Zoosymposia 6: 34–38 (2011)
www.mapress.com/zoosymposia/

ISSN 1178-9905 (print edition)
ZOOSYMPOSIA
ISSN 1178-9913 (online edition)

Some statistics on the taxonomy of the family Cunaxidae (Acari: Prostigmata)*

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* *In*: Moraes, G.J. de & Proctor, H. (eds) Acarology XIII: Proceedings of the International Congress. Zoosymposia, 6, 1–304.

Abstract

Cunaxidae is a cosmopolitan mite family consisting only of predatory species. Prompted by the goals of "Species 2000", a database for the cunaxids was prepared and made available at *www.catalogueoflife.org*. The family is presently arranged in five subfamilies, six tribes, 27 genera and 329 species. The three largest subfamilies are Cunaxinae, Coleoscirinae and Cunaxoidinae. *Cunaxa* is the most species-rich genus, followed by *Armascirus* and *Coleoscirus*. Most of the authors of new cunaxid species have their working bases in the Palaearctic, Oriental and Nearctic Regions. By far, the largest numbers of species have been described from South Africa, USA and Philippines, but the distribution of the described species may not reflect the actual diversity of these mites around the globe. Rather, it may reflect the variable dedication of authors in different countries in their study. In most countries, taxonomic studies of the cunaxids have hardly started, and much remains to be investigated. However, an immediate threat to the future of cunaxid taxonomy refers to the fact that most of the cunaxid taxonomists are retired, and that replacement by new taxonomists has not been considered a priority. Efforts should be directed to change this trend, motivating new professionals to take the cunaxids at least as part of their working priorities. In this work, I comment on the experience in trying to establish a database for the Cunaxidae, provide the most relevant results of this effort in relation to that family, and provide comments and advice for other professionals interested in doing similar work for other mite groups.

Key words: Biological control, catalog, database, predator.

Introduction

Cunaxidae is a cosmopolitan mite family consisting only of predatory species. They are found from tropical to arctic regions, feeding on nematodes and small arthropods (Walter & Kaplan, 1991), although some species will occasionally consume honeydew (Walter & Proctor, 1999). They occur in the litter and the immediate subjacent soil layer, on aerial plant parts and in stored food products. Very little is known about the biology of cunaxids; the life cycle of only seven species of this family has been studied (Castro & Moraes, 2010). Their potential as control agents of plant pests has not been adequately investigated but it has been suggested that mass production of these mites could be hampered by their strong tendency towards cannibalism (Gerson *et al*., 2003).

A list of cunaxid species was recently made available (Den Heyer, 2011). A total of 329 species are mentioned in that list. The database was compiled according to the requirements of "Species 2000"; an autonomous federation of taxonomic database projects, whose aim is to eventually compile the "Catalogue of Life" (CoL), a universal database including all the world's named species (plants, animals, fungi and microbes). It is available online at *www.catalogueoflife.org*, an electronic web-service.

The objective of this paper is to present important information about cunaxids that was obtained while preparing that database.

Materials and Methods

The information presented here was obtained through an analysis of data gathered to compile the cunaxid database for Species 2000 (Den Heyer, 2011). The vast majority of the papers used as primary

 Accepted by G. J. de Moraes: 30 Jul. 2011; Published: 20 Dec. 2011

sources of data to construct the database was available in the private reference collection of the author. The remaining sources were detected and obtained mainly by searches in printed databases, internet searches and direct contacts with acarologists.

In compiling the database, the basic classification system adopted was that of Den Heyer (1980), which was considered more appropriate that the system of Smiley (1992). When for the description of a particular species, drawings and text did not express the same thing in relation to the placement of a species in a genus, the species was placed as originally indicated by its author(s).

Not all synonyms presented in old literature (1875–1940) were considered appropriate, according to the judgment of the author of this paper. In this sense, Smiley's (1992) synonymizations of *Dactyloscirus* with *Armascirus*, *Cunaxa* with *Rubroscirus* and Bonziinae with Coleoscirinae were not accepted. In addition, based on the redescriptions of *Cunaxa bambusae* Gupta & Gosh, 1980 and *Cunaxa cynodonae* Gupta & Gosh, 1980 by Corpuz-Raros (2008), particularly in reference to the position of setae *hg4*, those species were transferred to *Riscus* Den Heyer.

Results

The cunaxids are presently arranged in five subfamilies, six tribes, 27 genera and 329 species (Table 1). The three largest subfamilies are Cunaxinae, Coleoscirinae and Cunaxoidinae, with 133, 91 and 90 species, respectively. Each of these subfamilies is divided in two tribes; the remaining two subfamilies (Bonziinae, Scirulinae) are not divided in tribes.

TABLE 1. World diversity of Cunaxidae (Prostigmata).

Subfamily	Tribe	Genus	Number of species per genus	Number of species per subfamily
Bonziinae		*Parabonzia*	7	13
		Bonzia	6	
Coleoscirinae	Neoscirulini	*Neoscirula*	25	91
		Pseudobonzia	5	
		Coleobonzia	22	
	Coleoscirini	*Orangescirula*	3	
		Coleoscirus	29	
		Scutascirus	7	
Cunaxinae	Cunaxini	*Cunaxa*	47	133
		Rubroscirus	24	
		Riscus	3	
		Cunaxatricha	1	
		Allocunaxa	1	
	Armascirini	*Armascirus*	33	
		Dactyloscirus	24	
Scirulinae		*Scirula*	2	2
Cunaxoidinae	Cunaxoidini	*Cunaxoides*	15	90
		Bunaxella	3	
		Funaxopsis	3	
		Dunaxeus	3	
		Qunaxella	1	
		Scutopalus	12	
		Denheyernaxoides	2	
		Paracunaxoides	1	
	Pulaeini	*Pulaeus*	21	
		Lupaeus	15	
		Neocunaxoides	14	
Total species				329

With 47 species, *Cunaxa* is the most species-rich genus, followed by *Armascirus* with 33 and *Coleoscirus* with 29 species. Five other genera have more than 20 species each (*Coleobonzia*, *Dactyloscirus*, *Neoscirula*, *Pulaeus* and *Rubroscirus*).

Most of the authors of new species have their working bases in the Palaearctic, followed by the Oriental and Nearctic Regions (Table 2). Few authors are based in the Neotropical and Afrotropical Regions, and none is based in the Australian Region. The total number of species described is slightly higher for the Oriental than for the Palaearctic Region. The numbers of species described in the Nearctic and Afrotropical Regions are similar, but the number of species described in the Neotropics is much lower, and, surprisingly, no species have been described from the Australian Region. By

TABLE 2. Authors describing species of Cunaxidae around the world and numbers of species that they have described.

Zoogeographical region	Country	Number of authors	Number of species
Palearctic		**27**	**93**
	China	6	19
	France	2	2
	Great Britain	2	2
	Germany	4	10
	Greece	2	4
	Italy	2	11
	Japan	1	8
	Netherlands	1	3
	Poland	1	2
	Russia	4	28
	Scandinavia	1	2
	Uzbekistan	1	2
Oriental		**22**	**112**
	India	5	19
	Pakistan	11	30
	Philippines	3	57
	Taiwan	1	5
	Thailand	2	1
Nearctic		**12**	**72**
	Canada	1	1
	Mexico	3	13
	USA	8	58
Afrotropical		**2**	**68**
	South Africa	2	68
Neotropical		**4**	**26**
	Brazil	1	13
	Mexico	3	13

far, the largest numbers of species have been described from South Africa (Afrotropical), USA (Nearctic) and Philippines (Oriental).

Den Heyer erected about 63% of the present valid genera of the family (Table 3). Other authors described between 18.5 and 3.7% of the genera. Five authors (and their co-authors) described 57.7% of all species, each describing between 20.6 and 3.3% of the species in the family (Table 4). About 62% of the valid species correspond to the original combination, which implies that a relatively smaller proportion of species (38%) correspond to new combinations. New combinations were established in the preparation of the database.

TABLE 3. Numbers of valid Cunaxidae genera described by authors around the world.

Author (single or co-author)	Number
Den Heyer, J.	13
Smiley, R.L.	5
Castro, T. M.M.G.	3
Berlese, A.	3
Baker, E.W. & Hoffmann, A.	1
Oudemans, A.C.	1
Bu, G.S. & Li, L.S.	1
Total	27

TABLE 4. Numbers and proportions of valid Cunaxidae species described by the five highest contributing authors around the world.

Authors	Number of species	% of the total number of species
Den Heyer, J. *et al*.	68	20.6
Corpuz-Raros, L.A. *et al*.	57	17.3
Smiley, R.L.	38	11.6
Chaudhri, W.M. *et al*.	16	4.9
Bashir, M.H. *et al*.	11	3.3
Total	**190**	**57.7**

Discussion

Many cunaxid species were described as adults while the illustrations clearly show that the types actually corresponded to immatures. This is a problem, given that each instar has a different and characteristic gnathosomal, idiosomal and leg chaetotaxy, as discussed by Den Heyer (1980). This will certainly lead to a considerable number of synonyms, as more detailed works are conducted, taking into account the different developmental stages of the species.

In preparing the database, many cases of uncertainty were observed, given the incomplete or inadequate description of species, especially in the older literature. It would be advisable for future descriptions and redescriptions that authors exert themselves by becoming thoroughly acquainted with the literature dealing with the anatomy, development and systematics of the group, work out clear and accurate descriptions and illustrations, and, whenever possible, include in the description or redescription an accounts of different developmental stages. This will certainly help to avoid synonymies as well as the correction of uncovered mistakes in published literature.

The preparation of this paper allowed a panoramic view of the world taxonomic knowledge of the cunaxid mites. The distribution of the described species may not reflect the actual diversity of these mites around the globe. Rather, it may reflect the variable dedication of authors in different countries in their study. In most countries, the taxonomic studies of the cunaxids have hardly started, and much remains to be done. However, an immediate threat to the future of cunaxid taxonomy refers to the fact that most of the taxonomists are retired, and that replacement by new taxonomists has not been considered a priority. Efforts should be directed to change this trend, motivating new professionals to take the Cunaxidae at least as part of their working priorities.

Acknowledgements

To G.J. de Moraes and R.C. Castilho (ESALQ-USP, Brazil) for assistance in the initial phase of the preparation of the cunaxid database and continued motivation. To my daughter, Martie Jacobs, for the help in the preparation of this manuscript. This paper is dedicated to Martie den Heijer (- van Jaarsveld) (22-VI-1942 to 7-V-2010).

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