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AUTHORSHIP PATTERN AND COLLABORATIVE RESEARCH IN THE FIELD OF ZOOLOGY

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ABSTRACT

Studies the trend in authorship pattern and collaborative research in zoology with a sample of 19,323 journal citations figured in the theses on zoology accepted for the award of the doctoral degree by Sri Venkateswara University, Tirupati, India. The study indicates that although multiple authorship is dominant, solo research also exists. The proportion of single authored papers has shown a declining trend during the period 1901-1995. It is observed that the proportion of single authorship is likely to be insignificant after the year 2030. The degree of collaboration in research is 0.75 in zoology as a whole.

KEYWORDS: Zoology; Authorship pattern; Collaborative research

INTRODUCTION

Collaborative research is a well-recognised feature of modern science, and there has been a consistent trend towards increased collaboration in all branches of science during the present century. Price (1963), on the basis of a survey of *Chemical Abstracts* observed a steady increase in the trend towards multiple authorship and held that "… if it continues at the present rate, by 1980 the single authored papers will be extinct". Though the above postulation may not hold true in zoology, a decline in the number of scientific papers published by single authors is evident. Fox and Faver (1984) are of the view that the increase in the number of multi-authored papers may be due to the collaboration of specialists leading to enhanced quality of research. The main reason for collaborative research can be attributed to the interdisciplinary nature of investigations, escalating cost of instrumentation, laboratory facilities and common interest of scientists in the same field.

A large number of studies have been conducted to analyse and interpret the trends in collaborative authorship in different disciplines. Maheswarappa and Mathias (1987) studied the research collaboration in different disciplines of applied sciences in India and observed an increasing trend towards collaborative research but the actual rates of increase varied from one discipline to another. Karisiddappa et al. (1990) analysed the authorship pattern in psychology and found that the proportion of single-

authored papers has fallen to 39.43% in 1988 when compared to 84% in the 1920's indicating the trend towards multiple authorship. Usha et al. (1993) analysed and interpreted the trends in multiple authorship in agricultural sciences and noticed the predominance of multiple authors over single authors. Begum and Rajendra (1990) in their study observed the dominance of multiple authorship over single authorship in zoological sciences. Vimala and Pulla Reddy (1996) observed a similar trend in botany. A variation in the extent of collaboration and relative rates have been found to vary from one discipline to another. The present study is undertaken to elucidate the authorship pattern and the degree of collaboration in the field of zoology and changes thereof as a function of time.

OBJECTIVES OF THE STUDY

The specific objectives of the study are: (i) to examine the nature of authorship pattern in the literature of zoology; (ii) to determine the proportion of single vs. multi-authored papers and (iii) to determine the degree of collaboration and average number of authors per paper.

DATA AND METHODOLOGY

The doctoral theses which are the products of research activity, have been examined for the present study. One hundred and twenty doctoral theses accepted between 1964-1995 by Sri Venkateswara University in the field of zoology, from the sample for the study. The total number of journal citations appended to these documents are 19,323. Necessary information has been recorded, analysed and tabulated for making observations.

The following four regression models have been fitted to examine the suitability of the model that explains well the trend in the single authorship pattern. The method of least squares is used to examine the relationship after subjecting the data to arcsin transformation.

$Y=a + bX$
$Y + a + bX + cX^2$
$\text{Log } Y = a + bX$
$\text{Log } Y = a + bX + cX^2$

Where Y is the proportion of authorship and X is the year.

Based on the value of R^2, Root Mean Square Error, signs and magnitude of the coefficients, the model that best suits the data has been selected for data analyses. The degree of collaboration is computed using the following formula given by Subramanyam (1983).

$$\text{The degree of collaboration } C = \frac{Nm}{Nm+Ns}$$

Where,
Nm = number of multi-authored papers in the discipline
Ns = number of single-authored papers in the discipline

RESULTS AND DISCUSSION

(a) Authorship pattern

Table 1 presents the authorship pattern in the field of Zoology. Two-authored papers comprised the highest percentage (37.5%) of the total 19,323 papers.

Table 1: Authorship Pattern in the Field of Zoology

Years(s)	No. of papers with 1,2,3 … n authors						
	1	**2**	**3**	**>3**	**Total number of papers**	**Total number of authors**	**Average number of authors per paper**
1901-05	4 (100.0)	0	0	0	4 (100.00)	4	1.00
1906-10	16 (76.19)	5 (23.81)	0	0	21 (100.00)	26	1.24
1911-15	20 95.24)	1 (4.76)	0	0	21 (100.00)	22	1.05
1916-20	19 (79.17)	4 (16.67)	0	1 (4.17)	24 (100.00)	32	1.33
1921-25	49 (62.82)	26 (33.33)	3 (3.85)	0	78 (100.00)	110	1.41
1926-30	91 (63.64)	45 (31.47)	7(4.9)	0	143 (100.00)	202	1.41
1931-35	120 (65.93)	52 (28.57)	10 (5.49).	0	182 (100.00)	254	1.40
1936-40	124 (48.63)	90 (35.29)	23 (9.02)	18 (7.06)	255 (100.00)	458	1.80
1941-45	77 (34.38)	113 (50.45)	33 (14.73)	1 (0.45)	224 (100.00)	408	1.82
1946-50	147 (41.41)	133 (37.46)	59 (16.62)	16 (4.51)	355 (100.00)	659	1.86
1951-55	329 (33.00)	392 (39.32)	150 (15.05)	126 (12.64)	997 (100.00)	2078	2.08
1956-60	493 (33.13)	474 (31.85)	387 (26.01)	134 (9.01)	1488 (100.00)	3163	2.13
1961-65	728 (33.70)	870 (40.28)	399 (18.47)	163 (7.55)	2160 (100.00)	4386	2.03
1966-70	883 (30.32)	1121 (38.50)	631 (21.67)	227 (9.51)	2912 (100.00)	6251	2.15
1971-75	857 (21.07)	1534 (37.72)	1060 (26.06)	616 (15.15)	4067 (100.00)	9838	2.42
1976-80	564 (15.36)	1490 (40.59)	909 (24.76)	708 (19.29)	3671 (100.0)	9583	2.61
1981-85	292 (13.25)	744 (33.77)	567 (25.74)	600 (27.24)	2203 (100.00)	6363	2.89
1986-90	45 (9.38)	155 (32.29)	136 (28.33)	144 (30.00)	480 (100.00)	1477	3.08
1991-95	2 (5.26)	11 (28.95)	11 (28.95)	14 (36.84)	38 (100.00)	115	3.03
Total	4860 (25.15)	7260 (37.57)	4385 (22.69)	2818 (14.59)	19323 (100.00)	45429	2.35

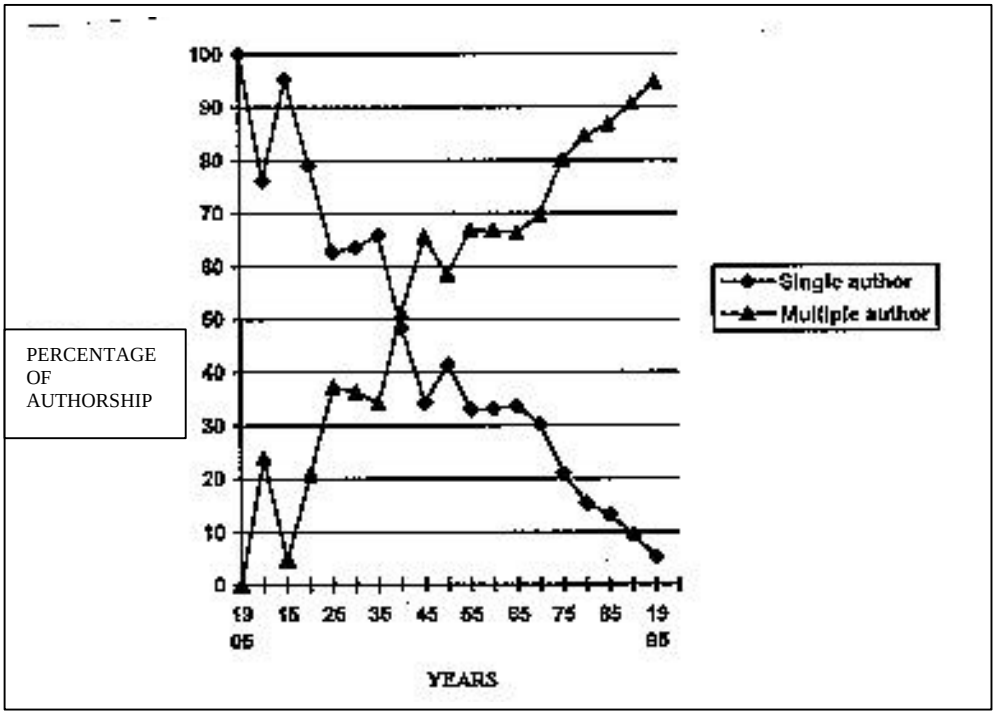
Table 2: Single vs Multi-Authored Papers and the Degree of Collaboration in the Field of Zoology

Year(s)	Papers		Degree of
	Single-authored	Multi-authored	Collaboration
1901-05	4 (100.00)	0 (0.00)	0.00
1906-10	16 (76.19)	5 (23.81)	0.24
1911-15	20 (95.24)	1 (4.76)	0.05
1916-20	19 (79.17)	5 (20.83)	0.21
1921-25	49 (62.82)	29 (37.18)	0.37
1926-30	91 (63.64)	52 (36.36)	0.36
1931-35	120 (65.93)	62 (34.07)	0.34
1936-40	124 (48.63)	131 (51.37)	0.51
1941-45	77 (34.38)	147 (65.63)	0.66
1946-50	147 (41.41)	208 (58.59)	0.59
1951-55	329 (33.00)	668 (67.00)	0.67
1956-60	493 (33.13)	995 (66.87)	0.67
1961-65	728 (33.70)	1432 (66.30)	0.66
1966-70	883 (30.32)	2029 (69.68)	0.70
1971-75	57 (21.07)	3210 (79.93)	0.79
1976-80	564 (15.36)	3107 (84.64)	0.85
1981-85	292 (13.25)	1911 (86.75)	0.87
1986-90	45 (9.38)	435 90.63)	0.91
1991-95	2 (5.26)	36 (94.74)	0.95
Total	**4860 (25.15)**	**14463 (74.85)**	**0.75**

Single authored papers constituted 25.15% of the cited papers. Three-authored papers accounted for 22.69% and the rest i.e., 14.59% were by four or more authors. Thus, multi-authored papers far outnumbered single-authored papers, accounting for 74.85% of the total cited papers.

Table 2 indicates that single-authored papers were on the decline from 100.00% (during 1901-1905) to 5.26% (during 1991-1995). As a result of which the multi-authored papers have increased from 0.00% tp 94.74%. After 1940 there was a tremendous change in the authorship pattern showing arapid decline in the single-authored papers and the reverse trend for multi-authored works in zoology. The increase in the mult-authored papers and the decline in single-authored papers over the years have been presented graphically in Figure 1. The figure indicates that the point of intersection of the two curves occur around 1940 which indicated that it took more than 40 years to have 50 percent of multi-authored papers. The trend was set after the 1940s.

Figure 1: Authorship Pattern in Zoology



(b) Single vs. Multi-Authored Papers

Table 2 shows the predominance of multi-authored papers (74.85%) over single-authored papers 925.15%). The ratio between single and multi-authored papers is approximately 1: 3. The high incidence of multiple authorship is a characteristic of the sciences. The four regression models have been estimated for the proportion of single authorship. The values of R^2, Root Mean Square Error (RMSE) and the estimates of the coefficients are present in Table 3.

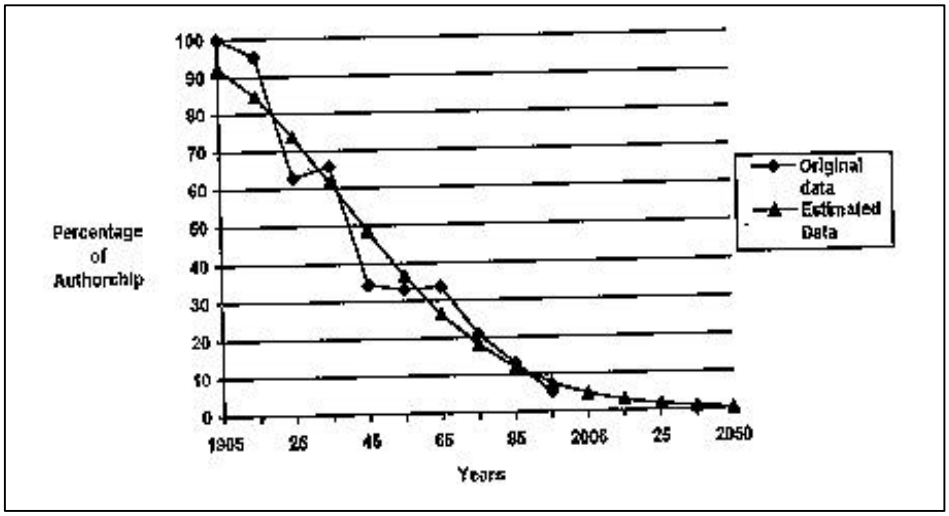
By looking into the R^2, RMSE, signs and magnitudes of the coefficients, it is clear that the model $\text{Log } Y = a + bX + cX^2$ fits well with the data of the proportions of single authorship and thus this model has beenselected for analysing the trends in single authorship pattern.

The actual proportions of single authorship and the estimated proportions based on the above selected model have been presented in Table 4 for the various time periods and this is represented graphically in Figure 2.

Table 3: Results of Four Regression Models Estimated for Single Authorship

Type of model	R^2	RMSE	a	c	c
$Y = a + bX$	0.8339	9.77	67.8640	-3.7835	----
$Y = a + bX + cX^2$	0.9030	7.70	83.4870	-8.2472	0.2232
$\text{Log } Y = a + bX$	0.9256	0.25	4.6042	-0.1523	----
$\text{Log } Y = a + bX + cX^2$	0.9467	0.21	4.2737	-0.0579	-0.0047

Figure 2: Single Authorship Pattern in Zoology



Assuming that the probability of having a single authorship is less than 0.01 as insignificant, it is clear from Table 4 that the estimated proportions will be less than 1 percent after the tear 2030. In other words it may be inferred that the proportion of single authorship is likely to be insignificant after the year 2030. This establishes the high incidence of 2030. This establishes the high incidence of multiple authorship in recent years and also in the future in the sciences, unlike in the social sciences.

(c) Degree of Collaboration and Average Number of Authors Per Paper

The extent of collaboration in research can be measured with the help of multi-authored papers. Using the formula given by Subramanyam, the degree of collaboration for various years have been computed and presented in Table 2. It is clear from the table that the defree of collaboration has increased from 0.00 (during 1901-1905) to 0.95 (during 1991-1995). The degree of collaboration is 0.75 as a whole. This clearly indicates the trend towards collaborative research. The average number of authors per paper has increased from 1.00 (during 1901-1905) to 3.03 (during 1991-1995). This supports the observation of Price (1963) that team research is a common trend in scientific activity

CONCLUSION

The following conclusions are drawn from the study.

1. Multi-authored papers are maximum accounting for 74.85% of the total cited papers.
2. The proportion of the single authored papers has shown a declining trend from 100% during 1901-1095 to 5.26% during 1991-1995.
3. It is observed that the proportion of single-authored papers is likely to be insignificant after the year 2030.

Table 4: Actual and Estimated Percentages of Single-Authored

Time period	Actual	Estimated
1901-1905	100.00	92.34
1906-1910	76.19	88.89
1911-1915	95.24	84.66
1916-1920	79.17	79.67
1921-1925	62.82	74.05
1926-1930	63.64	67.97
1931-1935	65.93	61.59
1936-1940	48.63	55.09
1941-1945	34.38	48.68
1946-1950	41.41	42.48
1951-1955	33.00	36.65
1956-1960	33.13	31.25
1961-1965	33.70	26.35
1966-170	30.32	21.98
1971-1975	21.07	18.15
1976-1980	15.36	14.83
1981-1985	13.25	12.00
1986-1990	9.38	9.62
1991-1995	5.26	7.61
1996-2000	----	6.00
2001-2005	----	4.66
2006-2010	----	3.59
2011-2015	----	2.74
2016-2020	----	2.07
2021-2025	----	1.55

2026-2030	----	1.15
2031-2035	----	0.84
2036-2040	----	0.61
2041-2045	----	0.44
2046-2050	----	0.31

4. The degree of collaboration has increased from 0.0 during 1901-1905 to 0.95 during 1991-1995.

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