
Abstract

Awareness about the mites and ticks dates back to ancient Egypt (1550 BC) and was continuously demonstrated throughout the writings of major Greek scholars; however, the science of acarology originated in the eighteenth-century Europe. Pliny the Elder (23–79 AD) reported ticks as the foulest and nastiest creatures. References to mites and ticks have also been found in the early writings of Hippocrates and Aristophanes. Greek terms *Kroton* or *Kynoraistis* for ticks and *A-Kari* (without head) had been used by Aristotle in describing about non-ixodid ticks. During medieval times, mites were commonly referred to as lice, beasties or little insects. The rediscovery of the term *Akari* or *Acari* appears to have occurred about 1650, but the term acarology began to appear regularly in the literature. Carl von Linnaeus used the generic word *Acarus* in the first edition of the *Systema Naturae* published in 1738. Historical account of acarology is discussed into three parts, i.e. prior to 1850 AD, between the period 1851 and 1950 and the developments from 1951 till today. A brief account of important books published, history of formation of acarological societies at regional and international levels and important journals published in acarology are discussed. Interest in acarology is rapidly developing because of the role of mites and ticks and their associations on different crops, storages and vectors of diseases and their impact as parasites/pests on human beings, domestic animals and poultry.

Keywords

Acari • Acarina • History • Linnaeus

Awareness of the mites and ticks dates back to ancient Egypt (1550 BC) and was continuously demonstrated throughout the writings of the major Greek scholars; however, the science of acarology originated in the eighteenth-century Europe. Historical account has been divided into three parts, i.e. prior to 1850 AD, between 1851 and 1950 and the developments from 1951 till today (Prasad [1982](#)).

2.1 Developments Prior to 1850 AD

The oldest reports are about a tick in the 1550 BC (Egyptian Ebers Papyrus), occurrence of ticks in the 850 BC in Ulysses' dog (Homer) and a record of mites on cheese in the 350 BC (Aristotle). Subsequently after another 500 years, a mite parasite of locusts (probably *Eutrombidium*) has been reported in *De Animalibus Histori Libri*. Pliny the Elder (23–79 AD) reported ticks as the foulest and nastiest creatures. References to mites and ticks have been found in the early writings of Hippocrates and Aristophanes.

Greek terms *Kroton* or *Kynoraistis* for ticks and *A-Kari* (without head) had been used by Aristotle in describing about non-ixodid ticks. Another possible derivation of the word *Acari* may have been from the Greek word *akares*, which means small or short. During medieval times, mites were commonly referred to as lice, beesties or little insects. As in Aristotle's time and until relatively recently, ticks were considered as an entity separate from mites and were referred to as *ticia* (old English) or *Zecken* (in Middle High German). The old English word *mite*, meaning very small, may well have been derived from the 'widows' mite – an early Flemish coin of very small size (Walter and Proctor 1999).

Rediscovery of the term *Akari*, or *Acari*, appears to have occurred about 1650, but it was not until the early twentieth century that the term acarology began to appear regularly in the literature (Krantz 1996). Carl von Linnaeus used the generic word *Acarus* in the first edition of the *Systema Naturae* published in 1738. Later, Linnaeus named the type species, *Acarus siro*, in the tenth edition of *Systema Naturae* published in 1758. In this edition, 30 mite species reported all under the genus *Acarus*. In this way Linnaeus did the ground work for the field of systematic acarology. During the one hundred years that followed Linnaeus, several schemes of higher classification of mites and ticks were introduced (DeGeer 1778; Leach 1815; Duges 1839). Many newly recognized mites and ticks were reported in this period. Oudemans' publication *Kritisch Historisch Overzicht der Acarologie* that appeared in three volumes (1926, 1929 and 1936–1937) included all acarological contributions made before 1850. But some early naturalists after Linnaeus many times mixed up the genera of mites with diverse groups such as crustaceans, the common sea spider, small beetles and harvestmen.

William Elford Leach (1790–1836) deserves credit for recognizing mites as an arachnid order *Monomerostomata* Leach 1815. But 4 years later, Leach (1819) replaced his ordinal name with a class *Acari*, although the credit for naming the taxon is given to Christian Ludwig Nitzsch (1782–1837) who introduced essentially the same name a year earlier as *Acarina* Nitzsch, 1818. By this time the 'mites' were now on their way to bring a definable and recognizable group (Krantz and Walter 2009).

2.2 Progress During 1851–1950 AD

The emergence of acarology as a modern science during the late nineteenth and early twentieth centuries was centred primarily in Europe and North America. Michael (1884) placed all *Acari* in two groups based on the basis of respiratory

systems: (i) Acari, Atracheata (including *Glycyphagus*, *Histiostoma*, *Phytoptus*, *Demodex* and Sarcoptidae), and (ii) Acari, Tracheata (including Prostigmata, Oribatidae, Gamasidae, Ixodidae, Tarsonemidae and Myobiidae). By this time members of mites and ticks were known by the names: Acarina, Acariens, Acaros and Acarida.

Grandjean (1882–1975) did an excellent work on mites regarding their systematics, morphology, phylogeny and ontogeny. Historic contributions during the above period were also made by Kramer (1877), Canestrini (1891), Banks (1904), Reuter (1909), Sig Thor (1929), Vitzthum (1940–1943) and Tragardh (1946) mostly regarding description of new taxa and classification of present day Acari. Many valuable contributions of the above scientists towards acarine systematics and classification proved instrumental in establishing acarology as a discrete discipline.

After World War II, intensive studies on mite-transmitted diseases such as scrub typhus and tick-borne haemorrhagic fever were reported. Following the introduction of several organochlorinated and organophosphate pesticides for the control of different insect and mite pest problems of agricultural and veterinary importance, the impact of these pesticides in disrupting the natural enemies of mites on agricultural crops was more thoroughly investigated. Several new mites and ticks were found and their damage was investigated in different locations.

2.3 Developments Since 1951

The eminent scientists, EW Baker and GW Wharton, investigated thoroughly diversity of plant-associated and animal parasitic mites. Both of them published jointly a monumental and very useful book: *An Introduction to Acarology* in 1952. The above text included briefly all the most important contributions towards systematics and classification of Acari and provided the base of modern day acarology. Many biologists were attracted to this branch of science after the publication of the above text. Baker and coworkers published in 1958 another very useful book: *Guide to Families of Mites*. The efforts of different scientists led to the development and production of some more books, establishment of acarological societies in different countries and production of various electronic publications and websites, which have put acarology on very sound footing. In many universities, *General and Applied Acarology* course is being taught at both graduate and postgraduate levels, and many shining students are opting this subject for their thesis/dissertation studies. To stimulate further interest in the subject of acarology, V. Prasad – an eminent acarologist – published a book *History of Acarology* in 1982 which included historical account of acarological investigations made in 22 different countries. The Acarological Society of America (ASA) honoured EW Baker and GW Wharton for their lifetime contributions in the field of acarology, at a specially organized symposium, *Acari: Life history, and Reproductive Patterns*, and considered them as the *Fathers of Acarology* (Prasad 1982; Lindquist 1984; Lindquist 2006).

2.4 OSU Acarology Development Programme

At Duke University (USA), Dr George W. Wharton established a section ‘The Institute of Acarology’ in 1951. Then Dr GW Wharton and Dr Edward W Baker together conducted ‘Acarology Summer Programme’ for the young acarologists at Ohio State University, at Columbus (Ohio), in the same year when Dr GW Wharton joined as Chairman of Department of Zoology and Entomology. Since then this course is being regularly conducted annually for training interested acarologists in the field of agriculture, medical, veterinary and soil acarology. Many present-day acarologists have got training from the above programme and produced useful findings which have made the subject of acarology as an important discipline (ER1).

A brief history of acarological developments in Hawaii (USA) and Australia is also reported in literature (ER2 and ER6). An overview of the story of French acarologists (ER4), and history of acarology in Egypt (ER5), is also available. Trends of publications made in the last 150 years in different aspects of acarology in different journals are also reported (ER3). The information pertaining to different acarological societies, journals devoted to acarology and important books published in the field of acarology are given below.

2.5 Acarological Societies

1. *International Congress of Acarology (ICA)*

<http://www.acarology.org/ica/>

Meeting of the International Congress of Acarology is held after every 4 years, and publications in book form are released. ICA also compiles a directory of acarologists of the world. First such meeting was held in Colorado (USA) in 1963, and the 14th International Congress of Acarology was held at Kyoto (Japan) in 2014. Details about ICA congresses held and proceedings published thereof are given in Table 2.1.

2. *Acarological Society of America (ASA)*

<https://www.facebook.com/AcarologicalSocietyofAmerica/>

<https://sites.google.com/site/acarologicalsociety/home>

ASA meetings are held in coordination with the Entomological Society of America (ESA). The society also publishes a directory of member acarologists, news and meetings. ASA also publishes on irregular basis its newsletter (ER2).

3. *Acarological Society of India (ASI)*

ASI was founded in 1973. The *Indian Journal of Acarology*, later renamed as *Journal of Acarology*; and *Acarology Newsletter* published regularly by the society till 2000 (Vol. 16 and 17), but subsequently thereafter published irregularly.

4. *Systematic and Applied Acarology Society (SAAS)*

[\(http://www.nhm.ac.uk/hosted_sites/acarology/saas/\)](http://www.nhm.ac.uk/hosted_sites/acarology/saas/)

SAAS was founded in 1996 and published *Systematic and Applied Acarology Journal*. SAAS also published *Special Publications* – a rapid publication for

Table 2.1 International Congress of Acarology

Congress	Held at	Period	President	Proceeding published
1st	Fort Collins, Colorado, USA	2–7 Sept. 1963	G. W. Wharton	Proceedings published as: Proceedings, in a special number of Acrologia. Acarologia, 1964–1966 (h.s.):1–439
2nd	Sutton, Bonington England (UK)	19–25 July 1967	T. E. Hughes	Proceedings by Akademiai Kaido, Budapest, in 1969, 652 pp
3rd	Prague (then Czechoslovakia)	31 Aug.–6 Sept, 1971	B. Rosicky	Proceedings of the 3rd International Congress of Acarology 1971, 837 pp
4th	Saalfelden, Austria	12–19 Aug. 1974	R. Schuster	Proceedings of the 4th International Congress of Acarology 1979, 752 pp. (ISBN 963 05 16950)
5th	East Lansing, Michigan (USA)	6–12 Aug. 1978	E. W. Baker	Recent advances in Acarology Vol I 631 pp. (ISBN 0-12-592201) & Vol. II 569H. (ISBN 0-12-592201-9)
6th	Edinburgh, Scotland	5–11 Sept. 1982	G. O. Evans	Acarology VI, Vol: 645645 pp. (ISBN 1984-085312-603) and, Vol. II (ISBN 0-85312-604-6)
7th	Bangalore, India	3–9 Aug. 1986	G. P. Channa Basavanna	Progress in Acarology 1988, Vol. I: 523 pp. (ISBN 81-204-0346-0), Vol. II: 484 pp. (ISBN 81-204-0347-9)
8th	Ceske Budejovice (Czechoslovakia)	6–11 Aug. 1990	B. Rosicky	Modern Acarology, 1991 Vol. I: 651 pp. (ISBN 80-200-0364-9) and Vol. II: 779 pp. (80-200-0369-9)
9th	Columbus, Ohio (USA)	17–22 July 1994	D. E. Johnston	Proceedings: Acarology IX 1996, 718 pp
10th	Canberra, Australia	5–10 July 1998	R. B. Halliday	Proceedings: Acarology Proceeding of the 10th International Congress 1998, 657 pp. (ISBN 0-643-06658-6)
11th	Merida, Yucatan, Mexico	8–13 Sept. 2002	Tila M. Perez	Acarology XI: Proceedings of the International Congress of Acarology, 2007, 726 pp. (ISBN 978-970-32-4451-5)

(continued)

Table 2.1 (continued)

Congress	Held at	Period	President	Proceeding published
12th	Amsterdam, the Netherlands	21–16 Aug. 2006	Maurice W. Sabelis	Trends in Acarology: Proceedings of the 12th International Congress 2010, 566 pp. and (ISBN 978-90-481-9836-8 and 12th e-ISBN 978-90-481-9837-5)
13th	Recife, Pernambuco	Aug. 2010	G. J. Demores and Heather Proctor	Acarology XIII: Proceedings of the 13th International Congress (2011) ISBN: 978-1-86977-804-0 (online edition)
14th	Kyoto, Japan	14–18 July 2014	H. Amano	Proceedings 14th International Congress of Acarology (2016)

Flechtmann (2011)

short papers and monographic works – which is now merged with *the* journal in 2012. It also publishes *Acarology Bulletin*, a newsletter of the society. It also issues books of special interest to members and maintains an online acarological e-reprint library for acarologists around the world. *Anyone interested in the study of mites and ticks is welcome to join SAAS.*

5. *African Acarology Association (AAA)*

<http://www.nhm.ac.uk/hosted-sites/acarology/saas/Hosted/aaa/index.htm>

AAA was founded in 1998 in South Africa. It holds symposia in acarology (regarding different topics) regularly after 3 years duration. The first symposium was held in 1998, and the fifth symposium was held at Livingstone, Zambia, in 2011. Abstracts of the third, fourth and fifth symposium are available on the website of AAA.

6. *The Acarological Society of Japan (ASJ)*

[\(http://en.acarology-japan.org/\)](http://en.acarology-japan.org/)

ASJ was founded in 1973 and replaced the earlier Japanese Association of Acarology which was established in 1973. ASJ publishes semi-annually a research journal, *Journal of Acarological Society of Japan*. ASJ also holds annual meetings and conducts symposiums regularly. The 14th International Congress of Acarology (ICA) was held at Kyoto, Japan, in 2014.

7. *European Association of Acarologists (EURAAC)*

[\(http://euraac.webs.upv.es/\)](http://euraac.webs.upv.es/)

EURAAC publishes an irregular newsletter and organizes symposia in Europe at regular intervals (ER4). Proceedings of different symposia have been published in book form as given in Table 2.2.

8. *The Egyptian Society of Acarology (ESA)*

[\(http://www.esaeg.org/\)](http://www.esaeg.org/)

ESA was founded in 2005 and is publishing annually a journal, *Acarines* (ER5).

Table 2.2 EURAAC symposiums

Symposium	Place held	Dates	Editors	Proceedings published as
1st	Graz (Austria)	1988	Schuster, R and Murphy P. W.	The Acari: Reproduction, Development and life-history strategies, pp. 564. Chapman and Hall, London, 1991
2nd	Krynica (Poland)	1992	Kropczynska, D; Boczek, J; and Tomczyk, A.	The Acari: Physiological and Ecological aspects of Acari-Host relationships, Pp. 698. Dabor Warsaw, 1995
3rd	Amsterdam (Netherland)	1996	Bruin J, Van der Geest LPS and Sabelis MW	Ecology and Evolution of the Acari. Pp 677, Kluwer Acad. Publishers, Dordrecht 1999
4th	Sienna (Italy)	2000	Bernin, F; Nannelli, R.; Nuzzaci, G.; and de Lillo, E.	Acari Polygeny and Evolution (Adaptations in Mites & Ticks). Pp. 472, Kluwer Acad. Publishers Dordrecht, 2002
5th	Berlin (Germany)	2004	Weigmann G; Alberti, G; Wohltmann, A; and Ragusa, S.	Acarine Biodiversity in the Natural and Human Sphere. Pp. 765. Phytophaga XIV, 2004 (2005)
6th	Montpellier (France)	2008	Bertrand, M; Kreikter, S.; Mc Coy, K. D.; Migeon, A.; Navajos, M.; M. S.; and Vial, L.	Integrative Ecology. Pp. 492, Euracac
7th	Vienna (Austria)	2012	K. D. Migeon, A; Navajos, M: Tyl	Acari in a changing world. Acarologia 53 (2),2013

9. *The Acarological Society of Iran (ASI)*

(<http://www.acarology.ir/>)

ASI was founded in 2008 and started publishing semi-annually – *Persian Journal of Acarology* – from January 2012.

10. *Sociedad Latinoamericana de Acarologia (SLA)*

(www.slaacarologia.com)

SLA was established for South American acarologists in 1994.

11. *Societe Internationale Des Acarologues De Langue Francaise (SIALF)*

(www.nhm.ac.uk/hosted-sites/acarology/saas/hosted/sialf/index.htm)

SIALF aims to promote research in acarology by exchanges of information among French-speaking members to support the growth of acarology. The society also organizes ‘International Courses of Acarology’ regularly.

2.6 Journals in Acarology

1. *International Journal of Acarology (IJA)*. [ISSN: 0164-7954 (print); and ISSN: 1945-3892 (online)]
<http://www.tandfonline.com/loi/taca20#.VPLsJHyUfp8>
 IJA was published biannually from 1975 till 2010. Taylor and Francis, from the United Kingdom, is publishing this journal from January 2011. Since its inception, this journal under the dynamic editorship of Dr V. Prasad – an eminent acarologist – honoured erstwhile and present distinguished acarologists through different activities published in IJA.
2. *Acarologia* (ISSN: 0044-586-x (print); 2107-7207 (online))
<http://www1.montpellier.inra.fr/CBGP/acarologia/latest.php>
 Marc Andre and Francois Grandjean founded this journal in 1959. This is the first and longest publishing acarology journal published quarterly and is devoted exclusively to acarology. From 2010, the online version is free through open access. A paper version is also available but through subscription.
3. *ACARINA*
<http://insects.ummz.lsa.umich.edu/acarina/>
 Russian Journal of Acarology (ISSN: 2221-51515 (online); and 0132-8077 (print).
 Published by KMK Scientific Press © on behalf of the Zoological Museum of Moscow University, since 1993. The journal is published in English; free PDFs are available.
4. *Acarology Bulletin* (ISSN: 1361-8091)
http://www.nhm.ac.uk/hosted_sites/acarology/saas/ab.html
<http://biotaxa.org/saa/>
 Acarology Bulletin is a newsletter published quarterly by ‘Systematic and Applied Acarology Society’. Contents of online issues are available from 1996 to 2008; thereafter, it merged with its sister journal and is publishing online since 1912 (DOI: <http://dx.doi.org/10.11158/saasp.23.1>).
5. *Experimental and Applied Acarology* (ISSN 0-168-8162)
<http://www.springer.com/life+sciences/entomology/journal/10493>
 The journal started publishing in 1985 and is publishing regularly. About 114 issues are available electronically (1997–2011).
6. *Indian Journal of Acarology* (ISSN: 970-1400)
www.acarology.in/html/ijoa.htm
 Published semi-annually from 1976 to 2000 and is publishing thereafter irregularly.
7. *Persian Journal of Acarology*
<http://www.acarology.ir/online/20issue.htm>
 A quarterly journal published by the Acarological Society of Iran since 2012 and is publishing regularly.
8. *ACARINES*
<http://www.esaeg.org/acarines.htm>
 Published biannually by the Egyptian Society of Acarology, since 2007.

2.7 Important Books Published

- Baker EW, Wharton GW. 1952. *An introduction to Acarology*, MacMillan, New York, 465 pp
- Chillar BS, Gulati R, Bhatnagar P. 2007. *Agricultural Acarology*. Daya Publishing House, Delhi (India), 353 pp
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In addition to the information given above, there may be several regional acarological associations and many other journals publishing important acarological investigations regularly throughout the world. Many books, monographs and technical bulletins/reports on different fundamental and applied aspects of acarology are being published by agricultural, medical and veterinary universities of different countries (Zakhvatkin 1952; Zhang 2011, 2014). So interest in acarology is picking up gradually as the role of mites and ticks is being realized because of their associations on different crops, storages, vectors of diseases and their impact as parasites/pests on human beings, domestic animals, zoo animals, poultry, etc. Recently many molecular studies on understanding higher levels of taxonomy and even at species level have been made. The results obtained from these studies are proving very useful tools even where morphological studies are not providing true information of relationship at different levels (Walter and Proctor 2010). Studies on genetic bar coding of different mites and tick species have also been reported.

2.8 Conclusions

Survey of literature reveals awareness about mites and ticks in ancient Egypt (1550 BC), but the science of acarology originated in the eighteenth century alone. References to the term Akari or Acari began appearing regularly in the literature, and Linnaeus used the generic word *Acarus* for mites in his first edition of *Systema Naturae* published in 1758. Later in tenth edition of *Systema Naturae* published in 1758, Linnaeus included 30 species of mites all under genus *Acarus*. Thereafter, references to mites and ticks regularly appeared and these organisms were reported under several schemes of higher classification. But the science of acarology (scientific study of mites and ticks) started emerging as a modern science during the late nineteenth and early twentieth centuries; however, during this period the mites and ticks were known by the names: Acarina, Acariens, Acaros and Acarida. Historic significant contributions that were made by Kramer (1877), Canestrini (1891), Banks (1904) and Vitzthum (1940–1943) proved instrumental in establishing acarology as a modern science. In 1952 a very useful book *An Introduction to Acarology* by Baker EW and Wharton GW appeared, and this stimulated interest in the science of acarology globally. Thereafter, many useful publications started appearing on taxonomy, ecology and other applied aspects from different regions of the world. This led to publication of the journal *Acarologia* in 1957; this journal published information exclusively on mites and ticks. Interest in acarology further resulted in formation of different societies at international, regional and country levels. Some more journals exclusively publishing information on mites and ticks and some good books were written by eminent scientists in their field of specialization, which further helped in the development of this discipline. At the international level, the ‘International Congress of Acarology’ was founded which organizes regularly after 4 years interval the meetings of the congress in different countries. The first congress was held in the USA, and the 14th congress was held in 2014 in Japan. Proceedings of the congress are being published regularly in book form. At regional and country levels, many associations were formed which are conducting symposiums at different intervals.

Further Reading

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