Growth and Development of BSI in Research Publication on Authorship Pattern during 1954 -2012: A Bibliometric Study

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Abstract

The main aim of this study is to develop the institutional repository and led to compare the actual research contribution of Scientists of BSI with the well-known international citation databases like Scopus and Web of Science (WoS) and to understand the Authorship Collaboration and to find out the authorship pattern exists in the corpus and the application of Lotka's Law was carried out. According to this the hypotheses has been framed to fulfill the objectives of this study. Thus, produced data were stored in the MS Excel Sheet and used for the publication analyses after making necessary data normalization. The research period covers from 1954 - 2012 (59 years). Using pivot table module of MS Excel the analysis was conducted and charts were prepared.

Keywords

BSI centers, Lotka's Law, Authorship pattern, Subject wise collaboration work, Center wise collaboration work etc

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INTRODUCTION

Documentation of research works provides the cornerstone for any institutional Repositories. In recent years, bibliometric analysis concentrates on the electronic databases of commercial vendors which were extensively based on the electronic journals. It is acceptable for the knowledge having universal applicability like medicine, biotechnology etc. and to the discipline having vast information. But, the research works like history, floras, exploration of regional plant wealth etc. will have more significance in the concerned geographical region. The bibliographical sources of those works are mostly in the printed form and scattered in the regional journals of internationally acclaimed. As far as systematic botany of India, Botanical Survey of India (BSI) is the pioneer institution having more than 60 years of research experience in the preliminary stage of developing Institutional Repositories. In the typical environment, where there is no predominant full text online database nor citation indexes available for the research work, it is indeed to have a work concentrates on the development of the digital form of the research publications of Botanical Survey of India especially Southern Regional Centre, BSI and extensive bibliometric analysis of the developed database with that of entire research yield of Botanical Survey of India covering all regional Centres irrespective of the limitations aroused out of the available electronic databases. To articulate the goal of assessing the research institutions' performance, it is necessary to analyses the research publications periodically. To enunciate the growth of research institution and its contribution in the field concerned, it is necessary to evaluate using bibliometric tools and its various parameters. This analytical study is to understand the scientific research activities of the institute "Botanical Survey of India" (BSI).

Concept of Bibliometrics

Bibliometric analysis is the quantitative assessment of the publications. In addition to the established techniques, the Scientometrics study also considers the other impact factors on the publications according to Braun et al. (1987)[1]

Centers of Botanical Survey of India

Botanical Survey of India is a research institution of Government of India working under the Ministry of Environment, Forests and Climate Change. The

headquarters of the organization is in Kolkata with a publication division of bringing out the research publications of the institute. BSI has 10 well established Centres, each of those Centre has their own jurisdiction to cover the entire territory of the country. The Head Quarters of BSI is at Kolkata having the country's largest herbarium called Central National Herbarium (BSICNH-HQ), which covers West Bengal, Bihar, Orissa and Jharkhand area of India.

Andaman and Nicobar regional Centre cover the Islands (BSIANRC), Arid Zone regional Centre covers the stated Rajasthan and Gujarat (BSIARID). The Arunachal Pradesh Regional Centre (BSIAPRC) covers the Arunachal Pradesh. The jurisdiction that comes under the Central Regional Centre (BSICRC) is Madhya Pradesh, Chattisgarh and Uttar Pradesh. Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura are covered by Eastern Regional Centre (BSIERC). The Northern Regional Centre (BSINRC) covers the Himachal Pradesh, Uttaranchal, Jammu & Kashmir, Punjab, Haryana, Chandigarh, and Delhi. The territory of Sikkim Himalayan Regional Centre (BSISHRC) covers Sikkim, Darjeeling Gorkha Hill Council. The jurisdiction coming under the Southern Regional Centre (BSISRC) is Tamil Nadu, Kerala, erstwhile Andhra Pradesh, Lakshadweep and Minicoy Islands. The states Maharashtra, Goa, Karnataka, Dadra, Nagar Haveli and Daman Diu were covered by Western Regional Centre (BSIWRC).

Scope of this Study

To develop the institutional repository and led to compare the actual research publications of the institution under study with the well-known international citation databases like Scopus and Web of Science (WoS). With this intention, the following scopes were attained.

- To develop a database constituting all forms of published research works say proceedings, books, chapters of the edited book, research articles etc., of BSI.
- To assess the research performance of the BSI, using the Bibliometric analysis on the database developed.
- It helps to throw light on the strength and weakness of the research activity of the institution under concern.

Objectives

The objectives of this study are:

- To arrive at the total contribution of Scientists of BSI
- To find out the authorship pattern exists in the corpus and the application of Lotka's Law was carried out.
- To understand the Authorship Collaboration

Hypotheses

The study has been conducted with the following hypotheses:

1. Multiple authorship patterns are dominating the research contribution of BSI.
2. There is a relationship between the number of research publications and the number of research contributors at BSI.
3. There is a relationship between the large articles production and the research career longevity of the BSI Scientists.
4. There is no significant difference between the distribution of publications by BSI researchers/authors and the theoretical prediction of Lotka (1926)[2] about the author productivity.

Methodology

This research work was purely depended on manual method of collecting data for pursuing the meticulous bibliometric analysis. As the works on Indian systematic botany developed by BSI were not comprehensively covered by any of the available bibliographical databases, it necessitates relying on the annual reports, project reports, progress reports etc developed by the institute for the data collection. Thus, produced data were stored in the MS Excel Sheet and used for the publication analyses after making necessary data normalization. The research period covers from 1954 - 2012 (59 years). Using pivot table module of MS Excel the analysis was conducted and charts were prepared.

Data Analysis

The authorship pattern was studied on block year wise, Centre wise, subject wise distribution. The collaborative pattern existed in the corpus was discussed with various other variables. Further, correlation coefficient prevailed among the research career longevity of BSI researchers with that of contribution was revealed. The application of Lotka's Law was examined.

[2]

- Application of Lotka's Law using the improvement and formula unveiled by Pao (1986)[3].
- Application of Bradford's law to find the core journal zones using the Egghe's (1990)[4] improved method.

Study on Collaborative Works

This part provides a detailed account of collaboration existed between the BSI researchers with that of other institutions since 1954. It has dealt with the block year wise distribution of collaborative works, BSI Centre wise collaboration with other Centres, rank list of the collaborative Centres which yield more research works with BSI, Authorship Position of the BSI Centres in the collaborative research works and about the subject wise analyses of the collaborative works of BSI with other research institute.

Block Year Wise Distribution of Collaborative Works

Table No.1 states that total of 1241 research contributions were out of collaborative work with other research Centres by BSI Scientists. The least number of collaboration was received during 1954-1960 with 11 entries.

Table 1: Block Year Wise Distribution of Collaborative Works

S. No.	Year Wise	Total No. of Research Contributions	No. of Collaborative Contributions	Percentage of Collaborative Works
1	1954 - 1960	161	11	0.9
2	1961 - 1970	1030	81	6.53
3	1971 - 1980	1157	177	14.26
4	1981 - 1990	1736	213	17.16
5	1991 - 2000	1298	198	15.95
6	2001 - 2012	1992	561	45.2
	Total	7374	1241	100

n the last block 2000 – 2012, the collaboration with other Centres has been increased and contributed with 561 entries (45.2%). However, when compared to the total contribution of the period 2001-2012 (1992 records), the collaborative work has gained 28% as shown in the table 1.

Centre Wise Distribution of Collaborative Works

The Table No. 2 provides the details about the research Centres that had joint authorship with that of BSI researchers. Each BSI Centre has been considered in the Table No. 2 with that of other institute and their contribution in the collaborative work. BSIANRC had a maximum of 22 contributions with Government College, Port Blair which was followed by Central Agricultural Research Institute, Port Blair (13).Central Agricultural University, Pasighat and North Eastern Regional Institute of Science and Technology have each produced 9 publications with the Centre BSIAPRC. Central Arid Zone Research Institute, Jodhpur and Maharshi Dayanand University (MDS), Ajmer yielded maximum of 6 and 4 research collaborations respectively with BSI Arid Zone.

Being the headquarters attached with it, The BSICNH had good opportunity to have extensive collaboration with other research institution and generated 409 records. It has to be mentioned that the BSICNH-HQ was having the direct collaboration with the national bodies of other countries in the world and also having different research units and facilities which were lacking in the regional Centres. Royal Botanic Garden, Kew (31) and University of Calcutta, Kolkata (28) have contributed maximum joint publications with BSICNH.

Table 2: Centre wise distribution of Collaborative Works

Centre	Collaboration Centre	No. of Contribution
BSIANRC	Calcutta Medical College, Kolkata	1
	Calicut University, Kerala	5
	Central Agricultural Research Institute, Port Blair	13
	Central Drug Research Unit, Lucknow	7
	Central Plantation Crops Research	4
	Central Soil Salinity Research Institute, Karnal	1
	Government College, Port Blair	22
	Kumaun University	1
	Nesamony Memorial Chistian College, Kanyakumari	9
	Royal Botanic Garden, Edinburgh	3
	SACON	1
	Silviculture Division, Forest Department, Portblair	7
	Thiagarajar College, Madurai	1
	University of Allahabad	2
	VisvaBharathi, Santiniketan	2
	Total	**79**
BSIAPRC	BarasatGovt.College, Barasat, West Bengal	1
	Central Agricultural University, Pasighat	9
	DoyingGumin College, Pasighat	3
	NBRI, Lucknow	5
	NERIST, Itanagar	9
	NISCAIR, New Delhi	2
	Rajiv Gandhi University, Itanagar	4
	Royal Botanic Garden, Edinburgh	3
	RRI, Itanagar	3
	SFRI, Itanagar	4
	St.Xavier's College Palayamkottai	7
	University of Kalyani	8
	Uthal University, Orissa	4
	Total	**62**
BSIARID	BNHS, Bharatpur	1
	Central Arid Zone Research Institute, Jodhpur	6
	Iowa State University, USA	2
	JNV University, Jodhpur	1
	Malabar Botanic Garden, Calicut	1
	MDS University, Ajmer	4
	National Remote Sensing Centre, Hyderabad	1
	NBRI	3
	Total	**19**
BSICNH	Ayurvedic Medical College and Hospital, Kolkata	3
	Baba SahebAmbedkar University	4
	Bose Institute, Kolkata	13
	Central Forensic Institute, Kolkata	12
	FRI Colleges, Dehra Dun	19
	G B Pant Institute, Uttaranchal	7
	G.C.Bose Biological Research Unit, Kolkata	21
	GangadharMeher College, Sambalpur	2
	Geological Survey of India, Kolkata	2
	Govt. P.G.College, West Bengal	14
	Indian Institute of Remote Sensing, Dehra Dun	8
	Indian Statistical Institute, Kolkata	3
	Koarov Botanical Institute, Russia	5
	Larambha College, Sambalpur	3
	M S Swaminathan Research Foundation, Wayanad	10
	Majalgaon Arts, Science & Commerce College, Maharashtra	4
	Midnapore College	2
	National Chemical Laboratory, Pune	1
	NBRI	27
	Nicholas Private Limited	16
	North Bengal University	14
	North Carolina State University, USA	4
	North Eastern Council, Shillong	1
	PG Institute of Basic Medical Sciences, Kolkata	18
	Plant Molecular & Cellular Genetics, Kolkata	9
	Presidency College, Kolkata	22
	Quest Institute of Life Science, Mumbai	2
	Regional Research Centre, Vijayawada	2
	ReservaEcologica do IBGE, Brazil	2
	Rijksherbarium, Ledien	6
	Rishi Bankim Chandra College, Naihati	3
	Royal Botanic Garden, Kew	31
	S N Pradhan Centre for Neuro Sciences, Kolkata	4
	Serampore College, Kolkata	12
	Shivaji University	3
	Sri Krishna Deva University	3
	ST.Xavier's College, Bombay	2
	T D P G College (Purvanchal University)Jaunpur	1
	The Field Museum, Chicago	4
	TM Bhagalpur University	2
	University College of Agriculture, Kolkata	11
	University College of Science, Kolkata	12
	University of Agricultural Sciences, Bangalore	7

	University of Calcutta, Kolkata	28
	University of Kalyani	23
	US Environmental Protection Agency, Oregon	2
	Vidyasagar University	5
	Total	**409**
BSICRC	ABL Herbarium, Netherlands	1
	Banaras Hindu University, Varanasi	27
	Botany Department, A P S University, Rewa	1
	Botany Dept., D N College, Meerut	3
	Burdwan University, West Bengal	1
	Chief Conservator of Forest, Rewa	1
	DAV College	33
	Deendayal Research Institute, Madhya Pradesh	3
	Divisional Forest Officer, Mizoram	1
	Dr.H.S. Gaur Vishwavidhyalaya, Sagar	1
	Forest Research and Extension Circle, Madhya Pradesh	1
	Gauhati University	8
	Gorakhpur University, Gorakhpur	2
	IARI, New Delhi	1
	Institute of Ethnobiology, Jiwaji University, Gwalior	1
	NBRI, Lucknow	19
	Royal Botanic Gardens, Kew	1
	T D College, Jaunpur	1
	The Field Museum, Chicago	1
	University of Allahabad	6
	VishwavidyalayaSagar	1
	Total	**114**
BSIERC	Aaranyak -Guwahati	12
	Assam University, Silchar	8
	Australian National University	2
	Birla Sahni Institute	3
	Cacharr Degree College, Assam	8
	Divisional Forest Officer, Mizoram	13
	Gauhati University. Guwahati, Assam	22
	Glendoick, Scotland	1
	Government PG College, Madhya Pradesh	2
	Jai Narain Degree College, Lucknow	3
	Meghalaya Forest Department	9
	Nagaland University	7
	North Eastern Hill University, Shillong	6
	Ranchi University	18
	Royal Botanic Garden, Kew	3
	St.Edmund's College, Shillong	6
	Total	**123**
BSINRC	Agharkar Research Institute, pune	14
	Argentina University	3
	BahugunaGarhwal University, Srinagar	4
	Birla College, Rajasthan	7
	Botanical Research Institute of Texas, USA	2
	Central Drug Research Institute, Lucknow	32
	CIMAP, Lucknow	22
	Constituent College, Almora	1
	DAV College, Dehra Dun	13
	FRI Colleges, Dehra Dun	21
	G.B. Pant Institute, Uttarakhand	8
	Garhwal University, Srinagar	6
	Ghent University, Ghent	9
	Ham Richmond Survey, UK	1
	Himachal Pradesh University	3
	Institute of Ecology, Mexico	1
	Kumaon University, Uttaranchal	1
	Lucknow University, Lucknow	20
	North-Eastern Hill University, Medziphema	1
	Pet Clinic, Dehra Dun	12
	Publications and Information Directorate, New Delhi	3
	Punjabi University, Patiala	1
	Rai University, Dehra Dun	8
	Royal Botanic Garden, Kew	4
	St.Edmund's College, Shillong	2
	University of Hyderabad, Hyderabad	1
	University of Wyoming, USA	1
	Vidyasagar University, Midnapore	3
	Total	**204**
BSISHRC	Fungal Biodiversity Centre, Netherland	1
	G B Pant Institute	2
	Gauhati University, Assam	7
	Govt. P.G.College, West Bengal	3
	Ham Richmond Survey, Uttaranchal	8
	Museum National d'HistoireNaturelle, France	1
	Natural History Museum, UK	1
	NBRI, Lucknow	1
	NEH University	1
	P G College, Pithoragarh	3
	Sikkim State Biodiversity Board	10
	UdaiPratap Autonomous College, Varanasi	1
	University of Ghent, Belgium	5
	University of Kalyani, Kolkata	3
	Total	**47**
BSISRC	BharathidasanUniversity,Tiruchirapalli	3
	Bharathiyar University, Coimbatore	3
	Biodiversity Institute of Ontario Herbarium, University of Guelph	3
	Botany Department, St. John's College, Tirunelveli	8
	CIMAP, Lucknow	4

	Department of Botany, P.S.G.R. Krishnammal Coll. for Women, Coimbatore, Tamil Nadu, India	6
	Department of Botany, University of Rhode Island, Kingston, RI 02881, United States	3
	Gorakhpur University, Gorakhpur	2
	Madras Christian College, Chennai	7
	National College, Tiruchy	8
	Post Graduate Department of Plant Science, Avvaiyar Government College for Women	2
	Salim Ali Centre for Ornithology, Coimbatore	6
	School of Biological and Conservation Sciences, University of KwaZulu-Natal, Durban, South Africa	3
	Scott Christian College, Nagercoil	4
	St.Xaviers Colleges, Palayamkotai	9
	TBGRI	5
	V.O.Chidambaram College, Tuticorin	6
	Total	**82**
BSIWRC	Andhra University, Waltair	1
	Auroville Herbarium	5
	B J S College	3
	BhojVishwavidhyalaya, Madhya Pradesh	22
	Central Drug Research Institute, Lucknow	5
	FRLHT, Bangalore	9
	IISc, Bangalore	3
	JamiaHamdard, New Delhi	2
	M.P.Private University Regulatory Commission, Bhopal	2
	Madras Christian College, Chennai	6
	Naroji Godrej Centre for Plant Research, Maharashtra	1
	National Chemical Laboratory, Pune	9
	NSS College, Kotayam	1
	PVP College Pravaranagar, Ahmednagar	1
	Rijksherbarium, Leiden	1
	Shri DyaneshwarMahavidyalaya, Ahmednagar	2
	Sri Krishna Deva University	1
	Sri Parashrambhau College, Pune	7
	St.Xaviers Colleges, Palayamkotai	4
	Survey of Medicinal Plants & Collection Unit, Ooty	1
	T C College, Pune	1
	University of Konstanz, Germany	1
	University of Kalyani	1
	University of Pune	13
	Total	**102**

BSICRC have unveiled 33 research publications with DAV College, Kanpur and 27 with Banaras Hindu University, Varanasi. BSIERC had a maximum collaboration with Guwahati University, Guwahati (22) and Ranchi University (18). Next to headquarters, BSINRC has produced 204 publications out of collaborative works with highest from Central Drug Research Institute (32) and Central Institute of Medicinal and Aromatic Plant, Lucknow (22). BSISHRC has generated only 47 publications on collaboration basis with 10 from Sikkim State Biodiversity Board and 8 from Ham Richmond Survey, Uttaranchal. St. Xaviers Colleges, Palayamkottai (9), St. John's College, Tirunelveli (8) and National College, Trichy (8) had brought out research publications along with BSISRC. Bhoj Vishwa Vidhyalaya, Madhya Pradesh (22) and University of Pune (13) were the leading collaborative research institutes of BSIWRC. Subject Wise Distribution of Collaborative Works

Table 3
Subject Wise Distribution of Collaborative Works

New Plant Discoveries (199), Phytogeography (175), Plant Revisionary studies (139) have been placed in the first three positions out of the collaborative research works as shown in the Table No. 3. The least contribution was observed in the sub- field Palynology with 0.6%. But as far as total number of pages generated out of collaborative works concerned the least percentage was obtained by Nomenclatural notes with 64 pages and 1.2%.

Authorship Pattern

The contribution of BSI has been analyzed in terms of authorship pattern that constitutes the Co-authorship pattern, Degree of Collaboration, Block Year wise authorship pattern, Centre wise and subject wise authorship pattern. Author capacity on research contribution and also in terms of pages of production were also been dealt. Prolific Authors based on the parameters of author capacity, number of research contributions, authorship position in the journal article published, career longevity and its relationship towards the number of research articles published and the application of Lotka's law of authorship productivity in the BSI research contribution were discussed in detail in this second major part of this data analysis and interpretation chapter.

Co-Authorship Pattern

The multiple authorship work dominates the research production of BSI which was evidently shown in the Table No.4. Figure 4 enunciated that single authorship pattern of research contribution have contributed with 2676 articles (36.29 %) while double authorship pattern had received with 3387 entries (45.93 %) which was followed with 991 articles (13.44%) by the triple authorship pattern.

Table 4 : Co-Authorship Pattern of BSI

S.No.	Authorship Pattern	Number of Research Contribution	Percentage
1	Single	2676	36.29
2	Double	3387	45.93
3	Triple	991	13.44
4	Quadruple	230	3.12
5	Pentuple	48	0.65
6	Hextuple	13	0.18
7	More than Hextuple	29	0.39
	Total	**7374**	**100**

S.No.	Year	Total No. of Contribution	No. of Collaboration	%	No. of Pages	%
1	General Studies	285	23	1.9	222	4.2
2	Cryptogamic Botany	606	106	8.5	460	8.8
3	Economic Botany	376	73	5.9	428	8.2
4	Ethno botany	389	71	5.7	448	8.5
5	Floristic Studies	865	96	7.7	794	15
6	New Plant Discovery	812	199	16	503	9.6
7	Nomenclatural Notes	253	33	2.7	64	1.2
8	Palynology	58	7	0.6	69	1.3
9	Phytochemistry	165	45	3.6	79	1.5
10	Phytogeography	1048	175	14.1	320	6.1
11	Plant Conservation	835	124	9.99	431	8.2
12	Plant Genetical Notes	148	30	2.41	84	1.6
13	Revisionary Studies	832	139	11.2	1055	20
14	Taxonomical Notes	702	120	9.7	294	5.6
	Total	7374	1241	100	5251	100

Degree of Collaboration (Dc) Amongst Co-Authorship Pattern

The degree of collaboration formula which was specified by Subramanyam (1983) has been employed below to reveal the nature of co-authorship pattern that dominates the data of this study.

C = Nm / Nm + Ns

Where C = extent of collaboration; Ns = number of single authored papers; Nm = number of multi authored papers.

Thus, the percentage of collaboration can be arrived at by applying the formula

$$C = \frac{N_m}{N_m + N_s X\ 100}$$

$$C = \frac{4698}{4698 + 2676\ X\ 100}$$

The co-authored works occupied with 63.71% while single authorship pattern has received 36.29%.

Hypothesis 1 has been proved valid and it was observed that 4698 records (63.7%) were produced out of multi authored works. From the corpus it is evident that multiple authorship patterns are dominating.

Block Year Wise Authorship Pattern

The trend of the authorship pattern reveals that during the initial two decades the single authorship pattern was dominating. The single authorship has received 116 research contributions out of 161 total contribution of BSI during 1954 -1960. In 1961-1970, single authorship pattern has occupied with 616 records (59.8%) out of total records of 1030. It has been observed from the analysis that after 1971 the trend of multi authored works was prevailing among the Scientists of BSI.

Table 5: Block Year Wise Authorship Pattern

S.No.	Year	Authorship Pattern							No of Contributions
		Single	Double	Trible	Quadruple	Pen tuple	Hex tuple	More than Hex tuple	
1	1954-1960	116	36	8	0	0	0	1	161
2	1961-1970	616	375	32	5	1	0	1	1030
3	1971-1980	479	520	119	29	5	1	4	1157
4	1981-1990	578	917	215	19	4	1	2	1736
5	1991-2000	425	646	189	25	5	2	6	1298
6	2001-2012	462	893	428	152	33	9	15	1992
	Total	**2676**	**3387**	**991**	**230**	**48**	**13**	**29**	**7374**

Centre Wise Authorship Pattern

In the Centre wise authorship pattern, BSICNH-HQ has obtained 1264 single authorship which was followed by BSISRC 286 single authorship research contributions. BSINRC has received 253 single authorship records and possessed third place in the contribution of single authorship pattern by the BSI Centres.

Table 6: Centre wise Authorship Pattern

S.No.	Centre	Authorship Pattern							Total
		Single	Double	Trible	Quad ruple	Pen tuple	Hex tuple	More than Hex tuple	
1	BSIANRC	124	183	56	16	4	0	0	383
2	BSIAPRC	48	75	26	6	1	1	0	157
3	BSIARID	60	86	13	6	2	1	0	168
4	BSICNH-HQ	1264	1219	310	53	13	5	11	2875
5	BSICRC	245	316	82	25	2	1	0	671
6	BSIERC	160	229	73	34	11	3	4	514
7	BSINRC	253	306	93	17	2	1	1	673
8	BSISHRC	48	70	26	4	0	0	0	148
9	BSISRC	286	622	216	35	6	0	6	1171
10	BSIWRC	188	281	96	34	7	1	2	609
11	All Centre	0	0	0	0	0	0	5	5
Total		2676	3387	991	230	48	13	29	7374

Subject Wise Authorship Pattern

The subject sub-fields plant revisionary studies (374), phytogeography (329) and floristic studies (310) have occupied first three positions in having single authorship pattern, while palynology sub-field (29) has received least number of single authorship pattern as shown in the Table No. 7. As far as multiple authorship pattern concern, the phytogeography (719), new plant discovery (610) and floristic studies (555) were having more research contributions with two and more than two authors.

Table 7: Subject wise Authorship Pattern

S.No.	Subject Sub-fields	Authorship Pattern							Total
		Single	Double	Trible	Quad ruple	Pen tuple	Hex tuple	More than Hextuple	
1	General Studies	143	102	29	9	0	0	2	285
2	Cryptogamic Botany	206	277	100	19	3	0	1	606
3	Economic Botany	144	155	61	10	4	0	2	376
4	Ethno botany	121	164	79	15	6	3	1	389
5	Floristic Studies	310	377	123	36	8	1	10	865
6	New Plant Discovery	202	467	112	24	3	2	2	812
7	Nomenclatural Notes	129	110	11	2	1	0	0	253
8	Palynology	29	15	10	4	0	0	0	58
9	Phytochemistry	69	57	20	11	4	3	1	165
10	Phytogeography	329	512	155	48	2	0	2	1048
11	Plant Conservation	300	373	121	23	12	3	3	835
12	Plant Genetical Notes	63	54	17	7	2	0	5	148
13	Revisionary Studies	374	373	71	12	2	0	0	832
14	Taxonomical Notes	257	351	82	10	1	1	0	702
	Total	2676	3387	991	230	48	13	29	7374

Findings and Suggestions

A compared to the total research publication of the period 2001-2012 (1992 records), the collaborative work has obtained 28 percentages. It is a good sign and helps to overcome the problem of lacking infrastructure by resource sharing among the researchers of other Centres.It was observed that BSICNH has been in direct collaboration with national institutions of other countries in the world and produced 409 records of collaborative works. The second position in generating collaborative works was occupied by BSINRC with 204 publications.

The head quarter of BSI has generated more number of research publications with single authorship pattern when compared to double authorship pattern. During the initial two decades the single authorship pattern was dominating, after 1971 the trend has changed to multi authored works among the Scientists of BSI as shown in Table No. 5. The highest single authorship pattern was received by the sub-field Plant Revisionary Studies with 374 records which was followed by Phytogeography with 329 records. To the extent 1307 of BSI authors have contributed the research publications under study. There exists a strong positive Correlation between the number of contributors and the number of research contributions. The moderate positive correlation existed between the author's career tenure and the research article publication was proved using Pearson's Coefficient Correlation. Based on the dataset the application of Lotka's Law was scrutinized. It has been revealed that the BSI's author productivity has not followed the pattern as stated in Lotka's law. It is evident from the section degree of collaboration that multiple authorship pattern has dominated the corpus and thus the Hypothesis 1 has been proved valid.There exists as strong positive correlation that the increase of number of contributors will have positive effect on the number of contribution and the Hypothesis 2 was proved valid.There exists a moderate relationship between the number of research articles produced and the career longevity of the BSI Scientists.

The Hypothesis 4 of there is no significant difference between the distribution of publications by BSI researchers/authors and the Lotka's theoretical prediction (1926) about the author productivity was rejected and proved nullified.

Conclusion

This study has highlighted on various aspects of the research activities of BSI. The growth trend of the publication, production of the institute on various sub-fields, preferred journals for the communication and highly cited research articles of BSI were discussed in this study. This research is a small way to probe the spheres of scientific communication in the field of Indian plant taxonomy carried out by the

BSI. The research of this kind is a common library science investigative technique used to determine the information dissemination pattern of any institute. In this aspect, this study will have immense effect in strengthening the research activities of the concerned institute to serve society.

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