Journal of Ethnopharmacology 133 (2011) 902–906

Contents lists available at ScienceDirect

Journal of Ethnopharmacology

journal homepage: www.elsevier.com/locate/jethpharm

Ethnopharmacological communication

Folk medicinal use of fauna in Mapimi, Durango, México

Maria del Rosario Jacobo-Salcedo[a,*], Angel Josabad Alonso-Castro[b,c], Alicia Zarate-Martinez[a]

[a] Facultad de Ciencias Químicas, Universidad Juárez del Estado de Durango, Gómez Palacio, Durango, Mexico
[b] Facultad de Química Universidad Nacional Autónoma de México, DF, Mexico
[c] Instituto Nacional de Cancerología, DF, Mexico

ARTICLE INFO

Article history:
Received 19 August 2010
Received in revised form 2 October 2010
Accepted 2 October 2010
Available online 16 October 2010

Keywords:
Medicinal fauna
Fidelity level
Factor informant consensus
Ethnopharmacological field study
Traditional medicine

ABSTRACT

Aim of the study: To document the use of animal species in traditional medicine from the municipality of Mapimi, Durango, México.
Materials and methods: Direct interviews were performed in several short visits with inhabitants from the municipality of Mapimi, Durango. The interviews were analyzed with two quantitative tools. The informant consensus factor that estimates the level of agreement between interviewees over which animals to use for each category and the fidelity level which indicates the percentage of informants claiming the use of a certain animal species for the same medicinal purpose.
Results: A total of 18 animal species, belonging to 17 families and four taxonomic categories, were reported by interviewees as used for medicinal purposes. Thirteen medicinal species were identified not previously reported. The results of the informant consensus factor showed that the dermatological, diabetes and reproductive categories had the greatest agreement. The most important species according to their fidelity level are: *Mephitis macroura* and *Crotalus atrox*.
Conclusion: This study demonstrates that many animal species play an important role in healing practices among inhabitants from Mapimi, Durango. Further experiments with medicinal fauna from Mapimi are needed to be carried out to obtain experimental information about their traditional uses, especially with *C. atrox*.

1. Introduction

Zootherapy has been considered an alternative in the treatment of different illnesses since ancient times. Worldwide, more than 230 animal species are used empirically for the treatment of several diseases (IFAW, 2002). In México, animal species such as bees (Meliponidae), ants (Formidaceae), hens (Phasianidae), and others have been employed as alternative medicine for many ailments since pre-Hispanic times (Hernández, 1959).

According to Corona-Martinez (2008), 27 birds such as ducks (Anatidae), pigeons (Columbidae), falcons (Falconidae), eagles (Accipitridae) and others were employed for therapeutic use in pre-Hispanic times. México has a great biodiversity of fauna consisting in 717 reptiles, 449 mammalians and 1150 birds (INEGI, 2010). However, limited reports are available about fauna with medicinal properties in México.

Enriquez-Vazquez et al. (2006) found that 74 animal species are used for indigenous inhabitants from Los Altos, Chiapas, México for the treatment of numerous diseases. Mexican species of crocodiles such as *Crocodylus moreletii* and *Crocodylus acutus* have been employed as diuretic and anti-inflammatory (Cupul-Magaña, 2003).

The municipally of Mapimi (Durango, México) is part of the region called Mapimi Biosphere Reserve (MBR) (Halffter, 1988). Previously, García-Gutiérrez et al. (2009) indicated that medicinal plants are employed as a common practice among the inhabitants of the region of MBR. Among the plants employed for medicinal purposes are *Larrea tridentata*, *Ruta graveolens*, *Arnica montana*, *Matricaria chamomilla* and others. Nevertheless, little attention has been paid to zootherapeutic practices in the region.

This work describes the results of an ethnopharmacological survey about the medicinal use of several animal species used for inhabitants from Mapimi, Durango, México.

* Corresponding author at: Facultad de Ciencias Químicas, Universidad Juárez del Estado de Durango, Avenida Articulo 123 sin número, Fraccionamiento Filadelfia, Gómez Palacio, Durango 35010, Mexico. Tel.: +52 871 715 8810; fax: +52 871 715 2964.
E-mail address: rosario_87_js@hotmail.com (M.d.R. Jacobo-Salcedo).

0378-8741/$ – see front matter © 2010 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.jep.2010.10.005

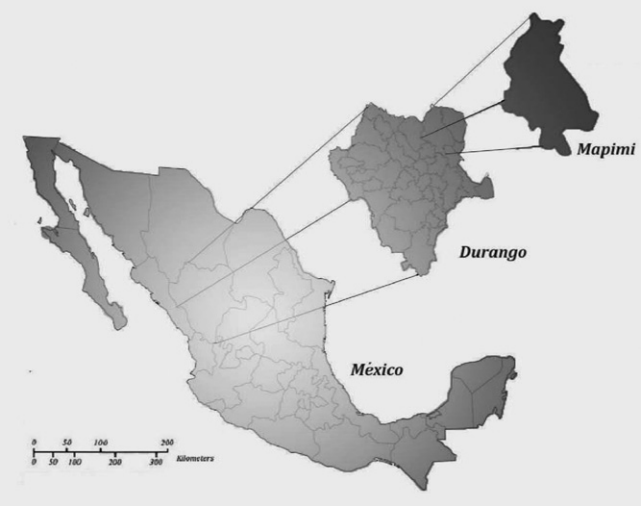

Fig. 1. Map of the study area, municipality of Mapimi, Durango, México.

2. Materials and methods

2.1. Study site

The municipality of Mapimi is located at 26°14′6″ north latitude and 104°29′14″ west longitude in the northern most portion of the state of Durango (Fig. 1). The weather in this region is semi-arid with annual mean temperature of 18 °C and an annual mean rain precipitation of 263.1 mm (INAFED, 2010). The main economical activity is agriculture. Mapimi consists of 241 towns, encompassing an area of 7126 km^2, and has a population of 22,940 inhabitants of whom 0.16% speak tarahumara (INAFED, 2010). Before the Spaniard arrival, the municipality of Mapimi was populated by the ethnic groups "Cocoyones", "Conchos" and "Tobosos". The name of Mapimi came from the tarahumara "stone in the high" or "high hill".

2.2. Data collection

Direct interviews with general population from Emiliano Zapata, San Isidro del Derrame, La Merced, San Agustin, El Diamante, Cardenas del Río, Ceballos, Yermo, El Porvenir, El 24, Las Marias, Jaralito, Santa María de la Paz, towns of Mapimi, were performed during March to April 2009. A total of 158 inhabitants, 71 men and 87 women between 35 and 75 age groups, were interviewed individually. Prior to interviews the inform consent was obtained. Interviews were conducted through semi-structure questionnaire. We asked questions about the local name of the animal used, medicinal use of animal species, their respective uses, preparation, and the body parts utilized. The animal material was properly identified and the animal names were revised in the approved international data bases. Zoological material was identified with the aid of specialists through (i) photographs, (ii) voucher specimens or (iii) vernacular names. Voucher specimens and/or photographs were deposited at Centro de Investigación de la Reserva de la Biosfera de Mapimi.

2.3. Data analysis

The fidelity level (FL) indicates the percentage of informants claiming the use of a certain animal species for the same medicinal purpose (Friedman et al., 1986). The categories proposed by Heinrich et al. (1998): (1) gastrointestinal, (2) respiratory, (3) pain/fiber, (4) dermatological, (5) muscular/skeletal, (6) cardiovascular, (7) urological, (8) diabetes, (9) reproductive, (10) cultural filiations, (11) oncologic, (12) others were employed in this work. The FL was calculated as follows:

$$\mathrm{FL}(\%) = \frac{N_\mathrm{p} \times 100}{N}$$

where N_p is the number of informants that claim a use of animal species to treat a particular disease, and N is the number of informants that use the animals as a medicine to treat any given disease.

The informant consensus factor (ICF), adapted by Heinrich et al. (1998), estimates the level of agreement between interviewees over which animals to use for each category. This factor was calculated as follows:

$$\mathrm{ICF} = \frac{n_\mathrm{ur} - n_\mathrm{t}}{n_\mathrm{ur} - 1}$$

where n_ur is the number of use citations in each category and n_t is the number of use citations in each category. The product of this factor ranges from 0 to 1, where a value close to 1 indicates a well-defined selection criterion in the community and/or if information is exchanged between informants whereas a low value indicates that animal species are chosen randomly, or if informants do not exchange information about their use.

3. Results

3.1. Use of medicinal fauna

A total of 18 animal species, belonging to 17 families and four taxonomic categories, were reported by interviewees as used for medicinal purposes. Examples of animals used as medicine in Mapimi are shown in Fig. 2. Most of animal species are endemic from the region, with the exception of *Ambystoma zempoalensis* who was introduced when dam Benjamin Ortega Cantero was built. The medicinal fauna come from insects (1), reptiles (4), birds (5) and mammals (8) (Table 1). From these species, 13 were identified not previously reported prescribed for treating a total of 17 illnesses and 4 cultural filiations (Table 1). These species were 1 insect (*Eleodes spinipes*), 4 reptiles (*Ambystoma mexicanum*, *Crotalus atrox*, *Gopherus flavomarginatus*, *Sceloporus grammicus*), 2 birds (*Cyrtonyx montezumae*, *Geococcyx californianus*) and 6 mammals (*Ammospermophilus interpres*, *Canis latrans*, *Didelphis virginiana*, *Lepus alleni*, *Sylvilagus cunicularius*, *Taxidea taxus*). *G. californianus* is employed for the empirical treatment of anemia, *A. zempoalensis* is used for cough, whereas *C. atrox* is used for the treatment of varicose veins (Table 1). In addition, *D. virginiana*, *C. latrans* and *A. interpres* are used as anti-inflammatories. Furthermore, *L. alleni* is employed for stomachache, *S. grammicus* for diarrhea and *G. flavomarginatus* for arthritis (Table 1).

On the other hand, fauna from Mapimi such as *C. montezumae*, *E. spinipes*, *S. cunicularius* and *T. taxus* are used for magical purposes (Table 1). For instance, *C. montezumae*, whole animal, is used to cure "mal de ojo" (evil eye), a local term which corresponds to diseases imposed on people through a ritual. In addition, skunk tail is employed as an amulet to defend people from evil spirits.

The informants get most of the animal species from hunting, only *Gallus gallus* and *G. flavomarginatus* are domestic animals. Furthermore, only *G. gallus* is utilized as food. On the other hand, ajolote (*A. mexicanum*) can only be found during May to June in dam Benjamin Ortega Cantero. None of the medicinal fauna mentioned by the informants are endangered species. The results indicated that 44% of animal species are reported to cure more than one ailment, most of the folk remedies are administrated in the form of soups, and the animal products used are meat, fat and skin (Table 1). Soups are made as follows: the cleaned animal is put in a pot with hot water. The water is brought to boil about 30 min and the fat is

Table 1
Animal species for medicinal purposes in Mapimi, Durango, México.

Scientific name	Voucher	Family	Common name	Used part	Preparation way	Disease	Number of mentions	Administration way	Category	Fidelity level
Birds										
Cathartes aura (Linnaeus, 1758)	RM0921	Cathartidae	Aura	Meat feather	Soup	Cancer	40	Oral	(11)	12.5%
					Soup	Epilepsy	4	Oral	(12)	25%
					Soup	Cardiac arrhythmias	12	Oral	(6)	16.7%
					Inhale the smoke of the feathers	Asthma	8	Inhalatory	(2)	12.5%
					Put the ash of the feathers	Injuries	31	Topical	(4)	16.1%
					Soup	Diabetes	18	Oral	(8)	44.4%
					Wash with the infusion	Burns	10	Topical	(4)	11.1%
Columba livia (Gmelin, 1789)	RM1122	Columbidae	Young pigeon	Meat	Soup	Anemia	21	Oral	(12)	47.6%
					Soup	Hemorrhage	5	Oral	(6)	20%
Geococcyx californianus (Lesson, 1829)	RM0943	Cuculidae	Pheasant	Meat	Soup	Cancer	8	Oral	(11)	25%
					Soup	Varicose veins	8	Oral	(6)	25%
					Soup	Inflammation	3	Oral	(5)	33.3%
					Soup	Bronchitis	1	Oral	(2)	0.0%
Cyrtonyx montezumae (Vigors, 1830)	RM0965	Odontophoridae	Quail	Whole animal	Ritual	Evil eye	4		(10)	25.0%
Gallus gallus (Linnaeus, 1758)	RM1043	Phasianidae	Hen	Fat	Fat	Cough	34	Topical	(2)	64.7%
					Fat	Hemorrhoids	18	Topical	(6)	55.6%
Insects										
Eleodes spinipes (Solier, 1848)	RM1202	Tenebrioninae	Pinacate	All	Ritual	To keep away from bad spirits	3	Topical	(10)	25.0%
Mammals										
Canis latrans (Say, 1823)	RM0978	Canidae	Coyote	Meat	Soup	Chronic pain	3	Oral	(3)	33.33%
Odocoileus virginianus (Golman and Kellog, 1940)	RM0910	Cervidae	Deer	Meat	Soup	Fertility	4	Oral	(9)	25.0%
Didelphis virginiana (Allen, 1900)	RM1210	Didelphidae	Tlacuache	Meat	Soup	Inflammation	14	Oral	(5)	28.6%
					Soup	Colitis	3	Oral	(1)	33.3%
					Soup	Gastritis	5	Oral	(1)	20.0%
Sylvilagus cunicularius (Walterhouse, 1847)	RM1313	Leporidae	Rabbit	Foot	Ritual	To bring good luck	4		(10)	25.0%
Lepus alleni (Mearns, 1890)	RM0913	Leporidae	Hare	Meat	Soup	Stomachache	3	Oral	(1)	20.0%
Mephitis macroura (Lichtenstein, 1832)	RM3411	Mephitidae	Skunk	Meat	Soup	Asthma	47	Oral	(2)	85.1%
				Fat	Soup	Bronchitis	36	Oral	(2)	55.6%
					Soup	Cancer	4	Oral	(11)	25%
					The fat	Chronic cough	19	Topical	(2)	84.2%
					Soup.	Pneumonia	21	Oral	(2)	57.1%
Taxidea taxus (Schreber, 1777)	RM1210	Mustelidae	Badger	Meat	Ritual	Witchcraft	2		(10)	17%
Ammospermophilus interpres (Merriam, 1890)	RM1001	Sciuridae	Squirrel	Meat	Soup	Inflammation	4	Oral	(5)	25.0%
Reptiles										
Ambystoma mexicanum (Shaw, 1789)	RM1345	Ambystomidae	Ajolote	Meat	Fat	Bronchitis	3	Topical	(2)	20.0%
				Fat	Soup	Cough	5	Oral	(2)	0.0%
Gopherus flavomarginatus (Legler, 1959)	RM2322	Emydidae	Tortoise	Meat	Soup	Arthritis	6	Oral	(5)	66.67%
Sceloporus grammicus (Weigmann, 1828)	RM1233	Phrynosomatidae	Lizard	Meat	Soup	Diarrhea	3	Oral	(1)	20.0%
Crotalus atrox (Linnaeus, 1758)	RM1198	Viperidae	Rattlesnake	Fat	Fat	Pneumonia	20	Topical	(2)	65.0%
				Meat	Fat	Muscular pain	9	Topical	(3)	77.8%
				Skin	Fat	Sight	6	Topical	(12)	66.7%
					Soup	Throat	18	Oral	(2)	83.3%
					Soup	Gangrene	11	Oral	(12)	18.2%
					Soup	Varicose veins	42	Oral	(6)	71.4%
					Soup	Ulcer	29	Oral	(1)	34.5%

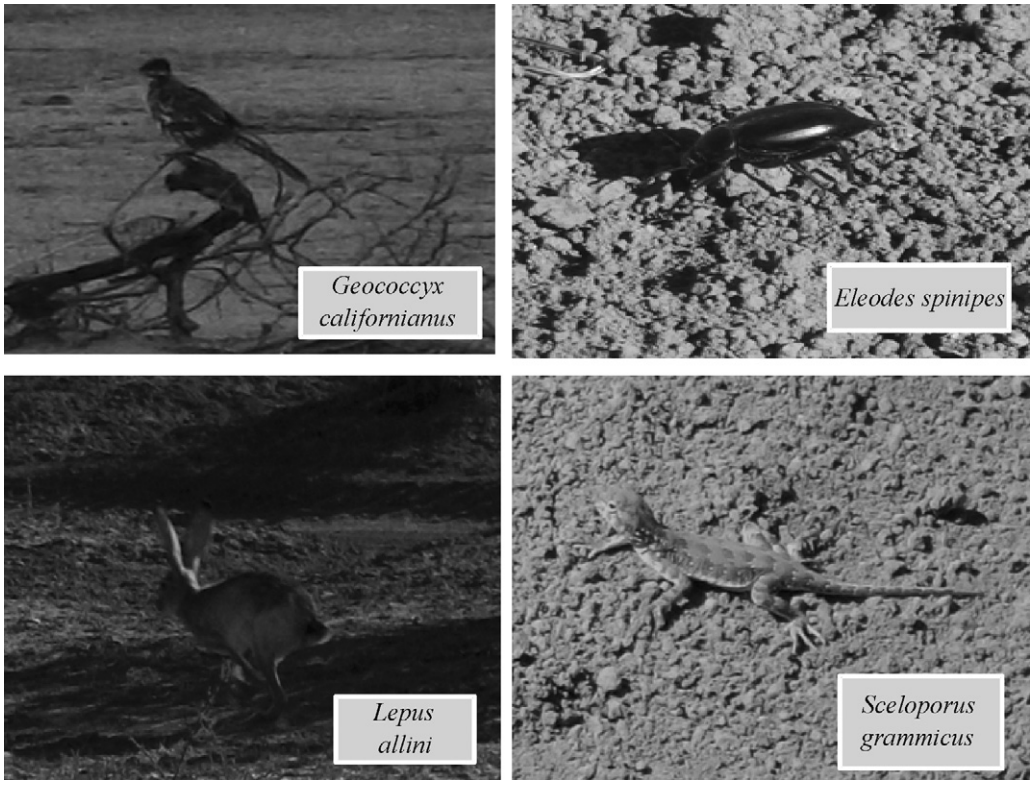

Fig. 2. Examples of medicinal species quoted in Mapimi, Durango.

removed from surface. In some cases, meat from aura, skunk and pheasant is used further for the soup. Zootherapeutic resources were used to cure about 26 ailments and 4 cultural filiations. Products of aura and rattlesnake are used to treat 7 illnesses, each one.

Even though the presence of clinics in the communities, 100% of the interviewed people have used medicinal animals as an alternative therapy for many types of diseases. Sixty percent of informants use medicinal fauna instead of prescribed medicine, and 40% of informants use medicinal animals combined with other prescribed drugs with advising their physicians. The lack of economical resources is the main reason to use medicinal fauna. In addition, people perceive the medicinal fauna to be efficient and safe because of their "natural" origin even when they know the lack of scientific evidence. The prescription of medicinal fauna is done by local healers called "chamanes" or by traditional knowledge. The most commonly mentioned species were *C. atrox* – rattlesnake ($n = 135$), *Mephitis macroura* – skunk ($n = 125$), *Cathartes aura* – aura ($n = 123$), *G. gallus* – hen ($n = 52$).

3.2. Fidelity level

For the pain/fever category, *C. atrox* (FI = 77.8%) was the most important specie according to its fidelity, whereas *C. aura* (FI = 44.4%) was the most important species in the diabetes category (Table 1). In the respiratory category, *M. macroura* (FI = 85.1%) and *C. atrox* (FI = 83.3%) had the highest fidelity level (Table 1). The most important animal species in the cardiovascular category were *C. atrox* (FI = 71.4%) and *G. californianus* (FI = 55.6%) whereas in the gastrointestinal category were *C. atrox* (FI = 34.5%) and *D. virginiana* (FI = 33.3%) (Table 1).

3.3. Informant consensus factor

The results showed that diabetes (ICF = 1.0), dermatological (ICF = 1.0) and reproductive (ICF = 1.0) had the greatest ICF values, followed by respiratory (ICF = 0.97) and oncologic (ICF = 0.97) categories (Table 2).

4. Discussion

México has great biodiversity and wide spread use of traditional medicine based, mainly, on herbolary; however, there are only few reports on medicinal fauna in México (Cupul-Magaña, 2003; Enriquez-Vazquez et al., 2006). Those studies have been conducted in Centre and South México, areas where the fauna is more abundant when compared to the North region of México. In our knowledge, this is the first report about fauna used for medicinal purposes in the North region of México.

The medicinal animal species not previously reported provide new information for the Mexican traditional medicine and demonstrates the importance of local biodiversity. Some of the medicinal animals used by the local people from Mapimi find mention in ancient medicinal literature in México. *C. aura* was used against syphilis, wounds, epilepsy and rabies, and *G. gallus* was used for

Table 2
Factor informant consensus.

Category	Taxons	Uses	ICF
(1) Gastrointestinal	4	43	0.92
(2) Respiratory	6	212	0.97
(3) Pain/fiber	2	12	0.9
(4) Dermatological	1	41	1.0
(5) Muscular/skeletal	4	27	0.88
(6) Cardiovascular	5	85	0.95
(7) Urological	0	0	0.0
(8) Diabetes	1	18	1.0
(9) Reproductive	1	4	1.0
(10) Cultural filiations	4	13	0.81
(11) Oncologic	2	44	0.97
(12) Others	2	38	0.97

the empirical treatment of arthritis, epilepsy and allergies (Corona-Martinez, 2008). The preparation and administration ways as well as the popular uses reported since ancient times are in accordance with the present study. Two animal species recorded in our work were reported previously in Mexican traditional medicine. Enriquez-Vazquez et al. (2006) showed that meat and fat of *M. macroura* are employed for the empirical treatment of stomach ache and cough, respectively. Our results are in agreement with the findings reported by Enriquez-Vazquez et al. (2006) on the use of *M. macroura* fat but indicate a new use for skunk meat: asthma. Enriquez-Vazquez et al. (2006) indicate that *Odocoileus virginianus* horns are employed for heart diseases; in the present work we report that *O. virginianus* meat is used for increasing womenĭs fertility, which is a new use for this animal specie.

On the other hand, some of animals recorded in the present study are also used in popular medicine in other countries. In Brazil, *Columba livia* meat is employed for the empirical treatment of cough (Alves et al., in press), whereas the fresh blood of this bird is employed for paralysis in India (Mahawar and Jaroli, 2007). In Brazilian traditional medicine, *G. gallus* fat is employed for the treatment of bronchitis, coughs, influenza, sore throat, sinusitis, tonsillitis, swelling, furuncles, tumors, and earache. The gizzard is used for poor digestion, and its eggs are employed for problems of navel and healing umbilical cord of newborn baby (Alves et al., in press). In Sudan, *G. gallus* meat is used as aphrodisiac (El-Kamali, 2000). Our results are in agreement with Alves et al. (in press) of the use of *G. gallus* meat but suggest a new use for *C. livia* meat: anemia.

Fauna from Mapimi such as *C. montezumae*, *E. spinipes*, *S. cuniculariusand T. taxus* are used for magical purposes (Table 1). In México, Enriquez-Vazquez et al. (2006) reported that *Cerrophidion tzotziloru*m fat, *D. virginiana* fat, *Coragyps atratus* meat, and others, are used to cure mal aire, which is said to be caused by an evil spirit or wind.

In our study, 89% of animal species are wild caught. This finding indicates that hunting reduces the acquisition costs of zootherapy. Our results are in agreement with Alves (2009) and Alves et al. (in press) who reported that 92% and 77%, respectively, of animal species used for medicinal purposes in different towns from Northeast Brazil are sourced from the wild. The results indicated that 44% of animal species are reported to cure more than one ailment. This trend is common practice in Mexican and other traditional medicines (El-Kamali, 2000; Enriquez-Vazquez et al., 2006; Mahawar and Jaroli, 2007; Alves, 2009).

The respondents had the perception that most animal remedies had no adverse side effects if their dosage and administration were appropriate. In addition, 40% of informants use medicinal animals combined with other prescribed drugs with advising their physicians. This constitutes a health risk because these products, which contain several constituents, could interact with the prescribed drugs and affect drug metabolism pathways. Also, animals such as rattle snakes are considered as poisonous.

In the present work, we found that medicinal fauna is employed for treating mainly diabetes, reproductive and dermatological diseases. Enriquez-Vazquez et al. (2006) showed that medicinal fauna from Los Altos, Chiapas, México was employed mainly for treating pain/fever followed by respiratory and dermatological illnesses.

Up to now, only one of the medicinal fauna reported in this work has studies on their pharmacological properties. Rennard et al. (2000) showed that *G. gallus* soup inhibited neutrophil chemotaxis *in vitro*, suggesting anti-inflammatory effects of this animal preparation. Many studies have confirmed that animal-based remedies present medicinal effects *in vitro* and *in vivo*. Aqueous extracts of water buffalo's (*Bubalus bubalis*) horn showed antypiretic actions on rats (But et al., 1991). Three protein fractions of the honeybee royal jelly from *Apis mellifera* showed mitogenic effects on Tn-5B1-4 insect cells, insulin-like activities on 3T3-442A murine preadipocytes and cytotoxic effects on human cervicouterine carcinoma HeLa cells (Salazar-Olivo and Paz-González, 2005). The ethanol extract of Chinese medicinal ants (*Polyrhachis lamelliden*) showed analgesic and anti-inflammatory activities in mice (Kou et al., 2005).

In summary, this study demonstrates that animal species play an important role in healing practices among inhabitants from Mapimi, Durango. Animals are also used in the form of amulets and charms in magic – religious rituals and ceremonies. In addition, the conservation of animal species needs to be considered to preserve the local medicinal knowledge. Further experiments with medicinal fauna from Mapimi are needed to be carried out to obtain experimental information about their traditional uses, especially with *C. atrox*. Also, the empirical knowledge described in this work would open good perspectives for the discovery of new sources of medicines for the drug industry.

Acknowledgements

AJAC (174493) was endowed with graduate fellowship from CONACYT. Thanks to Dra Concepcion Garcia-Lujan (UJED) for technical assistance and Alejandro De la Cruz for providing the map.

References

Alves, R.R., 2009. Fauna used in popular medicine in Northeast Brazil. Journal of Ethnobiology and Ethnomedicine 5, 1–11.
Alves, R.R., Barbosa, J.A., Santos, S.L., Souto, W.M., Barboza, R.R., in press. Animal-based remedies as complementary medicines in the semi-arid region of Northeastern Brazil. Evidence Based Complementary and Alternative Medicine.
But, P.P.H., Tam, Y.K., Lung, L.C., 1991. Ethnopharmacology of rhinoceros horn. II: antipyretic effects of prescriptions containing rhinoceros horn and water buffalo horn. Journal of Ethnopharmacology 33, 45–50.
Corona-Martinez, E., 2008. Las aves como recurso curativo y sus posibles evidencias en la arqueozoología. Archaebios 2, 11–18.
Cupul-Magaña, F.G., 2003. Cocodrilo: medicina para el alma y el cuerpo. Revista de Biomedicina 14, 45–48.
El-Kamali, H.H., 2000. Folk medicinal use of some animal products in Central Sudan. Journal of Ethnopharmacology 72, 279–282.
Enriquez-Vazquez, P., Mariaca-Mendez, R., Retana-Guiascon, O.G., Naranjo-Piñera, E.J., 2006. Uso medicinal de la fauna silvestre en los Altos de Chiapas, México. Interciencia 31, 491–499.
Friedman, J., Yaniv, Z., Dafni, A., Palewitch, D., 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev desert, Israel. Journal of Ethnopharmacology 16, 275–287.
García-Gutiérrez, I., Jacinto-Soto, R., Gómez-Lorens, F., 2009. Exploración etnobiológica en la Reserva de la Biosfera de Mapimi. MS thesis, Unidad Regional Universitaria de Zonas Áridas-Universidad Autónoma Chapingo. Bermejillo, Durango, México.
Halffter, G., 1988. El Concepto de Reserva de la Biosfera. In: Montaña, C. (Ed.), Estudio Integrado de los Recursos Vegaetación, Suelo y Agua en la Reserva de la Biosfera Mapimí. I. Ambiente Natural y Humano. Publicaciones del Instituto de Ecología AC, México, pp. 19–44.
Heinrich, M., Ankli, A., Frei, B., Wiemann, C., Sticher, O., 1998. Medicinal plants in Mexico: healer's consensus and cultural importance. Social Science and Medicine 47, 1859–1871.
Hernández, F., 1959. Historia Natural de Nueva España. Universidad Nacional Autónoma de México, 530 pp.
Instituto Nacional de Estadística y Geografía (INEGI), 2010. http://mapserver.inegi.gob.mx/geografia/espanol/datosgeogra/vegfauna/vegetaci.cfm?c=191 (accessed on 13.03.10).
Instituto Nacional para el Federalismo y Desarrollo Municipal (INAFED). http://www.inafed.gob.mx/work/templates/enciclo/durango/mpios/10013a.htm (accessed on 19.03.10).
International Fund for Animal Walfare (IFAW), 2002. Convention of international trade in endangered species of wild flora and fauna. 18 Reunión del Chomite de Animales. Lista de especies usadas para propósitos medicinales. AC 18 DOC 13.1 San José, Costa Rica, pp. 1–12.
Kou, J., Ni, Y., Li, N., Wang, J., Liu, L., Jiang, Z.H., 2005. Analgesic and anti-inflammatory activities of total extract and individual fractions of Chinese medicinal ants *Polyrhachis lamellidens*. Biological and Pharmaceutical Bulletin 28, 176–180.
Mahawar, M.M., Jaroli, D.P., 2007. Traditional knowledge on zootherapeutic uses by the Saharia tribe of Rajasthan, India. Journal of Ethnobiology and Ethnomedicine 3, 25–30.
Rennard, B.O., Ertl, R.F., Gossman, G.L., Robbins, R.A., Rennard, S.I., 2000. Chicken soup inhibits neutrophil chemotaxis *in vitro*. Chest 118, 1150–1157.
Salazar-Olivo, L.A., Paz-González, V., 2005. Screening of biological activities present in honeybee (*Apis mellifera*) royal jelly. Toxicology In Vitro 19, 645–651.