

## Knowledge and attitudes of Tunisian dog owners regarding leishmaniasis

Médiha Khamassi Khbou <sup>a,b,\*</sup>, Khawla Najahi <sup>b</sup>, Lilia Zribi <sup>c</sup>, Karim Aoun <sup>c</sup>, Mohamed Gharbi <sup>b</sup>

<sup>a</sup> Laboratory of Infectious Animal Diseases, Zoonosis and Sanitary Regulation, Univ. Manouba, Institution of Agricultural Research and Higher Education, National School of Veterinary Medicine of Sidi Thabet, 2020 Sidi Thabet, Tunisia

<sup>b</sup> Laboratory of Parasitology, Univ. Manouba, Institution of Agricultural Research and Higher Education, National School of Veterinary Medicine of Sidi Thabet, 2020 Sidi Thabet, Tunisia

<sup>c</sup> Laboratory of Parasitology, Institut Pasteur de Tunis, 13 Pl. Pasteur, BP 74, Tunis 1002, Tunisia

### ARTICLE INFO

#### Article history:

Received 22 November 2018

Received in revised form 22 February 2019

Accepted 23 February 2019

#### Keywords:

Leishmaniasis  
Knowledge  
Attitude  
Perception  
Dog owners  
Tunisia

### ABSTRACT

**Background:** Visceral leishmaniasis is a zoonotic disease of major public health concern in several countries in the world. The local population awareness would improve prevention, early detection and treatment of both human and animal leishmaniasis.

**Methods:** The aim of this survey was to assess the knowledge about visceral leishmaniasis in a sample of dog owners visiting the National School of Veterinary Medicine of Sidi Thabet, Tunisia, through a structured questionnaire.

**Findings:** Two hundred dog owners were interviewed, 87% were men and 47% had higher education level. Ninety four per cent were from neighbouring districts to Ariana, where the National School of Sidi Thabet is located. Out of 200 respondents, 79 confirmed knowing leishmaniasis. The correct answers concerning canine visceral leishmaniasis (CVL) (77%) were significantly higher than those concerning human visceral leishmaniasis (HVL) (23%). Correct answers concerning CVL were given in part by previously diseased dogs' owners. The respondent could not explain what is exactly leishmaniasis, but the majority of questioned persons know that human and dogs are the most important hosts. Forty-four out 79 (56%) of the persons think that mosquitoes or insects are the vectors of leishmaniasis and 63% (53/79) knows that it is a zoonotic disease but 72% (38/53) were not able to define how.

**Conclusion:** Despite the frequent visits to veterinarians for vaccination or other medical issues and their long experience in dog breeding, the sample of dog owners had not enough knowledge and several misconceptions regarding leishmaniasis. Large education programmes should be implemented in Tunisia to improve the knowledge of the Tunisian population, especially dog owners, concerning leishmaniasis.

© 2019 The Authors. Published by Elsevier Ltd on behalf of World Federation of Parasitologists.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

\* Corresponding author at: Laboratory of Infectious Animal Diseases, Zoonosis and Sanitary Regulation, Univ. Manouba, Institution of Agricultural Research and Higher Education, National School of Veterinary Medicine of Sidi Thabet, 2020 Sidi Thabet, Tunisia.

E-mail addresses: [mkhbou@hotmail.fr](mailto:mkhbou@hotmail.fr), (M. Khamassi Khbou), [lilia.zribi@pasteur.tn](mailto:lilia.zribi@pasteur.tn), (L. Zribi), [karim.aoun@pasteur.tn](mailto:karim.aoun@pasteur.tn). (K. Aoun).

## 1. Introduction

Visceral leishmaniasis is a vector-borne disease caused by *Leishmania infantum* and transmitted by female sand fly bites. Visceral leishmaniasis is present in several regions of the world, the Mediterranean sea is the most important foci of this disease (Alvar et al., 2012). In Tunisia, the incidence rate per 10,000 inhabitants of human visceral leishmaniasis (HVL) was about 0.04 cases in 2014 (World Health Organization, 2016). Visceral leishmaniasis is mainly present in humid, sub-humid and semi-arid bioclimatic zones in North and Centre of Tunisia (Ben-Ahmed et al., 2009). It is caused by *L. infantum*, predominantly, zymodeme MON-1 that is transmitted by *P. perniciosus* in a well-established transmission cycle (Aoun et al., 2003). It affects mostly children below 5 years of age (Belhadj et al., 1999) and it manifests essentially by fever, splenomegaly and hepatomegaly (Torres-Guerrero et al., n.d.). The HVL clinical cases are mainly reported in rural Tunisian populations but the development of human activities seems to cause the emergence of the disease in new geographic areas and activates the installation of the parasite and its extension to the Southern Tunisia (Ben Salah et al., 2007). Infected domestic dogs (*Canis familiaris*) remain asymptomatic for years; they are the main reservoirs of *L. infantum* MON-1 zymodeme (Ben Slimane et al., 2014). Canine visceral leishmaniasis (CVL) is frequent in Tunisia; it is generally expressed as chronic and multisystemic disease (Gharbi et al., 2015). Imported dog breeds are more susceptible than autochthonous dogs (Bouratbine et al., 2005). Lymph node enlargement and dermatological signs are the main symptoms of CVL and they are associated to emaciation, anorexia and when dog owners consult veterinarians, dogs are often in late stage of the disease (Gharbi et al., 2015). The cost and complexity of treatment constrain, in most cases, the veterinary clinician and/or the owner to opt for the dog's euthanasia.

Prevention of CVL is by far the best control option of leishmaniasis, but due to the complexity of transmission cycles, the polymorphic infection features and the low effectiveness of any of the prevention tools, the control of leishmaniasis must involve local populations. Intensive awareness programmes explaining the full epidemiological cycles with the role of all their actors should be implemented by all the stakeholders. As a prerequisite of these control programmes, an assessment of the knowledge and the practices regarding the disease and its control should be performed.

The present study is a survey of leishmaniasis knowledge and practices targeting dog owners that visiting the National School of Veterinary Medicine of Sidi Thabet (Tunisia).

## 2. Materials and methods

This cross-sectional survey based on interviews was conducted at the hospital of the National School of Veterinary Medicine of Sidi Thabet, Tunisia (NSVM).

A face-to-face questionnaire in Arabic was used to collect the responses given by 200 dog owners between October 2013 and December 2014. The questionnaire was tested on 12 dog owners before performing the survey. This pilot testing consisted of verifying that the length of the questionnaire was suitable, and that the questions were coherent and consistent. The anonymity of the participants was insured and all of them were informed verbally about the future use of the data. Despite no ethical approval was signed by the dog owners, none declined to participate.

The answers given for each question were classified as either correct or wrong according to the state of the art. When the dog owner gave both correct and wrong responses, it was considered as wrong.

To assess the reliability of answers, the Cronbach's alpha coefficient was calculated using SPSS® 21 for Windows® (IBM®, United States of America). This coefficient is a good indicator of the reliability and consistency of answers in a questionnaire. The consistency was considered as good when Cronbach's alpha value was higher than 70% (Cronback, 1951). Comparison of percentages was performed with chi square test at 0.05 thresholds. The calculation of the standard error (S.E) and the standard error of the mean S.E.M. were performed with Excel according to Schwartz (Schwartz, 1993).

## 3. Results

Eighty seven per cent of the questioned persons were males and 13% were females (sex ratio Males: Females = 6.7), their average age was  $35 \pm 0.7$  years [Range: 15–75 years]. Questioned dog owners had an average dog breeding duration of  $11 \pm 9.5$  years. Forty seven per cent of the questioned persons have higher education and 64.5% are working in either private or public sector (Table 1). The majority of the questioned persons (94%) were from the four great Tunis districts (Ariana, Manouba, Tunis and Ben Arous). Seventy three per cent of dog owners visit regularly a veterinarian and more than half of them (56%) do it yearling in order to vaccinate their dogs.

The dogs presented to the NSVM clinic were mostly of Pit-bull breed (16.5%), German shepherd (15%) and Mongreal (15%). The mean age of the dogs was  $22 \pm 2$  months [Range: 0.4–168 months]. One hundred thirty seven (68.5%) dogs were correctly vaccinated against the 6 core diseases: canine parvovirus, canine hepatitis, parainfluenza type 2 disease, canine distemper, leptospirosis and rabies.

### 3.1. Dog owner's knowledge regarding human and animal leishmaniasis

Out of 200 interviewed persons, 79 (39.5%) confirmed knowing leishmaniasis and 46% (37/79) of them responded correctly to up to 7 of the 14 asked questions. The responses given by these 79 respondents were significantly better than those given by the

**Table 1**  
Demographic characteristics of questioned dog owners (N = 200).

Characteristics	Number (%)
Gender	
Males	174 (87)
Females	26 (13)
Age (years)	35 ± 10.9 [15–75] <sup>a</sup>
Education level	
Illiterate	1 (0.5)
Primary school	16 (8)
Secondary school	89 (44.5)
University	94 (47)
Occupation	
Private/Public sector	129 (64.5)
Dog breeder	33 (16.5)
Jobless	14 (7)
Student	10 (5)
Retired	14 (7)
District of origin	
Ariana	70 (35)
Tunis	59 (29.5)
Manouba	45 (22.5)
Ben Arous	14 (7)
Other districts	12 (6)
Experience in dog breeding (years)	11 ± 9.5 [0.02–70] <sup>a</sup>
Frequent veterinary visit	
Yes	146 (73)
No	54 (27)
Purpose of regular veterinary visit	
Yearly vaccination	122 (56)
Others	78 (44)

<sup>a</sup> Mean ± standard deviation of the mean [Min; Max].

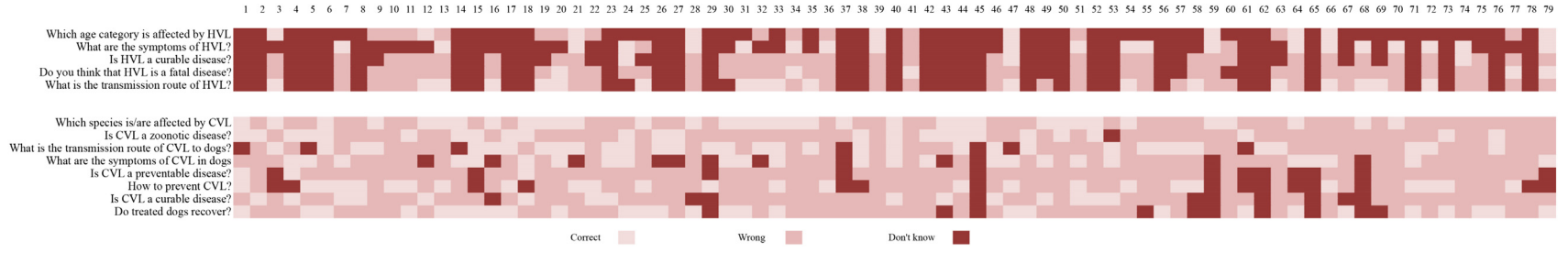
rest of the sample for all the questions ( $p < 0.001$ ). The Cronbach's alpha coefficient of answers to the 14 questions evaluating dog owners' knowledge regarding HVL and CVL was 0.95.

Among the 79 owners that confirmed knowing CVL, 9 (11%) confounded it with other diseases. All the answers (79/79) concerning the definition of leishmaniasis, were either wrong or "I don't know".

More than half (67%, 53/79) of the dog owners knowing leishmaniasis were aware that CVL is a zoonotic disease and knew the host species. Despite that 81% of the questioned persons knew that leishmaniasis is a preventable disease, less than half of them (48%; 38/79) responded correctly to the question about the available prevention tools. Regarding HVL, the ignorance of symptoms was very high and dog owners either gave wrong responses (27%; 21/79) or didn't know the response (70%; 55/79). The age category of affected people by HVL and the transmission route of HVL, were known by 18 and 32% of the questioned persons, respectively (Table 2).

**Table 2**  
Knowledge regarding human and canine visceral leishmaniasis in questioned dog owners (N = 79).

Question	Correct (%)	Wrong (%)	Don't know (%)
<b>Human visceral leishmaniasis (HVL)</b>			
Which age category is affected by HVL?	14 (18)	10 (13)	55 (70)
What are the symptoms of HVL?	3 (4)	21 (27)	55 (70)
Is HVL a curable disease?	34 (43)	3 (4)	42 (53)
Do you think that HVL is a fatal disease?	38 (48)	5 (6)	36 (46)
What is the transmission route of HVL?	25 (32)	19 (24)	35 (44)
<i>Subtotal</i>	114 (23)	58 (23)	223 (77)
<b>Canine visceral leishmaniasis (CVL)</b>			
What is Leishmaniasis?	0	61 (30.5)	139 (69.5)
Which species is/are affected by CVL?	44 (56)	35 (44)	0
Is CVL a zoonotic disease?	53 (67)	25 (32)	1 (1)
What is the transmission route of CVL to dogs?	38 (48)	34 (43)	7 (9)
What are the symptoms of CVL in dogs?	42 (53)	25 (32)	12 (15)
Is CVL a preventable disease?	64 (81)	3 (4)	12 (15)
How to prevent CVL?	38 (48)	26 (33)	15 (19)
Is CVL a curable disease?	54 (68)	15 (19)	10 (13)
Do treated dogs recover?	41 (52)	28 (35)	10 (13)
<i>Subtotal</i>	374 (77)	191 (77)	67 (23)
<b>Total</b>	<b>488</b>	<b>249</b>	<b>290</b>



**Fig. 1.** Heat map showing knowledge regarding human and canine visceral leishmaniasis of dogs' owners that confirmed knowing the disease (total number of questioned persons = 79).

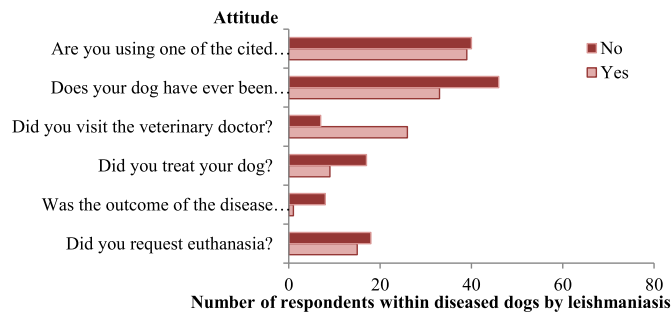


Fig. 2. Dog owners' attitude regarding prevention measures against canine visceral leishmaniasis and their attitude towards their diseased dogs.

Among dog owners that confirmed knowing leishmaniasis, the questions concerning CVL were significantly more frequently correct than those concerning HVL ( $p < 0.001$ ) (Table 2). The 5 questions regarding HVL at the top of the heat map contains more responses "I don't know" than the questions at the bottom (Fig. 1). Seven dog owners reported HVL cases in their surrounding (friend or neighbour).

### 3.2. Dog owners' attitude regarding leishmaniasis

Out of 200 questioned dog owners, 33 (16.5%) owned dogs that developed CVL during the last 5 years. Twenty-six among the 33 sick dogs were viewed by veterinarians and only 9 of them received treatment. Among these 33 dogs, twelve diseased animals died after a mean period of 3 months [Range: 1 week–1 year] and fifteen were euthanized (15/33) (Fig. 2).

## 4. Discussion

Globally, the interviewed dog owners that visited the National Veterinary School of Sidi Thabet clinic between October 2013 and December 2014, had not enough knowledge on leishmaniasis, since <50% of them confirmed knowing this disease. Despite the good education level of the respondents, there were misconceptions on the general knowledge regarding leishmaniasis. Between September 2015 and July 2016, among the 10,129 admitted animals to the hospital of the NSVM; 5029 were dogs (49.6%) (Unpublished data, 2017). There is obviously a spectacular increase of interest to dogs' breeding in Tunisia. The increase of dogs' population is inevitably associated to an increase of risks of zoonotic disease transmission (Otranto et al., 2009).

For the 79 persons who confirmed knowing leishmaniasis, almost half of them, experienced CVL with their dogs, they all gave correct answers about CVL. The occurrence of the disease in dogs and the fatal issue might affect dog owners for years and leave a memory of negative experience (Brown and Symons, 2016; Eckerd et al., 2016). Usually, dogs are in advanced stages of CVL with emaciation, skin lesions, and deep status alteration when they are presented to the veterinarians. As treatment is expensive and has several negative side effects, euthanasia is frequently recommended by the owner and or the veterinarian.

None of the respondents was able to define exactly leishmaniasis. Except medical and veterinarian staff and dog owners that had experience with their dogs, the name "leishmaniasis" is unknown to the local population and has no vernacular name. The medical community should suggest a vernacular name for the disease and promote its use through media. Another explanation for this bad knowledge could be due to the rural distribution of CVL that is mainly prevalent in Centre and South of Tunisia (Haouas and Babba, 2017).

More than half of respondents (56%) knew that dogs and humans are the most susceptible species for leishmaniasis but other animal species were thought to be affected (cattle for example). The frequency of this confusion with other diseases should be decreased through education campaigns by both animal health decision makers and private veterinarians.

The transmission of CVL between dogs by a mosquito or an insect bite was cited by almost half of the dog owners (48%). In Tunisia, the main vectors of zoonotic HVL is *P. perniciosus* which is more concentrated in Northern Tunisia (Tabbabi et al., 2017). All the respondents made confusion between sand flies and mosquitoes. The general population do not distinguish verbally between *Culicidae* and *Psychodidae*, since both are known in vernacular Arabic as "namous", which means "mosquito".

Erroneous knowledge concerned other transmission routes were reported by respondents (direct contagiousness, blood, mating and tick bite). Despite CVL being a vectorial disease, some authors reported other transmission routes under certain circumstances. Indeed, *Leishmania* can be exceptionally transmitted by blood transfusion in dogs (De Freitas et al., 2006); the venereal transmission route has been reported (Diniz et al., 2005) and the role of ticks in CVL transmission has extensively been discussed and hypothesized. *Rhipicephalus sanguineus* collected from dogs with confirmed CVL, harboured *Leishmania* spp. DNA or *L. infantum* in their salivary glands (Tabbabi et al., 2017; Dantas-Torres et al., 2010). Tunisian population are not enough aware about these anecdotal transmission routes and all the cited responses were random.

Dog owners gave a wide panel of CVL possible symptoms. As CVL is clinically polymorphic (Gharbi et al., 2015), it is difficult to state if dog owners truly know the symptoms or not. Alopecia, anorexia, weight lost, lethargy, onychogryphosis, ocular signs, skin lesions at the bony prominences and furfures were correctly reported by dog owners and most answers were correct even if they thought about other diseases.

Knowledge regarding CVL as treatable disease and if treated dogs recover or not was observed in 68 and 52% of respondents, respectively. Even if 81% of the owners knew that CVL is preventable, there was a gap of knowledge concerning the preventive tools. Insecticide impregnated collars (Foglia Manzillo et al., 2006) and vaccination (Leite et al., 2018) were the most cited preventive tools and less than half (48%) of the respondents confirmed using one or both of these methods. In Tunisia, the vaccine against CVL, Canileish® was introduced in 2011 but there is no data about the rate of vaccination and the proportion of dog owners that is aware of its availability in Tunisia. Erroneous responses such as: disinfection of dog kennel, anthelmintic treatment, frequent dog bathing, cleaning food supplying were also provided by respondents and show the erroneous knowledge about the control measures.

A large proportion of dog owners knew that leishmaniasis is zoonosis but more than half of them (53%) were unable to identify the transmission pathway. Big efforts are to be done in order to increase this proportion so that dog owners become aware of the preventive measures that can be implemented against canine visceral leishmaniasis. Respondents gave more correct answers about CVL than about HVL questions ( $p < 0.001$ ). It is evident that empathy established between one owner and his pet enhances the emotional connection and fosters the behaviour of welfare and protection (Remito, 2016). Moreover, 7 out of 79 respondents reported knowing someone that was affected by HVL, which reinforces the confusion between visceral and cutaneous human leishmaniasis and the misunderstanding about the human disease.

The sampled population included herein was persons that went to a veterinary hospital; this could represent a bias since these dog owners might be taking better care of the dogs if compared to the general population. If we consider the overall human population in Tunisia, it is expected that people that do not own dogs know less about the disease. Despite the sample size was not scientifically calculated, and taking into account the whole questionnaire, it's evident that a lot of misconception exists among dog owners regarding both CVL and HVL. As none of the dog owners declined to participate to the questionnaire, it would encourage further studies targeting other social categories to assess the knowledge regarding leishmaniasis, to implement large awareness programmes about the symptoms, transmission routes and the prophylactic measures targeting the exposed population. Finally, we suggest that a vernacular Arabic name should be given to this disease.

## Acknowledgement

The authors would like to thank all the dog owners that have accepted to participate to this survey.

## Funding

This work was supported by *Laboratoire d'épidémiologie d'infections enzootiques des herbivores en Tunisie* (Ministère de l'Enseignement Supérieur et de la Recherche Scientifique).

## References

- Alvar, J., et al., 2012. Leishmaniasis worldwide and global estimates of its incidence. *PLoS One* 7 (5).
- Aoun, K., et al., 2003. Leishmania infantum MON-1 : seul zymodème isolé chez les chiens leishmaniens en Tunisie. *Bull. Soc. Pathol. Exot.* 96 (2), 77–79.
- Belhadj, S., et al., 1999. Leishmaniose viscérale infantile à *Leishmania infantum* MON-24: une réalité en Tunisie. *Parasitology* 48 (1), 10–11.
- Ben Salah, A., Kamarianakis, Y., Chlif, S., Ben Alaya, N., Prastacos, P., 2007. Zoonotic cutaneous leishmaniasis in Central Tunisia: spatio-temporal dynamics. *Int. J. Epidemiol.* 36 (5), 991–1000.
- Ben Slimane, T., et al., 2014. An investigation on vertical transmission of *Leishmania infantum* in experimentally infected dogs and assessment of offspring's infectiousness potential by xenodiagnosis. *Vet. Parasitol.* 206 (3–4), 282–286.
- Ben-Ahmed, K., Aoun, K., Jeddi, F., Ghrab, J., El-Aroui, M.A., Bouratbine, A., 2009. Visceral leishmaniasis in Tunisia: spatial distribution and association with climatic factors. *Am. J. Trop. Med. Hyg.* 81 (1), 40–45.
- Bouratbine, A., et al., 2005. Données épidémiologiques, cliniques et parasitologiques sur la leishmaniose générale canine en Tunisie. *Bull. Soc. Pathol. Exot.* 98 (3), 359–362.
- Brown, O.K., Symons, D.K., 2016. "My pet has passed": relations of adult attachment styles and current feelings of grief and trauma after the event. *Death Stud.* 40 (4), 247–255.
- Cronback, L.J., 1951. Coefficient alpha and the internal structure of tests. *Psychometrika* 16 (3), 297–334.
- Dantas-Torres, F., et al., 2010. Detection of *Leishmania infantum* in *Rhipicephalus sanguineus* ticks from Brazil and Italy. *Parasitol. Res.* 106 (4), 857–860.
- De Freitas, E., Melo, M.N., Da Costa-Val, A.P., Michalick, M.S.M., 2006. Transmission of *Leishmania infantum* via blood transfusion in dogs: potential for infection and importance of clinical factors. *Vet. Parasitol.* 137 (1–2), 159–167.
- Diniz, S.A., et al., Sep. 2005. Genital lesions associated with visceral leishmaniasis and shedding of *Leishmania* sp. in the semen of naturally infected dogs. *Vet. Pathol.* 42 (5), 650–658.
- Eckerd, L.M., Barnett, J.E., Jett-Dias, L., 2016. Grief following pet and human loss: closeness is key. *Death Stud.* 40 (5), 275–282.
- V. Foglia Manzillo, G. Oliva, A. Pagano, L. Manna, M. Maroli, and L. Gradoni, 'Deltamethrin-impregnated collars for the control of canine leishmaniasis: evaluation of the protective effect and influence on the clinical outcome of *Leishmania* infection in kennelled stray dogs', *Vet. Parasitol.*, vol. 142, no. 1–2, pp. 142–145, 2006.
- Gharbi, M., Mhadhbi, M., Rejeb, A., Jaouadi, K., Rouatbi, M., Darghouth, M.A., 2015. Leishmaniosis (*Leishmania infantum* infection) in dogs. *Rev. Sci. Tech. l'OIIE* 34 (2), 613–626.
- Houas, N., Babba, H., 2017. Leishmaniasis in Tunisia: history and new insights into the epidemiology of a neglected disease. *The Epidemiology and Ecology of Leishmaniasis*. InTech.
- Leite, B.M.M., et al., 2018. The mass use of deltamethrin collars to control and prevent canine visceral leishmaniasis: a field effectiveness study in a highly endemic area. *PLoS Negl. Trop. Dis.* 12 (5), 1–19.
- Otranto, D., Dantas-Torres, F., Breitschwerdt, E.B., 2009. Managing canine vector-borne diseases of zoonotic concern: part two. *Trends Parasitol.* 25 (5), 228–235.
- Remito, S.K., 2016. 'In the eyes of the beholder: pet owners' attitude toward animals and perception of their pet's behavior', *CUNY Acad. Work.* 46.
- Schwartz, D., 1993. 'Méthodes statistiques à l'usage des médecins et des biologistes' Flammarion, 4th ed. France.
- Tabbabi, A., Sboui, S., Daaboub, J., Nov. 2017. The current status of phlebotomine sandflies (Diptera: Psychodidae) in Tunisia and their role on *Leishmania* transmission: a review. *Asian Pacific J. Trop. Dis.* 7 (12), 821–825.
- E. Torres-Guerrero, M. R. Quintanilla-Cedillo, J. Ruiz-Esmenjaud, and R. Arenas, 'Leishmaniasis: a review', *F1000Research*, vol. 6, no. May, p. 750, 2017.
- World Health Organization, 2016. Leishmaniasis in high-burden countries: an epidemiological update based on data reported in 2014. *Wkly Epidemiol. Rec.* 83, 285–296.