Indian Journal of Library Science Research & Information Technology
VOL 2 NO.1 (JAN-JUNE 2025)
ISSN - 3048-4677
(c) BMS PUBLISHING HOUSE
https://www.bmsgroup.in/product/indian-journal-of-library-science-research-information-technology/

Research Trends in Florigen During 2001-2020 : A Scientometric Mapping

Pradip Roy
Librarian, Nopany Institute of Management Studies, West Bengal, India
E.Mail id: pradip.roy.cu@gmail.com.
DOI Number-0000-0001-8868-9962

Dr. Bapan Kumar Maity
Librarian, Sammilani Mahavidyalaya, West Bengal, India.

Abstract

This paper aims to observe research output growth in Florigen during twenty years (2001-2020) based on the *Scopus*® database. Florigen-related research received a total of 371 publications and 19020 during twenty years time frame. The parameters studied include growth of Year-wise Distribution of Publications and Citations, Country-wise Distribution of Publications and Citations, Relative Growth Rate and Doubling Time (RGT and DT), Highly Productive Organization, Year-wise Authorship Pattern, Degree of Collaboration, Preference of Channels of Communication by the Scientists, Highly Cited Authors, Highly Cited Publications, Document-wise Distribution of Publications and Citations.

Keywords: *Florigen, Scientometric Mapping, Agricultural Science, Plant Cell, Plant Science, Plant Breeding.*

INTRODUCTION

The physiology of flowering is a very interesting topic in the research world. Julius Sachs father of the "flower hormone" concept [8], hypothesized that leaves in the light produce flower forming substances in very small amounts, which direct the assimilates to form flowers in darkened shoots. According to Garner and Allard [3], this hypothetical thought does not prove itself until the discovery of photoperiodism, which concludes that the response of plants to the relative length of day and night During that time, many research findings indicate that the flowering procedure can be controlled by a signal, and this signal is influenced by the length of the day and night. Chailakhyan [2] introduced the term "Florigen" (flower-former) for this floral stimulus, which he defined as specific substances with a regulatory function. Much earlier work on Florigen in various species pointed out that Florigen is universal in plants, but the establishment of its chemical structure was not clear and the research output turned out to be nonreproducible, so Florigen remained a physiological concept rather than

a chemical entity. The function of Florigen in the genetic level study is a hot topic in recent research; some progressive stages are reported but are still under research. If the physiology of flowering, which is controlled by Florigen, can be identified by scientists, then it directly affects agricultural production.

Scientometrics is one of the most important measures for the assessment of scientific productions. to this analytical model we analyze scientific publications and citations on appended to the papers to gain an understanding of the structure of science, growth of science at the global level. The performance of a country in a particular domain, the performance of institutions and scientific eminence of an individual scientist. Sagar et al. [11] noted that It also helps in knowing the information-seeking behavior of scientists and engineers by way of identifying where they publish and what they cite. Many scientometric studies have appeared in the literature to focus on the performance of Agricultural science field (Pouris [6], Balasubramanian and Ravanan [1], RayChoudhury and Sarkhel[7], Munusamy and Ragavan [5], Sagar et al.[9], Sagar et al.[10]). These studies will help the policy makers and science administrators to have better insights in framing science policy and guiding the researchers and it also useful to identify strengths and weaknesses of a country, organization and an individual in various domains of scientific endeavors.

OBJECTIVES

Main objective of the study is to track down Florigen-related research outputs in the last twenty years. this is the first attempt in Florigen research outputs mapping so, We using *Scopus* ® database to make the quantitative and qualitative assessment by way of analyzing various features of research output

To examine the growth of literature on Florigen during the period January to April 2020

To identify the country-wise research contribution of Publications, Citations and Collaboration Network;

To identify the highly productive institutions with Citations;

To identify the most productive authors with Citations and indexes;

To identify the most productive journals with Impact Factor;

To identify the Most Cited documents includes author, Source and Title;

To find the Authorship pattern and Most productive authors and impact;

METHODOLOGY

We collect Twenty years (2001 to 2020) Florigen-related research outputs data in 25th April 2021 through *Scopus* ® database. *Scopus* ® database was launched in November 2004 by Elsevier. Scopus cover over 25100 titles out of them Over 23,452 peer-reviewed journals and more than 5,000 international publishers, Scopus delivers the most comprehensive overview of the world's research output in the fields of science, technology, medicine, social science, and arts and humanities[12]. The search string 'Florigen' in the Title, Abstract, and Keyword field was used to extract publications related to Florigen. we received a total number of 371 published titles with 19020 citations. The data analysis was performed with MS Excel and VOSviewer software.

RESULTS AND DISCUSSION

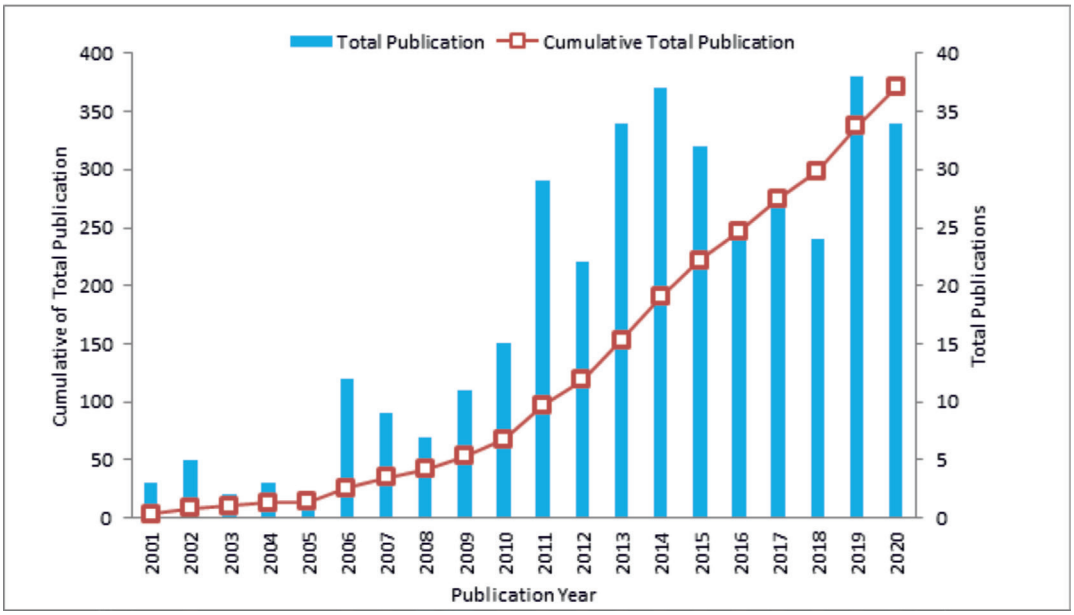
Year-wise Growth of Publications and Citations

A total of 371 publications were published in Florigen-related research during 2001-2020 and these publications received 19,020 citations. The highest number of publications (38) was published in 2019 whereas the highest number of citations (2522) was received in 2011. Table 1 and Figure 1 present the year-wise growth of publications and their citations. It was indicated that fast fifteen-year (2001-2015) Florigen-related publication were more circulated in this research domain which directly influences in increase in the last five year (2016-2020) publication productivity quantities.

Table-1 : Year-wise Growth of Publications and Citations on Florigen Research

Publication Year	No of Publication	Publication (%)	Number of Citation	Citation (%)
2001	3	0.81	37	0.195
2002	5	1.35	215	1.130
2003	2	0.54	178	0.936
2004	3	0.81	584	3.071
2005	1	0.27	181	0.952
2006	12	3.24	2122	11.157
2007	9	2.43	1764	9.275
2008	7	1.89	1142	6.004
2009	11	2.97	889	4.674
2010	15	4.04	1817	9.553
2011	29	7.82	2522	13.260
2012	22	5.93	1505	7.913
2013	34	9.16	1894	9.958
2014	37	9.97	1412	7.424
2015	32	8.63	1083	5.694
2016	25	6.74	408	2.145
2017	28	7.55	652	3.428
2018	24	6.47	277	1.456
2019	38	10.24	289	1.520
2020	34	9.16	49	0.258
Total	371	-	19020	-

Figure-1 : Year-wise Growth of Publications and Citations on Florigen Research



Country-wise Distribution of Publications and Citations

In total, there were 44 defined countries involved in Florigen-related research which published at least one publication. The result shows that the People's Republic of China topped the list with 91 (17.43%) publications that received 2616 (9.22%) citations and the average number of citations per paper was 28.75.After that Japan with 84 (16.09%) publications that received 5670 (19.98%) citations and the average number of citations per paper was 67.5.The United States of America (USA) with 71 (13.60%) publications which received 4699 (16.55%) citations and the average number of citations per paper was 66.18 and in the case of India we found 10 (1.92%) publications with receives 75(0.26%) citations (6.78%) .Table 2 presents the country-wise distribution of the publications and citations. The following result indicates that Asia is the most productive continent in the involvement of Florigen-related research.

Table -2 : Country-wise Distribution of Publications and Citations on Florigen Research

Country	Rank	Total Publication	Total Publication (%)	Total Citation	Total Citation (%)	Average Citations per Publication
PEOPLE'S REPUBLIC OF CHINA	1	91	17.43	2616	9.22	28.75
JAPAN	2	84	16.09	5670	20	67.50
USA	3	71	13.60	4699	16.6	66.18
GERMANY	4	30	5.75	2826	9.96	94.20
UK	5	27	5.17	2790	9.83	103.33
AUSTRALIA	6	21	4.02	872	3.07	41.52
ITALY	7	19	3.64	589	2.08	31.00
SPAIN	8	18	3.45	1257	4.43	69.83
ISRAEL	9	16	3.07	1528	5.38	95.50
SINGAPORE	9	16	3.07	919	3.24	57.44
SOUTH KOREA	9	16	3.07	563	1.98	35.19
FRANCE	10	15	2.87	708	2.49	47.20
NEW ZEALAND	11	12	2.30	336	1.18	28.00
INDIA	12	10	1.92	75	0.26	7.50

Country	Rank	Total Publication	Total Publication (%)	Total Citation	Total Citation (%)	Average Citations per Publication
SWEDEN	13	8	1.53	583	2.05	72.88
TAIWAN	13	8	1.53	258	0.91	32.25
CANADA	14	6	1.15	136	0.48	22.67
RUSSIAN FEDERATION	15	5	0.96	18	0.06	3.60

Organization-wise Distribution of Publications and Citations

There were 160 organizations producing research publications on Florigen-related research from 2001 to 2020. NARA Institute of Science and Technology (Japan) recorded the highest publication of 23 received 2748 citation and the average number of citations per paper was 119.48 followed by The Chinese Academy of Science (China) 22 publications with 1207 citations and an average number of citations per paper 54.86; next, is The Chinese Academy of Agricultural Science(China) published 21 publications with 670 citations and average number of citations per paper 31.90; flowed by Kyoto University (Japan) 18 papers (583 Citations); The University of Tokyo (Japan) 18 papers (561 Citations). Table 3 provides the top 15 organizations as per Publications with Citations. The flowing table indicated that Asian institutions are frontrunners in Florigen-related research.

Table 3: Organization-wise Distribution of Publications and Citations on Florigen Research

Rank	Institute Name	Total Publication	Total Citation	Average Citations per Publication
1	NARA INSTITUTE OF SCIENCE AND TECHNOLOGY	23	2748	119
2	CHINESE ACADEMY OF SCIENCE	22	1207	54.9
3	CHINESE ACADEMY OFAGRICULTURAL SCIENCE	21	670	31.9
4	KYOTO UNIVERSITY	18	583	32.4
5	THE UNIVERSITY OF TOKYO	18	561	31.2
6	INSTITUTE OFAGROBIOLOGICAL SCIENCES,NARO	18	1641	91.2
7	NATIONAL UNIVERSITY OF SINGAPORE	15	708	47.2
8	NANJING AGRICULTURAL UNIVERSITY	15	496	33.1
9	UNIVERSITÀ DEGLI STUDI DI MILANO (UNIVERSITY OF MILAN)	15	555	37.0
10	NATIONAL AGRICULTURE AND FOOD RESEARCH ORGANIZATION,NARO	12	408	34.0
11	MAX PLANCK INSTITUTE FOR PLANT BREEDING RESEARCH	12	1822	152.0
12	KYUNG HEE UNIVERSITY	9	145	16.1
13	WEIZMANN INSTITUTE OF SCIENCE,ISRAEL	9	1027	114.0
14	MINISTRY OF AGRICULTURE OF THE PEOPLE'S REPUBLIC OF CHINA	9	151	16.8
15	UNIVERSITY OF TASMANIA	9	186	20.7

Document Types

It has been distributed in various forms of documents over the last twenty years of Florigen-related research. According to Table 4, out of 371 documents, the majority were study in Article 276 (74.39%) documents with 13685 (71.95%) citations, followed by review documents 65

(17.52%) with 5086 (26.74%) citations, Book Chapter 15 (4.04%) documents with 37 (0.04%) citations, and some other documents are Conference Paper published 5 (1.35%) papers , Note published 4 (1.08%) papers, Short Survey published 4(1.08%) papers ,only one Book and Erratum published during this time periods.

Table 4: Document wise-Distribution of Publications and Citations on Florigen Research

Document Type	Total Publication	Publication(%)	Total Citation	Citation(%)
Article	276	74.40	13685	71.95
Review	65	17.52	5086	26.74
Book Chapter	15	4.04	37	0.20
Conference Paper	5	1.35	13	0.07
Note	4	1.08	4	0.02
Short Survey	4	1.08	20	0.11
Book	1	0.27	174	0.92
Erratum	1	0.27	1	0.01

Relative Growth Rate and Doubling Time

The relative growth rate (RGR) and doubling time (D_t) for publication are important indicators for studying and understanding the growth trends of Florigen-related research in the current research domain over time (2001-2020). The growth rate of all publications has been measured on the basis of the RGR and D_t models; the particular model was developed by Mahapatra [4]. RGR is calculated to analyze the increase in the number of publications over time, and the D_t is directly related to RGR.
In classical growth analysis RGR is calculated as:

$$RGR = (\ln N_2 - \ln N_1) / (t_2 - t_1)$$

Where N_2 and N_1 are cumulative number of publications in the years t_2 and t_1. In our case the time difference $t_2 - t_1$ is taken as 1 year. Therefore $RGR = \ln (N_2/N_1)$.

The D_t is the time required for publications to double in numbers for given RGR. This is expressed as:

$$D_t = (t_2 - t_1) \ln 2 / (\ln N_2 - \ln N_1)$$

(or)

$$Dt = \ln 2 / RGR$$

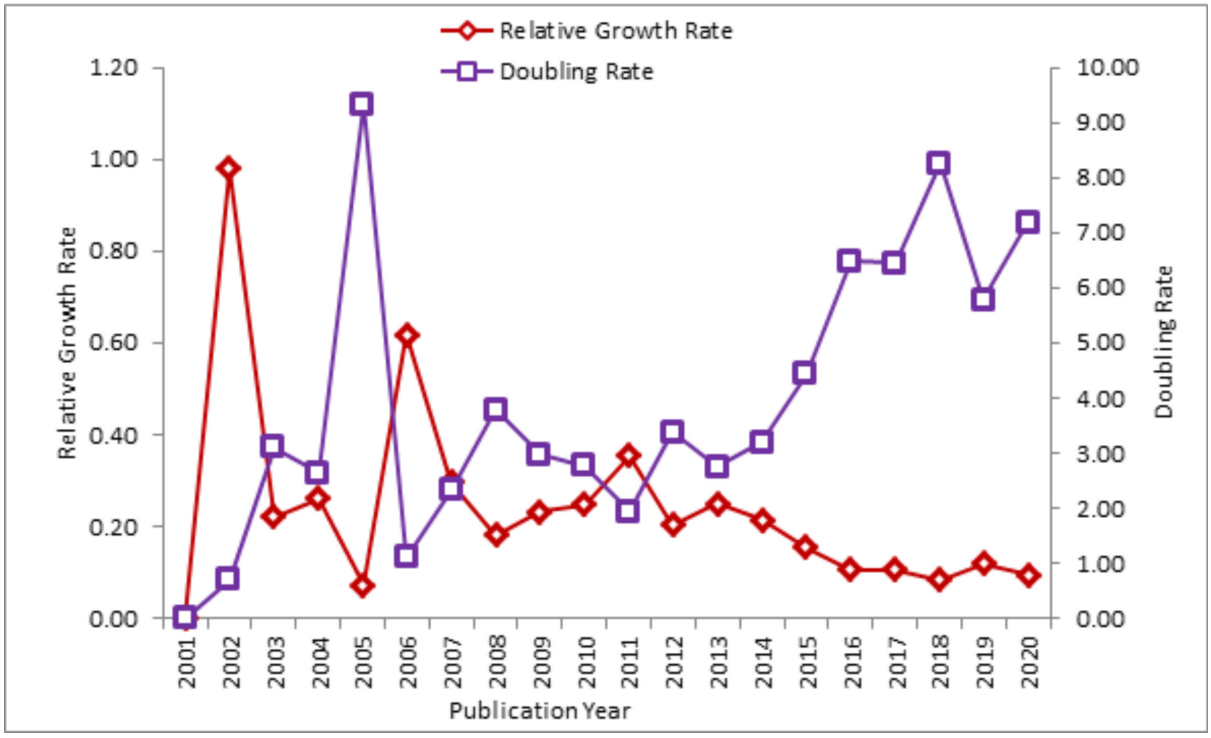
Table 5 and Figure 2 Relative Growth Rate (RGR) and Doubling Time (D_t) for publication of Florigen-related research. It was observed that the Relative Growth Rate (RGR) of Florigen-related research drops from 1.098 for the year 2001 to 0.096 for 2020 that's the reason Doubling value Time rises 7.21. We concluded that its relative growth rate has shown a declining trend, which means the rate of increased publication productivity is low in terms of proportion, and this has been highlighted by the doubling time for publications, which is more than the relative growth rate.

Table 5: Relative Growth Rate and doubling Time (RGT and DT) on Florigen Research

Sl. No	Year	Publication	Cumulative Total	W1	W2	RGR	Doubling Rate
1	2001	3	3		1.1	0	0

2	2002	5	8	1.10	2.08	0.98	0.71
3	2003	2	10	2.08	2.30	0.22	3.11
4	2004	3	13	2.30	2.57	0.26	2.64
5	2005	1	14	2.57	2.64	0.07	9.35
6	2006	12	26	2.64	3.26	0.62	1.12
7	2007	9	35	3.26	3.56	0.30	2.33
8	2008	7	42	3.56	3.74	0.18	3.80
9	2009	11	53	3.74	3.97	0.23	2.98
10	2010	15	68	3.97	4.22	0.25	2.78
11	2011	29	97	4.22	4.58	0.36	1.95
12	2012	22	119	4.58	4.78	0.20	3.39
13	2013	34	153	4.78	5.03	0.25	2.76
14	2014	37	190	5.03	5.25	0.22	3.20
15	2015	32	222	5.25	5.40	0.16	4.45
16	2016	25	247	5.40	5.51	0.11	6.49
17	2017	28	275	5.51	5.62	0.11	6.45
18	2018	24	299	5.62	5.70	0.08	8.28
19	2019	38	337	5.70	5.82	0.12	5.79
20	2020	34	371	5.82	5.92	0.10	7.21

Figure 2: Relative growth rate and doubling Time (RGT and DT) on Florigen Research



Highly Cited Authors

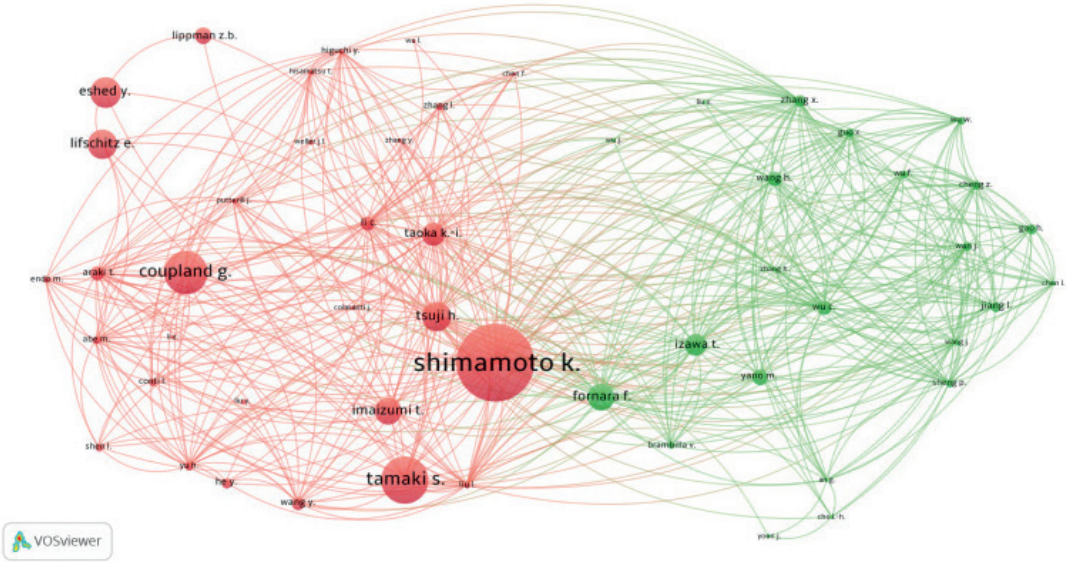
During the twenty-year period (2001-2020), 160 authors contributed 371 papers in Florigen-related research. Thus, the average number of authors per paper is 2.32. Figure 3 and Table 6 list the top 20 authors who published the most papers in the past twenty years. These 20

authors published 183 (49.33 %) papers that have been cited 13620 (71.61%) out of 371 papers. It is recognised that Shimamoto, Ko published 19 documents and obtained 2672 citations, establishing himself in this table as the first position with an impressive h-index (18) in Florigen-related research field, followed by Tsuji, Hiroyuki published 14 papers and received 1000 citations, and Araki, Takashi published 13 papers and obtained 481 citations. When we looked at the most cited authors in Florigen-related research, we discovered Shimamoto, Ko has 2672 citations in 19 documents, Tamaki, Shojiro has 1619 citations in 8 documents, and Coupland, George has 1483 citations in 7 documents.

Table6: Highly Cited Authors Distribution of Publications and Citations on Florigen Research

Sl . No	Author	Total Pubication	Total Citation	H Index	G Index	M Index
1	Shimamoto, Ko	19	2672	18	19	1.50
2	Tsuji, Hiroyuki	14	1000	11	14	1.00
3	Araki, Takashi	13	481	7	13	0.64
4	Yu, Hao	10	336	8	10	0.89
5	Abe, Mitsutomo	9	271	6	9	0.50
6	Izawa, Takeshi	9	752	7	9	0.58
7	Taoka, Kenichiro	9	807	8	9	0.80
8	An, Gyeunhung	8	140	5	8	0.83
9	Endo, Motomu	8	238	6	8	1.00
10	Eshed, Yuval	8	1063	7	8	0.50
11	Fornara, Fabio	8	929	8	8	0.67
12	Higuchi, Youhei	8	205	4	8	0.44
13	Tamaki, Shojiro	8	1619	7	8	0.78
14	WAN, Jian-Min	8	325	7	8	1.40
15	Weller, James L.	8	186	5	8	0.50
16	Zhang, Xin	8	311	7	8	1.40
17	Cheng, Zhijun	7	304	6	7	1.20
18	Coupland, George	7	1483	6	7	0.35
19	Guo, Xiuping	7	304	6	7	1.20
20	Hisamatsu, Tamotsu	7	194	4	7	0.44

Figure 3 : Highly Cited Authors Distribution of Publications and Citations on Florigen Research



Authorship Pattern

Authorship pattern is a very impotent indicator to understand research works collaborative nature during particular a time interval. When we study Florigen-related research last twenty year we found that 34 (9.16%) research publication receive 1754 (9.22%) citations published by the signal author and the rest 337 (90.84%) publications with 17266 (90.78%) citations published by multiple authors. Table 7 present the year-wise authorship pattern of publications and their citations. The flowing table directly indicated that Florigen-related research highly collaborative research during this time frame.

Table 7: Yearwise Single vs Multi Authorship Pattern on Florigen Research

Year	Single Author				Multiple Author			
	NUMBER of PAPER	PAPER (%)	TOTAL CITATION	CITATION (%)	NUMBER of PAPER	PAPER (%)	TOTAL CITATION	CITATION (%)
2001	0	0	0	0	3	0.89	37	0.214
2002	1	2.94	1	0.057	4	1.19	214	1.239
2003	0	0	0	0	2	0.59	178	1.031
2004	1	2.94	6	0.342	2	0.59	578	3.348
2005	0	0	0	0	1	0.30	181	1.048
2006	1	2.94	79	4.504	11	3.26	2043	11.833
2007	1	2.94	185	10.547	8	2.37	1579	9.145
2008	1	2.94	138	7.868	6	1.78	1004	5.815
2009	1	2.94	3	0.171	10	2.97	886	5.132
2010	4	11.77	757	43.159	11	3.26	1060	6.139
2011	5	14.71	268	15.279	24	7.12	2254	13.055
2012	4	11.77	121	6.899	18	5.34	1384	8.016
2013	2	5.88	35	1.995	32	9.50	1859	10.767
2014	3	8.82	71	4.047	34	10.09	1341	7.767
2015	2	5.88	16	0.912	30	8.90	1067	6.180
2016	1	2.94	3	0.171	24	7.12	405	2.346
2017	3	8.82	57	3.250	25	7.42	595	3.446
2018	1	2.94	11	0.627	23	6.83	266	1.541
2019	2	5.88	0	0	36	10.68	289	1.674
2020	1	2.94	3	5100	33	9.79	46	0.266

Degree of Collaboration

The Degree of Collaboration in research can be measured with the help given by Subramanyam [13]. It is a ratio of the number of collaborative publications to the total number of publications published in a discipline during a certain period of time.

The degree of collaboration (collaboration coefficient) among authors is measured mathematically as;

Degree of collaboration $C = N_m/N_m+N_s$

C = Degree of collaboration

N_m = Number of Multiple authors

N_s^m= Number of Single authors

In Table 8 present the year-wise the degree of collaboration calculated as per the equation proposed by Subramanian. The following result indicated that total the degree of collaboration in authorship trend works out to be 0.09 in Florigen-related research we can conclude that this is a highly collaborative research domain in last twenty year and every ten publication out of nine is multiple authors collaboration work.

Table 8: Degree of Collaboration on Florigen Research

Year	Single Authored	Multiple Authored	Degree of Colaboration
2001	0	3	0.00
2002	1	4	0.20
2003	0	2	0.00
2004	1	2	0.33
2005	0	1	0.00
2006	1	11	0.08
2007	1	8	0.11
2008	1	6	0.14
2009	1	10	0.09
2010	4	11	0.27
2011	5	24	0.17
2012	4	18	0.18
2013	2	32	0.06
2014	3	34	0.08
2015	2	30	0.06
2016	1	24	0.04
2017	3	25	0.11
2018	1	23	0.04
2019	2	36	0.05
2020	1	33	0.03
	34	337	0.09

Highly Cited Publications

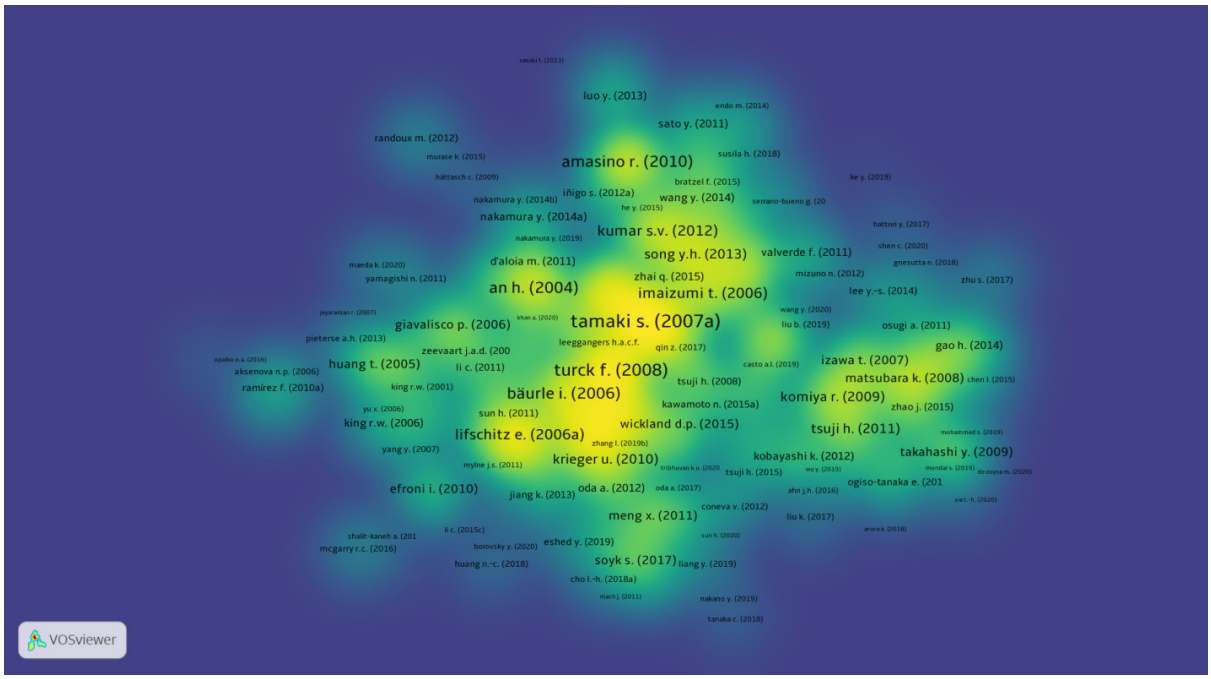
In the last twenty years, 371 documents in the field of Florigen-related research have been published; of these, 56 have received 100 or more citations, and 172 have received ten or more citations. Figure 4 and Table 9 give a list of twenty highly cited Florigen-related publications indexed and cited in *Scopus. These* twenty highly cited documents received a total of 7363 citations (38.71%) and revealed that out of the 20 documents, 14 were research articles and 6 were review articles. In research articles, "Hd3a protein is a mobile flowering signal in rice" by Tamaki, S et al. (2007) in *Science* received the highest 772 citations, while "Regulation and identity of Florigen: Flowering Locus T moves center stage" by Turck, F. et al. (2008) in the *Annual Review of Plant Biology* received the highest 659 citations in respect of review articles. We also observed that field weight citation impact as per *Scopus* "Seasonal and developmental timing of flowering" by Amasino, R (2010) in *Plant Journal* score highest impact (16.12) in these twenty articles.

Table 9: Highly Cited Publications on Florigen Research

Rank	Bibliographic Details	Citation	Field Weight Citation Impact	Type of Document
1	Tamaki, S. Matsuo, S. Hann, L.W. Yokoi, S. Shimamoto, K.(2007) .Hd3a protein is a mobile flowering signal in rice. Science .Vol (316), Issue 5827:pp.1033-1036	772	7.69	Article
2	Turck, F. Fornara, F. Coupland, G.(2008). Regulation and identity of florigen : Flowering Locus T moves center stage. Annual Review of Plant Biology .Vol(59):pp. 573-594	659	6.10	Review
3	Amasino, R.(2010). Seasonal and developmental timing of flowering. Plant Journal. Vol (61), Issue 6: pp. 1001-1013	519	16.12	Article
4	An, H. Roussot, C. Suárez-López, P.Corbesier, L.Vincent, C. Piñeiro, M. Hepworth, S. Mouradov, A. Justin, S. Turnbull, C. Coupland, G.(2004). CONSTANS acts in the phloem to regulate a systemic signal that induces photoperiodic flowering of Arabidopsis. Development. Vol (131), Issue 15: pp. 3615-3626	463	6.60	Article
5	Jaeger, K.E. Wigge, P.A.(2007). FT Protein Acts as a Long-Range Signal in Arabidopsis. Current Biology.Vol (17), Issue 12: pp.1050-1054	462	11.44	Article
6	Bäurle, I. Dean, C.(2006). The Timing of Developmental Transitions in Plants. Cell. Vol(125), Issue 4: pp 655-664	424	5.99	Review
7	Lifschitz, E. Eviatar, T. Rozman, A. Shalit, A. Goldshmidt, A. Amsellem, Z. Alvarez, J.P. Eshed, Y.(2006). The tomato FT ortholog triggers systemic signals that regulate growth and flowering and substitute for diverse environmental stimuli. Proceedings of the National Academy of Sciences of the United States of America. Vol (103),Issue 16: pp 6398-6403	409	3.61	Article
8	Kumar, S.V. Lucyshyn, D. Jaeger, K.E. Alós, E. Alvey, E. Harberd, N.P. Wigge, P.A.(2012). Transcription factor PIF4 controls the thermosensory activation of flowering. Nature.Vol(484), Issue 7393:pp 242-245	367	7.23	Article
9	Taoka, K.-I Ohki, I. Tsuji, H. Furuita, K. Hayashi, K. Yanase, T. Yamaguchi, M. Nakashima, C. Purwestri, Y.A.Tamaki, S. Ogaki, Y. Shimada, C. Nakagawa, A. Kojima, C. Shimamoto, K.(2011). 14-3-3 proteins act as intracellular receptors for rice Hd3a florigen. Nature.	339	5.26	Article
10	Kobayashi, Y. Weigel, D. (2007). Move on up, it's time for change - Mobile signals controlling photoperioddependent flowering. Genes and Development. Vol (21), Issue 19:pp 2371-2384	318	4.38	Review
11	Ahn, J.H., Miller, D.,Winter, V.J., Banfield, M.J., Jeong, H.L., So, Y.Y., Henz, S.R., Brady, R.L., Weigel, D.(2006). A divergent external loop confers antagonistic activity on floral regulators FT and TFL1. EMBO Journal. Vol(25), Issue 3 :pp 605-614	315	3.30	Article
12	Navarro, C., Abelenda, J.A., Cruz-Oró, E., Cuéllar, C.A., Tamaki, S., Silva, J., Shimamoto, K., Prat, S.(2011). Control of flowering and storage organ formation in potato by FLOWERING LOCUS T. Nature. Vol(478), Issue 7367:pp 119-122	307	4.73	Article
13	Imaizumi, T. Kay, S.A.(2006). Photoperiodic control of flowering: not only by coincidence. Trends in Plant Science. Vol(11), Issue 11: pp 550-558	305	6.02	Review
14	Song, Y.H., Ito, S., Imaizumi, T.(2013). Flowering time regulation: Photoperiod- and temperature-sensing in leaves. Trends in Plant Science. Vol(18), Issue 10: pp 575-583	298	4.94	Review
15	Krieger, U., Lippman, Z.B., Zamir, D.(2010). The flowering gene SINGLE FLOWER TRUSS drives heterosis for yield in tomato. Nature Genetics. Vol(42), Issue 5: pp 459-463	261	5.95	Article
16	Komiya, R., Yokoi, S., Shimamoto, K.(2009). A gene network for long-day flowering activates RFT1 encoding a mobile flowering signal in rice. Development. Vol (136), Issue 20: pp. 3443-3450	252	4.02	Article

Rank	Bibliographic Details	Citation	Field Weight Citation Impact	Type of Document
17	Song, Y.H., Shim, J.S., Kinmonth-Schultz, H.A., Imaizumi, T.(2015). Photoperiodic flowering: Time measurement mechanisms in leaves. Annual Review of Plant Biology. Vol(66) : pp 441-464	248	11.82	Article
18	Shalit, A.,Rozman, A.,Goldshmidt, A., Alvarez, J.P.,Bowman, J.L., Eshed, Y., Lifschitz, E.(2009). The flowering hormone florigen functions as a general systemic regulator of growth and termination. Proceedings of the National Academy of Sciences of the United States of America. Vol (106), Issue 20: pp. 8392-8397	224	3.13	Article
19	Tsuji, H.,Taoka, K.-I., Shimamoto, K.(2011). Regulation of flowering in rice: Two florigen genes, a complex gene network, and natural variation. Current Opinion in Plant Biology. Vol (14), Issue 1: pp. 45-52	214	3.46	Review
20	Watanabe, S., Xia, Z.,Hideshima, R.,Tsubokura, Y., Sato, S.,Yamanaka, N., Takahashi, R.,Anai, T., Tabata, S., Kitamura, K., Harada, K.(2011). A map-based cloning strategy employing a residual heterozygous line reveals that the GIGANTEA gene is involved in soybean maturity and flowering. Genetics. Vol (188), Issue 2: pp. 395-407	207	2.99	Article

Figure 4: Highly Cited Publications on Florigen Research



Preference of Channels of Communication by the Scientists

Channels of communication are an important indication of scientists' interest in publishing documents in a particular research domain. In Table 10, the top twenty most preferred and highly cited journals by scientists in Florigen-related research published from 2001 to 2020. We observed that out of 371 documents, these twenty highly cited journals published 194 (52.29%) research documents that have been cited 9518 (50.04 %). *Journal of Experimental Botany* published 20 papers, which is the highest figure in terms of research output, and received 1023 citations. It is followed by *Plant Physiology* published 18 papers (1020 citations), *Plant Cell* published 15 papers (883 citations), and *Plant Journal* published 14 papers (1218 citations). On the basis of table 7, we also observed that the highest CiteScore value (22.5) and SNIP

value (3.647) as per *Scopus*® has been observed for *Trends in Plant Science*. Plant Cell was found to have the highest SJR value of 5.399.

Table 10: Highly Preferred Channels of Communication by The Scientists on Florigen Research

Sl No	Name	Number of Publication	Number of Citation	Average	CITESCORE 2019	SJR 2019	SNIP 2019
1	Journal of Experimental Botany	20	1023	51.15	9.8	2.647	1.736
2	Plant Physiology	18	1020	56.67	12.5	3.616	2.006
3	Plant Cell	15	883	58.87	14.1	5.399	2.434
4	Plant Journal	14	1218	87.00	9.1	3.161	1.697
5	Plant and Cell Physiology	13	578	44.46	7.1	2.021	1.308
6	Proceedings of the National Academy of Sciences of the United States of America	13	1586	122.00	15.7	5.165	2.689
7	Frontiers in Plant Science	11	257	23.36	7.8	1.691	1.619
8	New Phytologist	10	229	22.90	13	3.702	2.282
9	PLoS ONE	10	325	32.50	5.1	1.023	1.205
10	Plant Science	9	82	9.11	5.9	1.5	1.319
11	Plant Signaling and Behavior	9	110	12.22	3	0.811	0.607
12	Trends in Plant Science	7	833	119.00	22.5	4.539	3.647
13	BMC Plant Biology	6	128	21.33	5	1.485	1.372
14	Journal of Integrative Plant Biology	6	103	17.17	8.1	2.32	1.619
15	Plant, Cell and Environment	6	302	50.33	11.1	2.739	1.891
16	PLoS Genetics	6	239	39.83	9	3.744	1.359
17	Russian Journal of Plant Physiology	6	45	7.50	1.8	0.377	0.563
18	Acta Horticulturae	5	13	2.60	0.4	0.184	0.227
19	Current Opinion in Plant Biology	5	504	100.80	14.3	4.262	2.057
20	International Journal of Molecular Sciences	5	40	8.00	5.3	1.317	1.3

CONCLUTION

The main focus of this study is to trace the Florigen- related research output in the *Scopus*® indexing database in the last twenty years (2001–2020). main finding, we noted that in the last twenty years, Florigen-related research has received 371 publications with 19020 citations. The most publications (38) were published in 2019, while the most citations (2522) were received in 2011. The maximum number of publications produced is 276, demonstrating that Florigen-related research is still a research-level topic. From 2001 to 2010, there were 68 publication outputs, but from 2011 to 2020, research publication enlisted 303 authors, so total publication output increased over the last ten years. The Republic of China reported the highest number of Florigen- related research outputs during this time period Republic of China enlisted 93 publications with 2616 citations; the next two countries are Japan (84 publications with 5670 citations), USA (71 publications with 4699 citations). NARA Institute of Science and Technology (Japan) recorded the highest publication of 23 and received 2748 citations. Florigen-related research outputs The authorship and collaboration trend indicates a move toward multi-authored jobs. *Journal of Experimental Botany* is a more preferred communication channel in

the Florigen-research domain; it published 20 papers and received 1023 citations; after that, *Plant Physiology* published 18 papers (1020 citations); and *Plant Cell* published 15 papers (883 citations). As a suggestion, we can say Florigen research is still in the progression stages, and the last twenty years' published outputs have helped in predicting the future prospects of the research fronts and will be useful to design the further research plan in this field.

REFERENCES

1) Balasubramanian, P. Ravanan, C.(2011). Scientometric analysis of agriculture literature: A global perspective. Libr Prog.31:p.1-18.

2) Chailakhyan, M.Kh. (1936). New facts in support of the hormonal theory of plant development. C. R. Acad. Sci. URSS. 13:p. 79–83.

3) Garner, W.W. Allard, H.A. (1920). Effect of the relative length of day and night and other factors of the environment on growth and reproduction in plants. J. Agric. Res. 18:p. 553–606.

4) Mahapatra, M. (1985). On the validity of the theory of exponential growth of scientific literature. Proceedings of the 15th IASLIC Conference, Bangalore, p. 61–70.

5) Munusamy ,S. Ragavan,S.S.(2012). Mapping of Agriculture Research From 1970 to 2012: A Scientometric Study. SALIS Journal of Information Management and Technology. 3(2):p. 7-16.

6) Pouris ,A. (1989). A scientometric assessment of agricultural research in South Africa. Scientometrics. 17: p. 401–413.

7) Ray Choudhury, N. Sarkhel, J. K.(2011). Mapping Agricultural Research in West Bengal-1993-2007: A Bibliometric study. Collnet Journal of Scientometrics and Information Management. 5(1):p. 99-113.

8) Sachs, J. (1865). Wirkung des lichtes auf die blu¨ tenbilding unter vermittlung der laubbla¨ tter. Bot. Ztg. 23:p. 117–121; 125–131; 133–139.

9) Sagar, A. Kademani,B.S. Bhanumurthy,K.(2013). Research trends in agricultural science: A global perspective .Journal of Scientometric Research. 2(3): p. 185-201.

10) Sagar, A. Kademani,B.S. Bhanumurthy,K.(2014). Agriculture Research in India: A Scientometric Mapping of Publications. DESIDOC Journal of Library & Information Technology.34 (3): p. 206-222.

11) Sagar, A. Kademani, B. S. Kumar, V. (2009). Research trends in Neutron Activation Analysis in Nuclear Science and Technology: a global perspective. International Journal of Low Radiation. 6(2): p.119-146.

12) Scopus Content Coverage Guide (2021) Access date 25.04.21 available at (https://www.elsevier.com/__data/assets/pdf_file/0007/69451/Scopus_ContentCoverage_Guide_WEB.pdf)

13) Subramnyam, K. (1983). Bibliometric studies of research collaboration: a review. Journal of information Science, 6(1): p.33–38.