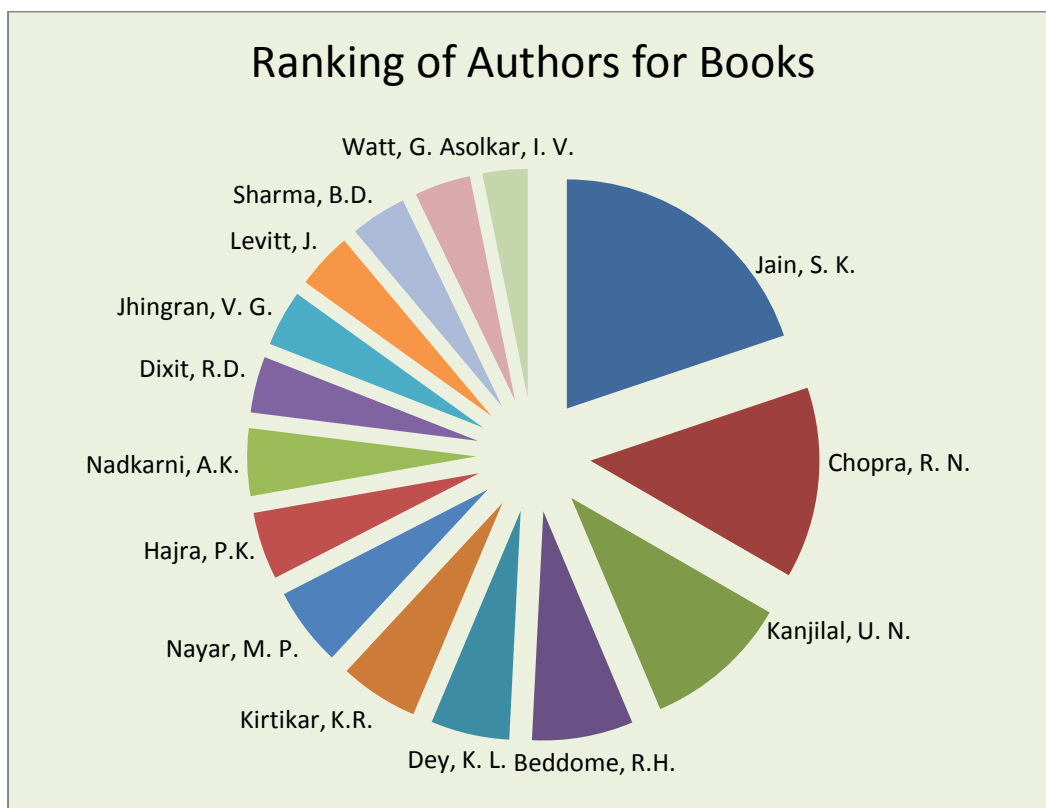


Figure 5.13. Ranking of Authors for Books

The Figure 5.13 clearly shows the contribution of citations by top 15 authors in the book citations.

5.20. SIGNIFICANT KEYWORDS USED BY SCHOLARS OF LIFE SCIENCES

Table 5.18 represents the significant keywords used by the researchers in life sciences in their doctoral theses. It was observed that “Mediciinal Plants” was the most significant keyword which was cited 143 times followed by “Flora” cited 101 times and “Pesticides” was cited 95 times having the second and third rank respectively.

Table 5.18 Significant Keywords Used

Sl. No.	Significant Key Words	No. of times used	Rank
1	Medicinal Plants	143	1
2	Flora	101	2
3	Pesticides	95	3
4	Ethnobotanical	90	4
5	Bronchiseptica	85	5
6	Ethnobotany	84	6
7	Genetotoxicity	74	7
8	Ferns	73	8
9	Clostridium perfringens	70	9
10	Rice	65	10
11	Tribals	65	10
12	Economic Plants	62	11
13	Pteridophytic	61	12
14	Arsenic	60	13
15	Candidiasis	60	13
16	Atrophic rhinitis	58	14
17	Cytogenetic	58	14
18	Pasteurella multocida	58	14
19	Plasmid	58	14
20	Mahseer	57	15

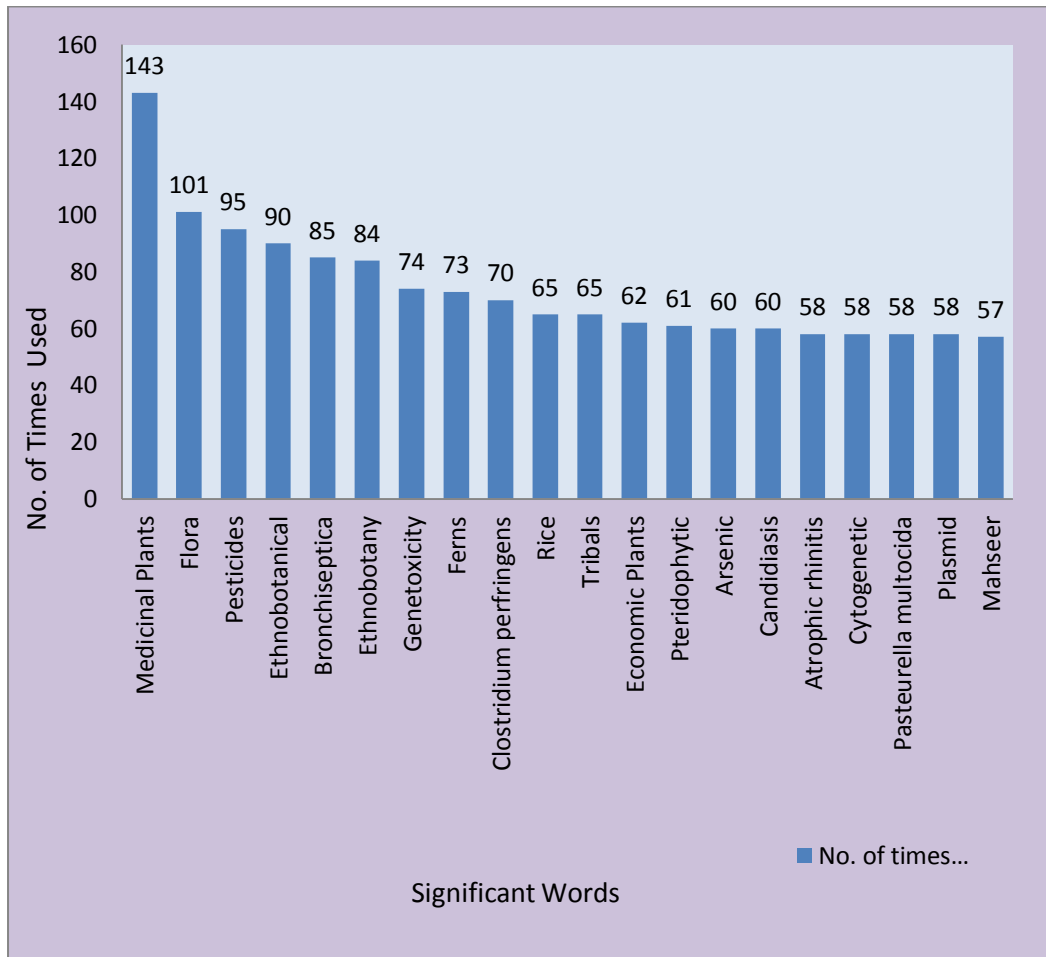


Figure 5.14: Significant Words used by Scholar in Life Sciences

Figure 5.14 shows clearly the numbers of important keywords used by the researchers. Some of the significant keywords used by the researchers in the citations are: Ethnobotanical, Bronchiseptica, Ethnobotany, Genotoxicity, Ferns, Clostridium perfringens Rice, Tribals etc.

5.21. PUBLISHER WISE NUMBER OF JOURNAL CITATIONS

A rank list prepared among the publishers of journals found in this study which is shown in Table 5.19 below:

Table. 5.19 Publisher Wise No Of Journal Citation(Rank 25)

Sl. No.	Name of Publisher	No. of Citation	Rank
1.	Elsevier	1128	1
2.	Springer	659	2
3.	Oxford University Press	335	3
4.	American Society of plant Biologists	252	4
5.	John Wiley & Sons	205	5
6.	Wiley-Blackwell	173	6
7.	Society for Economic and Taxonomic Botany of India	142	7
8.	American Society for Microbiology	126	8
9.	American Chemical Society	85	9
10.	Nature Publishing Group	80	10
11.	Association of Rice Research Worker	76	11
12.	American Association for the Advancement Science	54	12
13.	Oxford and IBH Publishing Co. Pvt. Ltd.	54	12
14.	American Association of Cancer Reasearch	53	13
15.	National Institute of Environmental Health Sciences	51	14
16.	Botanical Survey of India	50	15
17.	Current science Association	48	16
18.	Bombay Natural History Society	44	17
19.	Southern Illinois University Carbondale	42	18
20.	The Indian Fern Society	42	18
21.	BMJ Publishing Group	41	19
22.	Taylor and Francis Ltd	38	20
23.	United States National Academy of Sciences	38	20
24.	Central Inland Capture Fisheries Research Institute	37	21
25.	Informa	36	22
26.	American Society for Biochemistry and Molecular Biology	29	23
27.	Indian Academy of Science	29	23
28.	Academic Journals	28	24
29.	Medknow Publications And Media Pvt. Ltd.	28	24
30.	Central Council for Research in Ayurveda and Siddha	26	25

In the above Table 5.19, it is observed that Elsevier ranked top in the rank list followed by Springer contributing 1128 citations and 659 citations respectively. In the third rank there is Oxford University Press accounting for 335 numbers of citations.

5.22. PUBLISHER WISE NUMBER OF BOOK CITATIONS

A rank list has been prepared among the publishers of books found in the present study which is shown in Table 5.20 as below:

Table 5.20: Publisher Wise No. of Book Citation(Upto 15th Rank)

Sl. No.	Name of Publisher	No. of Citation	Rank
1.	CSIR Publications	34	1
2.	Academic Press	30	2
3.	Botanical Survey of India	30	2
4.	Bisen Singh and Mahendra Pal Singh.	27	3
5.	Oxford and IBH Publishing Co. Pvt. Ltd.	25	4
6.	John Wiley & Sons	24	5
7.	Scientific Publishers	17	6
8.	Plenum Press	13	7
9.	Springer-Verlag	12	8
10.	Williams and Wikins Co.	12	8
11.	Mc Graw Hill Book Co.	11	9
12.	Springer	11	9
13.	Today & Tomorrow Printers & Publishers	10	10
14.	Cambridge University Press:	9	11
15.	CRC Press	9	11
16.	Periodical Experts Book Agency	9	11
17.	Elsevier	8	12
18.	Kluwer Academic Publishers,	8	12

Sl. No.	Name of Publisher	No. of Citation	Rank
19.	Lippincott Williams & Wilkins Co.	8	12
20.	National Book Trust	8	12
21.	Daya Publishing House	7	13
22.	Popular Book Depot	7	13
23.	Soc. Ethnobotanist	7	13
24.	Chapman and Hall	6	14
25.	International Book distributors	6	14
26.	Naya prakash	6	14
27.	Deep Publications	5	15
28.	Kalayani Publisher	5	15
29.	Hindustan Publishing Corporation	5	15
30.	IRRI	5	15
31.	Marcel Dekker	5	15
32.	National Academy Press	5	15
33.	Oxford University Press	5	15
34.	Princeton Scientific Publishing Co.	5	15
35.	Macmillan Publishing Company	5	15

In the above Table 5.20, it is observed that CSIR Publications ranked top in the rank list contributing 34 numbers of citations followed by ‘Academic Press’ and ‘Botanical Survey of India’ both accounting for 30 numbers of citations each.

5.23. COUNTRY WISE CITATION OF JOURNAL

In the present study, it was observed that researchers used journals citations from India and other countries of the world as shown in the Table 5.21 below:

Table. 5.21 Country Wise Citation of Journal

Sl No.	Name of Country	No. of Citation	Rank	Cumulative No. of Citation	% of Citation	Cumulative percentage No. of Citation
1.	USA	1378	1	1378	17.09	17.09
2.	Netherland	1128	2	2506	13.99	31.08
3.	India	954	3	3460	11.83	42.91
4.	United Kingdom	708	4	4168	8.78	51.69
5.	Germany	688	5	4856	8.53	60.22
6.	Japan	52	6	4908	0.64	60.86
7.	Canada	31	7	4939	0.38	61.25
8.	Kenya	28	8	4967	0.35	61.59
9.	Australia	20	9	4987	0.25	61.84
10.	Switzerland	19	10	5006	0.24	62.08
11.	Slovakia	17	11	5023	0.21	62.29
12.	Brazil	16	12	5039	0.20	62.49
13.	Pakistan	13	13	5052	0.16	62.65
14.	Singapore	12	14	5064	0.15	62.80
15.	Greece	11	15	5075	0.14	62.93

The above Table 5.21 presents the country wise distribution of cited journals in the field of life sciences to identify the most productive countries. It is observed from the table that USA is the leading country contributed 1378 citations accounting for 17.09 % of total journal citations. Netherland has a contribution of 1128 citations accounting for 13.99% ranked as second followed by India with contribution of 954 citations (11.28%). It is observed that USA, Netherland and India are the most dominant countries for production of journals in the field of life sciences.

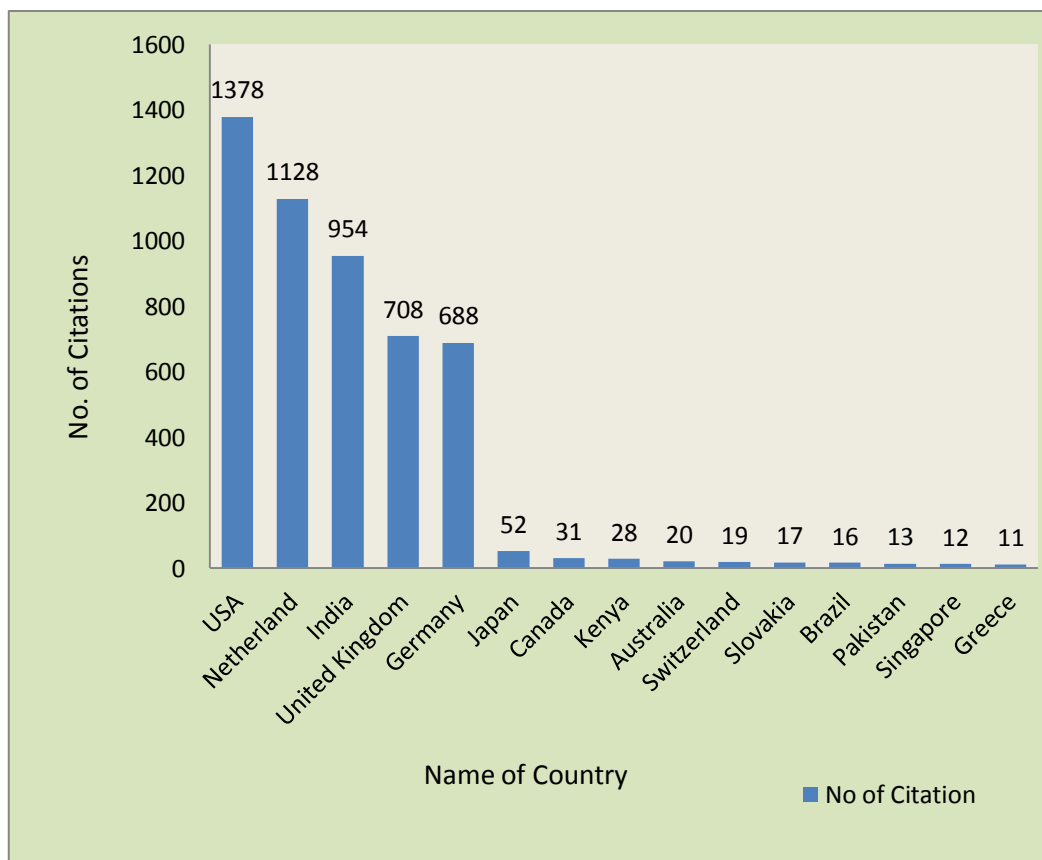


Figure 5.15. Country Wise Citation of Journals

The above Figure 5.15 depicts the contribution of numbers of citations from different countries of the world. United Kingdom and Germany ranked 4th and 5th respectively as it can be revealed from the figure. Greece is in the 15th rank containing only 11 citations.

5.24. COUNTRY WISE CITATION OF BOOKS

In this study, it was revealed that researchers used book citations from India and abroad as shown in the Table 5.22 below:

Table. 5.22 Country Wise Citation of Books

SL No	Name of Country	No of Citations	Rank	Cumulative No. of Citation	% of Citation	Cumulative percentage of Citation
1.	India	368	1	368	38.25	38.25
2.	USA	248	2	616	25.78	64.03
3.	United Kingdom	90	3	706	9.36	73.39
4.	Netherland	24	4	730	2.49	75.88
5.	Philippines	16	5	746	1.66	77.55
6.	Germany	13	6	759	1.35	78.90
7.	France	8	7	767	0.83	79.73
8.	Switzerland	8	7	775	0.83	80.56
9.	Italy	6	8	781	0.62	81.19
10	South Africa	4	9	785	0.42	81.60
11	China	3	10	788	0.31	81.91
12	Australia	2	11	790	0.21	82.12
13	Bangladesh	2	12	792	0.21	82.33
14	Bristol	2	13	794	0.21	82.54
15	Taiwan	2	14	796	0.21	82.74

The above Table 5.22 presents the country wise distribution of cited books in the field of life sciences to identify the most productive countries. It is observed from the table that India is the leading country that contributed 368 citations accounting for 38.25 % of total journal citations. USA has a contribution of 248 citations accounting for 25.78% ranked as second followed by U.K with contribution of 90 citations (9.36%). It is observed that India, USA and UK are the most significant countries from where researcher used the book as a source of knowledge or ideas for their research activities.

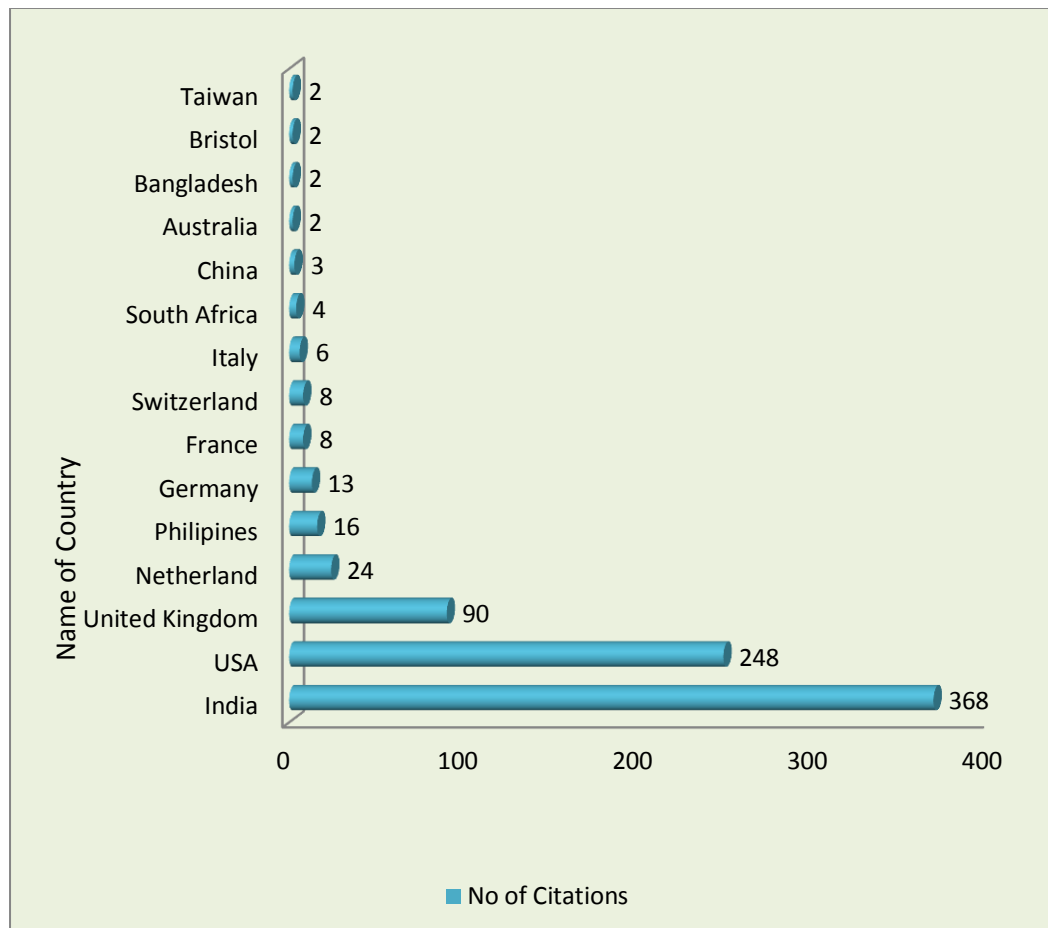


Figure 5.16. Country Wise Citation of Books

The above Figure 5.16 depicts the number of book citations from the different countries of the globe.

2.25. COUNTRY-WISE DISTRIBUTION OF CORE JOURNALS

Geographical distribution of core journals is shown in the Table 5.23. Geographical scattering of frequency of cited literature used to identify the most productive country in a particular subject. In the present study, journals were studied on the basis of their country of publication. Only 30 numbers of journals contributed 25% of the total journal citations. Table 5.23 shows the name of these 30 journals along with their place of publication and numbers of citations. It is observed from this table, that 10 numbers of journals having 679 numbers of journal citations contributed by U.S.A. and rank first, 4 numbers of journals with 450 number citations contributed by Netherland rank second, 7 numbers of journals with 446 numbers of citations contributed by India rank third position. New York contributed one journal with 49 numbers of citations which is least.

Table5.23: Country-wise distribution of core journals

Sl. No.	Rank	Name of the Journal	No. of Citations	Place of Publication
1	1	Mutation Research	287	Netherland
2	2	Plant Physiology	228	U. S.A
3	3	Journal of Economic and Taxonomic Botany	142	India
4	4	Plant and Soil	79	Germany
5	5	Oryza	76	India
6	6	Economic Botany	71	U. S.A
7	6	Physiologia Plantarum	71	U. S.A
8	7	Plant Science	66	Netherland
9	8	Nature	56	U.K.
10	9	Science	55	U. S.A
11	10	Journal of Enthnopharmacol	54	Netherland
12	11	Environment Health Perspect	52	U. S.A
13	12	Bulletin of the Botanical Survey of India	50	India
14	12	Current science	50	India

Sl. No.	Rank	Name of the Journal	No. Of Citations	Place of Publication
15	12	Journal of Experimental Botany	50	U.K.
16	12	Plant Cell Reports	50	Germany
17	13	Experimental Botany	49	U.K.
18	13	Plant Cell Environment	49	New York
19	14	Indian Fern Journal	46	India
20	15	Applied Biochemistry and Microbiology	44	Germany
21	15	The Journal of the Bombay Natural History Society	44	India
22	16	Ethnobotany	43	U. S.A
23	16	Phytochemistry	43	Netherland
24	17	Cancer Reasearch	41	U.S.A
25	17	Carcinogenesis	41	U.K.
26	17	New Phytologist	41	U.S.A
27	18	Journal of Clinical Microbiology	40	U.S.A
28	19	Planta	38	Germany
29	19	Indian Journal of Animal Science	38	India
30	20	Infection and Immunity	37	U.S.A

5.26. HALF-LIFE STUDIES OF CITATIONS

The half life/ median studies is necessary or helpful to identify the active citation which is usually taken upto 50 percent of total citations of cited literature. In the Table 5.24 all the citations are arranged according to their year of publication starting from the year 2012 to 1813 is descending order. The 50% of citation is 5006 out of total 10012 citations which may be seen near the year 1996. Year of publication not mentioned for 30 number of citation included in the year 1812 to 1993.

Table. 5.24 Citation Half-Life

Sl. No.	Year	No of Citation	Cumulative No of Citation(cf)	Percentage of Citations	Cumulative Percentage of Citations
1	2012	18	18	0.18	0.18
2	2011	71	89	0.71	0.89
3	2010	126	215	1.26	2.15
4	2009	219	434	2.19	4.33
5	2008	284	718	2.84	7.17
6	2007	284	1002	2.84	10.01
7	2006	326	1328	3.26	13.26
8	2005	392	1720	3.92	17.18
9	2004	360	2080	3.60	20.78
10	2003	438	2518	4.37	25.15
11	2002	419	2937	4.18	29.33
12	2001	379	3316	3.79	33.12
13	2000	432	3748	4.31	37.44
14	1999	393	4141	3.93	41.36
15	1998	362	4503	3.62	44.98
16	1997	359	4862	3.59	48.56
17	1996	332	5194	3.32	51.88
18	1995	291	5485	2.91	54.78
19	1994	278	5763	2.78	57.56
20	1993	253	6016	0.18	60.09
21	1813-1993	3996	10012	0.18	100.00

5.27. OBSOLESCENCE OF LITERATURE IN LIFE SCIENCE

Obsolescence is the term used to denote the materials which is no longer in use in any discipline. The rate of obsolescence varies with the discipline. Brookes in 1970 stressed that “rate of obsolescence is a function of both the subject literature and of the local usage of that literature”. A much more accurate usage of obsolescence would be in “sampling the actual usage of the literature in local library context.” Line and Sandison in 1974 defined obsolescence as the “decline overtime in validity of information.”

Table 5.25. Obsolescence of Citations

Sl. No.	Time Span	No of Citation	Cumulative No of Citation	Percentage of Citation	Cumulative Percentage of Citation
1	00-10	2518	2518	25.15	25.15
2	11-20	3498	6016	34.94	60.09
3	21-30	2060	8076	20.58	80.66
4	31-40	1058	9134	10.57	91.23
5	41-50	362	9496	3.62	94.85
6	51-60	204	9700	2.04	96.88
7	61-70	87	9787	0.87	97.75
8	71-80	77	9864	0.77	98.52
9	81-90	22	9886	0.22	98.74
10	91+(incl. year of pub. not mentioned)	126	10012	1.26	100.00

In the present study the researcher attempted to identify the rate of obsolescence of literature in the Life Science discipline as shown in Table 5.25 above. The chronological distributions of all the citations are tabulated in the table. The total 10012 citations were arranged according to their year of publications. The citations were distributed in 10 groups according to their age of publication.

The table above shows that age of publications increases (getting old) and the number of citation decreases. It is identified that the researchers in life sciences prefer to cite current citations.

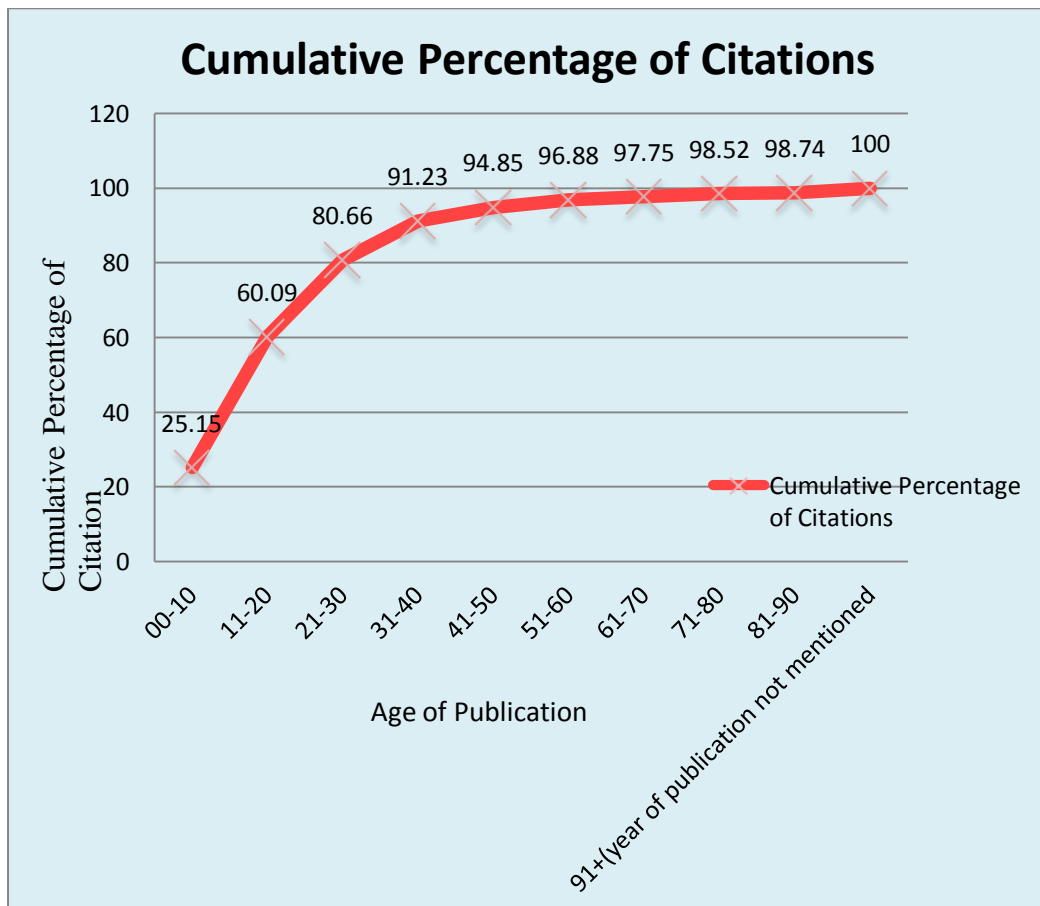


Figure 5.17. Obsolescence of Literatures in Life Sciences

The above Figure 5.17 shows that 8076 (80.66%) of literature were cited by the researchers in life sciences in their doctoral theses was up to 30 years old and 1624 (16.23%) numbers of citations cited by researchers are 31 to 60 years old and a very negligible percentage i.e. 3.11% of citation more than 60 years old.

5.28. CONCLUSION

In this chapter data analysis was done with the citations collected from 40 theses of Life Sciences available in the Central Library, Assam University, Silchar. The bibliographic details were first entered in the MS Access software and then exported to the MS Excell for tabulation and graphical representation. The present study extends the impact of citation analysis by ranking various parameters of bibliographic data for the evaluation of different criteria of acquisition policy. This study reveals that the journals are the most significant source of information for research activity in the field of Life Sciences. The journal entitled 'Mutation research' was found as the highly used journal published from Netherland. The author S. K. Jain was found the most prolific author in the field of Life sciences. The collaborative research pattern in the recent decade seems to be more. It was also observed that the research scholar prefers to use the information source published from foreign countries.