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Modeling the Growth of Bacterial Blight Research Literature

Dr. Gireesh A. Ganjihal[1], Vijayakumar A. Ganjihal[2], K. S. Kwati[3]

Assistant Librarian, University of Horticultural Sciences, Bagalkot, India[1]

Student, Karnatak University, Dharwad, India[2]

Student, Karnataka State Akkamahadevi Women's University, Vijayapur, India[3]

Abstract: Present study demonstrates the growth of bacterial blight research publications indexed in the Web of Science for the period 1997 to 2021 (25 years). Found that total 4418 research publications with a steady growth of publications for entire study period from 1.36% (60) to 9.10% (402) publications. Relative Growth Rate (RGR) decreased from 0.74 in the year 1997 to 0.09 in the year 2020 with average Relative Growth Rate of 0.18. The Doubling Time (Dt.) of publications increased over period from 0.80 in the year 1989 to 8.31. The distribution for global literature is positively skewed for all the block periods except 2002-2006. Growth of bacterial blight literature best fits in polynomial or order 2 curves with R^2 value is 0.977.

Keyword: Scientometric, Bacterial Blight; plant diseases; bibliometric; growth model.

I. INTRODUCTION

Agriculture is backbone of any country as its offers the food needs of the growing population across the world. Farming community is facing many problems mainly diseases in plants cause loss in the crop yield. The main cause of plants diseases are bacteria, viruses and fungi. Diseases with plants harmful to the crop production or yields, the loss in the yield further affects the seed quality and contamination of the grain (Skelsey & Newton, 2015).

Farming community facing many problems with plant diseases, scientists across the world involved in the prevent and support such type of plant diseases to overcome and get good crop yield. Blight is a specific symptom affecting plants in response to infection by pathogenic organism. Blight is a rapid and complete chlorosis, browning, this death of plant tissues such as leaves, branches, twigs or floral organs (Agrios, 2005).

Using bibliometrics and scientometrics analysis, we can further understand the status and trends of research on Bacterial Blight. In recent years Scientometrics has been broadly used as a quantitative analysis method in many scientific research fields (Rao, 1998). The measurement of bibliographic information offers the promise of providing a theory that will resolve many practical problems (Keshava, Hiremath, Lamani, & Ganjihal, 2009; Keshava, CAN, Ganjihal, & Lokesh, 2010).

It is claimed that patterns of author productivity, literature growth rates and related statistical distributions can be used to evaluate authors, to assess disciplines and to manage collections. In the present paper an attempt has been made to study the publication trends in Bacterial Blight research during 1989 to 2021.

II. REVIEW OF LITERATURE

The understanding of the process of growth of knowledge in research specialties and its modeling has challenged bibliometricians and sociologists for a long time, say Gupta et al. (1997). Gilberts ' (1978) work reveals the existing literature on the indicators of growth of knowledge in scientific specialties and lists many ways of measuring it.

The analysis of Gupta et al. (1999) suggests that the growth of Indian physics literature follows a logistic model, while the growth of world physics literature is explained by the combination of logistic and power models. Karki et al. (2000) investigate Indian Organic Chemistry research activity during 1971-1989 using Chemical Abstracts.

The authors conclude that the growth trends for India and world for organic chemistry follow the same patterns and the output in the three sub-fields is not going to saturate in the near future. Gupta et al. (2002) apply selected growth models to the growth of publications in six sub-disciplines of social sciences, namely economics, history, political science,

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psychology, and sociology in the world. The results show that the power model ($\alpha>0$, $\gamma>1$) followed by logistic models are best describing the cumulative growth of publications in all sub-disciplines.

Sangam, Liming & Ganjihal (2010) study the growth and dynamics of Indian and Chinese publications in the field of liquid crystals research (1997-2006) by applying growth models as suggested by Egghe and Ravichandra Rao (1992). The authors conclude that these power and growth models are likely to be fully applicable in the growth of Indian, and linear, power, and growth models applicable in the growth of Chinese liquid crystals literature. Ganjihal & Keshava (2008) conducted study on Scientometric dimensions of Astronomy and Astrophysics research in India (2001-2010): A study based on SCI. Ganjihal & Keshava (2015) analysid on Radio Astronomy Research in India (1999-2012).

Ganjihal & Keshava (2015) analysed the growth pattern of Indian Radio Astronomy literature and Chinese radio astronomy literature. Ganjihal, Ganjihal & Kwati (2023). Bradford's law applicability to the Bacterial Blight research: A bibliometric study.

Ganjihal, Keshava & Sangam (2017) analysed application of Bradford's law in the field of Radio Astronomy Research in India based on Web of Science. Hadagali & Anandhalli (2015) study demonstrates the growth of neurology literature for the period 1961-2010 and interprets that the observed data fit an exponential growth model. 20. Nayak & Bankapur (2018) study demonstrates the modeling the growth of Indian agricultural literature.

The result shows that there are lot of the studies very conducted on growth models on various subject field applying different growth models, but there is no significant study was conducted on growth trend analysis on bacterial blight research literature so far.

III. OBJECTIVES

The specific objectives of this study are:

- To identify the growth of Bacterial Blight research literature;
- To analyze the fit of Bacterial Blight research literature for cumulative number of publications inter terms of different models

IV. DATA AND METHODOLOGY

For the present study, the data was collected from Web of Science core collection database, records pertaining to the field Bacterial Blight research publications for the period of 25 years from 1997 to 2021, in the month of February 2022.

A total of 4,418 publications were retrieved in plain text format. Further the data was analysed with bibliometric methods quantitatively using MS excel and SPSS software and applied different growth patterns to check whether the bacterial blight research literature is fit for exponential, linear or polynomial models.

Data analysis and Discussion

Year wise distribution of research literature

Figure 1 shows that, the year wise growth of publications, total 4,418 publications were found on bacterial blight research during the year 1997 to 2021. It is observed that there is a steady growth of publications for entire study period from 1.36% (60) to 9.10% (402) publications except in the year 2017.

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Table 1 Year wise distribution of bacterial blight research literature

Year	Total Publications	%	Cumulative Publications	W1	W2	RGR	Mean	Dt	Mean
1997	60	1.36	60		4.09				
1998	66	1.49	126	4.09	4.84	0.74		0.93	
1999	62	1.40	188	4.84	5.24	0.40	0.42	1.73	1.95
2000	61	1.38	249	5.24	5.52	0.28		2.47	
2001	74	1.67	323	5.52	5.78	0.26		2.66	
2002	80	1.81	403	5.78	6.00	0.22		3.13	
2003	100	2.26	503	6.00	6.22	0.22		3.13	
2004	105	2.38	608	6.22	6.41	0.19	0.19	3.66	3.86
2005	106	2.40	714	6.41	6.57	0.16		4.31	
2006	104	2.35	818	6.57	6.71	0.14		5.10	
2007	135	3.06	953	6.71	6.86	0.15		4.54	
2008	155	3.51	1108	6.86	7.01	0.15		4.60	
2009	163	3.69	1271	7.01	7.15	0.14	0.14	5.05	4.97
2010	173	3.92	1444	7.15	7.28	0.13		5.43	
2011	204	4.62	1648	7.28	7.41	0.13		5.24	
2012	217	4.91	1865	7.41	7.53	0.12		5.60	
2013	206	4.66	2071	7.53	7.64	0.10		6.61	
2014	214	4.84	2285	7.64	7.73	0.10	0.11	7.05	6.50
2015	258	5.84	2543	7.73	7.84	0.11		6.48	
2016	275	6.22	2818	7.84	7.94	0.10		6.75	
2017	239	5.41	3057	7.94	8.03	0.08		8.51	
2018	297	6.72	3354	8.03	8.12	0.09		7.47	
2019	317	7.18	3671	8.12	8.21	0.09	0.09	7.67	7.73
2020	345	7.81	4016	8.21	8.30	0.09		7.72	
2021	402	9.10	4418	8.30	8.39	0.10		7.26	
Total	**4418**								

The Relative Growth Rate (RGR) increases in the number of publications per unit of time. This definition was derived from the description of relative growth rates in the study of growth analysis of individual plants and is effectively applied in the files of botany (Hunt, 1982) (Hoffman & Poorter, 2002; Ganjihal & Keshava, 2015). Doubling time (Dt.) is defined as the time to be taken to double in the size or value and exists a direct equivalence between the relative growth rate and the doubling time (Ganjihal & Keshava, 2015).

$$RGR = \frac{W2-W1}{T2-T1}$$

where

W1=natural log of initial number of publications
W2= natural log of final number of publications after a specific period of interval
T2-T1= the unit difference between the initial and final time.

Doubling Time (Dt.) = $\frac{\log e2}{R}$ = 0.693/R where, R is the Relative Growth Rate

It is observed that the value of Relative Growth Rate (RGR) (Keshava, Ganjihal, & Gowda, 2008) decreased from 0.74 in the year 1997 to 0.09 in the year 2020 with average Relative Growth Rate of 0.18. The values of doubling Time (Dt.) of publications increased over period from 0.93 in the year 1997 to 7.26 during 2021, with highest doubling time recorded in the year 2017 with 8.51.

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Table 2 Descriptive statistics (comparative statistics for different block periods)

5 years block period	Publications	Mean	Median	Standard Deviation	Sample Variance	Kurtosis	Skewness (β2)
1997-2001	323	64.6	62	5.73	32.8	1.84	1.49
2002-2006	495	99	104	10.86	118	4.09	-2.01
2007-2011	830	166	163	25.42	646	1.06	0.61
2012-2016	1170	234	217	30.54	932.5	-2.23	0.70
2017-2021	1600	320	317	60.10	3612	0.52	0.04

Table 2, interpret the dispersion using statistical parameters. Standard deviation for is an important absolute measure of dispersion. The value of standard deviation clearly shows that the publications are dispersed largely for all the periods; the dispersion is very high for 2017-2021 from the staring year 1997-2001. The highest mean number of articles is observed 320 in the years block 2017-2021 and least mean is observed 64.6 for the years 1997-2001.

Skewness helps to study the shape of the distribution while kurtosis refers to the flatness or peakedness of the curve. The distribution for global literature is positively skewed for all the block periods except 2002-2006 -2.01 and with max 1.49 degrees for the years 1997-2001.

For measuring Kurtosis, the coefficient value β2 for block period 2003-2007 is 4.09 which is greater than normal curve value for bacterial blight literature. So it follows leptokurtic curve distribution while for the block periods 1997-2001, 2007-2011 & 2017-2021 follows the platykurtic curve as β2 value is 1.84, 1.06 & 0.52 respectively. For the other block period 2012-2016, the literature follows the platykurtic curve as β2 value is negative.

Application of Growth Models

Table 3 shows the application of growth models (Linear, Exponential and Polynomial) on bacterial blight research literature for 25 years from 1997 to 2021.

Table 3 Application of Growth models (R^2 value)

Sl.	Growth Models	R^2 Value
1	Exponential	0.975
2	Linear	0.941
3	Polynomial of order 2	0.977

The R^2 value for the data is reflected in the table. It is clear from the table that, during the study period growth of bacterial blight literature best fits in polynomial or order 2 curves with R^2 value is 0.977.

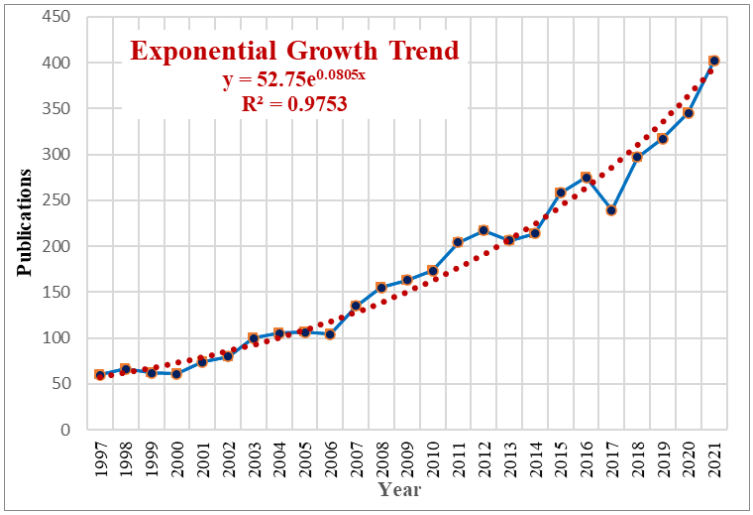

Figure 1 Exponential growth trend line for bacterial blight literature

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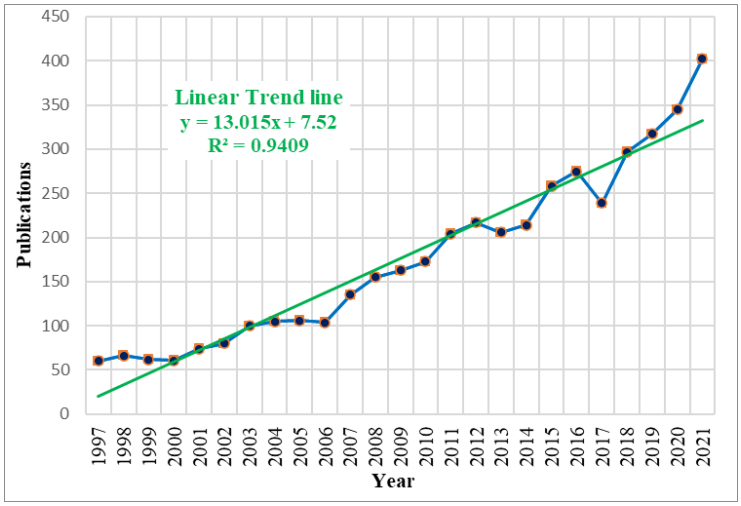

Figure 2 Linear growth trend line for bacterial blight literature

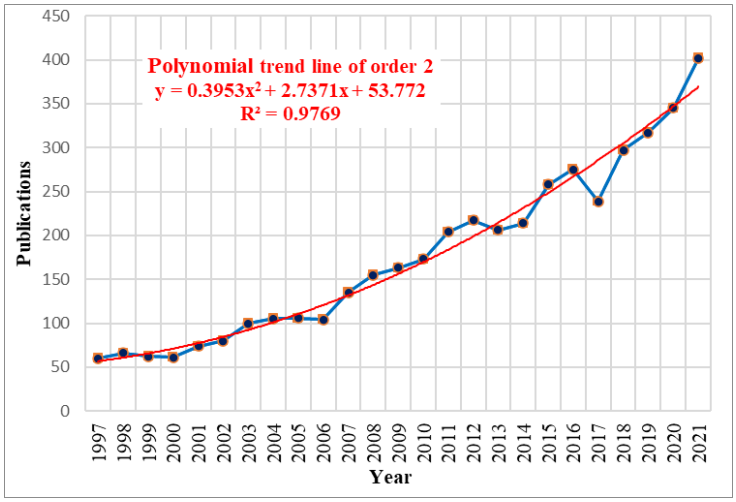

Figure 3 Polynomial growth trend line for bacterial blight literature

Figure 1, 2 and 3 presents the graphs on data for the growth models Exponential, Linear and Polynomial of order 2 respectively. It reveals that the trend line is fit with coefficient of regression value is 0.977.

V. SUMMARY AND CONCLUSION

An attempt was made in the present study to measure the trends in various aspects of published literature on bacterial blight research indexed in the Web of Science for the period 1997 to 2021 (25 years). Found that total 4418 research publications with a steady growth of publications for entire study period from 1.36% (60) to 9.10% (402) publications. Relative Growth Rate (RGR) decreased from 0.74 in the year 1997 to 0.09 in the year 2020 with average Relative Growth Rate of 0.18.

The Doubling Time (Dt.) of publications increased over period from 0.80 in the year 1989 to 8.31. The distribution for global literature is positively skewed for all the block periods except 2002-2006. The research literature well fit in polynomial or order 2 curves with R2 value is 0.977, however, it nearly follows the Exponential Growth Model. The study concludes that there has been a consistent trend towards increased growth of literature in the field of bacterial blight for the study period.

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