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PHOENIX DACTYLIFERA L: A BIBLIOMETRIC STUDY OF THE LITERATURE ON DATE PALM

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ABSTRACT

This study carried out a bibliometric analysis of the literature on Phoenix Dactylifera L (date palm). The purpose was to study the periodic growth of literature, author patterns, topical focus, language dispersal, and geographic origin of literature on dates. All related databases and several online catalogues of libraries were searched to identify a final list of 2,465 citations. This data set was analyzed using various bibliographic characteristics. The volume of literature on date palm started increasing from less than one publication per year before 1970 to 80+ papers annually during the 1990s. Most of this literature comes from Agriculture, Biological Sciences, and Chemistry. A small core of authors contributed about one-third of the citations. Four-fifths of the citations are the result of collaborative work. About two-fifths of the papers are published by only 36 journals. Iraq and Egypt are the leading contributors to this literature. English is the most predominant language. The findings of this study will be of benefit to scholars in several disciplines. By identifying various patterns in the literature, it will create awareness among concerned scholars regarding the core authors, core journals that publish this literature, areas where more research is being conducted, and areas where more research needs to be done. It should also encourage researchers to initiate collaborative and inter-disciplinary research.

Keywords: Phoenix dactylifera L; Dates; Date Palm; Fruit trees; Bibliometric analysis

INTRODUCTION

Plants have always been a major source of food, nutrition and health care for both humans and animals. The writings on nutritional and medicinal plants/trees go way back to 1500 B.C in Egypt, 800-400 B.C. in India, and 500 B. C. in China (Chadwick & Craker, 1988). Phoenix dactylifera L (date palm), called 'nakhla' and the 'Tree of Life' by the Arabs, is considered as one of the oldest cultivated fruit trees. It is believed to be indigenous to the countries around the Arabian Gulf (Chandra, Chandra & Gupta, 1992). The evidence of date palm cultivation goes as

far back as 4000 B.C. in what is now southern Iraq (Barreveld, 1993). Archaeological excavations have established that the date palm was also cultivated in the Indus Valley, now Pakistan, as early as 2000 B.C. Date palm that originated in North Africa is now distributed throughout the Middle East, North Africa, South Asia, China, South and Western USA, Central and South America, and Southern Europe (Spain and Italy). Dates are very low in proteins and fats but possess high nutritional value, with up to 70 % sugar and are very nutritious containing minerals and vitamins. Various parts of its tree have been used for a variety of purposes including preparation of animal feed, construction materials, household goods, and paper. However, scientific research interest on date palm was totally absent up to 1969. The first recorded publication appeared in 1938 and only 28 publications appeared up to 1969, a long period of 42 years. It received a thrust during the 1970s as a result of the activities of the Food and Agricultural Organisation in the Middle East region and the development of higher education and research infrastructure in the oil-rich countries. As result of these developments, the quantity of research literature on date palm has been growing steadily.

There is a large volume of bibliometric studies analyzing the characteristics of specific bodies of literature. This technique can be used to identify research trends and growth of knowledge in various subjects and to forecast publishing trends. Bibliometric analysis can also be used to study "longitudinal shifts in concept clusters to characterize the succession of theoretical paradigms in fields of research" and that "an increase in database coverage was an indicator of the topic's importance" (Paisley, 1990, p. 282, 285). An investigation of 294 scientists on the use of bibliometrics has shown that scientists are interested in such studies (Zus'man, 2000). The study of citations indicating documentary information flow in various disciplines helps us understand the generation and exchange of information in the scientific domain. Therefore, a demographic study of a defined set of literature can be used to identify its research focus and major trends that exist and may be developing.

The literature on date palm is widely scattered and difficult to identify due to the interdisciplinary nature of research. There is a need to identify and analyze this literature in order to study its periodic growth, author patterns, research focus and trends, and geographic origin. This can be done through bibliometric analysis of the available literature.

REVIEW OF LITERATURE

A number of bibliometric studies have been conducted on specific agricultural, chemical, biological, and medical topics. These include studies on single fruits, plants/trees, single specialized journals, and citations derived from one or a combination of specialised databases. Some of these studies that are closely related to this topic will be reviewed below.

Adenaike (1982) analysed some characteristics of the citations taken from two bibliographies on cowpea covering the period from 1888 to 1973. It was found that the literature doubled every 20 years, English language accounted for 87% of the literature, and journal was the most popular medium of publishing. Subbaiah (1984), who studied 1,373 citations on Indian grape research covering 1901-1981, based on a comprehensive published bibliography, found clustering of research in specific areas, increase in collaborative research, and journals as the main source of information. A study of literature on Azadirachta Indica (Neem, a popular medicinal tree grown in South Asia) published from 1989 to 1999 and retrieved from *Biological Abstracts* was conducted by Vijayakumar, Shehbaz and Naqvi (2002). They found that 89.02% of 1,111 papers were written by multiple authors whereas 27.4% of the papers were contributed by only 1.2% of the authors. Ten (3.3%) of the 300 journals published 24.0% of all papers. It is interesting to note that almost 56% of this literature was produced in India and that 96.4% of all papers were in English. They identified 28 (9.3%) titles as core journals for this literature. Anwar (2005) conducted a study of 530 citations on Nigella sativa (Black Seed) culled from 20 databases. It showed that the volume of literature has been growing since 1971 starting from one citation per year to 46 papers during the 1990s. Most of the literature came from Medical Sciences and Chemistry. Four-fifths of the citations were the result of collaborative effort and about two-fifths of the papers were contributed by 36 (13.8%) of 261 journals. English was the language of research on this subject.

Lal and Panda (1996) collected citations from 20 doctoral dissertations on plant pathology submitted to an Indian university during 1980-1993 and came up with a ranked list of 100 most frequently cited journals that provided 73.01% of the citations. Similarly, Krishna and Kumar (2004) analyzed 8,401 citations used in 68 theses submitted to another Indian university from 1996 to 2000 dealing with agriculture. Meera (1998) studied the characteristics of 4,840 citations on plant ecology derived from papers published during 1994-1995 in terms of their subject, language and geographic dispersion, and author and journal rankings.

A good number of studies have been conducted on the bibliometric analysis of single or several specialized journals using their papers and/or citations used in those papers from a variety of aspects such as author patterns, frequently cited journals, geographic origin, and language and subject dispersal. Some of these studies are Balog (1979-80), Lal (1993), Maheswarappa and Nagappa (1984), Ramesh and Nagaraja (2002), Ramesh, Venkata Ramana and Hussain (2000), Sarala (1995), and Senthilkumaran and Vadivel (2004). Maheswarappa and Rao (1982) analyzed the journal literature on food science and technology derived from three journals, one each from U.S.A, U.K., and India. They found that 10 (3.3%) of the 300 journals published 24.0% of all papers. Among other things, they identified 62 core journals in this field.

A search of literature dealing with Phoenix dactylifera L revealed a couple of bibliographic items. Barreveld's (1993) comprehensive work on date palm products includes a bibliography of 618 titles of various types. This is a very extensive bibliography but most of its citations are incomplete. An Indian publication that reviews research on date palm grown in its Thar Desert area includes a bibliography of 104 items (Chandra, Chandra & Gupta, 1992). As far as this researcher knows, neither a comprehensive bibliography nor a bibliometric study of literature on Phoenix dactylifera L has thus far been reported in the sources consulted.

In light of the review above, and the fact that literature on dates has not been subjected to bibliometric analysis so far, it is important that this literature is studied in detail in order to understand scholarly interests and activity on this tree. The findings of this research will, in addition to its specific results, create an awareness of trends and focus of research on Phoenix dactylifera L among scholars in several disciplines. It will clearly bring out the inter-disciplinary nature of research on this topic. The findings will also motivate potential researchers to work in areas where research is lacking. This study should also serve as a catalyst to encourage more collaborative research. The findings of this study will make a significant contribution to the existing literature on date palm.

RESEARCH OBJECTIVES

The purpose of this study was to investigate the demographic characteristics of the literature on date palm. It specifically focused on the following questions:

1. What is the periodic growth pattern of the literature on date palm?
2. What is the topical focus of the literature on date palm?

3. What author patterns are displayed in this literature in the following areas: author productivity, core authors, collaborative authorship, and institutional and organisational affiliation?
4. Which journals have published this literature?
5. What are the geographic origins of this literature?

Providing answers to questions like these will lead to a greater understanding of the research focus and trends related to this important body of literature.

METHODOLOGY

The literature on date palm, due to its multi-disciplinary nature, is scattered in a variety of sources. All relevant databases and online catalogues of some important libraries were searched in order to identify related citations. The year 2004 was used as the cut-off date for identifying citations. Over 6,000 citations were retrieved. Each citation and abstract was examined to select relevant material. Full bibliographical details were searched and verified for each citation selected.

Procite programme was used to create a bibliographic database of the selected literature. Duplication in citations, which was quite high, was removed as each new group of citations was loaded into the Procite programme. Once the potential sources of citations had been exhaustively searched and the selected citations had been added, the Procite database consisted of about 2,600 unique records. However, many of these citations were incomplete, lacking vital characteristics that were essential for bibliometric analysis. These citations would have caused inconsistencies in data analysis and, therefore, had to be excluded. The data set consisting of 2,465 citations was used to generate needed statistical reports. It may be pointed out that this figure includes some theses/dissertations, patents, consultant reports, and publications of descriptive nature.

RESULTS AND DISCUSSION

Periodic Growth of Literature

The data on periodic growth of literature on Phyoenix dactylifera L are presented in Table 1 in 5-year intervals. Eight publications did not have the year of publication and the first two publications that appeared in 1938 and 1951 are not included in the statistics. A very limited research or publication interest is displayed up to the year 1969, with a per year mean of 0.88 publications. This is similar to the early growth of literature on Nigella sativa, a plant of Middle Eastern origin (Anwar, 2005). The volume of literature starts increasing from the year 1971 that produced 23

publications compared to only nine in 1970. This trend continues on a steady pace up to 1984 when the number reached 79. There is a phenomenal jump in the publication output during 1985-1989 with 1985 registering 114 and 1989 110 items. However, the number drops suddenly to 79 publications in 1990 and then goes up again to 103 in 1993. This growth is mainly due to the maturity of research infrastructure in the countries traditionally home to date palm. It is evident that date palm has attracted the attention of many researchers from diverse disciplines in many countries.

The last year covered in the study, 2004, saw 90 publications compared with the two publications of 1965. It seems that the growth trend has stabilized and the yearly publication output might continue between 80 and 100. It will be satisfying if the production remains within that range. An interesting question that needs to be explored is to study the effect of several wars on the research output of Iraq, the leading center of research on date palm.

Table 1: Periodic Growth of Literature (n = 2,455)

Period	Number of Citations	Mean Citations Per Year
1965-1969	26	5.2
1970-1974	112	22.4
1975-1979	245	49.0
1980-1984	308	61.6
1985-1989	513	102.6
1990-1994	411	82.2
1995-1999	413	82.6
2000-2004	427	85.4

Subject Focus of Literature

Pheonix dactylifera L, as a nutritional tree, is of interest to researchers from many disciplines including Agriculture, Biological Sciences, Animal Sciences, Chemistry and Medicine. Therefore, topical coverage of this body of literature is so diverse and sometimes so specific in nature that makes it very hard to organise it under subjects of equivalent status. Some databases assign many very specific descriptors to each publication making it difficult to select one of them. Each of these citations was assigned only one broad subject that was necessary for creating general categories. This was done with the advice of a specialist from a related discipline. Topical distribution of 2,465 citations shown in Table 2 testifies to the difficulty mentioned above.

There is an overlap between topics related to Agriculture, Animal Sciences and Medical Sciences as well as between those related to Biological Sciences and Chemistry. To illustrate a few examples: Anti-microbial agents, Medicinal properties, Fertility / Anti-fertility effect are shared by Medical and Animal Sciences; Plant growth and Tissue culture are shared by Biological Sciences and Agriculture. This overlap bears out the inter-disciplinary nature of the literature of dates. If the groupings in Table 2 are merged into broader disciplines, Agriculture and Biological Sciences claim the largest share.

Table 2: Subject Dispersion of the Literature (N = 2,465)

S.No.	Subject	Citations
1	Plant Physiology	527
2	Plant Diseases	474
3	Food and Feed Chemistry	386
4	Plant Biochemistry	211
5	Biochemistry and Biochemical Studies	115
6	Post-Harvest Technology	98
7	General	90
8	Genetics	80
9	Soil Fertility	75
10	Human Health and Pharmaceuticals	65
11	Agrochemicals	62
12	Plant Sciences	49
13	Environmental Ecology	43
14	Animal Sciences	42
15	Industrial Organic and Inorganic Chemicals, Fats & Waxes	32
16	Agricultural Products	30
17	Horticulture	22
18	Water Resource Management	19
19	Engineering and Technology	17
20	Ethnobotany	14
21	History, Education and Documentation	14

Authorship Patterns

(a) Author Productivity

Eleven of the 2,465 citations were produced by corporate authors and are excluded from this analysis. A total of 3,583 single or multi-authors produced 2,454 publications with per citation mean of 1.46 authors. This figure shows that scholars active in this area tend to work in teams that vary anywhere from two to 17. Table 3

presents data on the number of publications produced by authors in this group. A large majority of the authors (n=2,630, 73.4%) contributed only one item each either singly or jointly. The remaining 953 (26.6%) authors contributed two or more items each. There are 40 (1.17%) authors who produced any where between 10 and 29 items each and contributed to 595 (24.25%) publications.

Table 3: Number of Publications by Number of Authors

Number of Publications	Number of Authors	Percentage
1	2,630	73.40
2	500	13.95
3	171	4.77
4	99	2.76
5	45	1.26
6	45	1.26
7	28	0.78
8	17	0.47
9	8	0.22
10	7	0.20
11	7	0.20
12	5	0.14
13	5	0.14
14	1	0.03
15	1	0.03
16	3	0.08
17	2	0.06
18	1	0.03
19	1	0.03
21	1	0.03
22	1	0.03
24	1	0.03
25	1	0.03
26	1	0.03
28	1	0.03
29	1	0.03
	3,583	100.02*

* Total is higher due to the rounding of figures.

(b) Core Authors

A total of 499 (20.33%) citations were contributed by only 28 (0.78%) of the 3,583 authors as compared to 2,630 (73.40%) individuals who authored only one citation

each. These 28 scholars who contributed to between 12 and 29 citations each can be considered as the core writers on dates. Their names and contributions are presented in Table 4.

Table 4: Authors Who Contributed Twelve or More Citations

	Name of the Author	Number of Publications		Name of the Author	Number of Publications
1	Shabana, H. R.	29	15	Saaidi, M.	16
2	DeMason, D. A.	28	16	Yousif, A. K.	16
3	Benjamin, N. D.	26	17	Benbadis, A. K.	15
4	Tisserat, B. B.	26	18	Osman, A. M. A.	15
5	Djerbi, M.	25	19	Baaziz, M.	13
6	Bounaga, N.	24	20	Bacha, M. A. A.	13
7	Toutain, G.	24	21	Blumberg, D.	13
8	Sedra, M. H.	22	22	Khalifa, A. S.	13
9	Zaid, A.	21	23	Kwaasi, A. A. A.	13
10	Ferry, M.	19	24	Al-Ogaidi, H. K. H.	12
11	El Hadrami, I.	18	25	Al-Whaibi, M. H.	12
12	Bukharev, V. T.	17	26	Aljuburi, H. J.	12
13	Hussein, F. H.	17	27	Shaheen, M. A.	12
14	Rhouma, A.	16	28	Tantaoui, A.	12

(c) Collaborative Authorship

Out of the 2,454 personal authored publications, 1,696 (69.11%) are the result of collaborative effort. The number of collaborating individuals varies from two to 17. Table 5 provides the data on collaborative authorship.

Table 5: Number of Collaborating Authors and Their Publications (n = 1,696)

No. of Authors	No. of Citations	Percentage*	No. of Authors	No. of Citations	Percentage*
2	607	35.79	8	22	1.30
3	564	33.25	9	1	0.06
4	310	18.28	10	4	0.24
5	115	6.78	11	1	0.06
6	50	2.95	14	2	0.12
7	19	1.12	17	1	0.06

* The percentage total comes to 99.95 due to rounding of figures.

(d) Author Affiliation

Institutional/organisational affiliation of researchers is indicative of the emphasis placed on research activity in certain locations. It was decided that this study use the affiliation of the first author for analysis because addresses of other authors are sometimes not available. The Procite database of 2,465 publications provided first author affiliation addresses for 1,733 publications. The remaining publications included consultancy reports, corporate authors, book and book-chapter authors, writers with personal addresses, and first authors with no address. These 1,733 citations originated from 403 institutions/organisations, with a mean of 4.30 per institution, located in 59 countries. The data for countries with three or more institutions are given in Table 6.

Table 6: Countries with Three or More Institutions/Organisations

Name of Country	No. of Publications	No. of Institutions	Mean Publications per Institution	Rank by Mean Publications
Iraq	268	12	22.33	1
Saudi Arabia	149	10	14.90	2
Morocco	144	15	9.60	3
Egypt	264	28	9.43	4
Kuwait	24	3	8.00	5
Oman	19	3	6.33	6
Syria	13	3	4.33	7
Algeria	61	15	4.07	8
France	120	31	3.87	9
U. A. E.	26	7	3.71	10
Pakistan	76	21	3.62	11
U. S. A.	122	36	3.39	12
Yemen	13	4	3.25	12
Iran	44	14	3.14	12
Tunisia	30	10	3.00	13
India	84	31	2.71	14
Sudan	21	8	2.63	15
Israel	37	17	2.18	16
Spain	27	14	1.93	17
U. K.	41	23	1.78	18
China	19	12	1.58	19
Japan	11	7	1.57	20
Germany	13	12	1.08	21
Austria	3	3	1.00	22
Belgium	3	3	1.00	22

USA, France, India and Egypt have the largest number of institutions where research on dates was conducted. However, if the volume of research activity was taken in terms of mean citations per institution, Iraq topped the list with 22.33, followed by Saudi Arabia with 14.90, Morocco with 9.60, and Egypt with 9.43. Iraq and Saudi Arabia claim a much higher productivity rate than all other countries. Mean papers for Pakistan, with 3.62, are higher than those of India with 2.71. It is interesting to note that the top eight positions are taken by the countries that are home to date palm. There is also a cultural touch to the date and its literature. Twenty-eight (47.46%) Muslim countries produce 69.76% of the publications presented in this section as compared to 30.24% produced by the other 31 (52.54%) countries. It is also obvious that institutions in developing countries are more active in research on dates as compared to those in advanced nations**.**

Which institutions among the 403 where research on Phoenix dactylifera L was conducted were more active than others? The institutions whose scholars are the first authors of 13 or more publications are listed in Table 7. Among the 36 institutions listed in Table 7, only seven are out of the Muslim world. Interestingly, most of the top institutions are located in developing countries.

Table 7: Institutions Whose Researchers Produced Thirteen or More Publications

Name of Country		Name of Institution	No. of Publications
1	Iraq	Agriculture and Water Resources Research Centre	81
2	Saudi Arabia	King Saud University	64
3	Iraq	Baghdad University	57
4	Morocco	Institut National de la Recherche Agronomique	50
5	Iraq	Palm and Date Research Centre	49
6	Saudi Arabia	King Faisal University	43
7	Egypt	Cairo University	38
8	USA	University of California, Riverside	38
9	France	Groupe de Recherche et l'Information pour le Developpment de l'Agronomique Oasienne	33
10	Egypt	Zagazig University	32
11	Egypt	Ain Shams University	28
12	Iraq	Nuclear Research Centre	27
13	Egypt	National Research Centre	24
14	Morocco	Universite Cadi Ayyad	24
15	Algeria	Institut National de la Recherches Agronomique	22

Table 7, continued

16	Iraq	Basra University	20
17	Egypt	Assiut University	20
18	Morocco	Station Centrale d'Agronomie Saharienne	19
19	USA	Agricultural Research Service	19
20	Egypt	Alexandia University	18
21	France	Centre International de Hautes Etudes Agronomique Mediterraneennes	18
22	Morocco	Faculte des Sciences, Semlalia	18
23	Algeria	Centre National de Recherches sur les Zones Arides	17
24	U. A. E.	U. A. E. University	17
25	Egypt	Plant Protection Research Institute	16
26	Israel	Agricultural Research Organisation	15
27	Kuwait	Kuwait Institute for Scientific Research	15
28	India	Haryana Agricultural University, Hissar	14
29	India	Punjab Agricultural University, Abohar	14
30	Iraq	[Agricultural and] Biological Research Centre	14
31	Pakistan	Pakistan Agricultural Research Council	14
32	Pakistan	University of Agriculture, Faisalabad	14
33	Saudi Arabia	King Faisal Specialist Hospital	14
34	Algeria	Institut National Agronomique	13
35	Egypt	Agricultural Research Centre	13
36	Oman	Sultan Qaboos University	13

Source Journals

(a) Subject Dispersion of Journals

Out of the 2,465 publications, 1790 are articles that come from 672 journals originating from a variety of disciplines. The subject dispersion of journals presented in Table 8 shows the scatter and inter-disciplinary nature of the literature on Phoenix dactylifera L. The largest number of journals comes from Agriculture and Biological Sciences. Presence of two journals from Natural History indicates an interest in the use of dates by the ancient civilizations.

(b) Number of Papers Published by These Journals

It was reported in the section above that 1,790 papers were published by 672 journals. The data on how many papers were produced by each of these journals are presented in Table 9. The figures show that a little less than two-thirds (n=418, 62.2%) of the 672 journals, by publishing only one paper each, produced less than one-fourth (23.35%) of the 1,790 papers. The remaining 154 (37.80%) journals together published 76.65% of all papers. Twenty (2.98%) journals together produced 577 (32.23%) of the papers and can be regarded as the core journals for the literature

on Phoenix dactylifera L. Details of the 20 journals that published 12 or more papers each are given in Table 10. Of these 20 journals, Iraq and Egypt together published nine titles contributing 339 (58.75%) of the 577 papers produced by this group.

Table 8: Subject Dispersion of Journals

Subject Category	No. of Journals	No. of Citations
Agriculture	162	737
Biology	158	324
Food Science and Technology	59	143
Chemistry	49	84
Botany	30	67
Science (General)	30	91
Horticulture	23	84
Medical Sciences	23	36
Environmental Science	21	38
Engineering and Technology	24	29
Biochemistry	11	17
Biotechnology	10	27
Pharmacy	9	12
Forestry	8	11
Animal Sciences	7	16
Earth Sciences	7	7
Microbiology	7	12
Nutrition	5	5
Physics	5	15
Life Sciences	4	4
General	4	6
Pharmacology	3	3
Natural History	2	8
Nuclear Science	2	2
Physiology	2	2
Textile	2	2
Water	2	2
Commerce and Management	2	2
Soil Science	1	4
Geography	1	1
Zoology	1	1
Total	672	1790

Table 9: Number of Papers by Number of Journals

No. of Papers	No. of Journals	Total Papers	No. of Papers	No. of Journals	Total Papers
1	418	418	15	1	15
2	108	216	18	1	18
3	50	150	19	2	38
4	28	112	22	1	22
5	19	95	23	2	46
6	13	78	25	1	25
7	12	84	28	1	28
8	3	24	30	1	30
9	8	72	35	1	35
10	4	40	46	1	46
11	2	22	62	1	62
12	6	72	140	1	140

Table 10: Journals Publishing Twelve or More Papers

	Name of the Journal	Country of Origin	Number of Papers	Rank
1	Date Palm Journal	Iraq	140	1
2	Journal of Agriculture and Water Resources Research	Iraq	62	2
3	Fruits (Paris)	France	46	3
4	Al-Awamia	Italy	35	4
5	Hortscience	USA	30	5
6	Annals of Agricultural Science	Egypt	28	6
7	Egyptian Journal of Horticulture	Egypt	25	7
8	Journal of Agricultural and Food chemistry	USA	23	8
9	Zagazig Journal of Agricultural Research	Egypt	23	8
10	Assiut Journal of Agricultural Sciences	Egypt	22	9
11	Arab Gulf Journal of Scientific Research	Saudi Arabia	19	10
12	Food Chemistry	Netherlands	19	10
13	Sarhad Journal of Agriculture	Pakistan	18	11
14	Agricultural Research Review	Egypt	15	12
15	Acta Horticulturae	Netherlands	12	13
16	Bioresource Technology	Netherlands	12	13
17	Bulletin of the Faculty of Agriculture, Cairo University	Egypt	12	13
18	Iraqi Journal of Agricultural Sciences, ZANCO	Iraq	12	13
19	Phytoparasitica	Israel	12	13
20	Secheresse	France	12	13

(c) Geographic Origin of the Journals

Geographic origin of 12 journals that published 16 papers in all could not be established. The remaining 660 journals originate from 60 countries varying in number from 98 titles to one (Table 11). Among the top eight producers of both journals and papers, Egypt and Pakistan have higher mean papers per journal than the other six. In general, the number of mean papers per journal is higher for the countries that publish less number of journals, for example, Iraq and Korea. The nine journals from Iraq are far more productive than any in the whole group. One needs to understand the reasons behind this level of productivity. Europe and Asia, combined together, lead all other regions in publishing a greater number (73.79%) of the journals and a larger number (70.07%) of the papers. The proportion of papers to journals in Africa and Asia is much higher than the other regions.

Table 11: Geographic Origin of Journals

S. No.	Name of Country	No. of Journals	No. of Papers	Mean Papers Per Journal
1	USA	98	239	2.44
2	UK	81	148	1.83
3	Germany	58	84	1.45
4	India	50	114	2.28
5	France	47	150	3.19
6	Netherlands	47	121	2.57
7	Egypt	43	223	5.17
8	Pakistan	23	79	3.43
9	Japan	22	22	1.00
10	Italy	21	39	1.86
11	China	15	20	1.33
12	Spain	11	16	1.45
13	Hungary	10	12	1.20
14	Iraq	9	231	25.67
15	Israel	9	30	3.33
16	Saudi Arab.	8	35	4.38
17	Australia	8	9	1.13
18	Poland	8	8	1.00
19	Iran	7	17	2.43
20	Switzerland	7	9	1.29
21	Canada	6	23	3.83
22	Austria	5	7	1.40
23	Russia	5	6	1.20
24	Denmark	4	11	2.75

Table 11, continued

25	Belgium	4	4	1.00
26	Sudan	3	13	4.33
27	Czech Rep.	3	11	3.67
28	Algeria	3	9	3.00
29	Syria	3	6	2.00
30	Thailand	3	4	1.33
31	Tunisia	3	3	1.00
32	Korea	2	10	5.00
33	Taiwan	2	4	2.00
34	Malaysia	2	3	1.50
35	Argentina	2	2	1.00
36	Ireland	2	2	1.00
37	Mexico	2	2	1.00
38	Romania	2	2	1.00
	22 countries	22	46	----
	All	660	1,774	2.69

Language Dispersion

The literature on dates covered by this study is produced in 22 languages as detailed in Table 12. Out of the 2,465 publications on Phoenix dactylifera L, the Tree of Life for the Arabs, 1,714 (69.53%) are in English whereas only 190 (7.71%) are in Arabic, which indicates that Arab researchers prefer to publish their output in foreign languages especially in English and French due to international visibility. Six languages have only one publication each. It may be noted that 97.5% of the literature on Nigella sativa (Anwar, 2005) and 87% of that on cowpea (Adenaike, 1982) was published in English. English, French and Arabic are the languages of scholarship on dates.

Table 12: Language Dispersion of the Literature

S. No.	Language	No. of Citations	Percentage	S. No.	Language	No. of Citations	Percentage
1	English	1,714	69.53	12	Thai	7	0.28
2	French	340	13.79	13	Hungarian	4	0.16
3	Arabic	190	7.71	14	Bulgarian	3	0.12
4	Chinese	65	2.64	15	Greek	2	0.08
5	Persian	35	1.24	16	Turkish	2	0.08
6	German	28	1.14	17	Africaans	1	0.04

Table 12, continued

7	Spanish	22	0.89	18	Austrian	1	0.04
8	Japanese	21	0.85	19	Korean	1	0.04
9	Hebrew	12	0.49	20	Macedonian	1	0.04
10	Italian	7	0.28	21	Portuguese	1	0.04
11	Russian	7	0.28	22	Swedish	1	0.04

Geographic Origin of All Publications

What is the geographical origin of all 2,465 publications included in this study? Sixty citations (27 with no place of publication, 17 international patents, and 16 from 12 journals whose place of publication could not be determined) were excluded from this analysis. The publishing count is based on the number of papers coming from journals published by each country and the place of publication given in each non-journal citation. These 2,405 publications originate from 64 countries varying in number from 306 items for Iraq to only one each from fifteen countries. The figures for the countries publishing 10 or more items are given in Table 13. Iraq, Egypt, Morocco and Saudi Arabia, home to the 'Tree of Life' and with a reasonably good research and publishing infrastructure, publish 27.44% of these 2,405 items. Iraq, USA, Egypt, France, and U.K. produce a little more than half of all literature on dates. Sixteen (25%) of the 64 countries publish 91.27% of this literature

Table 13: Geographic Origin of All Publications (n = 2,405)

S.No	Country	No. of Publications (%)	S.No	Country	No. of Publications (%)
1	Iraq	306 (12.72)	16	Sudan	36 (1.50)
2	USA	279 (11.60)	17	Japan	33 (1.37)
3	Egypt	265 (11.02)	18	Israel	32 (1.33)
4	France	222 (9.23)	19	Sweden	25 (1.04)
5	U. K.	172 (7.15)	20	Canada	24 (1.00)
6	Netherlands	136 (5.65)	21	Algeria	23 (0.96)
7	India	117 (4.86)	22	Syria	18 (0.75)
8	Germany	100 (4.16)	23	Hungary	13 (0.54)
9	Pakistan	93 (3.87)	24	Denmark	12 (0.50)
10	Italy	74 (3.08)	25	Australia	11 (0.46)
11	China	63 (2.62)	26	Czech Republic	11 (0.46)
12	Spain	62 (2.58)	27	Korea	11 (0.46)
13	Morocco	51 (2.12)	28	Austria	10 (0.42)
14	Iran	41 (1.70)	29	Lebanon	10 (0.42)
15	Saudi Arabia	38 (1.58)	30-64	35 other countries	9 or less each

CONCLUSION

The growth of the literature analyzed in this study indicates that research on Phoenix dactylifera L grew very fast from 1971 onward, reached its peak by 1989, and stabilized after that. The findings confirm that the literature on date palm is of interdisciplinary nature. However, most of the citations deal with Agriculture, Biological Sciences and Chemistry. There is a clear focus in research on improving plant breeding, managing plant diseases, and augmenting the food and feed quality. The literature from medical aspects lays more emphasis on the animal side rather than the human side.

This literature is mostly the result of team effort that has been increasing over time displaying a high degree of collaboration. Twenty-eight writers, who publish from 12 to 29 publications each, emerge as the core writers on this subject. Out of the 36 most active research producing institutions, 27 are located in the Arab countries and out of the top 15 research producing institutions only two are located in the west.

The journal literature on dates is dispersed over 272 titles. Twenty journals that publish from 12 to 140 papers each produce almost one-third of all the papers and can be considered as the core journals for date palm. Europe and Asia are the leading producers of journals that publish this literature. Journal articles and English language are the dominant characteristics of this literature. A small number of countries produce a larger part of this literature.

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