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SCIENTOMETRIC MAPPING OF DEFENCE LIFE SCIENCE JOURNAL

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ABSTRACT

This paper analyzes scientometric mapping of 178 articles which was published in the Defence Life Science Journal. 14 issues from 4 volumes during 2016-2019 have been considered for the current study. To analysis the publication year of the articles to know authorship pattern to identify how many single and multiple author contribute to know how many pages in maximum articles to discuss top 10 cited articles to identify author productivity degreeof collaboration; collaboration index: all these are to mainly discussed in the research. This study reveals that out of 178 publications 5(2.8%) paper contributed by single author and rest of articles 173(97.2%) papers contributed from multiple authored.

Keywords: Scientometric research, Defence Life Science Journal, Authorship pattern, Productivity of Authors, Top Citation review.

INTRODUCTION

Scientometric study is used to measure and analyze scientific literature. Nalimov and Mulchenko (1969) introduced the word scientometric for characterizing terms like structure, growth, inter-relationship, and productivity in science studies (Correia et al., 2018). Scientometric can measure and analyze science, technology and innovation (Ahmadi, 2018) according to De Solla Price (2000), scientometrics is the application of mathematical and statistical methods of scientific literature (Tunga, 2014).

The present study investigates Defence Life Science Journal (DLSJ) as a source journal on indicator like authorship pattern, degree of collaboration, top 15 most cited paper etc. DLSJ is being published by Defence Scientific Information & Documentation Centre (DESIDOC), DRDO. Defence Life Science Journal is a quarterly publication which follows double-blind peer-review process (Defence Life Science Journal's Page on Publons). This journal provides open access to its content to the public. First issue of Defence Life

Science Journal was published in the June 2016 as Vol. 1, No. 1**.** (About context/ Defence Life Science Journal).

LITERATURE REVIEW

K.G. & V., (2020) examine 25,132 biochemistry research contributed by Indian scientists during 2004 to 2013.Data were collected from Web of Science. In this research author reported that study on biochemistry was growing continuously and overall annual rate of growth was 36.84 %. The 97.46 % papers were composed by multiple authors. Co- authorship index was commonly expanding, and it changed through 93 to 105 during the measure of research. Journal articles contribute 89.43 percent of the entire output followed by reviews (7.14 %). Indian researchers do analysis work together with the researchers of USA (2.49 %). The geographical circulation reveals that Tamil Nadu, Uttar Pradesh and Delhi lead the listing. The research also indicates that, C. Abdul Jaleel (58) and L. Pai (37) are the most elevated positioned authors inside the field.

Sudarsana & Baba, (2019) carried out scientometric analysis on global nuclear fuel research during 2000 to 2017. Author uses various types of scientometric indicators such as: prolific authors, collaboration networks of authors, productive organization involved and the citation pattern. A total 402 bibliographic records from online Science fundamental collection database were the knowledge source and CiteSpace and VOSviewer software analyzed the data. As half no. of publications (4166; 56%) were published from 2011-2017, this year has best number of publications (679; 9%).

Galyani-Moghaddam, (2019) conducted a study on visualization of collaboration in psychology during the period 1970 to 2016. Author data collected from Web of Science and social network analysis techniques, a network of co-authorship for psychology papers published by Iranian authors have been analyzed. Total 2,204 records were retrieved from Web of Science; single authored papers were 18.11% rest 81.88% papers from multi-authors. The collaboration network has 63% density, which is over the average and shows that the network is moderately interconnected, with researchers cooperating on joint publications.

N. & CA., (2018) conduct study of Environmental Management research output between 1989–2014 and investigation that a total 61877 research publication was published and after evaluate it analyzed that 2014, the highest number of research papers were published, and Huang GH was the most popular author with 213 contribution, followed by Change NB with 83 contributions, 0.19 is relative rate of growth and 0.85 degree of collaboration which is maximum within the year 2008 and 2009.

OBJECTIVES OF THE STUDY

The main intention of this study is:

1. To examine the growth of publication output of Defence Life Science Journal.

2. To investigate the authors productivity and authorship pattern of the articles
3. To recognize Degree of collaboration, Co-authorship and Collaboration Index.
4. To construct and analyze the co-authorship network for research output of Defence Life Science Journal
5. To identify the average page length of articles

METHODOLOGY

For the purpose of the present study, Defence Life Science Journal has been selected as the source journal, fourteen issues of four volumes from 2016 to 2019 (vol.1 to 4) are considered. The relevant 178 papers have been downloaded from the DRDO websites and entered in Microsoft Excel sheet which identified variables like authorship pattern, distribution of articles, degree of collaboration, collaboration Index, author productivity, number of pages etc. The relevant data was stored, tabulated and assimilated in a logical order for interpretation and analysis purpose.

RESULTS AND DISCUSSION

Year wise distribution of articles

Table1: Year wise distribution of articles

Year	Vol. No.	No. of issues	No. of contribution	Percentage
2016	1	2	23	12.92
2017	2	4	61	34.26
2018	3	4	58	32.58
2019	4	4	36	20.22
Total		**14**	**178**	**100**

Figure 1: Year wise distribution of articles

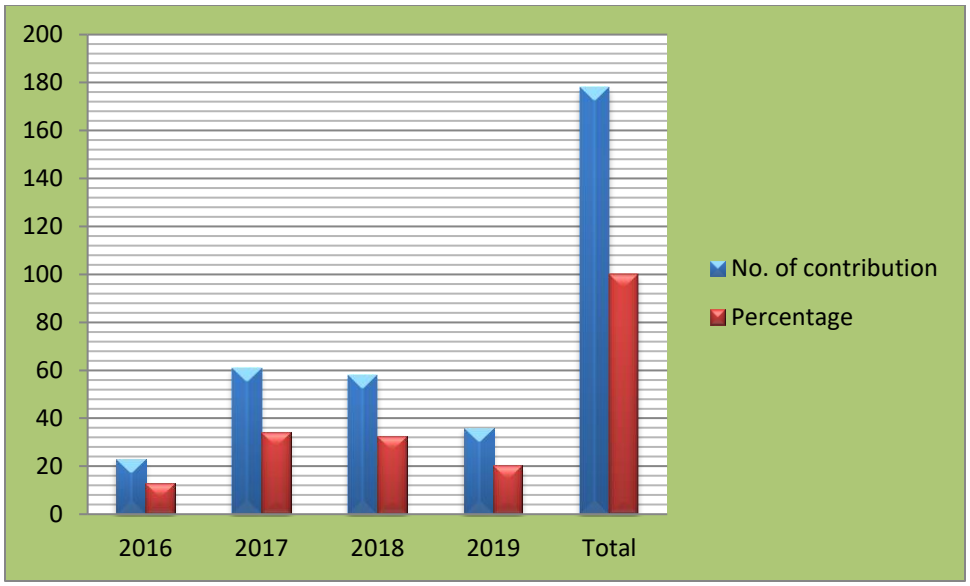


Table 1 and figure 1 display chronological distribution of publication. A total of 178 articles were published during the period 2016-2019, in which the highest number of articles 61 (34.26 %) were published in 2017 followed by 58 (32.58%) is 2018, 36 (20.22%) is 2019 and 23 (12.92%) is 2016. The range of articles distributed every year during the period of the study was between 23 and 61.

Author Productivity of Defence Life Science Journal

Table 2: Author Productivity of Defence Life Science Journal

Year	Volume No.	No. of Authors	No. of Publication	AAPP	APA
2016	1	80	23	3.47	0.28
2017	2	241	61	3.95	0.25
2018	3	254	58	4.37	0.22
2019	4	151	36	4.19	0.23
Total		**726**	**178**	**4.07**	**0.24**

Table 2 shows author productivity of Defence Life Science Journal and it shows that total average of authors per paper is 4.07 for the 178 articles. The average productivity per author (AAPP) is 0.24 and Articles per authors (APA) was 0.24 during the time of research. Author productivity is determining with the below formula:

AAPP = Number of authors ÷ Number of papers

APA = Number of papers ÷Number of authors

Authorship pattern

Table 3: Authorship pattern

Year	Single Author	Double Authors	Three Authors	Four Authors	Five Authors	Six Authors	More than Six authors	No. of Publication
2016	0	9	3	5	3	3	0	23
2017	1	11	13	18	7	5	6	61
2018	4	13	10	10	4	6	11	58
2019	0	7	12	1	7	5	4	36
Total	5	40	39	34	20	19	21	178
Percentage	**2.8**	**22.47**	**21.91**	**19.1**	**11.23**	**10.67**	**11.79**	**100**

Figure 2: Authorship pattern

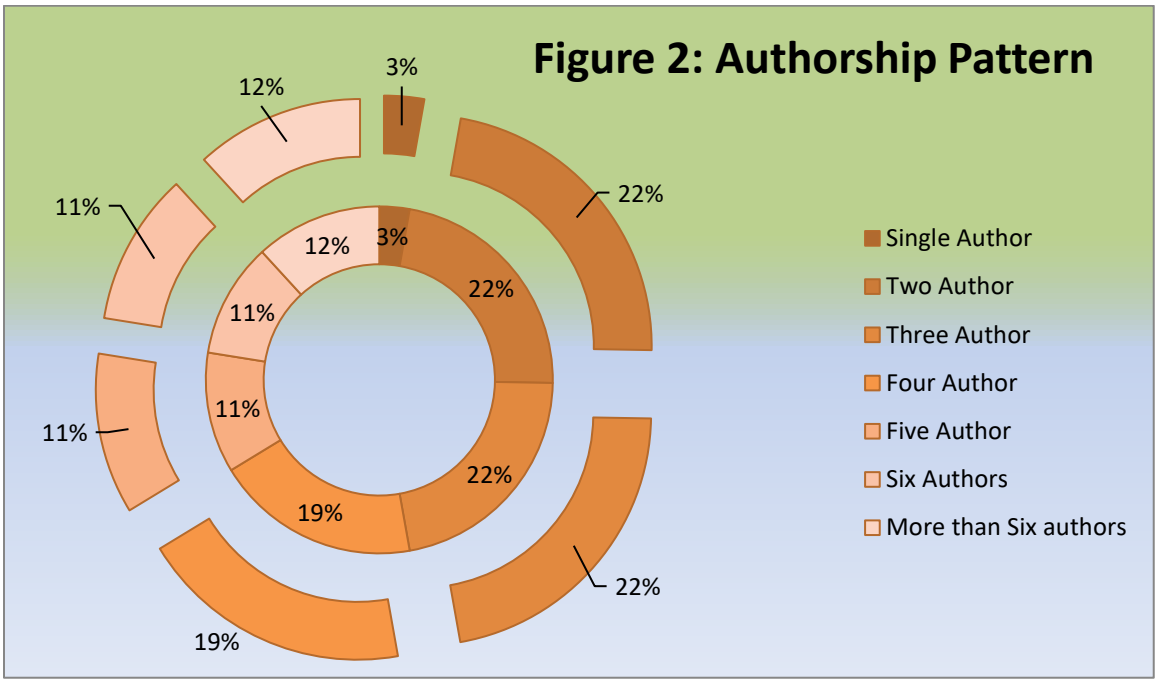


Table 3 and figure 2 describe the authorship pattern. During the research a total 178 articles are found, in which there are 5 (2.8%) single author articles, 40 (22.47%) two authors articles, 21 (21.91%) three authors articles, 34 (19.1%) four authors articles, 20 (11.23%) five authors articles, 19 (10.67%) six authors and 21 (11.79%) more than five authors articles. In the year 2017 maximum number of authors (61) published their

articles. This study reveals that single author contributions are 2.8%, whereas 97.19% are multiple authors contribution. It shows that article publication trend was towards the multiple authors' approach.

Degree of Collaboration

Table 4: Degree of Collaboration

Year	Single Author Publications (Ns)	Multiple Author Publications (Nm)	Nm+Ns	Degree of Collaboration DC=Nm/(Nm+Ns)
2016	0	23	23	0
2017	4	60	61	0.98
2018	1	54	58	0.93
2019	0	36	36	0
Total	5	173	178	**0.97**

Table 4 demonstrates DC of papers published in the journal of Defence Life Science during the research period and its shows that single author contributed only 5 articles out of 178 articles and rest of 173 articles are contributed by multiple authors which shows that authors published their articles with collaboration. In the year 2016 and 2019 Degree of collaboration was zero and the overall Degree of collaboration during the research was 0.97.

To calculate degree of collaboration, the formula recommended by (Subramanyam, 1983)**.**

$$DC = \frac{Nm}{Nm+Ns}$$

DC = degree of collaboration

Nm = number of multi-authored research articles

Ns =number of single authored research articles

Collaborative Index

It is a mean number of authors per joint paper (Velmurugan &Radhakrishan, 2016). To calculated collaborative Index, the following formula has been used:

$$CI = \frac{\text{Total no. of authors}}{\text{Total joint papers}}$$

Table 5: Collaborative Index

Year	Multi-author Papers	Total Authors of Multi-author Papers	Collaborative Index
2016	23	80	3.47
2017	60	240	4
2018	54	250	4.62
2019	36	151	4.19
Total	173	721	4.16

Figure 3: Collaborative Index

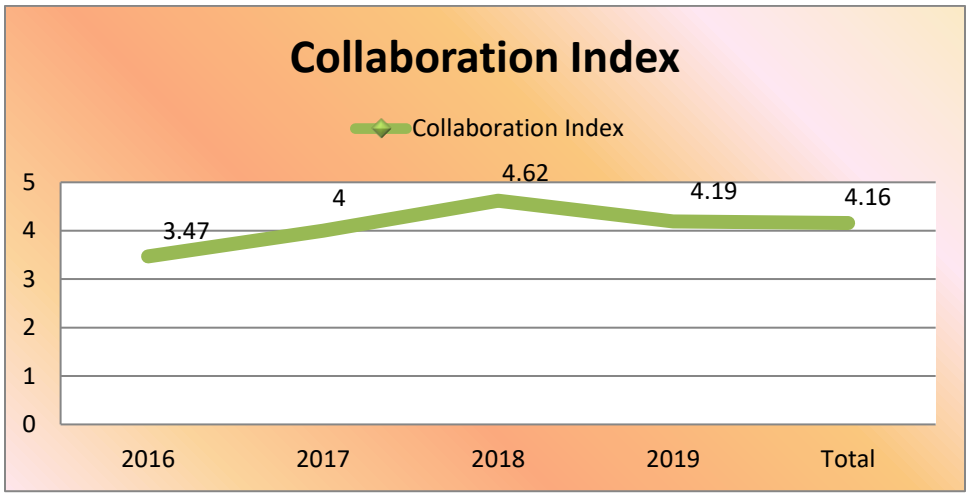


Table 5 and figure 3 provide the year wise mean number of authors per joint authored paper. CI ranges from 3.47 (2016) to 4.19 (2019) were recorded, the highest CI (4.62) was recorded in 2018 and average CI was 4.16 for per Joint authored paper which indicates the researcher team trip between 3 and 4.

Co-Authorship Index:

Co-authorship index is applying by calculating proportionately the publications by single author, two authors and multiple authored articles; below formula is proposed by (Garg & Padhi, 1999).

$$CAI = \frac{Nij/Nio}{Noj/Noo} X100$$

Where:

N_{ij}= Number of papers having authors in block i

N_{jo}= Total output of block j

N_{oj}= Number of papers having j authors for all blocks

N_{oo}= Total number of papers for all authors and all blocks

Thus table 6 is calculated by the use of above formula; for example to take single author's CAI of 2018

$$CAI = \frac{4/5}{58/178} X100$$

=> 2.45517242 X 100

=> 245.46

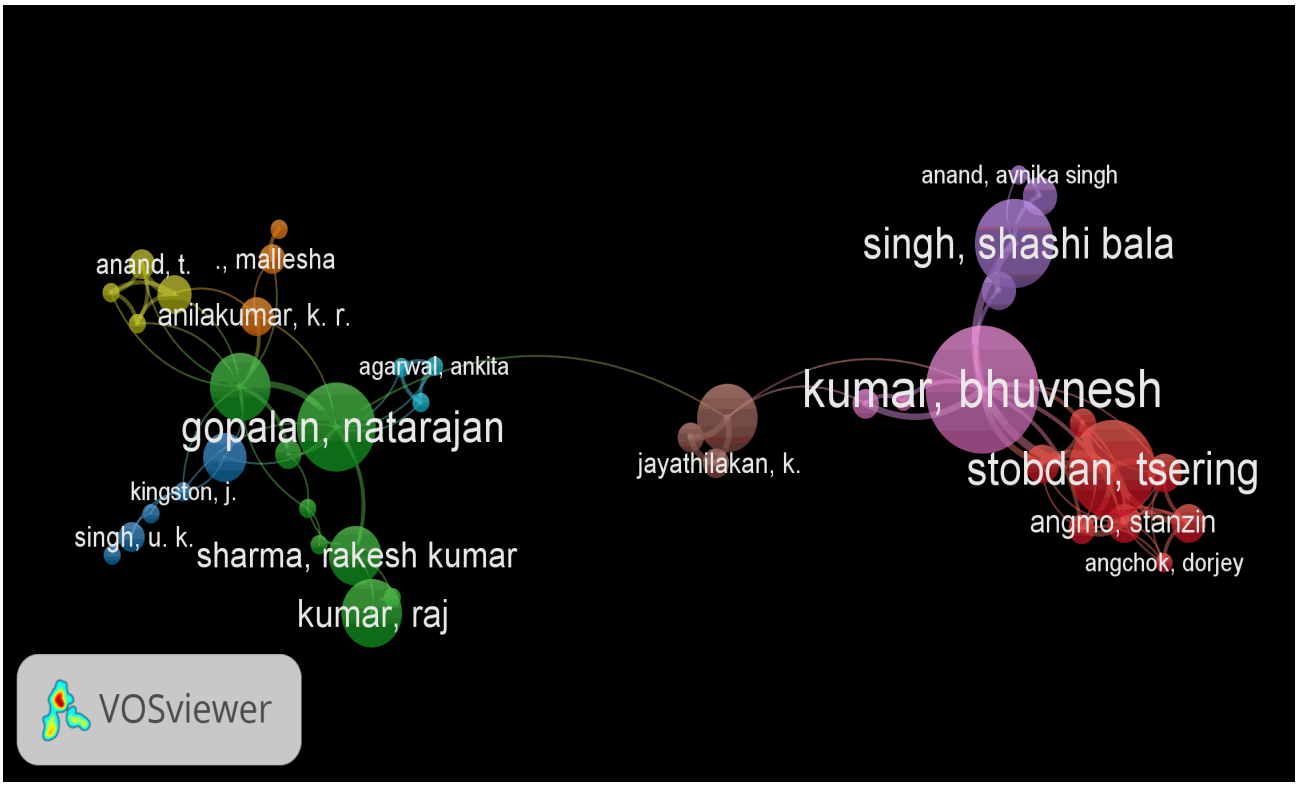
Similarly, all the data in table 6 is calculated by this formula

Table 6: Co-Authorship Index

Year	**Single authors**	**CAI**	**Two authors**	**CAI**	**Three authors**	**CAI**	**Four authors**	**CAI**	**Five authors**	**CAI**	**Six authors**	**CAI**	**More than six authors**	**CAI**	**Total**
2016	0	0	9	174.14	3	61.1	5	113.82	3	110.56	3	122.2	0	0	23
2017	1	58.37	11	80.25	13	99.83	18	154.49	7	97.27	5	76.8	6	83.38	61
2018	4	245.46	13	99.75	10	80.77	10	90.27	4	58.46	6	96.92	11	160.76	58
2019	0	0	7	86.53	12	156.15	1	14.55	7	164.81	5	130.12	4	94.18	36
Total	5	100	40	100	38	100	34	100	21	100	19	100	21	100	178

Table 6 shows Co-Authorship Index and it is analyzed that the value of CAI for single author paper in 2018 was the highest i.e. 245.46, In two authored paper the highest CAI was recorded 174.14 in 2016 in three authored paper the highest CAI was recorded 156.15 in 2019, similarly for four authored paper the highest CAI was recorded in 2017 i.e. 154.49, value of CAI for five authored paper in 2019 was the highest i.e. 164.81, in six authored paper CAI was recorded in 2019 i.e. 130.12 and the value of CAI for more than six author paper in 2018 was the highest i.e. 160.76.

Figure 4: Co-authorship (Authors) Network



Co-authorship network has been created using VOSviewer software (VOSviewer- Visualizing Scientific Landscapes, n. d.). In the above figure 4 a node symbolizes an author while the size of the node represents the activity of the authors. The curved line between the two authors shows the publication collaboration relationship between them. The thickness of the curve shows the extent of collaboration between the respective authors. For this analysis the defined criteria were set up. Purely those authors have been taken for the study which has minimum 2 documents and 1 citation. The software analyzes the manually defined criteria and out of 545 such authors 66 meet threshold for each of the 66 authors the total strength of the co-authorship link with other authors has been calculated, the highest number of authors found connected

and from clusters were 41. Therefore, the co-authorship analysis of these 41 authors has performed. The software separates these 41 authors into 9 clusters which form 87 links with a total strength of 150. Kumar, Bhuvnesh has the total links strength of 26 with the 13 documents, while the Stobdan, Tsering has the total strength of 25 with the 10 documents. In the figure Cluster 9 have maximum numbers of co-authorship links with others authors i.e. 11 links and 26 total links strength with 13 documents whereas, cluster 6 has minimum numbers of co-authorship links with other authors i.e. 3 links and 5 total link strength with 2 documents (VOSviewer- Visualizing Scientific Landscapes).

Distribution of Pages

Table 8: Distribution of Pages

Page Range	2016	2017	2018	2019	Total Page
1 to 5	6	14	18	9	47
6 to 10	14	43	39	25	121
11 to 15	3	4	1	2	10
Total	23	61	58	36	**178**

Table 8 reveals the distribution of pages in different volumes of Defence Life Science Journal during 2016 to 2019. Out of 178 papers most of the papers (121) published between 6-10 pages in length while 47 papers covered 1-5 pages and 10 papers have covered 11-15 pages.

Top cited articles during 2016-2019:

Table 9: Top cited articles

Sr. No.	**Year**	**Tile of the Paper**	**Author Name**	**No. of Citations**
1	2017	Green synthesis of iron oxide nanoparticles using Lagenariasiceraria and evaluation of its antimicrobial activity	S Kanagasubbulakshmi, K Kadirvelu	31
2	2016	Biopesticides: use of rhizosphere bacteria for biological control of plant pathogens	Satyavir S Sindhu, Anju Sehrawat, Ruchi Sharma, Anupma Dahiya	15

3	2017	Non-destructive quality monitoring of fresh fruits and vegetables	S Lakshmi, AK Pandey, N Ravi, OP Chauhan, Natarajan Gopalan, RK Sharma	12
4	2017	Seabuckthorn (Hippophaerhamnoides L.) in trans-Himalayan Ladakh, India	TseringStobdan, PhuntsogDolkar, OP Chaurasia, Bhuvnesh Kumar	8
5	2017	All year round vegetable cultivation in trenches in cold arid trans-Himalayan Ladakh	StanzinAngmo, PhunchokAngmo, DiskitDolkar, TsewangNorbu, Eli Paljor, Bhuvnesh Kumar, TseringStobdan	8
6	2017	Multiscale modelling of blast-induced TBI mechanobiology-from body to neuron to molecule	Raj K Gupta, X Gary Tan, Mahadevabharath R Somayaji, Andrzej J Przekwas	7
7	2017	Health benefits of quercetin	R Kumar, S Vijayalakshmi, S Nadanasabapathi	7
8	2016	Nanocurcumin Prevents Oxidative Stress Induced following Arsenic and Fluoride Co-exposure in Rats	Abhishek Yadav, S Flora, P Kushwaha	6
9	2016	Ultrafine particles of diesel exhaust induces cytochrome P450 1A1 mediated oxidative stress and DNA damage in cultured blood and lung cells	Ankita Srivastava, Sanjay Yadav, Alok K Pandey, Uppendra N Dwivedi, Devendra Parmar	6
10	2018	Phytoremediation and nanoremediation: emerging techniques for treatment of acid mine drainage water	Pratyush Kumar Das	5

Source: http//scholar.google.co.in/

Table 9 depicts the highly cited papers of Defence life Science Journal during the period of study. The highly cited 10 papers are identified. The data was exported on April 10, 2020. Criteria: Publication Years is 2016 or 2017 or 2018 or 2019; from Google Scholar (*Google Scholar Citation*). Table shows the list of highest ten most cited publication with their respective authors, title and year of publication. The publication authored by S Kanagasubbulakshmi, K Kadirvelu. Entitled ***"Green synthesis of iron oxide nanoparticles using Lagenariasiceraria and evaluation of its antimicrobial activity"*** published in the year 2017 got the maximum 31 citations. The second most cited article entitled ***"Biopesticides: use of rhizosphere bacteria for biological control of plant pathogens"*** have published in the year 2016 was cited 15 times.

FINDINGS AND CONCLUSION

Present study represented some general inferences on the basic Scientometric study of research article published in Defence Life Science Journal. These are the major findings of the study:

- Maximum number of research papers 61 (34.26%) were published in 2017 and the minimum number of research articles 23 (12.92%) were published in 2016.
- The aim of the authorship pattern study was to identify the percentage of single and multi-authorship. It is analyzed that the highest 22.47% contributions have been made by two authors, followed by 21.91% contributions by three authors, 19.1% contributions by four authors, 11.79% contributions by more than six authors, 11.23% contributions by five authors, 10.67% contributions by six authors and minimum contribution 2.8% are by single author. Therefore, it can be concluded that the number of joint- authored articles increases very fast.
- The maximum collaboration index is4.62 in 2018 and the average collaboration index are 4.16.
- An average Degree of collaboration range is 0.97 during the study time and in the year 2016 and 2019the Degree of collaboration is zero.
- Out of 178 articles, the maximum 173 articles are co-authorship index while 5 articles single author index.
- The total average number of authors per paper is 4.07 and the average productivity per author is 0.24.
- It is observed from distribution of pages that most of the publications are between 6-10 pages.
- Kanagasubbulakshmi (2017), Sindhu (2016), Lakshmi (2017) and Stobdan (2017) are the most highly cited publications.

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