Acarologia is proudly non-profit, 
with no page charges and free open access

Please help us maintain this system by 
encouraging your institutes to subscribe to the print version of the journal
and by sending us your high quality research on the Acari.

Subscriptions: Year 2022 (Volume 62): 450 €
http://www1.montpellier.inra.fr/CBGP/acarologia/subscribe.php
Previous volumes (2010-2020): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France
ISSN 0044-586X (print), ISSN 2107-7207 (electronic)

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under 
the reference ID 1500-024 through the « Investissements d’avenir » programme
(Labex Agro: ANR-10-LABX-0001-01)

Acarologia is under free license and distributed under the terms of the 
Creative Commons-BY
Ethnoacarology: the cultural importance of Acari around the world

Angel Herrera-Mares

Laboratorio de Ecología de Enfermedades y Una Salud, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México, 04510, Coyoacán, Ciudad de México, México.

ABSTRACT

Ethnobiology is the science that identifies, describes, and classifies organisms with a cultural importance that are utilized by a particular human group. The term ‘cultural importance’ refers to the way people perceive an organism either as food or ornament, the role they play in the myths and legends in a region or even their usage in religious and civic ceremonies. Despite the high biological diversity of Acari, their cultural importance has been poorly studied, with information scarce and scattered. In this paper, I define ethnoacarology as the branch of acarology that compiles, documents, and analyzes the cultural values given to mites and ticks by a particular human group. I conducted a bibliographic search in databases with a combination of words: articles were classified according to the cultural values given to Acari. Thirty articles were recovered: most of them focused on the traditional knowledge and management of Acari and tick-borne diseases and other acariasis. I recognized five categories for the cultural value of Acari: 1) vernacular and autochthonous names; 2) management of pests and diseases; 3) Acari in oral and written tradition; 4) Acari and toponymy, and 5) entomophagy and traditional medicine. Citizen science represents an opportunity for acarology to obtain this type of data faster. Making people part of an acarological community could derive in faster data obtention, alternative techniques for the management of pests and diseases, the revalidation of traditional knowledge, and the participation of society in decision-making that can open the door to obtaining financing, among other benefits.

Keywords  citizen science; ethnobiology; traditional knowledge

Introduction

Ethnobiology is the science that identifies, describes, and classifies organisms with a cultural importance for a particular human group (Maldonado Koerdell 1940; Albuquerque and Alves 2016). The term ‘cultural importance’ refers to the way people perceive and use an organism either as food or ornament, the role they play in the myths and legends of a region, or even their usage in religious and civic ceremonies (Maldonado Koerdell 1940). This descriptive approach was addressed in the early days of this science, but currently ethnobiology is regarded as an interdisciplinary approach, with a greater cooperation among research from different areas to handle more complex problems where biological and cultural diversity are engaged (Sobral and Albuquerque 2016). Similar to biology, ethnobiology is divided according to the group of organisms studied, and accordingly ethnozoology is the field that studies animals at different levels such as the following: folk taxonomy, presence and importance of animals in tales, myths and legends, their ecological and cultural aspects, and the practices related to the usage, management and conservation of fauna resources (Santos Fita et al. 2009). With near 55 000 species (Zhang 2011) Acari are ubiquitous in every sort of aquatic, terrestrial and arboreal ecosystems; they can establish a broad range of interspecific relationships with vertebrates and invertebrates, and they are a major component of biological diversity (Walter and Proctor...
In addition, Acari have agricultural, medical, and veterinary importance: they are pests, but they could be also used in biological control (Krantz 2009). Despite the high biological diversity of Acari, their cultural importance has been poorly studied with information on the subject scarce and scattered. Due to the above, the aim of this work was to compile the usage and cultural importance given to Acari around the world through a bibliographic search.

Material and methods

I conducted a bibliographic search on several databases such as BioOne, Google Scholar, and ResearchGate with the following combination of words: ‘Acari’, ‘mites’, ‘ticks’, ‘cultural’, ‘entomophagy’, ‘traditional knowledge’, ‘art’, ‘representation’, and ‘myths’. Articles were then classified according to the cultural values given to Acari. Inclusion criteria were set as follows: valid vernacular and autochthonous names were considered if the name was published in a dictionary, compendium book or an article resulting from a study with semi-structured questionnaires; names coined by a single person were excluded from the database. I constructed a word cloud to highlight the most frequent Acari taxonomic categories (order, family, and genus) that were referred to in the articles reviewed. For this purpose, I listed the implicit and explicit taxonomic categories of the articles; for example, for ‘ticks’ I only recognized the order Ixodida unless the authors mentioned the family or genus. Larger words in the word cloud indicate words that are more frequently mentioned. The word cloud was constructed with the Wordle™ software (Feinberg 2014).

Results and discussion

I introduce for the first time the term ethnoacarology defined as the branch of acarology that compiles, documents, and analyzes the cultural values given to these organisms by a particular human group. As a new developing field, ethnoacarology can be classified within the cognitive approach of ethnobiology (Albuquerque and Alves 2016), where the acarologist is concerned with how cultures perceive and know the Acari. This approach also includes the traditional knowledge that exists about their biology, management and even the prevention of Acari-transmitted diseases.

For this work, I analyzed 30 articles, the majority of them focused on the traditional knowledge and management of Acari and tick-borne diseases and other acariasis. The most frequent orders found in these articles were Ixodida, Trombidiformes, and Sarcoptiformes (Figure 1). I recognized five categories for the cultural importance of Acari: 1) vernacular and autochthonous names, 2) management of pests and diseases, 3) Acari in oral and written tradition, 4) Acari and toponymy, and 5) entomophagy and traditional medicine.

Vernacular and autochthonous names

In ethnozoology, there is a strong correlation between an animal with a given name and its cultural use: the most known/used/abundant animal will be given a name (Santos Fita and Costa Neto 2009). Most Acari are barely perceptible, and unfortunately for many people, they only become visible and known when they produce damage as pests or produce diseases (Walter and Proctor 2013). As might be expected, Acari that are locally named are those that are visible to the naked eye and produce some type of damage. In Mexico, ticks receive several local and autochthonous names according to their geographical location (Table 1). In Trinidad and Tobago, the local names ‘Garrapat’ and ‘Cayenne’ are used for the ticks Rhipicephalus microplus (Canestrini 1888) (Ixodida: Ixodidae) and Amblyomma cajennense (Fabricius 1757) (Ixodida: Ixodidae), respectively (Wanzala 2017). A similar case is found in Yucatan, Mexico where Mayan people have the word ‘peech’ for ticks in general, but they can differentiate ‘Sojolpeech’ (Amblyomma spp.) from ‘Bu’ultal peech’ (R. microplus) (Dzul-Rosado et al. 2020). In northern Tanzania, the Maasai tribe recognize the names ‘Armaheripus’
for Amblyomma variegatum (Fabricius 1794), ‘Endenuri/ Armaherikima’ for Rhipicephalus decoloratus Koch 1844, and ‘Aramheriodo’ for Rhipicephalus appendiculatus Neumann 1901 (Kioko et al. 2015).

Chiggers (Trombidiformes: Trombiculidae and Leeuwenhoekiidae) are known as ‘tlalzahuates’ (from Nahuatl language ‘tlalli’ that means ‘ground’, and ‘zahuatl’ that means ‘mange’), ‘aradores’ ‘baiburínes’, ‘check’ech’, ‘güinas’ and ‘coloradillas’ in Mexico (Hoffmann 1990, 2003). In Paraguay, they are known as ‘piques’; while in Venezuela they are known as ‘sicotú’ and ‘niguas’ (Sánchez Silva 2011), and as ‘isangos’ in Peru (Beltrán et al. 2009).

In Europe, the name ‘Herbstgrasmilben’ (which means ‘harvest mite or autumn chigger’) is reported from Germany for the species Trombicula autumnalis (Shaw 1790) (Trombidiformes: Trombiculidae) (Hoffmann 1990). Spider mites (Trombidiformes: Tetranychidae) are known as ‘aradores’ and ‘ácaros’ by farmers in Patzún, Guatemala (Morales and Perfecto 2000).

Table 1 Vernacular and autochthonous names given to Acari around the world.

| Country         | Vernacular or autochthonous name | Taxa referred                                | Language | Reference(s)              |
|-----------------|---------------------------------|---------------------------------------------|----------|---------------------------|
| Germany         | Herbstgrasmilben                | Trombicula autumnalis (Shaw 1790) (Trombidiformes: Trombiculidae) | German   | Hoffmann 1990              |
| Guatemala       | Aradores, ácaros                | Spider mites (Trombidiformes: Tetranychidae) | Spanish  | Morales and Perfecto 2000 |
| Mexico          | Turicatas, Tustiones, conchadas  | Amblyomma cajennense Koch 1844 (Ixodidae: Ixodidae) | Spanish  | Hoffmann 2003; Guzmán-Cornejo et al. 2019 |
|                 | Pech                            | Amblyomma spp. (Ixodidae: Ixodidae)         | Mayan    | Hoffmann 2003; Guzmán-Cornejo et al. 2019 |
|                 | Kajti                           | Tumbrela acutipennis (Hammond 1988) (Ixodidae: Ixodidae) | Mayan    | Hoffmann 2003; Guzmán-Cornejo et al. 2019 |
|                 | Traltzle                        | Eutrombicula affrugins (Oudemans 1910) (Trombiculidae) | Mayan    | Hoffmann 2003; Guzmán-Cornejo et al. 2019 |
| Conacos or garrapatillas | Sacoripus scabies De Geer 1778 (Sarcoptiformes: Sarcoptidae) | Spanish | Hernandez Cruz and Vitoria-Torquemada 2010 |
| Paraguay        | Pijos                           | Trombiculae (larvae)                         | Spanish  | Herrán et al 2003         |
| Peru            | Sarcoptes scabei                 | Sacoripus scabies De Geer 1778 (Sarcoptiformes: Sarcoptidae) | Spanish  | Herrán et al 2003         |
| Tanzania        | Amblyomma variegatum            | Amblyomma variegatum (Fabricius 1794) (Ixodidae: Ixodidae) | Spanish  | Herrán et al 2003         |
|                 | Rihipicephalus decoloratus      | Amblyomma decoloratus (Koch 1844) (Ixodidae: Ixodidae) | Spanish  | Herrán et al 2003         |
| Trinidad and Tobago | Cayote                       | Amblyomma cajennense (Fabricius 1757) (Ixodidae: Ixodidae) | Spanish  | Herrán et al 2003         |
|                 | Sarcoptes scabei                 | Sacoripus scabies De Geer 1778 (Sarcoptiformes: Sarcoptidae) | Spanish  | Herrán et al 2003         |

Herrera-Mares A. (2022), Acarologia 62(1): 186-192. https://doi.org/10.24349/0om5-7vmj
Contrarily, the term ‘arador de la sarna’ is related to the species *Sarcoptes scabei* De Geer 1778 (Sarcoptiformes: Sarcoptidae) in Mexico (Cruz-Reyes and Camargo-Camargo 2001). Fowl mites [Mesostigmata: Dermanyssidae: *Dermanyssus gallinae* (De Geer 1778)] are known as ‘corucos’ or ‘garrapatillas’ in Mexico (Cruz-Reyes and Camargo-Camargo 2001; Hoffmann 2003) (Table 1).

**Management of pests and diseases**

Several orders of Acari are implicated in crop damage and in the transmission of some devastating diseases in animals and humans. For this reason, people have sought traditional methods for the management of these pests and diseases. The use of medicinal plants has been reported against scabies (Sarcoptiformes: Sarcoptidae) (Wanzala 2017; Akram *et al.* 2019) and ticks on livestock (Habeeb 2010; Magwede *et al.* 2014; Wanzala 2017; Dhital 2018). Seven families of plants are used worldwide to control and prevent tick infestations (Pavela *et al.* 2016), and some species of grass have been used to avoid the host-seeking ticks by pastoralists (Wanzala 2017). Other local materials for tick control include salt water and soap water in Nepal (Dhital 2018).

In Colombia, the U’wa (Tunebos) people reported the use of a resin called ‘ótova’ or ‘otiva’ to heal the scars produced by trombiculid mites, as well as the use of ground tobacco to treat the local inflammation and pruritus (Sánchez Silva 2011).

In Morocco, berber-speaking beekeepers smoke the colonies with plants such as thyme and artemisia to control *Varroa* mites (Mesostigmata: Varroidae) (Roué *et al.* 2015).

Vernacular names for ticks are important to know in order to recognize them in semi-structured interviews and to elaborate management proposals and control measures. In some regions of Africa, tick-borne diseases receive a specific name: for example, ‘kukojowa damu’ which means ‘urination of red urine’ in Kurya language is used for babesiosis; ‘chintura’ and ‘amastyo’ are names used for the East Coast Fever in Tanzania and Uganda, respectively, and ‘mageka’ for heart water disease in Tarime, Tanzania (Chenyambuga *et al.* 2010).

**Acari in oral and written traditions**

Acari appears in some proverbs around the world. In Mexico ‘más viejo que la sarna’ (older than mange) makes reference to the antiquity of the knowledge of this disease to make reference to something old (Hoffmann 2003). In Brazilian folklore, the riddle ‘Qual é o animal que consegue atravessar um rio com um boi na boca? O carrapato!’ (What animal can cross a river with an ox in its mouth? A tick!) is documented by Ribeiro *et al.* (2008). The answer refers to a tick that is attached to an ox while the latter crosses a river, as if the tick were carrying the ox in its ‘mouth’ (hypostome). The Chupacabra is an urban legend that was transmitted orally in a widespread manner in America in the 1990’s; the myth mentioned a canid-like animal that attacked goats in rural areas. Some authors argue that this mythical creature was in fact coyotes or feral dogs that suffered severe scabies (Cano and Palomo-Muñoz 2017). In Yucatán, Mexico, Mayan people associate the day of St. Francis of Assisi (October 4) with the appearance of ticks in the region (Dzul-Rosado *et al.* 2020). ‘Paper mites’ is a term used to describe various skin conditions among office workers that are convinced that they and their workspace are infested with dust mites (Sarcoptiformes: Pyroglyphidae), when in fact they are not (Mullen and OConnor 2019).

Despite their small-sized bodies, mites and ticks appear in the title of some books, for example ‘Allí te comerán las turicatas’ [There you will be eaten by the turicatas] by Rivera Garza (2013) or they have a main role in the development of the story as in the novel ‘Doctor Death’ by Kaaberbol (2010). In this novel, the mite *Pneumonyssoides caninum* (Chandler & Ruhe, 1940) (Mesostigmata: Halarachnidae) was a key to solving a crime.
Acaro and toponymy

Acaro can also be used to name locations such as states. For example, in Mexico there are some locations such as Tucurato, Michoacán and Garrapatas, Guerrero which are named after ticks. The Mexican state of Campeche means ‘place of snakes and ticks’ since the Mayan word ‘peech’ means ‘tick’ (Herrera Mares and Serrano González 2018). The name of the town San Simón Zihuatlán in Oaxaca State means ‘a place with scabies’ (Hoffmann 2007).

Entomophagy and traditional medicine

Although entomophagy is related to the study of edible insects, the term has been also used for other groups of arthropods (Mitsuhashi 2008). Evidence of Acaro consumed by humans include a coprolite found in a cave from Utah, U.S.A. that contained a well-preserved tick, which was determined as a member of the genus Dermacentor (Ixodida: Ixodidae). The taphonomy found near the coprolite suggests that people consumed the ticks from the hunted hosts, which were apparently rabbits (Johnson et al. 2008). In caves of the Ozark Mountains located between Arkansas and Missouri, USA, some groups of insects, ticks and mites were also isolated from coprolites (Mitsuhashi 2008). The mite Tyrophagus casei Oudemans 1910 (Sarcoptiformes: Acaridae) is employed during the traditional production of Milbenkäse cheese, and this same species has a memorial in Würchwitz, Germany (Ribeiro et al., 2009).

In Indian traditional medicine, the oil from the red velvet mite Trombidium grandissimum (Koch 1867) (Trombidiiformes: Trombidiidae) is used against paralysis but also as an aphrodisiac and is known as “the Indian Viagra” (Mahawar and Jaroli 2008). There is a record of the use of powdered ticks to “attract and attach” love and lovers in Central Mexico, just like this group of Acaro attaches to their hosts (Herrera Mares and Serrano González 2018).

Final considerations

Most Acaro are conspicuous only to acarologists. This review shows that they acquire cultural importance in the moment when they become pests or produce damage. However, what if other groups of Acaro are culturally important to a group people but we have not yet asked them? Are Acaro really mostly invisible to non-acarologists? Citizen science and crowdsourcing have been popular in many scientific areas such as astronomy and ornithology (Dickinson et al. 2010), but others such as botany, mycology and arachnology have been explored recently (Dickinson et al. 2010; Wang et al. 2018) These tools are beneficial for scientists and society: as scientists, we get access to data that would not have been attainable through individual research, while citizens get the satisfaction of being involved in science (Welvaert and Caley 2016). A good example of citizen science power is the description of new species based on observations in social media, including oribatid mites (see Collins et al. 2011; Clause et al. 2020; Pflingstl et al. 2021), and the use of citizen science databases has helped to estimate the distribution areas and geographical expansion patterns for poorly known taxa (Wang et al. 2018). It is time for acarology to implement ethnoacarological and citizen science approaches in the development of projects. Making people part of an acarological community could derive in faster data obtention, alternative techniques for the management of pests and diseases, the revalidation of traditional knowledge, and the participation of society in decision-making that can open the door to obtaining financing, among other benefits.

Acknowledgments

I dedicate this article to the memory of the biologist José León Pérez (1977-2017), an exceptional ethnobiologist, professor and friend that showed and shared with me this fascinating science. I am grateful to Dr. Lise Roy and two anonymous referees who made great comments to improve this manuscript. I thank to Rodrigo Ponciano (The Churchill School and College, Mexico City).
and Margarita Ojeda (Laboratorio de Ecología y Sistemática de Microartrópodos, UNAM) for improving the English version of this manuscript.

References

Akrar M., Riaz M., Noreen S., Shariati M.A., Shaheen G., Akhter N., Parveen F., Akhtar N., Zafar S., Ghauri A.O., Riaz Z., Khan F.S., Kausar S., Zainab R. 2019. Therapeutic potential of medicinal plants for the management of scabies. Dermatologic Therapy, 33: e13186. https://doi.org/10.1111/dth.13186

Albuquerque U.P., Alves A.G.C. 2016. What is ethnobiology? In: Albuquerque U.P., Alves A.G.C. (Eds). Introduction to ethnobiology. Switzerland: Springer. p. 3-7. https://doi.org/10.1007/978-3-319-28155-1_1

Beltrán M., Valdivia C., Ponce-Ramírez R., Chambergo M., 2009. *Trombicula autunnalis* (Isangos) en un jardín de niños de la selva peruana. Revista Peruana de Medicina Experimental y Salud Pública, 26: 58-60.

Cano E.B., Palomo-Muñoz G. 2017. La verdadera historia del Chupacabras: la importancia de las Colecciones de Historia Natural en la desarticulación de los mitos modernos. Revista de la Universidad del Valle de Guatema, 34: 50-57.

Chenyambuga S.W., Waiswa C., Saimo M., Ngumi P., Gwakisa P.S. 2010. Knowledge and perception of traditional livestock keepers on tick-borne diseases and sero-prevalence of *Theileria parva* around Lake Victoria Basin. Livestock Research for Rural Development, 22: 7.

Clause A.G., Luna-Reyes R., Nieto-Montes de Oea A., 2020. A new species of *Abronata* (Squamata: Anguidae) from a protected area in Chiapas, Mexico. Herpetologica, 76: 330-343. https://doi.org/10.1655/Herp.2019.00047

Collins A.G., Bentagle B., Gillan W., Lynn T.H., Morandini A.C., Marques A.C., 2011. Naming the Bonaire banded box jelly, *Tamoya ohboya*, n.sp. (Cnidaria: Cubozaa: Carybdeida: Tamoyiidae). Zootaxa, 2753: 53-68. https://doi.org/10.11646/zootaxa.2753.1.3

Cruz-Reyes A., Camargo-Camargo B. 2001. Glosario de términos en parasitología y ciencias afines. Ciudad de México: Universidad Nacional Autónoma de México. pp. 347.

Dhill B., 2018. Farmer’s perception on ticks problems and ethnoveterinary management practices in livestock. Journal of Animal Science and Veterinary Medicine, 3: 154-159. https://doi.org/10.31248/JASVM2018.109

Dickinson J.L., Zuckerberg B., Bonter D.N., 2010. Citizen science as an ecological research tool: changes and benefits. Annual Review of Ecology, Evolution, and Systematics, 41: 149-172. https://doi.org/10.1146/annurev.ecolsys.102209.144626

Dzul-Rosado K., Lugo-Caballero C., Juárez-Ramírez C., Gómez-Dantés H., Montalvo-Nah E., Cituk-Cob S., Puerto-Manzano F., 2020. Understanding risk perception from traditional knowledge of Mayan farmers on rickettssioses. Global Public Health, 15: 1857-1870. https://doi.org/10.1080/17441692.2020.1762860

Feinberg J. 2014. Wordle: Beautiful Word Clouds. [Internet]. [02 November 2020]. Available from: http://www.wordle.net/

Guzmán-Conruego C., Herrera-Mares A., Robbins R.G., Rebollo-Hernández A. 2019. The soft ticks (Parasitiformes: Ixodida: Argasidae) of Mexico: species, hosts, and geographical distribution. Zootaxa, 4623: 485-525. https://doi.org/10.11646/zootaxa.4623.3.3

Habeeb S.H. 2010. Ethno-veterinary and medical knowledge of crude plant extracts and its methods of application (traditional and modern) for tick control. World Applied Sciences Journal, 11: 1047-1054.

Herrera-Mares A.E., Serrano González R. 2018. Los parásitos en las tradiciones mexicanas. ¿Cómo ves?, 26: 195-202.

Hoffmann A. 1990. Los trombicúlidos de México (Acarida: Trombiculidae), parte taxonómica. Ciudad de México: Universidad Nacional Autónoma de México. pp. 275.

Hoffmann A. 2003. Animales desconocidos: relatos acarológicos. Ciudad de México: Fondo de Cultura Económica. pp. 129.

Hoffmann A. 2007. Acarology in Mexico: Prehispanic to modern times. In: Morales-Malacara J.B., Behan-Pelletier V., Ueckermann E., Pérez T.M., Estrada-Venegas E., Badíi M. (Eds). Acarology XI: Proceedings of the International Congress. Mexico: Instituto de Biología and Facultad de Ciencias, Universidad Nacional Autónoma de México; Sociedad Latinoamericana de Acarología. p. 21-26.

Johnson K.L., Reinhard K.J., Sianto L., Araújo A., Gardner S.L., Janovy J. Jr. 2008. A tick from a Mahawar M.M., Jaroli D.P. 2008. Traditional zootherapeutic studies in India: a review. Journal of Ethnobiology and Ethnomedicine, 4: 17. https://doi.org/10.1186/1746-4269-4-17

Krantz GW. 2009. Habits and habitats. In: Krantz G.W., Walter D.E. (Eds). A manual of Acarology, third edition. Texas: Texas Tech University Press. p. 64-80.

Krabbe J., Narvaez A. 2012. *Abronia* (Squamata: Anguidae) from a prehistoric Arizona coprolite. Journal of Parasitology, 98: 296-298. https://doi.org/10.1645/GE-1059.1

Maldonado Koerdell M. 1940. Estudios etnobiológicos I. Revista Mexicana de Estudios Antropológicos, 20: 24-27.

Mahawar M.M., Jaroli D.P. 2008. Traditional zootherapeutic studies in India: a review. Journal of Ethnobiology and Ethnomedicine, 4: 17. https://doi.org/10.1186/1746-4269-4-17

Tamoya ohboya, n.sp. (Cnidaria: Cubozaa: Carybdeida: Tamoyiidae). Zootaxa, 4623: 485-525. https://doi.org/10.11646/zootaxa.4623.3.3

Theileria parva

https://doi.org/10.1007/978-3-319-28155-1_1

Abronia (Squamata: Anguidae) from a prehistoric Arizona coprolite. Journal of Parasitology, 98: 296-298. https://doi.org/10.1645/GE-1059.1
Mitsuhashi J. 2008. Entomophagy: human consumption of insects. In: Capinera L. (Ed). Encyclopedia of entomology. Leipzig: Springer. p. 1341-1343.

Morales H., Perfecto I., 2000. Traditional knowledge and pest management in the Guatemalan highlands. Agriculture and Human Values, 17: 49-63. https://doi.org/10.1023/A:100780272631

Mullen G.R., O'Connor B.M. 2019. Chapter 26. Mites (Acari). In: Mullen G., Durden L.A. (Eds). Medical and veterinary entomology, third edition. London: Academic Press. p. 533-602. https://doi.org/10.1016/B978-0-12-814043-7.00026-1

Pavela R., Canale A., Melthorn H., Benelli G., 2016. Application of ethnobotanical repellents and acaricides in prevention, control and management of livestock ticks: a review. Research in Veterinary Science, 109: 1-9. https://doi.org/10.1016/j.rvsc.2016.09.001

Pfingsl T., Hiruta S.F., Nemoto T., Hagino W., Shimano S. 2021. Ameronothrus twitter sp. nov. (Acari, Oribatida) a new coastal species of oribatid mite from Japan. Species diversity, 26: 93-99. https://doi.org/10.12782/specdiv.26.93

Ribeiro A.E.L., Oliveira A.R., Flechtmann, C.H.W. 2008. Gloria Acari III. Boletim Informativo da Sociedade Entomológica do Brasil, 33: 3.

Ribeiro A.E.L., Oliveira A.R., Alberti G., Flechtmann, C.H.W. 2009. Gloria Acari V. Boletim Informativo da Sociedade Entomológica do Brasil, 34: 3.

Rivera Garza C., 2013. Allí te comerán las turicatas. Ciudad de México: La caja de cerillos Ediciones. pp. 40.

Roué M., Battesti V., Césard N., Simenel R., 2015. Ethnoecology of pollination and pollinators. Revue d’ethnoécologie, 7: 1-27. https://doi.org/10.4000/ethnoecologie.2229

Sánchez Silva D.J. 2011. La etnomedicina de la obra de José Gumilla, el Orinoco ilustrado y defendido. Informed, 13: 373-386.

Santos Fita D., Costa Neto E.M., 2009. Sistemas de clasificación etnozoológicos. In: Costa Neto E.M., Santos Fita D., Vargas Clavijo M. (Eds). Manual de etnozooloogía: una guía práctica para investigar la interconexión del ser humano con los animales. Valencia: Tundra Ediciones. p. 67-94.

Santos Fita D., Costa Neto E.M., Cano Contreras E.J. 2009. El quehacer de la etnozooloogía. In: Costa Neto E.M., Santos Fita D., Vargas Clavijo M. (Eds). Manual de etnozooloogía: una guía práctica para investigar la interconexión del ser humano con los animales. Valencia: Tundra Ediciones. p. 23-44.

Sobrall A., Albuquerque U.P. 2016. History of ethnobiology. In: Albuquerque U.P., Alves A.G.C. (Eds). Introduction to ethnobiology. Switzerland: Springer. p. 9-14. https://doi.org/10.1007/978-3-319-28155-1_2

Walter D.E., Proctor H.C. 2013. Mites: Ecology, evolution & behaviour. Life at microscale. Dordrecht: Springer. pp. 494. https://doi.org/10.1007/978-94-007-7164-2

Wang Y., Casajus N., Buddle C., Berteaux D., Larivée M., 2018. Predicting the distribution of poorly-documented species, Northern black widow (Latrodectus variolus) and Black purse-web spider (Sphodros niger), using museum specimens and citizen science data. PLoS ONE, 13: e0201094. https://doi.org/10.1371/journal.pone.0201094

Wanzala W. 2017. Potential of traditional knowledge of plants in the management of arthropods in livestock industry with focus on (Acari) ticks. Evidence-Based Complementary and Alternative Medicine, 2017: 8647919. https://doi.org/10.1155/2017/8647919

Welvaert M., Caley P., 2016. Citizen surveillance for environmental monitoring: combining the efforts of citizen science and crowdsourcing in a quantitative data framework. SpringerPlus, 5: 1890. https://doi.org/10.1186/s40064-016-3583-5

Zamora Islas E. 2016. Estudio de la gramática nahuat (sic!) de la Sierra Norte de Puebla. Tzinacapan: Tetsijtsilin. pp. 102.

Zhang Z-Q. 2011. Animal biodiversity: An introduction to higher-level classification and taxonomic richness. Zootaxa, 3148: 7-12. https://doi.org/10.11646/zootaxa.3148.1.3