From Conventional Journals to Free Internet Access, to Use Entomology as an Example

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Abstract

There were 61 entomological journals included in the SCI journal citation reports (1995) and most of them could be founded in the library of a university. Like other scientific publications, because of high cost, error, and time consumed in the printing process, new "on-line" publishing policy is sought. The experiences of entomological society suggest it can be done cheaply, even profitably.

In the fourth century BC, Aristotle used the word "entoma" to describe the animals to have three basic body parts. So entomology is the science to study insects. Insects are the most varied group of animals on the earth. More than one million species have been already catalogued in literature, so the journal published entomological research works are many, and there were 61 recognized journals by the Institute for Scientific Information (Philadelphia PA. 19104 U.S.A.) in 1995. Among these different journals, 36 journals are index in the Science Citation Index (SCI) as core journals because most scientists were like to publish their paper in these journals than other journals according to a survey conducted in 1984 (Garfield 1984). Table 1 lists these 36 core journals and the year each of these core journals began publication is also shown. Fifteen of the journals in table are published in the US. The UK accounts for six core entomology journals. Canada, France, and Japan each publish 2 core journals. Australia, Czechoslovakia, Germany, India, the Netherlands, New Zealand, People's Republic of China, South Africa and Switzerland each publish one of the journals listed in Table 1.

Since the SCI put much emphasis on the impact factor and citing half-life of a paper published in the core journal, so it is not hard to find out the most cited paper in the core journals in the past. Table 2 lists the 44 most-cited articles from the core entomology journals. They are arranged alphabetically by first author. The number of citations each article received from 1961 through 1982 in SCI is also shown. The most-cited paper, by W.S. Abbott, US Department of Agriculture, Washington, DC, is also the oldest paper on the list. Published in 1925 in journal of Economic Entomology, Abbott's paper discusses a method for calculating the effectiveness of insecticides. This paper was cited at least 650 times between 1955 and 1982.

Despite its age, it continues to be highly cited. Of cause, the biology is a big family, entomologist can also published his paper in non-core entomology journals, such as Nature, Science, Journal of Experimental Biology, etc. Table 3 lists the 14 most-cited entomology articles selected from 1955 to 1982. Among this, Miriam Rothschild is co-author with T. Reichstein and colleagues on the paper published in Science in 1968, and Rothschild is always famous on the topic about the meeting cultures of art and science.

In table 2, we have Hsiao C. co-author with her major professor Fraenkel G. published the paper on Bursicon, an insect tanning hormone. In table 3, we have Pan M. L. co-author with his major professor Wyatt G. R. published the paper on insect plasm proteins. Dr. Hsiao was graduated from the Chunghsing University located in the central part of Taiwan, and Dr. Pan was graduated from Taiwan University, in the northern part of Taiwan, both of them got very good training in entomology from Taiwan.

Table 1. Core entomology journals indexed by SCI and the year each began publication.

Acta Entomologica Bohemoslovaca-1965
Acta Entomologica Sinica-1950
Annales de la Societe Entomologique de France-1832
Annals of the Enotmological Society of America-1908
Annual Review of Entomology-1956
Applied Entomology and Zoology-1966
Bulletin of Entomological Research-1910
Canadian Entomologist-1968
Ecological Entomology-1976
Entomologia Experimentales et Applicata-1958
Entomon-1976
Entomophaga-1956
Environmental Entomology-1972
Florida Entomologist-1917
Great Lakes Entomologist-1966
Insect Biochemistry-1971
Insectes Sociaux-1954
International Journal of Insect Morphology and Embrylogy-1971
Japanese Journal of Applied Entomology and Zoology-1957
Journal of Arachnology-1972

Journal of Economic Emtomology-1908
Journal of Medical Entomology-1964
Journal of the Australian Entomological Society-1967
Journal of the Entomological Society of Southern Africa-1939
Journal of the Georgia Entomological Society-1966
Journal of the New York Entomological Society-1893
Mosquito News-1941
New Zealand Entomologist-1951
Pacific Insects-1959
Physiological Entomology-1976
Proceedings of the Entomological Society of Ontario-1959
Proceedings of the Hawaiian Entomological Society-1905
Systematic Entomology-1976
Zeitschrift fur Angewandte Entomologie-Journal of Applied Entomology-1914

Table 2. The 44 most-cited articles from the core entomology journals cited 100 or more times, 1961-1982 SCI in alphabetical order by first author. At the time these data were collected, the 1955-1964 SCI was not yet available. I have added (in parentheses) the additional cites for the papers published in 1960 or earlier.

Citations 1961-1982	Bibliographic Data
604	(55) Abbott W S. A method of computing the effectiveness of an insecticide. J. Econ. Entomol. 18:265-7, 1925.
119	(0) Adkisson P L, Vanderzant E S, Bull D L & Allbon W E. A wheat germ medium for rearing the pink bollworm. J. Econ. Entomol. 53:759-62, 1960.
120	Auclair J L. Aphid feeding and nutrition. Annu. Rev. Entomol. 8:439-90, 1963.
115	(20) Baumhover A H, Graham A J, Bitter B A, Hopkins D E, New W D, Dudley F H & Busbland R C. Screw-worm control through release of sterilized flies. J. Econ. Entomol. 48:462-6, 1955.
162	Beck S D. Resistance of plants to insects. Annu. Rev. Entomol. 10:207-32, 1965.
129	Berger R S. Isolation, identification, and synthesis of the sex attractant of the cabbage looper. Trichoplusia ni. Ann. Entomol. Soc. Amer. 59:767-71, 1966.
111	(5) Bonhag P F. Ovarian structure and vitellogenesis in insects. Annu. Rev. Entomol. 3:137-60, 1958.
126	Bursell E. Aspects of the metabolism of amino acids in the tsetse fly, Glossina

(Diptera). J. Insect Physiol. 9:439-52, 1963.

104 Craig G B & Vandehey R C. Genetic variability in Aedes aegypti (diptera: culicidae). I. Mutations affecting color pattern. Ann. Entomol. Soc. Amer. 55:47-58, 1962.

128 Cumtoins K W, Trophic relations of aquatic insects. Annu. Rev. Entomol. 18:183-206, 1973.

123 (0) Dethier V G, Browne L B & Smith C N. The designation of chemicals in terms of the responses they elicit from insects. J. Econ. Entomol. 53:134-6, 1960.

112 Fraenkel G & Hsiao C. Bursicon, a hormone which mediates tanning of the cuticle in the adult fly and other insects. J. Insect Physiol. 11:513-56, 1965.

112 Highnam K C, Lusis O & Hill L. The role of the corpora allata during oocyte growth in the desert locust, Schistocerca gregaria Forsk. J. Insect Physilo. 9:587-96, 1963.

135 Hill L. Neurosecretory control of haemolymph protein concentration during ovarian development in the desert locust. J. Insect Physiol. 8:609-19, 1962.

245 (1) Holling C S. The components of predation as revealed by a study of small-mammal predation of the European pine sawfly. Can. Entomol. 91:293-320, 1959.

213 (1) Holling C S. Some characteristics of simple types of predation and parasitism. Can. Entomol. 91:385-8, 1959.

103 (20) Hoskins W M &Gordon H T. Arthropod resistance to chemicals. Annu. Rev. Entomol. 1:89-122, 1956.

104 Ignoffo C M. A successful technique for mass-rearing cabbage loopers on a semisynthetic diet. Ann. Entomol. Soc. Amer. 56:178-82, 1963.

110 Karlzon P & Bode C. Die Inaktivierung des Ecdysons bei der Schmeissftiege Calliphora erythrocephala Meige. (Ecdysone inactivation in the blow-fly Calliphora erythrocephala Meigen.) J. Insect Physiol. 15:111-8, 1969.

154 (4) Karlson P & Butenandt A. Pheromones(ectohormones) in insects. Annu. Rev. Entomol. 4:39-58, 1959.

148 (14) Knipling E F. Possibilities of insect control of eradication through the use of sexually sterile males. J. Econ. Entomol. 48:59-62, 1955.

139 Krishnakuwared A, Pery S I, Oberlander H & Schneiderman H A. Nucleic acid synthesis during insect development-II. Control of DNA synthesis in the cecropia silkworm and other saturniid moths. J. Insect Physiol. 13:1-57, 1967.

106 Kroeger H & Lean M. Regulation of gene action in insect development. Annu. Rev. Entomol. 11:1-22, 1966.

103 LaBrecque G C. Studies with three alkylating agents as house fly sterilants. J. Econ. Entomol. 54:684-9, 1961.

112 Lichtenstein E P & Schuiz K R. The effects of moisture and microorganisms on the persistence and metabolism of some organophosphorous insecticides in soils, with special emphasis on parathion. J. Econ. Entomol. 57:618-27, 1964.

103 Mayer R J & Candy D J. Control of haemolymph lipid concentration during locust flight: an adipokinetic hormone from the corpora cardiaca. J. Insect Physiol. 15:611-20, 1969.

109 McMorran A. A synthetic diet for the spruce budworm, Choristoneura fumiferana (Clem.) (Lepidoptera: toriricidae). Can. Entomol. 97:58-62, 1965.

101 Notrot C & Quennedey A. Fine structure of insect epidermal glands. Annu. Rev. Entomol. 19:61-80, 1974.

156 Salt R W. Principles of insect cold-hardiness. Annu. Rev. Entomol. 6:55-74, 1961.

147 Satir P & Glluta N B. The fine structure of membranes and intercellular communication in insects. Annu. Rev. Entomol. 18:143-66,1973.

140 Shasya E & Karlson P. Der Ecdysontiter wahrend der Insektenentwicklung-II. Die postembryonale Entwicklung der Schmeissfliege Calliphora erythrocephala Meig. (The ecdysone titer during insect development-II. The post-embryo development of the blow-fly Calliphora erythrocephala Meig.) J. Insect Physiol. 11:65-9, 1965.

243 Shorey H H & Hale R L. Mass-rearing of the larvae of nine noctuid species on a simple artificial medium. J. Econ. Entomol. 58:522-4, 1965.

162 Slifer E H. The structure of arthropod chemoreceptors. Annu. Rev. Entomol. 15:121-42, 1970.

178 (9) Solomon M E. Control of humidity with potassium hydroxide, sulphuric acid, or other solutions. Bull. Entomol. Res. 42:543-54, 1951.

101 Staal G B. Insect growth regulators with juvenile hormone activity. Annu. Rev. Entomol. 20:417-60, 1975.

141 Sudia W D & Chamberlain R W. Battery-operated light trap, an improbed model. Mosq. News. 22:126-9, 1962.

262 Teller W H. The mechanism and control of yolk formation. Annu. Rev. Entomol. 10:161-84, 1965.

203 (0) Thorsteinson A J. Host selection in phytophagous insects. Annu. Rev. Entomol. 5:193-218, 1960.

149 Vanderzant E S, Richardson C D & Fort S W. Rearing of the bollworm on artificial diet. J. Econ. Entomol. 55:140, 1962.

111 Waters T F. The drift of stream insects. Annu. Rev. Entomol. 17:253-72, 1972.

105 Wigglesworth V B. Chemical strrcture and juvenile hormone activity: comparative tests on Rhodnius Prolixus. J. Insect Physiol. 15:73-94, 1969.

194 Wyatt G R. The biochemistry of insect hemolymph. Annu. Rev. Entomol. 6:75-102, 1961

118 Yamamoto R T. Mass rearing of the tobacco hornworm II. Larval rearing and pupation. J. Econ. Entomol. 62:1427-31, 1969.

129 (4) Yamasaki T & Narahashi T. The effects of potassium and sodium ions on the resting and action potentials of the cockroach giant axon. J. Insect Physiol. 3:146-58,1959.

Table 3. Sample of highly cited entomology articles published in non-core journals, in alphabetical order by first author.

Total SCI Citations 1955-1982 Bibliographic Data

136 Bollenbacher W E, Vedeckls W V, Gilbert L I & O'Connor I D. Ecdysone titers and prothoracic gland activity during the larval-pupal development of Monduca sexta. Develop. Biol. 44:46-53, 1975.

58 Bowers W S, Ohta T, Cleere I S & Marsella P A. Antiallatotropins: inhibition of corpus allatum development. Science 197:1369-71,1977.

168 Bowers W S, Ohta T, Cleere J S & Marsella P A, Discovery of insect antijuvenile hormones in plants. Science 193:542-7, 1976.

61 de Barjac H. Une noubelle variete de Bacillus thuringiensis tres toxique pour les moustiques: B. thuringiensis var. israelensis serotype 14. (A new subspecies of Bacillus thuringiensis very toxic for mosquitoes: Bacillus thuringiensis var israelensis new variety serotype 14.) C.R. Acad. Sci. Ser. D. 286:797-800,1978.

251 Feeny P. Seasonal changes in oak leaf tannins and nutrients as a cause of sprine feeding by winter moth caterpillars. Ecology 51:565-81,1970.

174 Hagedorn H H, O'Connor J D, Fuchs M S, Sage B, Schiaeger D A & Bohm M K, The ovary as a source r-ecdysone in an adult mosquito. Proc. Nat. Acad. Sci. US 72:3255-9,1975.

79 Kennedy J S & Marsh D. Pheromone-regulated anemotaxis in flying moths. Science 184:999-1001,1974.

87 Nijhout H F & Williams C M. Control of moulting and metamorphosis in the tobacco hornworm. Manduca sexia (L.): growth of the last-instar larva and the decision to pupate. J. Exp. Biol. 61:481-91.

64 Nijhout H F & Williams C M. Control of moulting and metamorphosis in the tobacco hornworm. Manduca sexia (L.): cessation of juvenile hormone

secretion as a trigger for pupation. J. Exp. Biol. 61:493-501,1974.

74 Reichstein T, von Euw J, Parsons J. A. & Rothschild M. Heat poisons in the monarch butterfly. Science 161:861-6, 1968.

71 Scriber J M. Limiting effects of low leaf-water content on the nitrogen utilization, energy budget, and larval growth of Hyolophora cecropia (Lepidoptera: Saturniidae). Oecologia 28:269-87, 1977.

84 Slansky F & Feeny P. Stabilization of the rate of nitrogen accumulation by larvae of the cabbage butterfly on wild and cultivated food plants. Ecol. Monogr. 47:209-28, 1977.

116 Truman J W. Physiology of insect rhythms. I. Circadian organization of the endocrine events underlying moulting cycle of larval tobacco hornworms. J. Exp. Biol. 57:805-20, 1972.

87 Wyatt G R. & Pan M L. Insect plasma proteins. Annu. Rev. Biochem. 47:779-817, 1978.

From these journals, we can also classify them into two classes, one class belong to the academic society such as the Entomological Society of America and the Royal Society of London, the other class is published by commercial company such as Reed Elsevier. The purpose of the former is to disseminate the results of research to its members, so the subscription price of the former is cheaper than the later. For instance, you have to pay $ 103 per issue for Reed Elsevier's Journal of Insect Physiology in contrast you only pay $ 32 per issue for Entomological Society of America's Journal of Economic Entomology. Besides the high price you have to pay in order to get new information, accuracy of the paper is also important in scholar communication. According to ISI 1992 Science Citation Index Journal Citation Report (Kristof 1997), an average citation's error of the reference citation of each Journal in the filed of medicine and library science were 31.1% (Table 4). A Similar study examined for 5 core entomological journal, Archives of Insect Biochemistry and Physiology, Ecological Entomology, Insect Biochemistry and Molecular Biology, Journal of Insect Physiology, Pesticide Biochemistry and Physiology in the first issue of each journal in 1992 showed a very closed average error rates 30.1 in Table 5.

Set against this backdrop has been the rapid development of the Internet and the World Wide Web (the interface that allows data files, graphics, pages, text and even movies to be "served" to personal computers around the world). These technological leaps make it likely that access to scientific knowledge will be revolutionized by "on-line" publishing, the questions now being "when?" and "how?" In a few years, in my view, current issues of all journals will indeed be available on the Web, and so will complete backfiles of all major journals.

Within some fields of science, meanwhile, alternative and economical do-it-ourselves models have emerged. Most notably, physicists and mathematicians now routinely submit their manuscripts as "e-prints" to an Internet server at the same time they submit them to traditional journals. The Florida Entomological Society, to which I belong, began in 1994 to examine these trends and consider a move toward electronic publication. The Florida Entomological Society's success with low-cost electronic publishing is based on its use of the file format known as the PDF, or Portable Document Format (produced by Adobe Acrobat software, http://csssrvr.entnem.ufl.edu/). For about $1 a page, a journal printer can save individual articles as PDF files, which can be read and printed with free software that is available for computers using any major operating system. The articles retain the appearance of the printed originals; effectively, a PDF file is a stored photocopy-quality image that can be searched and read on a computer screen or used to make a faithful printout at home or in the office. The costs of serving journal articles this way are the cost of space on a Wed-serving computer and of preparing and maintaining table-of contents files with hypertext links to articles. Web-server space costs and estimated 35 cents per megabyte per year, a PDF file for an average article is about 0.6 megabytes, and the average journal has 123 articles annually. Thus posting a year's contents of an average journal should cost less than $26 annually. The user must of course have a Web connection, "client" software and, if hard copy is desired, a printer.

The Florida Entomological Society has about 450 members. In November 1994, a few weeks after free software to display and print Acrobat PDF files became available, the Society started posting all articles in Florida Entomologist (An International Journal for the Americas), its long-published (since 1917) refereed journal, http://www.fcla.edu/FlaEnt/. Our start-up costs were less than $500. Since then, features have been added, but the total cost to the society of preparing articles for publication on the Web is less than $3 per page. So, there are 3 ways to get scientific information (Fig. 1).

The free-access model (Fig. 2) will revolutionize journal publishing whereas the current mix of subscriptions. Site licenses and pay-per-view plans attempts to maintain current revenue streams, the greatest of which is from research libraries.

But free access to traditional journals is affordable and achievable. It is the right thing to do for those who pay for the research and for those who do it. Societies that offer free access will gain modestly in revenues and in their competition with commercial publishers for the best manuscripts, and they will again greatly in their service to their members and the public. Members should therefore make sure their societies provide it. For instance, Entomological Society of American is developing a new, all-electronic journal, Entomological Technique

(http://www.entsoc.org/prescorn.htm; April 1998), and Scientific Reference Resources launched its first two publications, Arthropod Endocrinology News and the Directory of Arthropod Endocrinologists on 1st September 1998. They are available both in printed form and on the website http://www.sciref.org/about.htm. Taking action now can secure an information highway where toll gates do not limit access to the literature of science.

Table 4. Comparison of reference citation accuracy studies in biological, physical, and social sciences.

Author	Subject scope	No. citations verified	No. citations found with errors	Most errors found in	Citations with errors, %[a]
Benning and Speer (1993)	Library Sci./Medicine	525	152	Author names	29.0
Boyce and Banning (1979)	Social Sciences	1,012	150	Numerical data	14.8
de Lacey et al. (1985)	Medicine	279	71	-	25.5
Doms (1988)	Dentistry	475	186	Article titles	39.2
Eichorn and Yankauer (1987)	Public Health	150	46	Author names	30.7
Evans et al. (1990)	Surgery	150	72	-	48.0
Foreman and Kirchhoff (1987)	Nursing	112	35	-	31.3
George and Robbins (1994)	Dermatology	240	99	Author names	41.3
Goldberg et al. (1993)	Emergency Medicine	145	40	-	27.6
Goodrich and Roland (1977)	Medicine	2,195	634	Article titles	28.9
Hinchcliff et al. (1993)	Veterinary Medicine	295	88	Author names	29.8
McLellan et al. (1992)	Anesthesiology	348	175	Article titles	50.3
Nuckles et al. (1993)	Dentistry	298	64	Article titles	21.5
Pandit (1993)	Library Science	1,094	193	Numerical data	17.6
Pope (1992)	Library Science	100	30	Author names	30.0
Poyer (1979)	General Sciences	2,448	367	Author names	15.0
Putterman and Lossos (1991)	Medicine	374	118	Author names	31.6
Stull et al. (1991)	Physical Education	973	457	Author names	47.0
Average					31.1

-,data not available from study.

[a]Percentages may not be those reported by authors because some included unverifiable citations in their analyses.

Table 5. Citation accuracy in 1st issues of 5 entomological journals for 1992.

Journal title	No. articles in 1st 1992 issue	No. citations examined[a]	Total citations verified	Total no. errors	Total no. citations with error(s)	Citations with ≥1 errors, %
Archives of Insect Biochemistry and Physiology	5	155	154	70	43	27.9
Ecological Entomology	15	377	371	115	98	26.4
Insect Biochemistry and Molecular Biology	11	311	309	141	108	35.0
Journal of Insect Physiology	8	249	248	110	80	32.3
Pesticide Biochemistry and Physiology	10	245	241	84	69	28.6
Totals	49	1,337	1,323	520	398	30.1

[a]Excludes items "in press" (n=15) and patents (n=3).

Bibliography

Garfield E. 1984. Journal citation studies 41. Entomology Journals-what they cite and what cites them. Current contents 1984:3-10.

Kristof C. 1997. Accuracy of reference citations in five entomology journals. American Entomologist. 43:246-251.

Walker T. J. 1998. Free internet access to traditional journal. Am. Sci. 86:463-471

Walker T. J. 1998. The future of scientific journals: Free access or pay per view? American Entomologist. 44:135-138.