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MITES AS MODERN MODELS: ACAROLOGY IN THE 21ST CENTURY

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ABSTRACT — We present a literature survey and analysis of the profile of mites (Acari, exclusive of Ixodida) in recent literature and on the World Wide Web, and compare their prominence to that of spiders (Araneae). Despite having approximately the same number of described species, spiders outshine mites on the Web, although the study of mites (Acarology) is better represented than the study of spiders (Araneology). Broad searches of scientific literature imply that publications on mites exceed those on spiders by 2-3x; however, this dominance was reversed when a smaller number of journals with broad readerships and no taxonomic orientation (e.g., *Nature, Science*) were surveyed. This latter analysis revealed that the topical content of mite and spider papers in these general-science journals differs significantly. A troubling leveling-off of taxonomic publications on mites also was discovered. We conclude by suggesting some strategies that acarologists and editorial boards might follow in order to raise mites to their proper status as exemplary models for ecological and evolutionary research.

KEYWORDS — mite; spider; Acarology; World Wide Web; ecology; evolution; internet; key

INTRODUCTION

A decade ago, when we wrote our book *Mites: Ecology, Evolution and Behaviour* (Walter and Proctor, 1999), it was with the goal of revealing to students, scientists, and laypeople the wonders of the acarological world. We were spurred on both by a love of mites and by our experiences in academia, where we had repeatedly encountered otherwise well-educated colleagues who could not understand why we found mites so fascinating. Yet these same people often accepted work on a related taxon, spiders, as appropriate vehicles for addressing questions in evolutionary biology and ecology. On this the 50th anniversary of *Acarologia*, the first journal devoted to the study of mites, and coincidentally the 10th anniversary of the publication of our book, we decided to make an assessment of how Acarology has progressed over the last 50 years. We hope that readers will find this paper informative, entertaining, and insightful - particularly for determining which paths *Acarologia* may wish to tread in the coming years.

Mites, or at least the mites that we call "ticks", have been a part of human culture at least since Homer started singing of a parasite on Ulysses' dog nearly twenty-nine centuries ago, and the Acari have been the subject of serious scientific study for about two centuries (Krantz, 2009). But how serious is this study; or rather, how seriously is the discipline of Acarology perceived by society at the end of the first decade of the 21st Century? This time,

rather than relying on personal experience, we take advantage of the electronic tools that have flourished since 1999, the internet and associated search engines and databases, to assess how Acarology has penetrated popular culture and the scientific literature.

First we will estimate how well acarological topics are represented on the World Wide Web in comparison to other relevant disciplines and terms. We will follow this with a brief synopsis of how Acarology is presented on the web.

Second, since spiders are fellow arachnids and have a similar number of described species, we put special emphasis on comparing and contrasting scientific publications on the Acari and Araneae. Where appropriate we compare the prominence of mites to that of spiders to determine if mites are on par with spiders as subjects for research published in some major scientific journals.

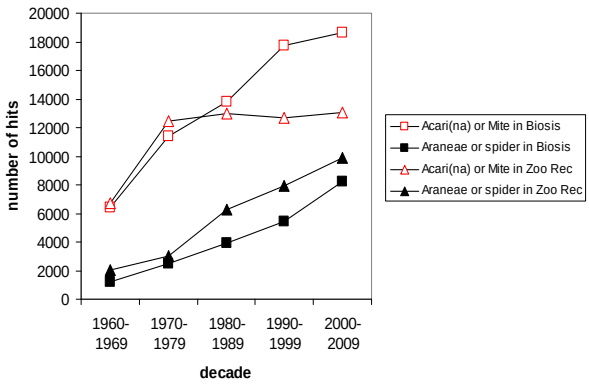


FIGURE 1: Number of hits for mites and spiders using two search engines over the past five decades.

In these surveys we did not include Ixodida (ticks) in great detail, in part because of the historical separation between those who study this group and those interested in non-tick Acari (which is reflected in the paraphyletic phrase "mites and ticks"), and in part because of the problem with the word "tick" having many different meanings in English. This latter greatly affects the number of irrelevant returns from general searching on the Web, and to a lesser extent in journals as well (see comments in Results and Discussion).

MATERIALS AND METHODS

Mites and Acarology on the World Wide Web

We used the *Google*™ Web Search (Google Canada, 2009) with default search settings to estimate the number of sites (hits) with terms or strings of words (in quotes) appropriate to our comparison.

All of our searches were carried out in English, but with the Search Language unrestricted (http://www.google.com/preferences?hl=en). Safe Search Filtering was left at the default "moderate filtering" which excludes only "explicit images".

Acarological Research in the Scientific Literature

To estimate the amount of scientific literature that has been published on mites and spiders, we used two electronic databases available via the University of Alberta library. *Biosis Previews* ® (1926-2009) is a combination of *Biological Abstracts* ® and *Biological Abstracts Reports, Reviews, Meetings* ® and provides a general life sciences abstracting service with a very broad scope.

Zoological Record (1864-2009) is the oldest and most comprehensive listing of animal taxonomic information. These databases are available through the *ISI Web of Knowledge* (2010) and the search engine allows Boolean operators such as 'or' and 'and' to be used to search for compound terms. When compiling totals, publications with unknown publication dates were deleted from totals. Additionally, we used the *ISI Web of Knowledge* (2010) to compare the 5-year journal citation Impact Factors of the 'high-profile' journal below.

Mites versus Spiders in High-profile Journals

The existence of a large number of publications on Acari may not accurately reflect the profile of mites in the scientific community. Are acarologists mainly publishing in taxon-delimited journals, and hence are talking mostly to other acarologists, or are they publishing in venues that are regularly read by a broad diversity of scientists? To answer this question, we narrowed our scope of search to a few high-profile journals that cover a wide range of disciplines and taxa, and compared the number of papers on 'mites' to those on 'spiders'. Although the

TABLE 1: Results of using the *Google*™ search engine on 29 December 2009. Phrases in quotes (e.g. "Department of Acarology") are searches for the exact string.

Search Term	Resulting hits	Recognition Factor (%)
mite vs tick	12,400,000 vs 28,900,000	42.10%
mite vs spider	12,400,000 vs 69,300,000	17.90%
mite + tick vs spider	41,300,000 vs 69,300,000	59.60%
Acari vs Acarina	1,300,000 vs 316,000	411%
Acari vs Araneae	1,300,000 vs 572,000	227%
acarology vs zoology	129,000 vs 17,000,000	0.80%
acarology vs entomology	129,000 vs 8,680,000	1.50%
acarology vs araneology	129,000 vs 4,480	2902%
"Department of Acarology" vs "Zoology"	94,200 vs 1,200,000	7.90%
"Department of Acarology" vs "Entomology"	94,200 vs 448,000	21%
"Department of Acarology" vs "Araneology"	94,200 vs 0	
Acarologia vs "*Journal of Arachnology* "	118,000 vs 32,400	364.20%

number of extant species of mites probably exceeds that of spiders by an order of magnitude, the number of described species of each taxon is very similar, between ~40-50 thousand (Halliday *et al.* 2000, Chapman 2009). All else being equal, one might expect a similar number of publications on each taxon.

We searched 7 journals (5 year ISI Impact Factor) for the time period from January 1999 to November 2009 for articles dealing with "mite(s)" or "spider(s)": *Nature* (31.434), *Science* (30.268), *Naturwissenschaften* (2.338), *Proceedings of the Royal Society B* (4.952), *Proceedings of the National Academy of Science* (10.228), *Ecology* (6.112) and *Evolution* (5.427). None of these publications is oriented to any particular taxon. Our rationale was that appearance in one of these widely cited journals indicated that a topic was considered (by editors, at least) to be of interest to a wide scientific audience rather than to a taxon-specific audience. At the low-impact end of our selection, *Naturwissenschaften* was included in order to have a representative journal based outside of the U.S. and U.K. Although its impact factor of 2.338 is relatively low compared to the other selected journals, *Naturwissenschaften*'s IF is about twice the impact factor of the highest rated acarological journal. We checked each of the returned search items to check for relevancy (e.g., did "mite" refer to Acari or was it the second half of "ter-mite"?). We divided articles into several types: (1) primary research articles; (2) literature reviews; (3) 'editor's pick' articles in which there is an overview of a paper published in that issue; (4) 'journal club' articles in which a paper published in a different journal is highlighted (in this case, the identity of the other journal was not relevant); (5) book reviews.

For each retrieved item we determined the following: the proportion of the item devoted to the mites/spiders (1 = minor, 2 = moderate, 3 = major, 4 = entire); number of species of that taxon (1 = single species, 2 = between 2-5 spp., 3 = 6-10 spp., 4 = more than 10 spp.); and whether the item included aspects of genetics, physiology, biochemistry, development, morphology, evolution, ecology, behaviour, agriculture, forestry, medical-veterinary applications, or applied materials sciences (0 = not included, 1 = included). For this last set of variables, each publication was scored for as many topics as were included. Data were analyzed in two ways. We used a Wilcoxon Signed Ranks test to compare numbers of 'mite' and 'spider' publications in the seven journals. Frequencies of occurrence of the different categories described above were compared between the two taxa using Chi-square tests.

TABLE 2: Some acarological sites with general information and links on the World Wide Web.

Web site	Address
Acarina, Russian Journal of Acarology	http://insects.ummz.lsa.umich.edu/ACARINA/
Acarines, Journal of the Egyptian Society of Acarology	http://journals.indexcopernicus.com/karta.php?action=masterlist&id=3350
Acarologia	http://www1.montpellier.inra.fr/CBGP/acarologia/
Acarology Laboratory, Department of Evolution, Ecology and Organismal Biology, The Ohio State University	http://www.biosci.ohio-state.edu/~acarolog/summerProgram/
Acarological Society of America	http://acariweb.com/ASA/
Acarological Society of Japan	http://acari.ac.affrc.go.jp/e_index.php/e/Journal
Acarology Home Page	http://www.nhm.ac.uk/hosted_sites/acarology/
Acarology.org	http://www.acarology.org/
African Acarology Association	http://www.nhm.ac.uk/hosted_sites/acarology/saas/Hosted/aaa/index.htm
BugGuide Subclass Acari – Mites and Ticks	http://bugguide.net/node/view/91197/bgimage?from=0
Database of IPM Resources (DIR) Internet Resources on Acarology	http://ipmnet.org/cicp/pests/mites.htm
Department of Acarology, National Museum, Bloemfontein	http://www.nasmus.co.za/ACAROL/ACAROL1.HTM
European Association of Acarologists	http://euraac.boku.ac.at/
Experimental and Applied Acarology	http://www.springerlink.com/content/100158/
François Alfred GRANDJEAN (1882-1975)	http://www.annales.org/archives/x/grandjean.html
Indian Journal of Acarology	http://www.acarology.in/html/ijoa.html
International Congress of Acarology	http://www.acarology.org/ica/
Mites that attack humans	http://edis.ifas.ufl.edu/ig086
National Academy of Sciences of Ukraine – I.I. Schmalhausen Institute of Zoology, Department of Acarology	http://www.izan.kiev.ua/eng/deps/depacar.htm
North American Bee-Associated Mites	http://insects.ummz.lsa.umich.edu/beemites/
Societe Internationale Des Acarologues De Langue Francaise	http://www.nhm.ac.uk/hosted_sites/acarology/saas/Hosted/sialf/index.htm
Spider Mites Web	http://www1.montpellier.inra.fr/CBGP/spmweb/
Systematic and Applied Acarology	http://www.nhm.ac.uk/hosted_sites/acarology/saas/
The Acarology Unit, Infectious Diseases Research Centre	http://www.imr.gov.my/org/akaro_r.htm
The International Journal of Acarology	http://www.tandf.co.uk/journals/titles/01647954.asp
Tree of Life. Acari: The Mites.	http://tolweb.org/Acari/2554
Texas A&M University Tick Research Laboratory	http://ticsys.tamu.edu/
University of Rhode Island Tick Encounter Resource Center	http://www.tickencounter.org/

For these analyses, we used the statistical software package SPSS version 17.0, and included only 'primary research article' publications. We also compared 'mite' and 'spider' papers in multivariate space using the software package PATN 3.12 (http://www.patn.com.au/patn_v3.htm). For this analysis we restricted the publications to those primary research articles that were entirely devoted to mites or spiders (category 4). This was done in order to reduce the number of objects (publications) to allow particular tests to be done in PATN. The matrix consisted of the publication objects and their attributes: mites/spiders (0 or 1), number of species (1-4), aspects covered (0 or 1 for each of the categories listed above), year of publication. All but the year were used as intrinsic variables, and hence played a role in the construction of the ordination. A 3-D ordination was created using the semi-strong hybrid multidimensional scaling (SSH) algorithm (Belbin, 1989). Correlation of variables with the ordination was assessed using the Monte-Carlo Attributes in Ordination (MCAO) feature, and vectors significant at $P<0.05$ were plotted . We tested the hypothesis that papers focussed on mites were significantly different from those dealing with spiders using the Analysis of Similarity (ANOSIM) test. ANOSIM is analogous to ANOVA (Belbin, 1989).

Results and Discussion

Mites and Acarology on the World Wide Web (WWW)

Acarology, of course, is the study of mites; and thus, 'mite' would seem to be its least common denominator. Using the search engine *Google*™ (all languages, moderate filtering) and the word 'mite' yielded about 12,400,000 hits (see Table 1). This is much less than some other 4-letter words for animals, e.g. 'duck' produces 58,800,000 hits, 'bull' 106,000,000, and 'tick' 28,900,000. However, all of these simple English words have several meanings that are unrelated to their zoological definitions or have special usages, such as in Mighty Mite Portable Sawmill. In addition, acronyms also are picked up by *Google*™; and for MITE, we have (among others): Midwest Institute for Telecommuting Education, Monterey Institute for Technology and Education, and Minority Introduction to Engineering and Science. Additionally, there is the complication of MITEs (Miniature Inverted-repeat transposable elements) found in their thousands in genomes and *Google*™ searches alike. Thus, we needed more technical terms to estimate the penetration of mites into the WWW.

The two most technical terms for mites are Acari and Acarina. According to *Google*™ (Table 1), Acari is the more favoured term and is used about four times more frequently. Additionally, Acari is more than twice as commonly found on webpages as Araneae (although Araneae is more than 10 times as common as Ixodida [52,300] and three times as common as Ixodidae [183,000], the largest family of ticks). This somewhat balances the result that 'spider' is almost six times as common as 'mite'. In contrast, 'Aves' a class of mite habitats of some interest, appears about 20 times (25,300,000) more commonly than 'Acari'. It also is worth noting that a search of *Google Books* produces 3,097 hits for 'Acari' and '22,019' for 'Aves'.

A final approach is to search for 'Acarology' itself. On 17 December 2009, *Google*™ yielded 132,000 hits, but on 29 December 2009 only 129,000 hits. The decline of about 2% is unexplained, but presumably relates to the algorithms used by the search engine and one hopes not a sudden decline in interest in the study of mites. As a discipline, Acarology is often nested within Entomology, and always within Zoology. Not surprisingly, Zoology, the largest discipline receives many more hits, but Entomology does rather well (51%) and Acarology does poorly against both. This time the spiders come to the rescue: Acarology is 29 times more commonly mentioned on web pages than its sister discipline Araneology. These trends carry over when searching for strings with "Department of . . . " too.

In conclusion, although mites are well represented on the WWW (despite the exclusion of ticks), much of this results from pages of little immediate interest to acarologists. When more technical search terms are used, the study of mites appears to be poorly represented compared to other disciplines. However, a wealth of acarological informa-

TABLE 3: Some keys to the identification of mites present on the World Wide Web.

Web site and address
Almanac of Alberta Oribatida (downloadable pdf of traditional dichotomous keys, descriptions, and ecological information; periodically updated). http://www.royalalbertamuseum.ca/natural/insects/research/research.htm
Artificial Key to Families of North American Bee-Associated Mites (a combination of dichotomous and hyper-link keys that is still under construction) http://insects.ummz.lsa.umich.edu/beemites/Family_key.htm
Families of Parasitiformes in Soil (Lucid 2.2, Windows operating system required) http://www.lucidcentral.com/keys/cpitt/public/Mites/Parasitiformes/Default.htm
Invasive Mite Identification: Tools for Quarantine and Plant Protection. Colorado State University, Ft. Collins, CO and USDA/APHIS/PPQ Center for Plant Health Science and Technology, Raleigh, NC (Lucid 3.3, platform independent) http://www.lucidcentral.org/keys/v3/mites/Invasive_Mite_Identification/key/Whole_site/Home_whole_key.html
Keys to the Families and Genera of Blood and Tissue Feeding Mites Associated with Albertan Birds. Canadian Journal of Arthropod Identification 02 June 28, 2006. (dichotomous key with hyper-links) http://www.biology.ualberta.ca/bsc/ejournal/kp02/kp_02.html
Mites: Key to Some Species Commonly Infesting Households and Stored Food (downloadable pdf of traditional dichotomous keys) http://www.cdc.gov/nceh/ehs/Docs/Pictorial_Keys/Mites.pdf
Orders, Suborders and Cohorts of Mites in Soil (Lucid 2.2, Windows operating system required) http://www.lucidcentral.com/keys/cpitt/public/Mites/Soil%20Mites/Index.htm
Soil Microarthropods (Lucid 2.2, Windows operating system required) http://www.lucidcentral.com/keys/cpitt/public/Mites/Microarthropods/Index.htm

tion is available on the web. We have divided our brief survey into three categories and present examples in the tables below (Tables 2-4).

General acarological sites including society and journal webpages that provide acarological information and links are presented in Table 2. Of special interest here is the webpage of *Systematic and Applied Acarology* which pioneered web-based publication of taxonomic Acarology, includes freely available Special Publications, and also hosts an Acarological Reprint Library (http://www.nhm.ac.uk/hosted_sites/acarology-/saas/e-library/index.html). Also, the Acarological Society of Japan has made its papers available for free download as pdfs.

Sites that host keys to mite identification are presented in Table 3. These include a variety of formats, some of which require proprietary third-party software to run (see Walter and Winterton, 2007, for a review). However, others can be used by anyone with a (preferably high-speed) internet connection or the ability to download and use Adobe pdf files. In terms of future directions, the most relevant of these keys (Knee and Proctor 2006) is hosted by the *Canadian Journal of Arthropod Identification* - a journal devoted to the online publication of freely available interactive keys.

Finally, sites with lists of mite faunas are presented in Table 4. Other than Joel Hallan's monumental compilation on the Arachnida of the world (Hallan, 2005), the fauna list sites seem to be dominated by Oribatida.

Acarological Research in the Scientific Literature

In order to get a better idea how mites were fairing as subjects for scientific research in comparison to spiders, we used two well known abstracting services to search for publications in scientific journals and books that used the terms Acari, Acarina, or mite compared to Araneae or spider. The first of these, *Biosis Previews*®, is the more general and recorded almost eighty thousand publications that referred to mites since 1926 (76,993). In contrast, spiders were mentioned in only 30.2% as many studies (23,249). A similar pattern emerged from *Zoological Record*, a primary taxonomic reference that ex-

TABLE 4: Some sites on the World Wide Web with lists of mite faunas.

Web site and address
Synopsis of the Described Arachnida of the World http://insects.tamu.edu/research/collection/hallan/acari/0ReportHi.htm
Canopy Projects at the University of Victoria http://web.uvic.ca/~canopy/canopy.html
Catalogue of the Oribatida (Acari) of Finland http://users.utu.fi/ritniemi/ActaZoolFenn207.html
Diversity of Oribatida in Canada http://www.cbif.gc.ca/spp_pages/mites/phps/index_e.php
Listado Sistemático, Sinonímico y Biogeográfico de los Ácaros Oribátidos (Acariformes: Oribatida) del Mundo http://www.ucm.es/info/zoo/Artropodos/Catalogo.pdf

tends back to 1864, with publications mentioning acarines (64,632) almost twice as often as those mentioning spiders (35,853). These results were consistent across all subcategories (mites vs spiders): articles (60,273 vs 34,333); book chapters (3,561 vs 1,491); meeting papers (1,253 vs 706), books (794 vs 447) and meetings (88 vs 24).

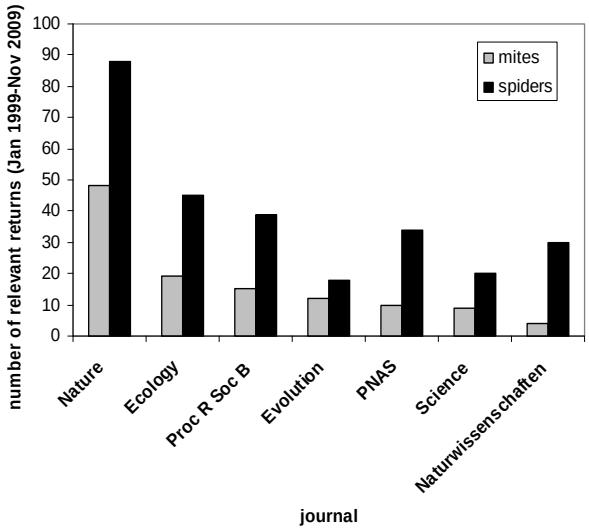


FIGURE 2: Number of 'mite' and 'spider' papers in seven target journals. Spider-related papers are significantly more abundant (Wilcoxon Signed Ranks, Z = 2.38, 2-tailed P = 0.018).

However, when the number of publications per decade over the last 50 years is considered (Fig. 1), a disturbing trend emerges in the *Zoological Record* results: the number of papers being published on the taxonomy of mites appears to have leveled off. This result is similar to what Halliday *et al.* (2000) noted in the description of new species of mites at the end of the last century. No such trend is present in the spider taxonomic research - a strong positive slope is apparent - nor in total publications mentioning mites as shown in the slope for the *Biosis Previews*® results.

Mites versus spiders in general journals

Searches of the seven journals over the past decade retrieved 172 returns for "mite" and 456 for "spider"; however, after discarding non-relevant hits the counts were reduced to 116 and 273, respectively. In contrast to the general survey of literature described above, every one of the seven journals surveyed had more spider-related articles than mite articles (Fig. 2).

With regard to primary research papers only, there was no significant difference between 'mite' and 'spider' articles based on either proportion of each article devoted to the target taxon (Fig. 3) or the number of species of the target taxon in each article (Fig. 4). These results were somewhat surprising, as we had expected that research involving mites would more often include them as a subset of larger assemblages (e.g., of soil microarthopods) or as symbionts of a taxon that was the major focus of the paper (e.g., nest mites of birds). We had also ex-

pected that papers on spiders might more often be focussed on a single species, whereas mite papers would cover many acarine taxa.

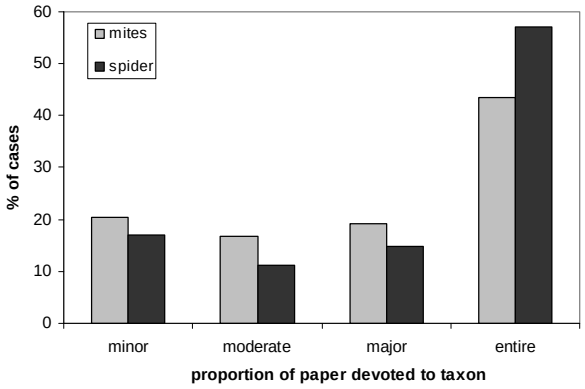


FIGURE 3: Distribution of primary research articles in seven target journals (see Methods) based on the proportion of each article devoted to the target taxon. There was no significant difference in the frequencies of the different categories in 'mite' versus 'spider' papers ($\chi^2_{\text{df}=3} = 4.51, P > 0.1$).

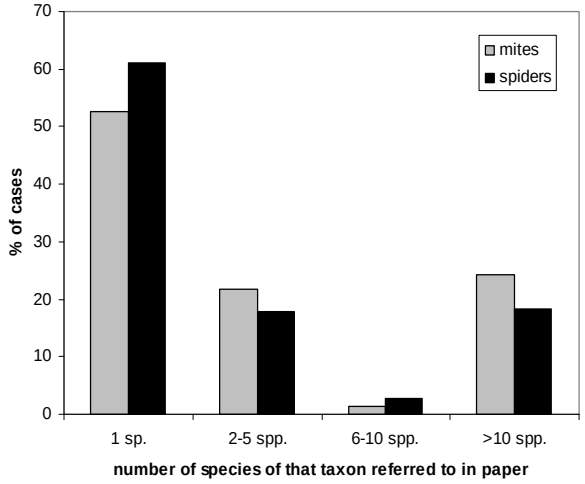


FIGURE 4: Distribution of primary research articles in seven target journals (see Methods) based on the number of species of the target taxon in each article. There was no significant difference in the frequencies of the different categories in 'mite' versus 'spider' papers ($\chi^2_{\text{df}=3} = 2.73, P > 0.5$).

Although there was a trend towards this (Fig. 4), it was not significant. However, we did find a significant difference in the topics covered by 'mite' vs. 'spider' research articles (Fig. 5).

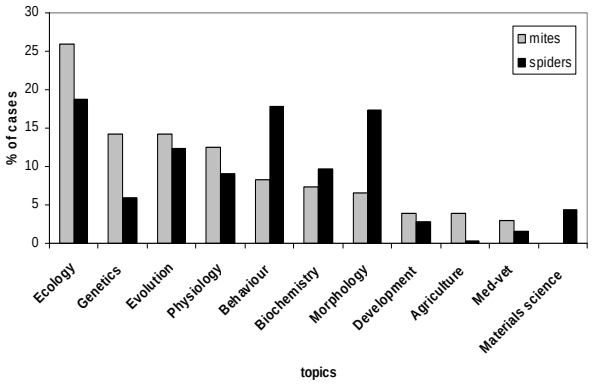


FIGURE 5: Distribution of primary research articles in seven target journals (see Methods) based on the topics covered in each article. Only two papers included Forestry as a topic, so this was not included in the analysis. The overall Chi-square model revealed a significant difference in the frequencies of the different categories in 'mite' versus 'spider' papers ($\chi^2_{\text{df}=10} = 72.47, P < 0.005$).

Ecology, genetics and agriculture more often occurred as topics in papers involving mites, whereas behaviour, morphology and materials science occurred much more often in those involving spiders. For materials science, the structure of spider webs was the main theme, and there were no papers at all involving mites or mite silk.

These differences were reflected in the ordination analysis (Fig. 6). 'Mite' papers and 'spider' papers fall into different regions of the ordination. This degree of clumping is much tighter than one would predict by chance (ANOSIM statistics: real f-ratio = 1.45, best of 100 randomizations = 1.06, P < 0.01). Many of the vectors that most strongly match the mite/spider divide (e.g., morphology, ecology, genetics, agriculture) are those that differed greatly between the taxa in Fig. 5. It might be argued that this clumping is an artifact of having included taxon as one of the intrinsic attributes in the ordination. However, we re-ran the analysis with the influence of taxon removed, the clumping of 'mite' vs. 'spider' papers was still significant (real f-ratio = 1.095, best = 1.06, P < 0.01).

The disciplinary separation between those who study ticks and those who study non-tick acarines was strongly reflected in the journal survey: none of the 116 articles returned in the search for Acari* or mite* was about ticks. We quickly did a sur-

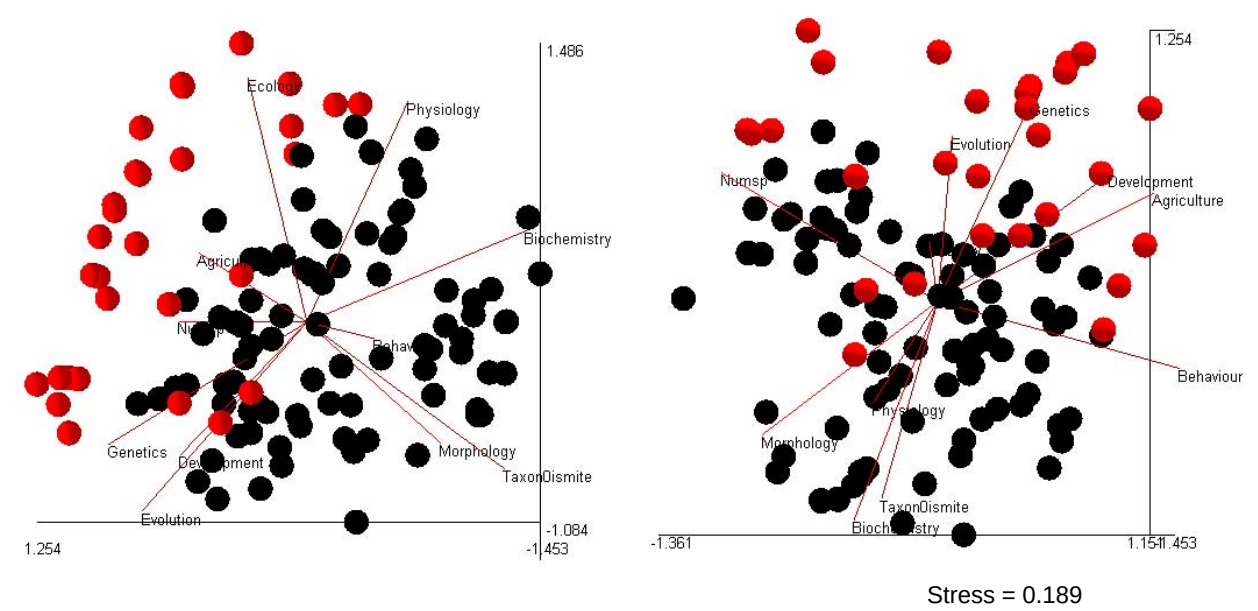


FIGURE 6: SSH ordination of primary research articles with a taxon-devotion level of 4 in seven target journals (see Methods). Mite papers are indicated by red circles and spider papers by black circles. Two pairs of the three axes are shown (2 and 3 and 1 and 3); the remaining pair had most of the mite papers hidden behind the spider papers, making interpretation difficult. Vectors plotted are those that were correlated with the ordination at P<0.05, and hence were important in creating the topology of the ordination. Vectors point towards areas in which they have higher values. In the case of the taxon vector, mite papers were given a value of 0 and spider papers a value of 1, therefore the vector points towards the cluster of black circles. ANOSIM statistics: real f-ratio = 1.45, best of 100 randomizations = 1.06, P < 0.01).

vey of those same seven journals for the same time period in order to determine how many additional papers included either "ixodid*" or "tick*". The returns were as follows, presented in the form of "(total/relevant)": *Nature* (256/40), *Science* (18/6), *Naturwissenschaften* (13/5), *Proceedings of the Royal Society B* (7/6), *Proceedings of the National Academy of Science* (27/27), *Ecology* (6/6), *Evolution* (3/3). Although no detailed analysis of content was done, the majority of the papers dealt with ticks as vectors, with a focus on disease or bacterial biology rather than having the biology of ticks as the focus. It is interesting to note than only 3 of the 93 relevant articles included "ixodid*"; it seems that ticks tend to be presented as taxonomy-free entities in these journals.

CONCLUSIONS

Although mites do have a significant presence on the World Wide Web, the results of our surveys indicate that Acarology as a science still has a long way to go to achieve parity with related disciplines in high profile scientific publications. We note that many of the high-profile journal articles on spiders highlighted fascinating aspects of their behaviour and morphology: courtship behaviour, male ornamentation, male and female genitalic extravagances; maternal care and social behaviour; predatory behaviour and web structure. Mites can match spiders in all of these areas (Walter and Proctor, 1999; Krantz and Walter, 2009), perhaps with the exception of web diversity (but see Saito 2010), but acarologists have yet to convince a significant number of research scientists that this is so.

We also find it unfortunate that, although the Acari most likely have an extant diversity many times that of spiders, the number of described species is similar. The traditional role of acarological journals has been to publish descriptions of new species and this has been a strong point of the journal *Acarologia*. However, the apparent loss of mo-

mentum in the publication of taxonomic acarological papers apparent in Fig. 1 and in description of new species noted by Halliday *et al.* (2000) suggests that we are finding it difficult to keep up. Part of this is undoubtedly due to the small number of acarologists and the low regard in which basic taxonomic work can be held in many academic circles (see Walter and Winterton, 2007). Another aspect of this problem may be that journals willing to accept acarological taxonomy are approaching saturation.

As *Acarologia* enters its second half-century, it will be interesting to see how our premier taxonomic journal responds. We offer two recent journal models as examples of ways that may be considered by *Acarologia* and other acarological journals - and by acarologists publishing in other journals. The first has already been discussed, the *Canadian Journal of Arthropod Identification* (*CJAI*). Perhaps the primary impediment to finding evolutionary biologists or ecologists who are willing to work with mites is the difficulty of identifying them. *CJAI* publishes keys on-line where they can be used by anyone interested to identify arthropods - and then use them in their research. A second model is the highly successful journal *Zootaxa* (2009). *Zootaxa* is the fastest and best refereed taxonomic journal that we have experienced. Quick reviews by knowledgeable specialists and rapid publication facilitates bringing taxonomic knowledge to other biologists (and also helps academic acarologists to publish and avoid perishing). *Zootaxa* encourages authors to purchase open-access publication options for their papers, which allows any user with access to the internet to download the paper. Finally, there is a technique that many journals have experimented with in recent years: a lead or forum article for each issue that is designed to grab the attention of a broad array of researchers. Perhaps if we make more of an effort to introduce outsiders into the exciting realm of mites, our science will flourish in the 21st Century.

REFERENCES

Biosis Previews ® 1926-2009 — Available from: http://thomsonreuters.com/products_services/science/science_products/a-z/biosis_previews

Belbin L. 1989 — PATN Technical Reference — CSIRO Division of Wildlife and Ecology, P.O. Box 84, Lyneham, ACT, 2602. 167 pp.

Canadian Journal of Arthropod Identification 2009 — Available from: http://www.biology.ualberta.ca /bsc/ejournal/ejournal.html

Chapman A.D. 2009 — Numbers of Living Species in Australia and the World, 2nd Edition — Report for the Australian Biological Resources Study. Canberra. pp. 80.

Google 2009 — Available from: http:/ /www.google.ca /webhp? sourceid=navclient&ie=UTF-8

Hallan J. 2005 — Synopsis of the Described Arachnida of the World — http://insects.tamu.edu/research /collection/hallan/acari/0ReportHi.htm

Halliday R.B., OConnor B.M., Baker, A.S. 2000 — Global Diversity of Mites — In Raven P.H., Williams T. (Eds.), Nature and Human Society: The Quest for a Sustainable World. National Academy Press: Washington D.C.: p. 192-203.

ISI Web of Knowledge, 2010 — Available from: http://isiwebofknowledge.com/

Knee, W., Proctor H.C. 2006 — Keys to the Families and Genera of Blood and Tissue Feeding Mites Associated with Albertan Birds — Canadian Journal of Arthropod Identification 02 June 28, 2006 http://www.biology.ualberta.ca/bsc/ejournal /kp02/kp_02.html

Krantz G.W. 2009 — Introduction — In Krantz G.W., Walter D.E. (Eds.). A Manual of Acarology 3rd Edition. Texas Tech University Press p. 1-2.

Krantz G.W., Walter D.E. (Eds.), 2009 — A Manual of Acarology 3rd Edition — Texas Tech University Press. pp. 807.

Saito Y. 2010 — Plant Mites and Sociality: Diversity and Evolution — Tokyo: Springer. pp. 191.

SPSS for Windows, Rel. 17.0.0 — 2008 — Chicago: SPSS Inc.

Walter D.E., Proctor H.C. 1999 — Mites: Ecology, Evolution and Behaviour. Sydney: University of NSW Press. pp. 322.

Walter D.E., Winterton S. 2007 — Keys and the Crisis in Taxonomy: Extinction or Reinvention? — Ann. Rev. Entomol., 52: 193-208.

Zoological Record 1864-2009 — Available from: http://thomsonreuters.com/products_services /science /science_products/a-z/zoological_record

Zootaxa 2009 — Available from: http://www.mapress.com/zootaxa/

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