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INFORMETRICS ON NEEM RESEARCH IN INDIA

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Research on use of *Neem* plant products for control of Insect Pests, Nematodes, Fungus and Virus has gained importance in India. Yearwise and domainwise publications and their scattering is analysed.

Key words/Descriptors : Bibliometrics; Scientometrics; Informetrics; Collaboration Coefficient; Publication Density; Publication Concentration; History of Science.

1 INTRODUCTION

Neem (*Azadirachta indica* A. Juss.) belonging to Meliaceae family is a native of Indian subcontinent. It has antibiotic properties. Various products obtained from neem can control insect pests, nematodes, fungus diseases and virus diseases to a considerable extent in a variety of crops. Neem exerts behavioural, physiological and biochemical effects on insects. The plant nematodes can be controlled by soil amendments of neem products. It has biodegradable properties and is relatively safe to beneficial organisms in the environment. Hence it is useful in integrated pest management as a botanical component.[1]

2 METHODOLOGY

Indian publications on neem [2] were considered for the bibliometric analysis. The necessary bibliographical contents of each contribution were recorded on reference cards. These reference cards were arranged and rearranged as per requirement of study for data recording.

The collaboration coefficient [3] is defined as the ratio of the number of collaboration papers to the total number of papers published in a domain during a certain period of time.

The Zonal Bradford distribution [4] was calculated for channels of communications grouped into four *Zones*.

Vinkler [5] defined publication density as number of papers published per number of journals used; and publication concentration as number of journals containing half of the paper published times 100 per total number of journals used during the period under study.

Above methodologies were applied to the files to get information on neem plant product usage.

3 RESULTS AND DISCUSSION

Yearwise publications output (*Table 1* and *2*) provides data on research activity where highest contributions (368) were for insect pests followed by nematodes (66), fungus diseases (42) and virus diseases (20). Although first publication on uses of neem was in 1937 for insect pests, continuous research activity began in 1962 and peak of research contributions(60) was in 1990. Publications on use of neem products for control of nematodes began in 1967 whereas for fungus diseases it was 1973 followed by virus diseases in 1974. Overall mean range of collaboration coefficients (0.70 to 0.88) was indicator of active team work in all domains. Highest research activity on insect pests may be due to the cos-

Year	Insect pests				Nematodes			
	No. of Publications			Collaboration Co-efficient	No. of Publication			Collaboration Co-efficient
	Single author	Multi author	Total		Single author	Multi author	Total	
1937	1	—	1	0.00	—	—	—	—
1962	—	1	1	1.00	—	—	—	—
1963	—	2	2	1.00	—	—	—	—
1964	—	1	1	1.00	—	—	—	—
1965	—	1	1	1.00	—	—	—	—
1966	1	—	1	0.00	—	—	—	—
1967	1	1	2	0.50	—	1	1	1.00
1968	1	2	3	0.66	—	—	—	—
1969	—	3	3	1.00	—	—	—	
1971	—	5	5	1.00	--	1	1	1.00
1972	—	1	1	1.00	2	--	2	0.00
1973	1	1	2	0.50	—	2	2	1.00
1974	—	3	3	1.00	—	2	2	1.00
1975	3	3	6	0.50	1	1	2	0.50
1976	5	6	11	0.54	—	2	2	1.00
1977	4	5	9	0.55	—	—	—	—
1978	—	5	5	1.00	—	1	1	1.00
1979	3	7	10	0.70	—	3	3	1.00
1980	1	9	10	0.90	—	1	1	1.00
1981	—	7	7	1.00	—	1	1	1.00
1982	3	3	6	0.50	—	2	2	1.00
1983	4	12	16	0.75	—	—	—	—
1984	5	16	21	0.76	1	5	6	0.83
1985	4	24	28	0.85	—	8	8	1.00
1986	6	23	29	0.79	1	8	9	0.88
1987	7	40	47	0.85	—	5	5	1.00
1988	8	23	31	0.74	1	5	6	0.83
1989	2	17	19	0.89	1	2	3	0.66
1990	8	52	60	0.86	1	6	7	0.85
1991	2	15	17	0.88	—	2	2	1.00
1992	1	9	10	0.90		—	—	—
TOTAL	**71**	**297**	**368**	**0.80**	**8**	**58**	**66**	**0.87**

TABLE 1
Yearwise publication on uses of Neem plant parts/products for control of various insect pests and nematodes

mopolitan importance of insect pests in damaging economic yield of crops and current research interest to find out biodegradable botonical products. The research on nematodes, fungus diseases and virus diseases control through neem products is at very low level *(Figure 1)*.

Year	Fungus Diseases				Virus Diseases			
	No. of publications			Collaboration co-efficient	No. of publications			Collaboration co-efficient
	Single author	Multi author	Total		Single author	Multi author	Total	
1973		1	1	1.00	-	-	-	-
1974		1	1	1.00	1	-	1	0.00
1975		-	-	-	-	1	1	1.00
1976		-	-	-	-	-	-	-
1977	-	-	-	-	-	-	-	
1978	-	-	-	-	-	-	-	-
1979	1	-	1	0.00	-	-	-	-
1980	-	2	2	1.00	1	-	1	0.00
1981	-	2	2	1.00	-	-	-	-
1982	-	3	3	1.00	1	1	2	0.50
1983	-	2	2	1.00	-	1	1	1.00
1984	-	-	-	-	-	-	-	-
1985	-	2	2	1.00	-	1	1	1.00
1986	-	3	3	1.00	-	1	1	1.00
1987	-	5	5	1.00	-	3	3	1.00
1988	-	2	2	1.00	2	2	4	0.50
1989	1	5	6	0.83	-	-		
1990	2	9	11	0.81	1	3	4	0.75
1991	1	-	1	0.00	-	1	1	1.00
1992	-	-	-	-	-	-		
Total	5	37	42	0.88	6	14	20	0.70

TABLE 2
Yearwise publications on uses of Neem plant parts/products for control of various fungus and virus dieases

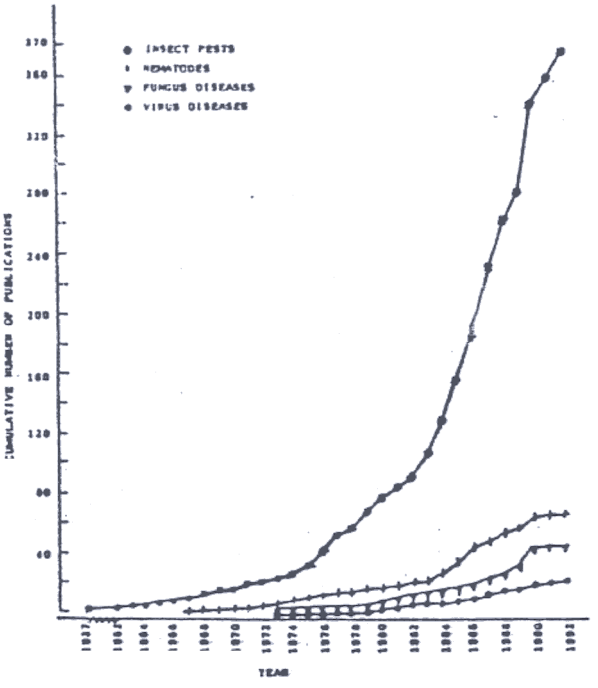

FIGURE 1
Research Productivity on uses of Neem products for crop protection

The data on total channels of communications *(Tables 3,4,5 and 6)* used for dissemination of generated research information indicated domainwise scattering as for insect pests (104) followed by nematodes (24), for fungus diseases (30) and for virus diseases (15). Neem Newsletter has published 57 papers on insect pests followed by 5 papers for virus diseases, totalling 68 articles, thus topping the list of core channels of communications for neem research.

each for nematodes and fungus diseases, and one paper

National symposium on problems and prospects of botanical pesticides in integrated pest management has published 35 articles on insect pests followed by 6 articles for nematodes and achieving status of second core channel of communication. For literature on neem products pertaining to control on insect pests important journals are : Pesticides, Indian J.Ent., Indian J.Plant Prot., Indian J.Agric.Sci. and Phytoparasitica. Similarly for nematodes control, core journal is Indian J.Nematol. where 26 papers pertaining to use of neem products are available.

three articles for virus diseases thus totalling 44 and

The best known statistical law in Bibliometrics is Bradford's Law. It describes the scatter of scientific articles or papers in scientific journals for a given bibliography. It was stated by Bradford as follows: If all the scientific journals relevant to a given subject are assigned ranks according to the number of the articles they carry on the subject, and the journals are grouped into m zones each containing the highest ranking journals and the last zone containing the lowest ranking journals, then the number of journals in the succeeding zones form a geometric series with a common ratio by which depends only on b_m.

Table 7 provides data on the distribution of articles on Bradford's law of scatter among journals for insect pests control using neem plant products. When plotted as cumulative total of communications against natural log of the total productivity channels, the elongated S-shaped curve was obtained for insect pests literature *(Figure 2)*. Part one of the curve, the initial concave portion, represents the higher density or nuclear zone, part two the linear portion of the curve and part three called upper non-linear region with the groos drop [6] showing deviation from the normal. Insect pests domain has thus well established standing for publishing uses of neem products. With reference to nematodes, fungus diseases and virus diseases research communication channels and productivity is slowly emerging.

Table 8 provides data on Bradford distribution (four zones) for insect pests publications. Average Bradford multiplier was 3.37.

Table 9 provides domainwise data on publication density and publication concentration. Insect pests research communication channels had highest publication density of 3.54 communications per channel followed by nematodes with 2.75, fungus with 1.4 and virus with 1.33 values.

Publication concentration indicated that except insect pests other domains had very high level of scattering of publications, probably due to low coordination among research teams.

4 CONCLUSION

Bibliometric study can provide valuable information on the status of research productivity. The core channels of communications identified out of many channels can help researchers to copeup with core channels at least and may help for getting recommendations for subscribing core journals in institutional special libraries. It is suggested that while publishing bibliographies an appendix of bibliometric analysis also should be added so that readers get valuable information immediately. It will also encourage researchers to publish their papers in core journals by which coordination among research teams can be established.

It can act as a basis for establishing strong links between information generating system and information using system. The gap between these two systems can be bridged effectively.

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Sl. No.	Channels/Journals	COMMUNICATIONS			
		Total	Cumulative	Percentage	Cumulative percentage
A	B	C	D	E	F
1.	Neem Newsl.	57	57	15.49	15.49
2.	National symposium on problems and prospects of Botanical pesticides in integrated pest management, CTRI, Rajahmundry (21-22 jan. 1990)	35	92	9.51	25.00
3.	Pesticides	26	118	7.06	32.06
4.	Indian J. Ent.	25	143	6.79	38.85
5.	Indian J. Plant Prot.	16	159	4.35	43.20
6.	Indian J. Agric.Sci.	11	170	2.99	46.19
7.	Phytoparasitica	10	180	2.72	48.91
8.	Theses (M.Sc. 8, Ph.D.2)	10	190	2.72	51.63
9	Int. Rice Res. Newsl.	7	197	1.90	53.53
10	Madras Agric.J.	7	204	1.90	55.43
11	Utilization of Neem (Azadirachta Indica Juss) and its by-products (C.M. Ketkar ed.)Final Tech. Report. Modified Neem Cake Manurial Project).	7	211	1.90	57.33
12	Proc. 1st Nat. Symp. Allelopathy in Agroecosystem (Agriculture and Forestry), HAU, Haryana.	6	217	1.63	58.96
13.	Bull. Grain Technol.	6	223	1.63	60.59
14.	Plant Prot. Bull.	5	228	1.36	61.95
15.	Agric. Res. J. Kerala	4	232	1.09	63.04
16.	Pestology	4	236	1.09	64.13
17.	J.Econ.Ent.	4	240	1.09	65.22
18.	J.Exp.Biol.	4	244	1.09	66.31
19.	Integrated pest control progress and perspectives (N.Mohandas and G.Koshyeds.) Trivandrum Association of Advancement of Entomology	4	248	1.09	67.40
20.	Proc. 2nd Int.Neem Conf.Ranischholzhausen,F.R.G.	4	252	1.09	68.49
21.	3rd Int.Neem Cuf. Nairobi Kenya	4	256	1.09	69.58
22.	Behavioural and Physiological approaches in pest management (A.Ragupathyand S.Jayaraj Eds.) TNAU, Coimbatore	4	260	1.09	70.67
23.	Tob. Res.	3	263	0.82	71.49
24.	J.Ent.Res.	3	266	0.82	72.31
25.	Curr.Sci.	3	269	0.82	73.13
26.	Proc.Indian National Sci. Academy (Animal Sciences)	3	272	0.82	73.95
27.	Zeitschrift fur Angewandte Entomologie	3	275	0.82	74.77
28.	Res. Dev. Reporter	3	278	0.82	75.59
29.	Appl.Ent.Zool.	2	280	0.54	76.13
30.	Andhra Agric. J.	2	282	0.54	76.67
31.	J.food Sci.Technol.	2	284	0.54	77.21
32.	Insect Sci. and Applications	2	286	0.54	77.75
33.	J.Coffee Res.	2	288	0.54	78.29
34.	Pyrethrum post	2	290	0.54	78.83
35.	Sneh Sandesh	2	292	0.54	79.37
36.	Indian Fmg.	2	294	0.54	79.91
37.	Int.Arachis Newsl.	2	296	0.54	80.45
38.	J.Appl. Ent.	2	298	0.54	80.99
39.	8th Int. Tob. Sci. Cngress	2	300	0.54	81.53
40.	Nat.Symp.on Insect Physiology Ecology and Behaviour	2	302	0.54	82.07
41.	J.Maharashtra Agric. Univ.	2	304	0.54	82.61
42.	Entomon.	2	306	0.54	83.15
43-104	Journals having single paper in each one	62	368	16.85	100.00

TABLE 3
Channels used for communication of Research on uses of 'Neem' Plant products for the control of Insect Pests

A	B	C	D	E	F
1	Indian J. Nematol.	26	26	39.39	39.39
2	National symp. on problems and prospects of Botanical pesticides in integrated pest management, CTRI, Rajahmundry (21-22 Jan. 1990)	6	32	9.09	48.48
3	Neem Newsl.	5	37	7.58	56.06
4	Acta Bot. Indica	4	41	6.06	62.12
5	Souvenir and Abstracts Nat. Symp. in soil pest and soil organisms BHU, Varanasi, (Oct .29-31, 1984)	4	45	6.06	68.18
6	Thesis(M.Sc. 1, Ph.D.2)	3	48	4.55	72.73
7-24	Journals having single paper in each one	18	66	27.27	100.00

TABLE 4
Channels used for communication of research on uses of 'Neem' Plant products for the control of nematodes

A	B	C	D	E	F
1	Neem Newsl.	5	5	11.90	11.90
2	Nat. Acad. Sci. Lett.	3	8	7.14	19.04
3	Int.Rice Res. Newsl.	3	11	7.14	26.18
4	Madras Agric. J.	2	13	4.76	30.94
5	Indian J. Nematology	2	15	4.76	35.70
6	Indian Coconut J.	2	17	4.76	40.46
7	Acta Botanica Indica	2	19	4.76	45.22
8-30	Journals having single paper in each one.	23	42	54.76	99.98

TABLE 5
Channels used for communication of research on uses of 'Neem' Plant products for the control of fungus diseases

A	B	C	D	E	F
1	Nat. Symp. on problems and prospects of Botanical pesticides in Integrated pest management CTRI, Rajahmundry (21-22, Jan. 1990)	3	3	15.00	15.00
2	9th Int. Tob. Sci. Congress China (Oct. 9-13, 1988)	2	5	10.00	25.00
3	Tob. Res.	2	7	10.00	35.00
4	Indian J.Virology	2	9	10.00	45.00
5-15	Journals having single paper in each one.	11	20	55.00	100.00

TABLE 6
Channels used for communication of research on uses of 'Neem' Plant products for the control of virus

CH	C	CH.C	∑CH	∑CH.C
1	57	57	1	57
1	35	35	2	92
$1\frac{1}{1}$	$25\frac{26}{16}$	$25\frac{26}{16}$	$4\frac{3}{5}$	$143\frac{118}{159}$
1	11	11	6	170
2	10	20	8	190
3	7	21	11	211
2	6	12	13	223
1	5	5	14	228
8	4	32	22	260
6	3	18	28	278
14	2	28	42	306
62	1	62	104	368

TABLE 7
Distribution of articles on Bradford's Law of scatter among Journals for Insect Pests control using 'neem' plant products

Note : CH - Channels Of Journals; C - Communications or No. of publications; CH.C - Total communications; ∑CH - Cumulative channels; ∑CH.C - Cumulative total communications.

Zone	Journal Title	Articles	Percentage Articles	Bradford multiplier
First	2	92	25.00	-
Second	6	98	26.63	3.00
Third	20	88	23.91	3.33
Fourth	76	90	24.46	3.80

TABLE 8
Bradford distribution (four Zones) for Insect pests publications.

Note : Average Bradford Multiplier ($\bar{B}$) = 3.37

Domain	Publication Density	Publication concentration
Insect pets	3.54	7.69
Nematodes	2.75	12.5
Fungus	1.4	40
Virus	1.33	60

TABLE 9
Publication Density and publication concentration of articles on 'Neem' plant products

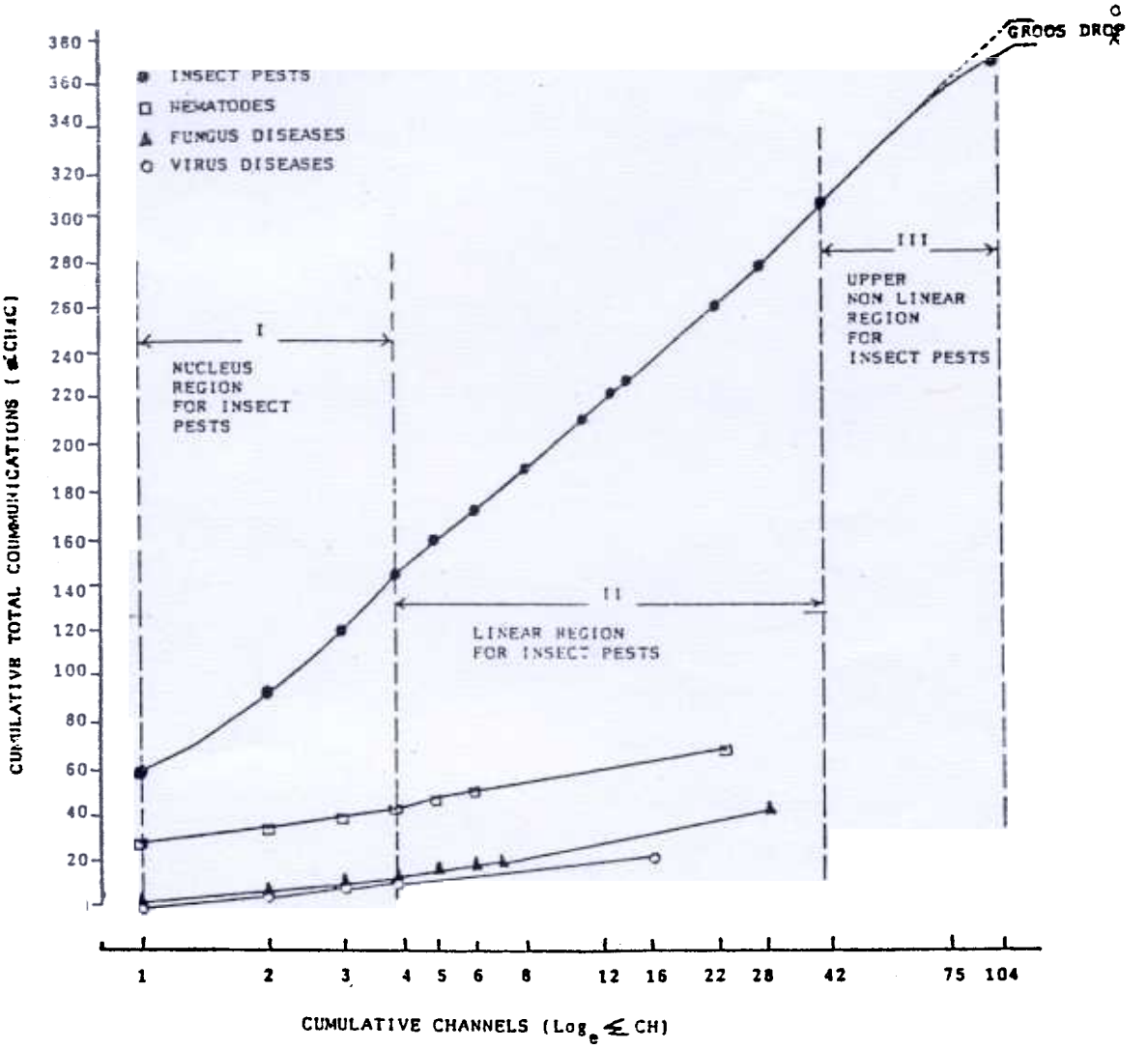

FIGURE 2
Bradford–Zipf Bibliograph

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