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Scientometric Portrait of L. L. Narayana

V. L. Kalyane

INTRODUCTION

Kuhn (1970) had urged that greater attention be paid to exemplars in science and to the social structure of science. Schubert and Glanzel (1992) expressed an evergrowing stress on scientometrists to publish data on individual scientists. We have studied individual scientists in the following disciplines: *Astrophysics* - S Chandrasekhar (Kademani, et. al. 1996 b); *Physics* - C.V. Raman, (Kademani, et. al. 1994 b), P. K. Iyengar (Kademani, et.al. 1994 a) K.S. Krishnan (Kademani, et.al. 1996 a), P. G. de Gennes (Kalyane and Sen, 1996); *Chemistry* - T. S. West (Kalyane and Munnolli 1995); *Crystallography* - R. Chidambaram (Kalyane and Kademani 1995, Kademani and Kalyane 1996); *Modern Biology* - P. M. Bhargava (Kalyane 1995), Barbara McClintock (Kalyane and Kademani 1997); *Medical Science* - Vinodini Reddy (Kalyane and Kalyane 1993); and *Agriculture* - M.S. Swaminathan (Kalyane 1992; Kalyane and Kalyane 1994), U. R. Murty (Kalyane and Kademani 1994), C.S. Venkata Ram (Kalyane and Devarai 1994), and K. Ramiah (Kalyane and Samanta 1995). The studies generated inquisitive responses from the historians of science, biographers of scientists, science policy makers, administrators of scientific establishment, R and D managers, scientometricians, educationists, young scientists, documentalists information scientists, science journalists, etc. 'Scientometric portraits of individual scientists' has emerged

as an interdisciplinary multi-disciplinary, and extra-disciplinary domain of research which has practical implications.

Present paper deals with quantitative facts about a renowned *botanist* L.L. Narayana whose pivotal role was recognised by publishing a commemorative volume of the *Indian Journal of Botany* (Sathyanarayana 1990).

RESULTS AND DISCUSSION

L. L. Narayana has published 26 single - authored papers during 1955 -1975 at his 25-45 years age. Multiauthored papers to his credit were 149. Out of 86 two-authored papers, he was first author in 46 papers, and second author in 40 papers. He has published 44 three - authored papers during 1978-1990 in which he was first author in seven papers, second author in five papers, and third author in 32 papers. Four - authored papers to his credit were 19 published during 1980-1990; wherein he was first author in three papers; second and third author in one each; and fourth author in 14 papers (Table 1). He was main author in 82 papers, and co- author only in 93 papers.

Publication productive life (the count from the year in which first paper by an author was published to the latest year of publication) of L.L. Narayana was 36 years (1955-1990). Noteworthy feature is that 46 years age onwards all of his papers were collaborative. Collaboration coefficient is the ratio of no. of Multi-authored papers to the total number of papers published in the same period. He had three authored papers after 48 years age, and four authored papers after 50 years age.

Domainwise classification (Table 2) indicated the highest 57 papers in *Chemotaxonomy*, followed by *Floral Anatomy* (53), *Embryology* (37) and *Systematic Position* (15). His first paper in *Chemotaxonomy* appeared in 1977 at 47 years of age, and with collaborative pursuits resulted in maximum output of 12 papers in 1984. Domainwise growth curves of publications is shown in Fig. 1.

Fifty percentile age (the corresponding productivity year of 50 percent of all papers) was 27 at his 51 years age in 1981. It

is interesting to document that second 50 percent of articles were published in just nine years (1982-1990) of latest professional life. Fifty percentile age is expected to accelerate the progress of a scientist resulting into high visibility and recognition. Productivity coefficient (the ratio of 50 percentile age to the total productivity age) was 0.45. publication rate (the number of papers published per annum) was four. Papers published during first half of professional life (1955-1972) were 40, and second half of professional life (1973-1990) were 135. He has published 19 papers in 1984; 14 papers in 1978; and 11 papers each during 1989 and 1990.

Tables 3 and 4 document research group productivity of L. L. Narayana and associates. Total authorships were 406 out of which multi-authorships were 380 establishing the fact that it was indeed an excellent team. M. Radhakrishnaiah collaborated during 1976-1990 in 60 papers with L.L. Narayana, followed by D. Rao (24) during 1965-1978, G. Nageswar (17) during 1983-1990, K.T. Sundari (15) during 1977-1984, S.M.J. Anuradha (12), P.S. Narayana (10), and M. Satyavati (9). In all 35 collaborators (including 12 Ph. D. Students) received the benefit of mentorship by L.L. Narayana. Active researchers and active collaborators are delineated in Fig.2.

Mentors, Models, and a special companion or companions often play an essential role in the development of creativity which probably depends upon a nurturant and facilitating environment in the family, in the interpersonal network, and in society (Gedo 1996). Creativity is required at all stages (Bamfield 1996). Scientists have two sorts of offsprings: their contributions to the substantive content of science and, their scientific descendants. With respect to the first sort of offspring, some scientists generate numerous bright ideas and produce mass of publications, while others cherish every publication. With respect to the second sort of offspring, some scientists work very much in social isolation and discourage the advances made by other scientists to become their descendants, while others are extremely social, maintaining

large number of graduate students and junior colleagues. The prevalence of one strategy over the other varies with respect to individual scientists, but it also varies with respect to fields of inquiry at particular times (Hull 1988).

Domainwise author productivity and distribution of authors and papers (Table 5) indicated 0.57 positive correlation coefficient between author productivity and areas of research interest.

As per 80/20 rule 20 percent of the authors (7.2) are supposed to get credit of 80 percent of the authorships (324). Since, here, we are considering only seven authors for calculation (as round figure), they are supposed to contribute 315 authorships but here observed value is 313. This clearly indicated that 80/20 rule is valid in the present case of research group of L.L.Narayana.

The journals (Table 6) wherein L.L. Narayana had published more than 10 papers were: *Current Science* (34); *Journal of Japanese Botany* (28); *Journal of Botanical Society* (21); and *Proceedings of Indian Academy of Sciences* (11). Publication density (the frequency of papers per journal) was 5.5. Publication concentration (the ratio in percentage of the number of journals possessing half of the papers published to the total number of journals used) was 12.5 percent. He has used 32 journals to publish his 175 papers. Bradford-Zipf bibliograph is depicted in Fig.3.

Average Bradford multiplier was 5.1 (Table 7). First zone had 52 papers in two journals only. Second zone had 72 papers in three journals. Third zone had 51 papers scattered in 27 journals.

Familywise keywords (from titles of the articles) frequencies (Table 8) indicated maximum contributions to Linaceae (19), Pittosporaceae (15); and Humiriaceae eight only. Genuswise frequency for *Sorghum* was five; and for *Pittosporum* three; and for *Belanites*, *Bauhinia*, *Indigofera* and *Gisekia* it was two each. Tribe and species keywords frequencies are provided

in Table 9. Above data clearly indicates divergent creativity of L.L. Narayana and his research group members.

CONCLUSIONS

Gaillard (1991) stated that most of the developing countries lack local role models to motivate other contemporary scientists. Present paper refutes the statement with clear-cut documentary evidence of the fact that there is no dearth of local role model scientists at least in India. However, organised efforts are necessary in the research on individual scientists.

REFERENCES

1. Bamfield, P. (1996) Creativity and innovation. In: *Research and Development Management in the Chemical Industry*. Weinheim: VCH: 93-109. (ISBN 3-527-28778-7)
2. Gaillard, J.E. (1996) *Scientists in the Third World*. Lexington, Ky. USA.
3. Gedo, J.E. (1996) *The Artist and the Emotional World: Creativity and Personality*. New York, Columbia University Press (ISBN 0-231- 07853-6)
4. Hull, D.L. (1988) *Science as a process: An Evolutionary Account of the Social and Conceptual Development of Science*. Chicago, the University of Chicago Press; (ISBN 0-226-36050-4).
5. Kademani B. S., Kalyane V. L. and Balakrishnan M. R. (1994 a) Scientometric Portrait of P. K. Iyengar, *Library Science with a slant to Documentation and Information Studies*, Vol.31, No.4, pp.155-176. (ISSN 0254-2553) <http://eprints.rclis.org/archive/00001283/>
6. Kademani B. S., Kalyane V. L. and Kademani A. B. (1994 b) Scientometric Portrait of Nobel Laureate Dr. C.V. Raman, *Indian Journal of Information, Library & Society*, Vol.7, No.3-4, pp.215-249. (ISSN 0971-4286) <http://eprints.rclis.org/archive/00001377/>
7. Kademani B. S. and Kalyane V. L. (1996) Outstandingly Cited and Most Significant Publications of R. Chidambaram, a Nuclear Physicist, *Malaysian Journal of Library & Information Science*, Vol.1, No.1, pp. 21-36. (ISSN 1394-6234) <http://eprints.rclis.org/archive/00001277/>
8. Kademani B. S., Kalyane V. L. and Kademani A. B. (1996 a) Scientometric Portrait of Sir K. S. Krishnan, *Indian Journal of Information, Library & Society, International Prof. Kaula Special Number*, Vol.9, No.1-2, pp. 125-150. (ISSN 0971-4286) <http://eprints.rclis.org/archive/00001313/>
9. Kademani B. S., Kalyane V. L. and Kademani A. B. (1996 b) Scientometric Portrait of Nobel Laureate S. Chandrasekhar, *JISSI: The International Journal of Scientometrics and Informetrics*, Vol.2, No.2-3, pp. 119-135. (ISSN 0971-6696) <http://eprints.rclis.org/archive/00001516/>
10. Kalyane V. L. (1992) Dr. M. S. Swaminathan - Biologist par excellence, *Biology Education*, Vol.9, No.3, pp.246-248. (ISSN 0970-5961) <http://eprints.rclis.org/archive/00001309/>

11. Kalyane V. L. and Kalyane S. V. (1993) Scientometric Portrait of Vinodini Reddy, *Journal of Information Sciences*, Vol.4, No.1, pp.25-47.
(ISSN 0971 3360)
<http://eprints.rclis.org/archive/00001304/>
12. Kalyane V. L. and Devarai Rajashekhar S. (1994) Informetrics on C. S. Venkata Ram, In: *New Horizons in Library and Information Science: Dr. Velaga Venkatappaiah Festschrift*, Editors : C. P. Vashishth, L. S. Ramaiah, N. V. Jagga Rao and T. V. Prafulla Chandra, Madras: T. R. Publications, pp.475-478.
(ISBN 81-85427-54-2)
13. Kalyane V. L. and Kalyane S. V. (1994) Scientometric Portrait of M. S. Swaminathan, *Library Science with a slant to Documentation and Information Studies*, Vol.31, No.1, pp.31-46.
(ISSN 0254-2553) <http://eprints.rclis.org/archive/00001288/>
14. Kalyane V. L. (1995) Scientometric Portrait of P. M. Bhargava, *Lucknow Librarian*, Vol.27, No.1-4, pp. 42-70.
(ISSN 0024-7219) <http://eprints.rclis.org/archive/00001398/>
15. Kalyane V. L. and Kademani B. S. (1995) Scientometric Portrait of R. Chidambaram: A Publication Productivity Analysis, *Journal of Information Sciences*, Vol.5, No.3, pp.101 -140. (ISSN 0971-3360)
16. Kalyane V. L. and Munnolli S. S. (1995) Scientometric Portrait of T. S. West, *Scientometrics*, Vol.33, No.2, pp.233-256. (HU ISSN 0138-9130)
<http://eprints.rclis.org/archive/00001402/>
17. Kalyane V. L. and Samanta R. K. (1995) Informetrics on K. Ramiah, In: *New Vistas in Library and Information Science: Papers in Honour of Professor G. V. S. L. Narasimha Raju*, Editors: A. A. N. Raju, L. S. Ramaiah, N. Laxman Rao and T.V. Prafulla Chandra., New Delhi, Vikas Publishing House Pvt. Ltd., pp.565-578.
(ISBN 0-7069-9126-5) <http://eprints.rclis.org/archive/00001278/>
18. Kalyane V. L. and Sen B. K. (1996) Scientometric Portrait of Nobel Laureate Pierre-Gilles de Gennes, *Malaysian Journal of Library & Information Science*, Vol. 1, No.2, pp.13-26. (ISSN 1394-6234) <http://eprints.rclis.org/archive/00001065/>
19. Kalyane V. L. and Kademani B. S. (1997) Scientometric Portrait of Barbara McClintock: The Nobel Laureate in Physiology, *KELPRO Bulletin*, Vol.1, No.1, pp.3- 14. (Reg. No.389/93) <http://eprints.rclis.org/archive/00001247/>
20. Kuhn, T. S. (1970) *The Structure of Scientific Revolutions*. 2nd ed. (Chicago: University of Chicago press)
21. Sathyanarayana, A. (1990) *Indian Journal of Botany*, Half-yearly Journal of Research. Professor L.L. Narayana Commemorative Volume, 13. p. I-VIII. Hyderabad.
22. Schubert, A. and Glanzel, W. (1992) The 100 most frequent family names among science authors, 1981-1985. *Psientometrics*, 60, p. 3.

Table 1 : Yearwise authorship Pattern in Publications of L.L.Narayana with collaboration coefficients and age

Publication Year	Single authored	Two authored		Three authored			Four authored				Total authorships	Collaboration Coefficient	Total publications		Age of L. L. Narayana
		I	II	I	II	III	I	II	III	IV			Main auth.	co. auth.	
1955	-	-	1	-	-	-	-	-	-	-	1	1.00	-	1	25
1957	2	-	1	-	-	-	-	-	-	-	3	0.33	2	1	27
1958	2	1	-	-	-	-	-	-	-	-	3	0.33	3	-	28
1959	3	1	-	-	-	-	-	-	-	-	4	0.25	4	-	29
1960	4	-	-	-	-	-	-	-	-	-	4	0.00	4	-	30
1962	1	-	-	-	-	-	-	-	-	-	1	0.00	1	-	32
1963	2	-	-	-	-	-	-	-	-	-	2	0.00	2	-	33
1964	2	-	-	-	-	-	-	-	-	-	2	0.00	2	-	34
1965	1	-	2	-	-	-	-	-	-	-	3	0.66	1	2	35
1966	1	1	1	-	-	-	-	-	-	-	3	0.66	2	1	36
1968	-	-	2	-	-	-	-	-	-	-	2	1.00	-	2	38

Continued

Continued Table 1

1969	-	2	2	-	-	-	-	-	-	4	1.00	2	2	39
1970	6	-	-	-	-	-	-	-	-	6	0.00	6	-	40
1971	-	1	1	-	-	-	-	-	-	2	1.00	1	1	41
1973	-	3	-	-	-	-	-	-	-	3	1.00	3	-	43
1974	1	2	-	-	-	-	-	-	-	3	0.66	3	-	44
1975	1	-	-	-	-	-	-	-	-	1	0.00	1	-	45
1976	-	5	1	-	-	-	-	-	-	6	1.00	5	1	46
1977	-	5	3	-	-	-	-	-	-	8	1.00	5	3	47
1978	-	7	5	-	2	-	-	-	-	14	1.00	7	7	48
1979	-	2	-	-	1	1	-	-	-	4	1.00	2	2	49
1980	-	3	1	-	-	1	-	-	1	6	1.00	3	3	50
1981	-	2	1	1	-	1	-	-	-	5	1.00	3	2	51
1982	-	2	2	1	1	2	-	-	-	8	1.00	3	5	52
1983	-	2	1	1	-	1	1	-	-	6	1.00	4	2	53
1984	-	6	1	1	-	8	-	1	-	2	1.00	7	12	54
1985	-	-	2	1	-	-	1	-	-	2	1.00	2	4	55
1986	-	-	2	1	-	3	1	-	-	1	1.00	2	6	56

Continued

Continued Table 1

1987	-	-	2	-	-	3	-	-	-	4	9	1.00	-	9	57
1988	-	1	2	-	-	3	-	-	-	1	7	1.00	1	6	58
1989	-	-	3	-	-	5	-	-	-	3	11	1.00	-	11	59
1990	-	-	4	1	1	4	-	-	-	1	11	1.00	1	10	60

I = First author, II = second author, III = Third author, IV = Fourth author

Table 2 : Domainwise publications of L.L. Narayana

Publication Year	A	B	C	D	E	F	G	H	I	J	Total	Perc-entage	Cumulative
1955	-	-	-	-	-	-	-	-	1	-	1	0.57	0.57
1957	-	-	3	-	-	-	-	-	-	-	3	1.71	2.28
1958	-	2	-	-	1	-	-	-	-	-	3	1.71	3.99
1959	-	1	3	-	-	-	-	-	-	-	4	2.29	6.28
1960	-	-	1	3	-	-	-	-	-	-	4	2.29	8.57
1962	-	-	1	-	-	-	-	-	-	-	1	0.57	9.14
1963	-	-	2	-	-	-	-	-	-	-	2	1.14	10.28
1964	-	-	1	-	1	-	-	-	-	-	2	1.14	11.42
1965	-	-	2	-	-	-	1	-	-	-	3	1.71	13.13
1966	-	1	1	-	-	1	-	-	-	-	3	1.71	14.84
1968	-	-	1	-	1	-	-	-	-	-	2	1.14	15.98
1969	-	4	-	-	-	-	-	-	-	-	4	2.29	18.27
1970	-	-	6	-	-	-	-	-	-	-	6	3.43	21.70

Continued

Continued Table 2

1971	-	2	-	-	-	-	-	-	-	-	2	1.14	22.84
1973	-	3	-	-	-	-	-	-	-	-	3	1.71	24.55
1974	-	3	-	-	-	-	-	-	-	-	3	1.71	26.26
1975	-	-	-	-	1	-	-	-	-	-	1	0.57	26.83
1976	-	5	-	-	1	-	-	-	-	-	6	3.43	30.26
1977	1	5	2	-	-	-	-	-	-	-	8	4.57	34.83
1978	1	7	3	1	-	-	1	1	-	-	14	8.00	42.83
1979	-	1	3	-	-	-	-	-	-	-	4	2.29	45.12
1980	2	3	1	-	-	-	-	-	-	-	6	3.43	48.55
1981	2	2	1	-	-	-	-	-	-	-	5	2.86	51.41
1982	4	2	-	2	-	-	-	-	-	-	8	4.57	55.98
1983	3	2	1	-	-	-	-	-	-	-	6	3.43	59.41
1984	12	4	1	1	-	1	-	-	-	-	19	10.86	70.27
1985	3	-	2	1	-	-	-	-	-	-	6	3.43	73.70
1986	5	2	1	-	-	-	-	-	-	-	8	4.57	78.27
1987	8	1	-	-	-	-	-	-	-	-	9	5.14	83.41

Continued

Continued Table 2

1988	4	1	-	1	-	-	-	-	-	1	7	4.00	87.41
1989	8	1	-	2	-	-	-	-	-	-	11	6.29	93.70
1990	4	1	1	4	-	1	-	-	-	-	11	6.29	99.99

A = Chemotaxonomy.

B = Floral anatomy,

C = Embryology.

D = Systematic position.

E = Floral anatomy and Embryology.

F = Floral morphology.

G = Vascular anatomy.

H = Floral Morphology and Embryology.

I = Life history.

J = In vitro germination

Table 3 : Research group of L.L. Narayana

Author code	S	Two			Three				Four					AGT	Year Fp-Lp
	I	I	II	T	I	II	III	T	I	II	III	IV	T		
NLL	26	46	40	86	7	5	32	44	3	1	1	14	19	175	1955-90
VJ	-	2	-	2	-	-	-	-	-	-	-	-	-	2	1955-77
SM	-	-	2	2	-	-	-	-	-	-	-	-	-	2	1958-59
RD*	-	2	22	24	-	-	-	-	-	-	-	-	-	24	1965-78
SR	-	1	-	1	-	-	-	-	-	-	-	-	-	1	1966-68
RNGP	-	1	-	1	1	-	3	4	-	-	-	-	-	5	1968-90
SK	-	6	-	6	-	-	-	-	-	-	-	-	-	6	1968-78
RM*	-	2	9	11	3	25	3	31	2	2	13	1	18	60	1976-90
SK T*	-	1	6	7	2	3	1	6	-	-	1	1	2	15	1977-84
SVV LN*	-	3	2	5	-	1	-	1	-	-	-	-	-	6	1977-90
DBSM	-	-	-	-	1	-	-	1	1	1	-	-	2	3	1978-84
PA*	-	3	2	5	-	-	2	2	-	-	-	-	-	7	1978-90
RRN*	-	-	-	-	1	1	1	3	-	-	-	-	-	3	1978-90
PPS	-	-	-	-	1	2	-	3	-	1	-	1	2	5	1979-86

Continued

Continued table 3

KVL*	-	3	1	4	-	-	-	-	-	-	-	-	-	4	1980-84
RMI	-	-	-	-	-	-	-	-	1	-	-	-	1	1	1980-80
GRB	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1980-80
SC	-	1	1	2	1	-	-	1	-	-	-	-	-	3	1981-84
RBB*	-	1	-	1	1	-	-	1	-	-	-	-	-	2	1982-82
NG	-	-	-	-	8	2	1	11	1	3	1	1	6	17	1983-90
RRV	-	-	-	-	1	-	-	1	-	-	-	-	-	1	1983-83
KK	-	-	-	-	2	-	-	2	3	2	-	-	5	7	1984-90
SM	-	-	-	-	7	1	-	8	-	1	-	-	1	9	1984-90
NPS*	-	6	-	6	-	2	-	2	-	2	-	-	2	10	1985-90
RVS	-	-	-	-	-	-	1	1	-	-	2	-	2	3	1985-86
SPR*	-	-	-	-	-	-	-	-	1	-	-	-	1	1	1985-85
ASMJ	-	-	-	-	5	-	-	5	5	2	-	-	7	12	1986-89
RTPS	-	1	-	1	-	-	-	-	-	-	-	-	-	1	1986-86
SDVL*	-	2	1	3	1	-	-	1	-	-	-	-	-	4	1986-88
PC	-	-	-	-	-	1	-	1	-	-	-	-	-	1	1986-86
VBK	-	-	-	-	-	-	-	-	-	2	-	-	2	2	1987-87

Continued

LK	-	I	-	I	-	-	-	-	-	-	-	-	-	1	1987-87
RAM	-	-	-	-	I	-	-	I	-	-	-	-	-	1	1988-88
KPB	-	-	-	-	-	I	-	I	-	-	-	-	-	1	1988-88
RMS	-	-	-	-	I	-	-	I	2	2	1	-	5	6	1988-90
RDD*	-	4	-	4	-	-	-	-	-	-	-	-	-	4	1989-90

* = Those who have completed Ph. D. under the guidance of L. L. Narayana.

I = First author,

II = Second author,

III = Third author,

IV = Fourth.

T = Total,

AGT = Authorship grand total

Fp = First Paper,

Lp = Last Paper,

S = Single authored papers.

Two = Two authored Papers.

Three = Three authored Papers, and

Four = Four authored Papers.

Table 4. Author Productivity

<i>No. of Papers (a)</i>	<i>Active associates</i>	<i>Total No. of researchers</i>	<i>Total Papers (a.b)</i>	<i>Percentage</i>	<i>Cumulative percentage</i>
1		10	10	2.46	2.46
2		4	8	1.97	4.43
3		3	9	2.22	6.65
4		4	16	3.94	10.59
5		3	15	3.69	14.28
6		2	12	2.96	17.24
7		2	14	3.45	20.69
9	Satyavati, M.	1	9	2.22	22.91
10	Narayana, P. S.	1	10	2.46	25.37
12	Anuradha, S. M. J.	1	12	2.95	28.33
15	Sundari, K. T.	1	15	3.69	32.02
17	Nageswar, G.	1	17	4.19	36.21
24	Rao, D.	1	24	5.91	42.12
60	Radhakrishnaih, M.	1	60	14.78	56.90
175	L.L. Narayana	1	175	43.10	100.00

*Table 5 : Author Productivity and distribution of authors and papers
by number of subject categories (domains)*

<i>NPP</i>	<i>Number of domains to which contributions belong and number of contributors</i>										<i>TNR</i>
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	
1	2	5	1	-	-	-	-	-	-	2	10
2	2	1	2	2	-	-	-	-	1	-	4
3	1	6	-	2	-	1	-	-	-	-	3
4	5	4	5	1	-	-	-	-	-	-	4
5	5	4	6	-	-	-	-	-	-	-	3
6	6	5	-	-	1	-	-	-	-	-	2
7	10	1	1	2	-	-	-	-	-	-	2
9	6	1	-	2	-	-	-	-	-	-	1
10	6	1	2	2	-	-	-	-	-	-	1
12	12	-	-	-	-	-	-	-	-	-	1
15	4	3	8	-	-	-	-	-	-	-	1
17	16	-	-	1	-	-	-	-	-	-	1

Continued

Table No. 5 continued

24	-	20	1	-	-	1	1	1	-	-	1
60	42	12	-	4	-	1	1	-	-	-	1
175	57	53	37	15	5	3	2	1	1	1	1
Total	174	115	63	31	6	6	4	2	2	3	36

A = Chemotaxonomy,

B = Floral anatomy,

C = Embryology.

D = Systematic Position,

E = Floral anatomy and Embryology, F = Floral morphology.

G = Vascular anatomy,

H = Floral morphology and embryology.

I = Life history,

J = In vitro germination,

NPP = Number of papers productivity

TNR = Total number of researchers

Table 6: Journalwise scattering of papers of L. L. Narayana

Rank	Journal title	TP	Percentage	Cumu. (%)	PJU FP-LP	Total
1.	Curr. Sci.	34	19.43	19.43	1955-89	35
2.	J. Jap. Bot.	28	16.00	35.43	1965-81	17
3.	J. Indian Bot. Soc.	21	12.00	47.43	1958-90	33
4.	J. Econ. Tax. Bot.	12	6.86	54.29	1982-89	8
5.	Proc. Indian Acad. Sci. Sec. B.	11	6.29	60.58	1960-90	31
6.	Fedders Report	10	5.71	66.29	1986-90	5
7.	J. Swamy Bot. Club	9	5.14	71.43	1984-88	5
8.	Bull. Indian Nation Sci. Academy	6	3.43	74.86	1970-70	1
9.	Indian J. Bot.	5	2.86	77.72	1978-87	10
10.	Nation. Acad. Sci. Letters	4	2.29	80.01	1978-90	13
11.	Phytomorphyology	4	2.29	82.30	1957-59	3
12.	Act. Bot. Indica	4	2.29	84.59	1978-84	7

Continued

Conntinued Table 6

13.	Phytochemistry and Taxonomy	3	1.71	86.30	1990-90	1
14.	Sci. Cult	2	1.14	87.44	1952-59	8
15.	Life Sci. Adv.	2	1.14	88.58	1982-82	1
16.	Plant and Nature	2	1.14	89.72	1983-83	1
17.	J.Pl.Anat.Morph.	2	1.14	90.86	1984-84	1
18.	Bangladesh J.Botany	2	1.14	92.00	1989-89	1
19.	Indian J.Genet.	1	0.57	92.57	1968-68	1
20.	Bull.Torrey Bot.Club	1	0.57	93.14	1969-69	1
21.	Caryologia	1	0.57	93.71	1978-78	1
22.	Phyta	1	0.57	94.28	1980-80	1
23.	Bot.Notiser	1	0.57	94.85	1980-80	1
24.	Can.J.Bot.	1	0.57	95.42	1982-82	1
25.	Trends Pl.Res.	1	0.57	95.99	1985-85	1
26.	Plant Syst Evol.	1	0.57	96.56	1986-86	1
27.	Proc.Nation.Acad. Sci.(B)	1	0.57	97.13	1987-87	1

Continued Table 6

28.	Ad.Plant Sci.	1	0.57	97.70	1988-88	1
29.	Indian J.Forestry	1	0.57	98.27	1989-89	1
30.	Plant Sci. Res.in India	1	0.57	98.84	1989-89	1
31.	Proc. Symp. Andhra University	1	0.57	99.41	1990-90	1
32.	Geophytology	1	0.57	99.98	1990-90	1

TP = Total Papers.

FP = First Paper year.

LP = Last Paper year

PJU = Period of Journal usage. Cumu. = Cumulative

Table 7 : Bradford's Zones for Research Papers of L. L. Narayana

Zones	Number of Papers	Number of Journals	Bradford Multiplier (b)
First	52	2	-
Scnd	72	3	1.5
Third	51	27	9.0
Average Bradford Multiplier (b)			5.1

Table 8 : Keywords frequencies for family and genus included in the articles published by L. L. Narayana

Family	Frequency	Genus	Frequency
Linaceae	19	Sorghum	5
Pittosporaceae	15	Pittosporum	3
Humiriaceae	8	Belanites	2
Erythroxyaceae	5	Bauhinia	2
Balsaminaceae	5	Indigofera	2
Acanthaceae	5	Gisekia	2
Oxalidaceae	4	Staurogyne	1
Rubiaceae	4	Trapa	1
Geraniceae	3	Cuscuta	1
Bigonaceae	3	Ceratophyllum	1
Stegnospermataceae	3	Moringa	1
Boraginaceae	3	Cassia	1
Simarobaceae	2	Hibiscus	1
Meliaceae	2	Pandanus	1
Burseraceae	2	Typha	1
Capparidaceae	2	Aesculus	1
Papilionaceae	2	Arachis	1
Moringaceae	2	Abrus	1

Continued

Continued Table 8

384		<i>Knowledge Societies and Libraries</i>	
Corynocarpaceae	2	Clerodendron	1
Mimosaceae	2	Crotalaria	1
Lentibularaceae	2	Heylandia	1
Staphyleaceae	1	Cicer	1
Rutaceae	1	Acacia	1
Topaeolaceae	1	Ixora	1
Ochnaceae	1	Gardenia	1
Primulaceae	1	Jacaranda	1
Scrophulariaceae	1	Parmentiera	1
Pedaliaceae	1	Averrhoa	1
Annonaceae	1	Impatiens	1
Menispermaceae	1		
Averrhoaceae	1		
Malvaceae	1		
Tremandraceae	1		
Basellaceae	1		
Balanitaceae	1		
Viticeae	1		
Crescematiceae	1		
Melastomataceae	1		

Table 9 : Keyword frequencies for Tribes and Species included in the titles to the articles published by L. L. Narayana

<i>Tribe</i>	<i>Frequency</i>	<i>Species</i>	<i>Frequency</i>
Amhersticeae	2	Hydrocera triflora	2
Trifolieae	1	Stegnosperma haliminifolium	2
Ruellieae	1	Garuga pinnata	1
Vicieae	1	Cipadessa baccifera	1
Bignoniaceae	1	Boswellia serrata	1

Continued

Acantheae	1	<i>Impatiens leschenaultii</i>	1
Nelsoniaceae	1	<i>Biophytum intermedium</i>	1
Cynometraeae	1	<i>Oxalis pubescens</i>	1
Caesalpinionideae	1	<i>Primula floribunda</i>	1
Hedysareae	1	<i>Utricularia caerniea</i>	1
Crescenteae	1	<i>Utricularia stricticeaulis</i>	1
Eucaesalpineae	1	<i>Nepenthes khasiana</i>	1
		<i>Pronaya elegans</i>	1
		<i>Marianthus bignonaceae</i>	1
		<i>Moringa concanensis</i>	1
		<i>Cuscuta chinensis</i>	1
		<i>Pittosporum floribundum</i>	1
		<i>Utricularia aurea</i>	1
		<i>Utricularia exoleta</i>	1
		<i>Utricularia stellaria</i>	1
		<i>Emilia flammea</i>	1
		<i>Sesamum indicum</i>	1
		<i>Gyrocarpus americanus</i>	1
		<i>Phryma leptostachya</i>	1
		<i>Schizanthus wisetonensis</i>	1
		<i>Tetrateca efoliata</i>	1
		<i>Corynocarpus laevigatus</i>	1
		<i>Tetrateca affinis</i>	1
		<i>Vigna trilobata</i>	1
		<i>Hydrocera triflora</i>	1

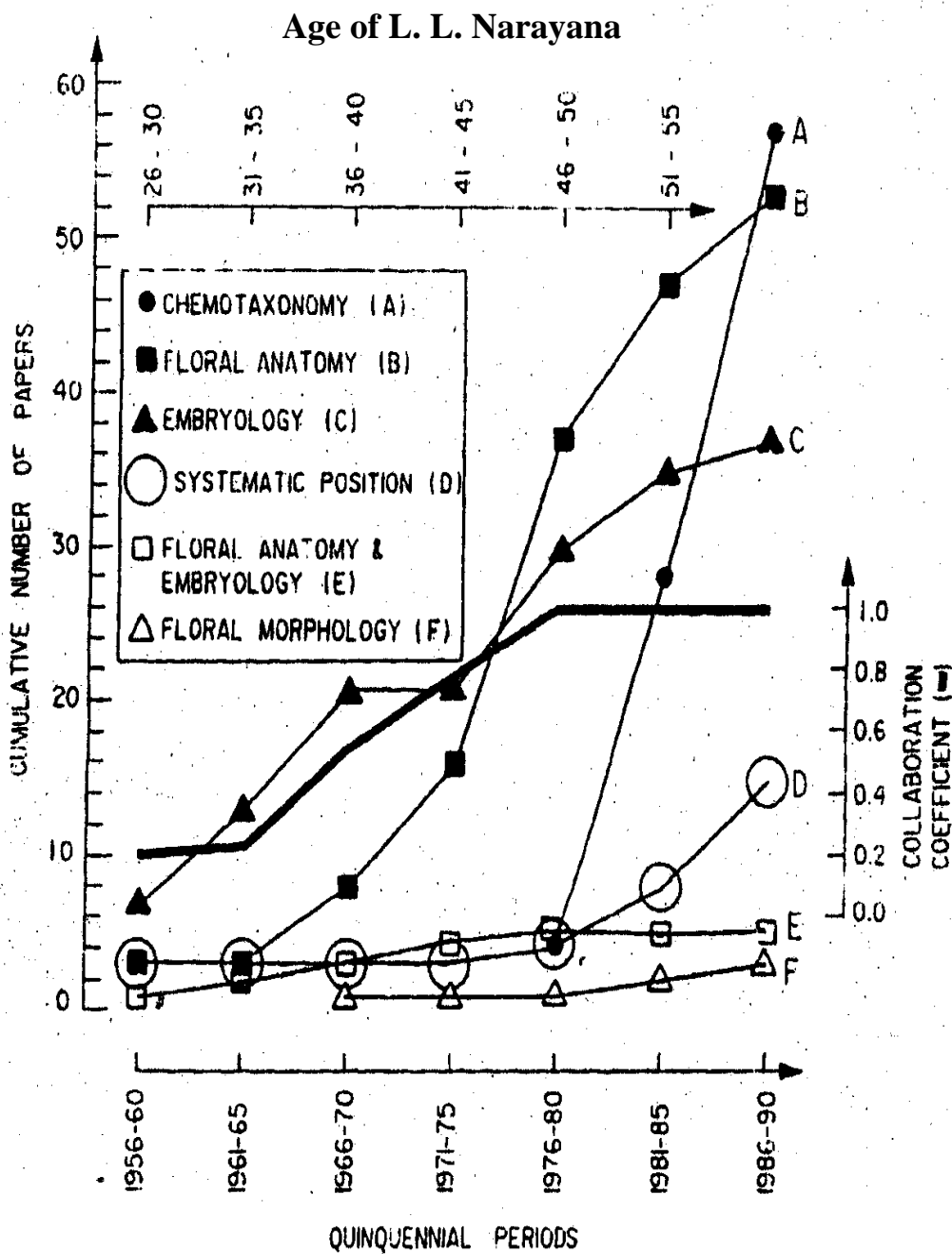


Fig. 1. Domainwise contributions of L.L. Narayana

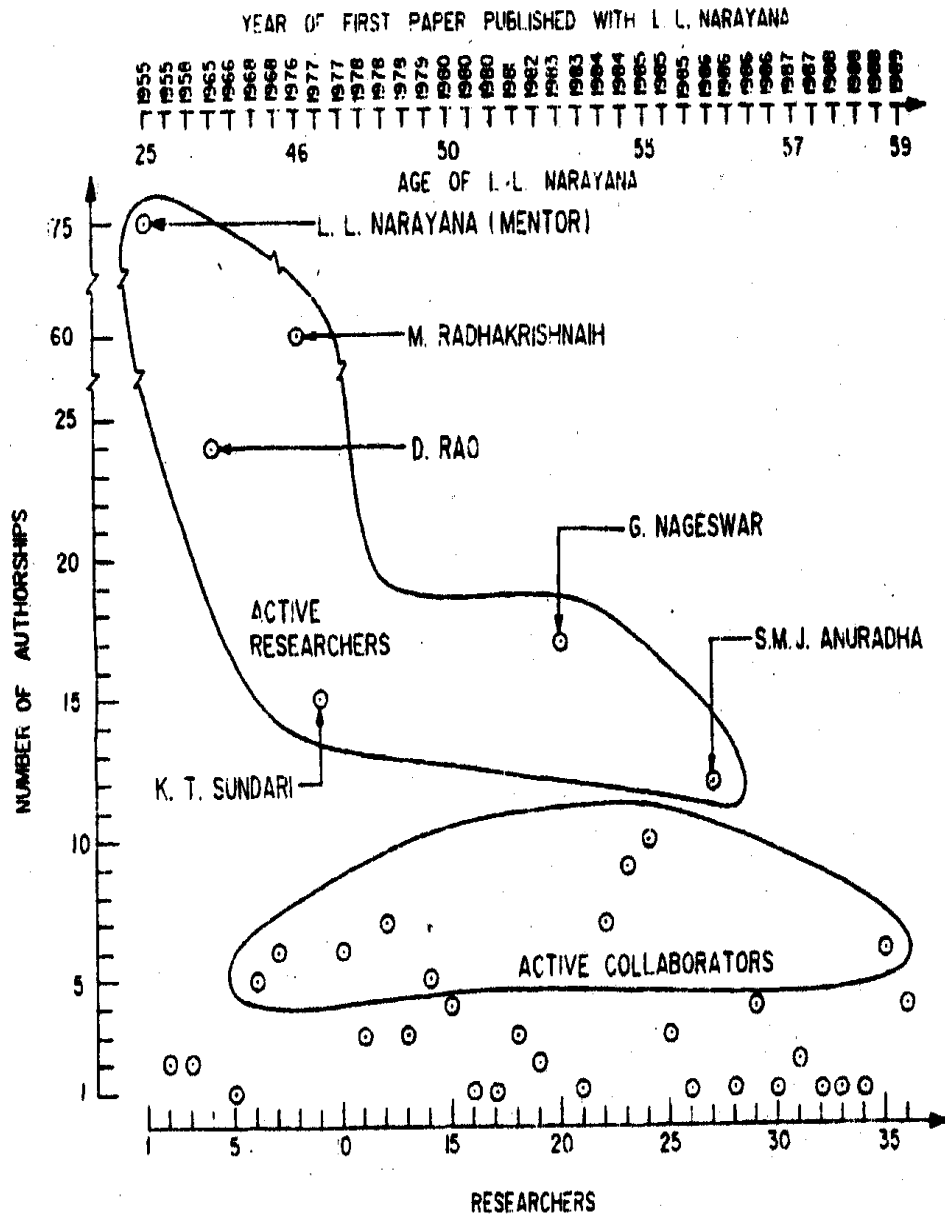


Fig. 2. Authorship credits to the researchers in chronological order

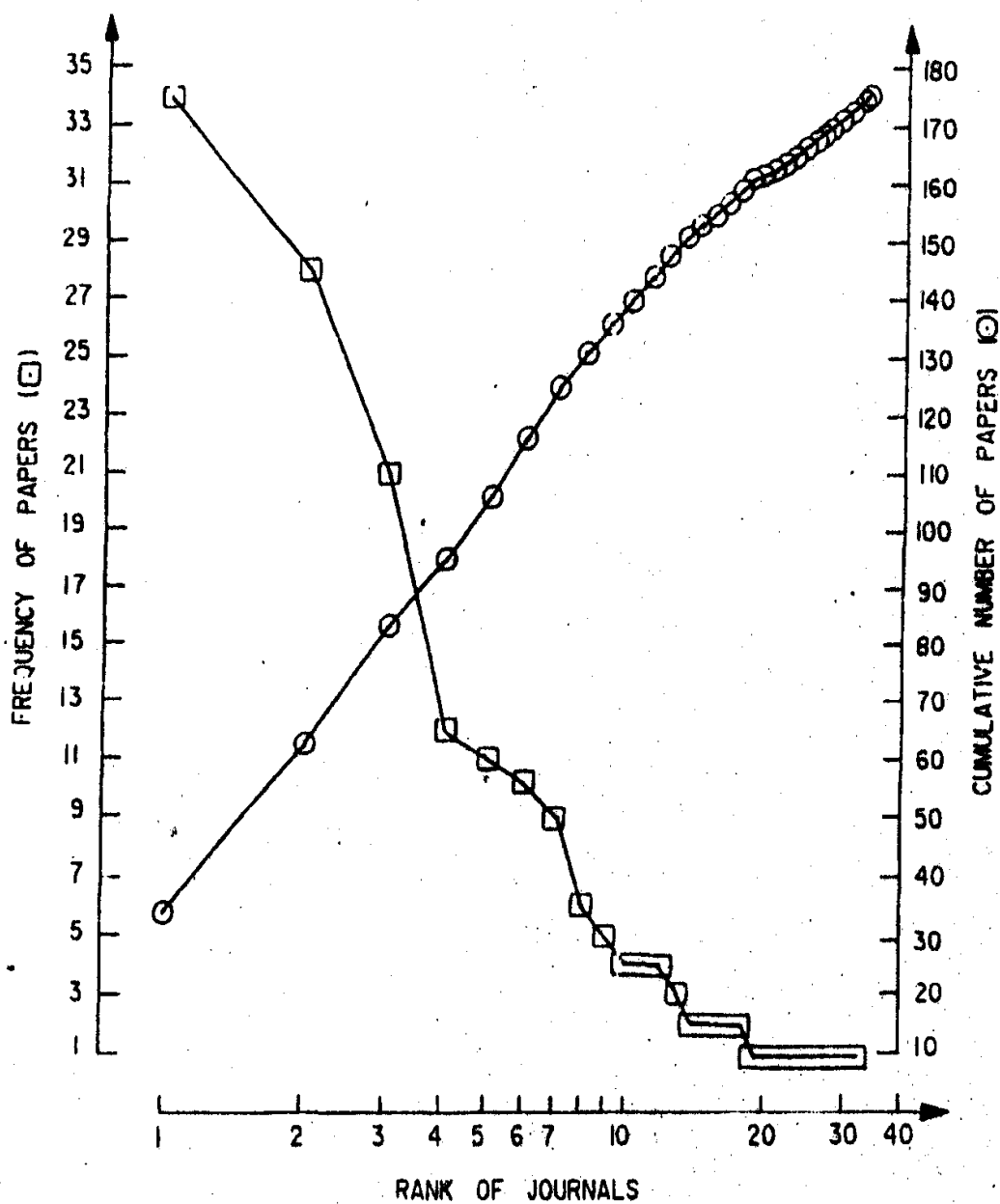


Fig. 3. Bradford - Zipf bibliograph on publications of L.L. Narayana