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REVIEW ARTICLE ASSOCIATION BETWEEN PARASITES, INFECTIONS AND DISEASES

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ABSTRACT:

Parasites are microorganism that need host to continue its lifecycle, some of them need more than one host (primary and intermediate). In this review article the researcher focus on the main types of parasites that causes a certain infections that's leads to a certain diseases and classified them into diseases that caused by one cell parasites such as malaria, and Leishmania, and that was caused because of infection from multi cells parasites such as elephantiasis, and bilharzias which are due to the importance of these two infections as the most popular diseases all of the world. Also the article went through the life cycles of each disease. The article also went through the needed precautions to avoid infections with all kinds of parasites like personal hygiene, avoid contaminated food and water, as well as infected places.

Keyword: Malaria, Elephantiasis, parasites, infection, diseases.

Introduction:

Parasitism is an association between two living organisms (host and parasite), usually parasite gets beneficial from host which eventually leads to either harm or kills the host (which generally either plant, animal, or human) [1, 2, 3].

Millions of people all over the world suffer and affected from that cause incredible and great suffers which sometimes leads to death, precisely in countries that considered as less and has low development especially in health system [4]. Every year a lot of people in the worldwide (millions of them) are died because of diseases caused by paradises, mostly due to Malaria, or protozoan (a single or one cell parasite) [5]. Thus, and because of these consequences caused by parasites, studying the biochemistry of parasites is very important to find out a solution to these issues. Besides, it is also essential to study the molecular pathology of these evolved organisms (parasites) will leads to find a route to support the immune system against infection, and diseases caused by parasites [6, 7].

On the other hand the glycobiology of parasite could be depressed due to the complexity in finding an adequate quantity of the materials and substances that are under study, as well as the difficulties in achieving experiments, investigation, and researches in the labs (in vitro). Additionally, and because of a lot of parasites needs an intermediate host to complete its lifecycle stages, this will increase the difficulties in studying these types of parasites [8, 9].

Table 1 shows some main disease caused by parasites all over the world, it is clear from this table that filarial worms (caused by helminthes paradises) is the most effective disease on the human beings on the world wide (657 million), while the second one is the roundworm (531 million), on the other hand Malaria is the most harmful disease caused by parasitic protozoans (the one cell parasite), the population affected by malaria all over the world are around (500 million), Table 1[4, 5].

Table 1: Distribution of few main diseases caused by different types of parasites

Disease	Infected people in million (approximately)	Fatality/year in million (approximately)
One cell parasites (parasitic protozoans)		
Plasmodium (Malaria)	500	3
Onchoceriasis (River blindness)	18	0.27 (270,000 individual)
South American trypanosomiasis (Chagas' disease)	18	0.05 (50,000 individual)
Leishmaniasis	12	0.057 (57000 individual)
African trypanosomiasis (sleeping sickness)	0.45 (450,000 individual)	0.066 (66,000 individual)
Multi-cells parasites (Parasitic helminthes)		
Filarial worms	657	0.050 (50,000 individual)
Roundworm (Ascaris)	531	0.003 (3,000 individual)
Whipworm (Trichuris)	212	0.002 (2000 indivdual)
Schistosomiasis	200	0.014 (14,000 individual)
Pinworms or threadworms (Enterobius vermicularis)	200	Very rare
Hookworms (Necator/Ancylostoma)	194	0.007 (7000 individual)

Malaria parasite (Plasmodia):

Historically, malaria was recorded before more than 4700 in ancient civilization of China, as well as in the Empire of Roman and turns it down and affected them and they called it as Fever of Roman [10].

In human beings, malaria is disease that hit the humans due to the infection with plasmodium micro-organism precisely with a certain paradise species that leads to a complex lifecycle called P. falciparum that involving mosquito (Anopheles female) through different and many stages in the tissues such as ((erythrocytes, and hepatocytes) via the stream of the blood. Each stage needs an interaction between the cell of the host and the cell of parasites, it is a big challenge for parasite cells to stick with host and live inside it [11, 12, 13]. Figure 1 shows the lifecycle of malaria

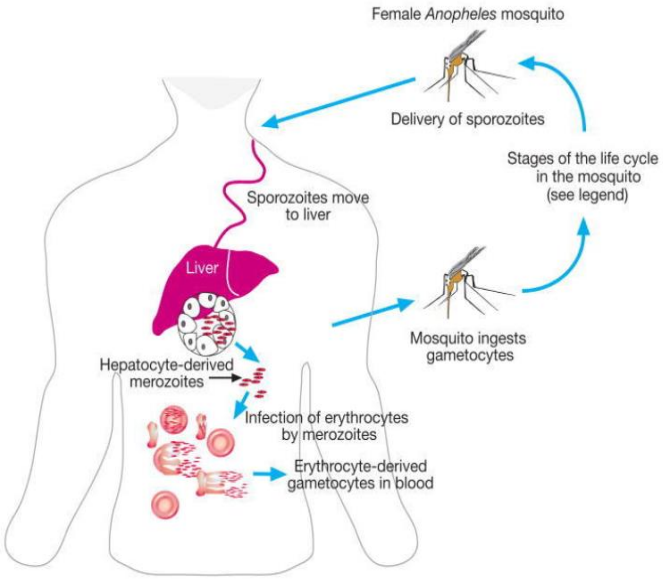

Figure 1: The life cycle of Plasmodium falciparum in human [4]

Mosquito female produce sporozoites and insert it (by bite) inside the host (human), after that the progression and the development is shown in figure 1. The parasites (malarial gametocytes) are transfer from blood stream to midgut of the mosquito to continue its next stage of lifecycle as shown in figure1.

Some people with malaria experience cycles of malaria "attacks" and the attack usually begins with shivering and chills, followed by a high fever, followed by sweating and then a return to a normal temperature [14, 15]. Malaria signs and symptoms usually begin within a few weeks after being bitten by an infected mosquito, however, some types of parasites that cause malaria can remain dormant in your body for up to a year [16, 17].

Plasmodium can be transmitted using many genera types of mosquitoes as intermediate and vectors such as Aed, Culex, Mansonia, Anopheles, and Culiceta [18].

There are different types of malaria some of them caused fatal while others have mild effect, and the others hit the mosquitoes itself, among them are [19, 20, 21, 22, 23]

- Plasmodium knowlesi (P. knowlesi): affect mosquitoes, but it also can cause infection

to the humans.

- Plasmodium ovale (P. ovale): this kind cause a mild effect, but it may hit the liver of the humans and may remain there for several years.
- Plasmodium falciparum (P. faliparum): this type is the strongest, and usually located in Africa and may cause serious problems to the humas health.
- Plasmodium malariae (P. malariae): this one has a mild effect and does not cause death to the infected mammals (it usually hit animals), and may stay in the blood stream for more than 10 years.
- Plasmodium vivax (P. vivax): this type is the most known all over the world, it doesn't cause death, and mostly it is concentrated in India, it may hit the human liver and may remain there for a period of time.

Leishmaniasis:

It is a kind of disease that caused by a certain parasite called Leishmania and mostly common in Asia, South Europe, and Africa. Leishmania usually lives on an infected sand fly which carries the infected parasite [24].

Mainly there three types of Leishmania, which comes from three different parasites, they are as the following [25]:

Visceral leishmaniasis:

This type of leishmaniasis disease come after around 5 months from infected parasite bite which lives of sand fly, it hit bone narrow, liver, and spleen of the humans (internal organs) and it reached the immune system [26].

Cutaneous leishmaniasis:

This type of Leishmania hit the human skin causes ulcers and it is considered as the most common types of Leishmania diseases [27].

Mucocutaneous leishmaniasis:

This type of disease is very uncommon and usually it is caused by a certain type of Leishmania that effect the skin and can remain in the skin for many months (even after the healing of the skin ulcer and the parasite can extend to the mouth, nose, and throat by which the Leishmania were destructed completely [28].

All Leishmaniasis diseases are caused due to a certain type of parasite (protozoan), and all of them occur due to a bite from infected sand fly (precisely the female) [29].

Figure 2 shows the general life cycle of all types of Leishmania [28]

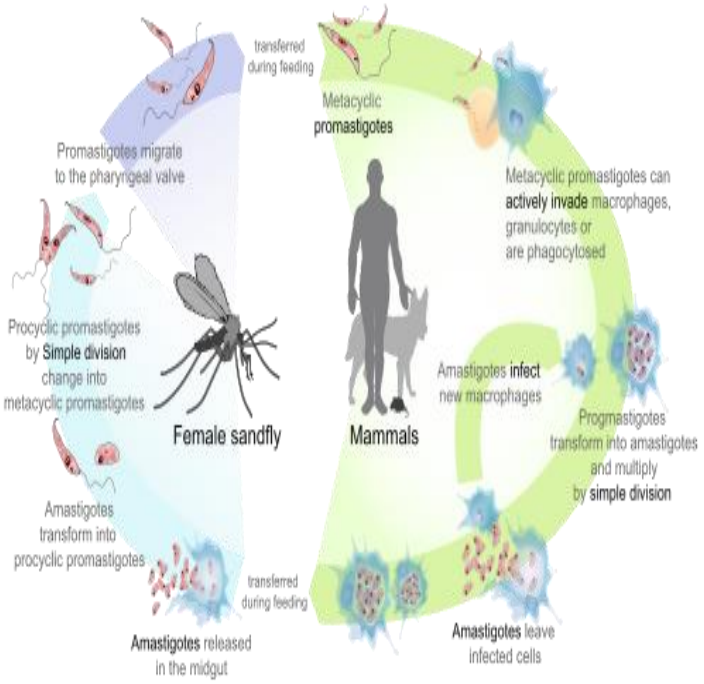

Figure 2: life cycle of all types of Leishmania [26]

Filarial Worms (phylum Nematoda):

It is a type of parasites that needs 2 hosts (primary, and intermediate) to complete its life cycle. The larval stage usually takes place and arises inside the insect body, while the reproduction stage take place in the mammal body (animal or human) [30].

The worm female produce a huge numbers of embryos (named microfilariae), this microscopic species. When an insect bit an

infected animal, microfilariae move and transferred to the blood of the insect, and there it lives and continue its primary stage of the lifecycle inside the muscles of the insect, and it can repeat its primary stage until it find the intermediate host (mammal) [31].

The worms of the filarial mammal cause many diseases if it is transferred from the insect to the mammal (animal, or human), such as river blindness, heartworm, and elephantiasis [32].

Elephantiasis:

Elephantiasis (lymphatic filariasis) is the disease that hit the humans in more than 73 countries in the world, it is caused by mosquitoes, it has no clear symptoms (in the beginnings), and it causes enlargement in the lymphatic vessels and eventually, enlarged kegs and arms. This disease also affects the patient skin and become harder and thicker than normal skin, this disease in more common and familiar in subtropical and tropical countries [32, 33].

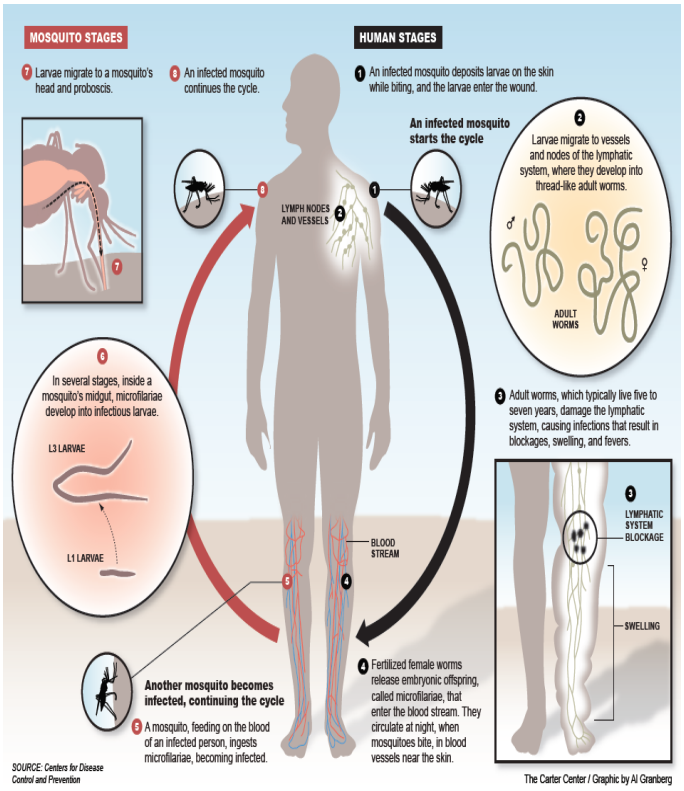

Figure 2: the lifecycle of lymphatic filariasis [34]

Three main different types of mosquitoes that can cause elephantiasis (lymphatic filariasis) in humans as the following [35]:

- ➢ Brugia timori.
- ➢ Wuchereria bancrofti.
- ➢ Brugia malayi.

This disease hits the vessels of lymph and caused infection and actually around 90% of the patients were infected due to Wuchereria bancrofti, while the remain 105 are caused by the other types (Brugia malayi, Brugia timori) [34].

Parasitosis:

Parasitosis is a human reaction, and feeling that comes when the person is infected or bitten by parasite. Usually the bite may cause irritation in the skin, pain, and scabies [35].

In 2015, Cholewiński and his coworkers [36] mentioned that "As consequences of the interaction between parasites and hosts eventually will cause pathological conditions in the mammals hosts (humans or animals)" [37], as a result of this interaction, parasites did a lot of adaption to ensure a secure environment to live in [38].

Although, most of the risky diseases were due to infection caused by parasites, still there are other causes of transferring the diseases between people and countries, such as immigration, tourism, importing and exporting products… and much more. However, still the infections and the diseases that caused by parasites are the most common and highest percent that may leads to suffers, and fatal [39], 40.

Facts about parasites infections:

There are general common facts about infections and diseases that are caused differet types of parasites, among them are [28, 39]:

- ✓ Parasites infect the host mostly either throughout skin or mouth.

- ✓ Parasites transmitted in developed countries from travelers, immigrants, or even from weakened people (low immunity).
- ✓ Parasite diseases are more frequent in undeveloped countries (countries in Asia, South America, and Africa), and that's why it is recommended to people who travel to these countries to increase their awareness from parasites infection in their drinks, food, shopping, and even in their residency places (hotels).
- ✓ Parasites infection usually diagnosed in clinics and labs by taking samples of urine, blood, phlegm, stool, or biopsy from the suspected tissues.
- ✓ There are treatments, drugs, and medication to most of the diseases and the infections that caused by parasites.

To prevent parasites infection, there are certain step needs to be taken which are recommended by specialists, among them are [26, 29]:

- ✓ Stay away from parasites bites.
- ✓ Keep in excellent hygiene.
- ✓ Avoid in touch with infected soil or water.
- ✓ Keep away from infected places, communities.

Schistosomiasis (Bilharzias):

Also, sometimes named the fever of snail, this type of disease is chronic and it is caused by a certain type of parasite named schistosomes (the flukes of blood), and there are three main types of schistosomes that caused bilharzias, and these are [40-41]:

- ➢ S. japonicum
- ➢ Schistosoma mansoni
- ➢ S. haematobium

It is important to know that these parasites use contaminated water as a medium to spend part of its lifecycle, that's why people must be aware and have some precautions to avoid the infection with the larva (it has a fork shape) [42], this shape enable it to inter the skin through penetration and then inter the blood and move through blood vessels to progress and developed from larva to adult and release eggs, this will leads to some symptoms such as blood in urine, diarrhea, and other [43], as well as anemia (in children).

When this infection become a chronic disease it may hit the bladder, liver as well as the intestines, this infection may developed to more serious diseases like HIV [43].

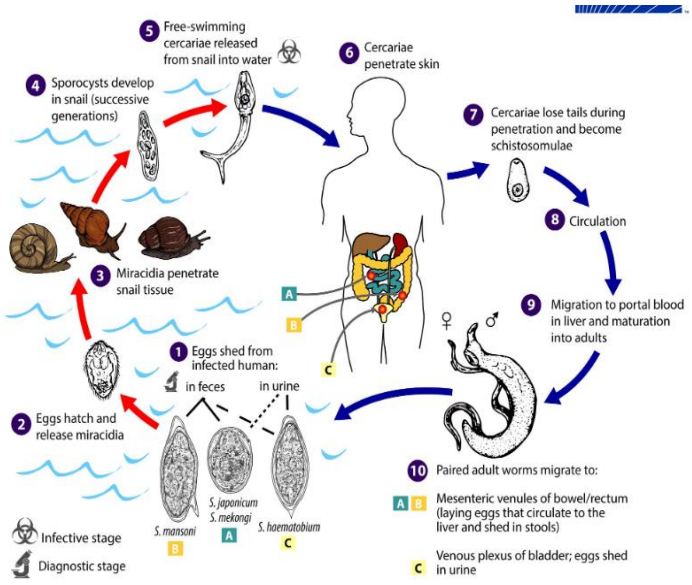

Figure 4: lifecycle of Bilharziasis [43]

Delusional parasitosis:

Delusional parasitosis (DP), is a exceptional and unusual disorder that causes mental and psychiatric issues. This type of parasitosis (which is also named as Ekbom syndrome) has nothing to do with parasites [12],

CONCLUSIONS:

This review article focused on the infections and the diseases that caused by parasites, and precisely, on Malaria, Leishmania, lymphatic filariasis, and bilharzias. Also the article describes the lifecycle of each one of them. Additionally, the precautions that is required to prevent contamination, and infections from parasites.

REFERENCES:

1) Joseph P. The Cell: Evolution of the First Organism. Infobase Publishing. 2014. ISBN 9780816067367.
2) Jean-Claude B, Pierre C, Philippe L, Robert M, et al. Environmental Microbiology: Fundamentals and Applications: Microbial Ecology. 2015. Springer. ISBN 9789401791182.
3) Gooday AJ, da-Silva A, Pawlowski J. Xenophyophores (Rhizaria, Foraminifera) from the Nazaré Canyon (Portuguese margin, NE Atlantic). Deep-Sea Research Part II: Topical Studies in Oceanography. 2011; 58 (24–25): 2401–2419.
4) Varki A, Cummings RD, Esko JD, et al. Essentials of Glycobiology. 2nd edition. Chapter 40, pp: 1-9. Cold Spring Harbor Laboratory Press (NY). 2009. https://www.ncbi.nlm.nih.gov/books/NBK1899/
5) Kabatereine NB, Malecela M, Lado M, Zaramba S, Amiel O, Kolaczinski JH. How to (or not to) integrate vertical programmes for the control of major neglected tropical diseases in subSaharan Africa.PLoS Negl Trop Dis. 2010; 4(6): e755
6) Paniker CK Jayaram . Paniker's textbook of medical parasitology .seventh edition. Indian Council of Medical Reserch, New Delhi, India. (2013), Page 276.
7) Burkot TR, Taleo G, Toeaso V, Ichimori K. Progress towards, and challenges for, the elimination of filariasis from Pacific-island communities. Annals of Tropical Medicine and Parasitology. 2002; 2:61–69.
8) Sumruayphol S, Apiwathnasorn C, Komalamisra N, Ruangsittichai J, Samung Y, Chavali -tshewinkoon-Petmitr P. Bionomic status of Anopheles epiroticus Linton & Harbach, a coastal malaria vector, in Rayong Province, Thailand. The Southeast Asian Journal of Tropical Medicine and Public Health. 2010; 41: 541-547.
9) Yu G, Yan G, Zhang N, Zhong D, Wang Y, He Z, Yan Z, Fu W, Yang F, Chen B. The Anopheles community and the role of Anopheles minimus on malaria transmission on the China-Myanmar border. Parasites & Vectors. 2013; 6: 264.
10) Beck-Johnson L.M, Nelson WA, Paaijmans KP, Read AF, Thomas MB, Bjornstad ON. The effect of temperature on Anopheles mosquito population dynamics and the potential for malaria transmission. Plos One. 2013; 8: e79276.
11) https://hr.un.org/sites/hr.un.org/files/Malaria%20Guidelines_DHMOSHPH_2019-04_FINAL_0.pdf
12) https://apps.who.int/iris/bitstream/handle/10665/330011/9789241565721-eng.pdf
13) Blasco-Costa I, Poulin R. Parasite life-cycle studies: a plea to resurrect an old parasitological tradition. Journal of Helminthology. 2017; 91: 647–656.
14) Addiss DG, Louis-Charles J, Roberts J, LeConte F, Wendt JM, Milord MD, Lammie PJ, Dreyer G. Feasibility and effectiveness of basic lymphedema management in Leogane, Haiti, an area endemic for Bancroftian filariasis. PLoS Negl Trop Dis. 2010; 4(4): e668.
15) Negreiros LP, Tavares-Dias M, Elisei C, Tavares LER, Felipe B, Pereira FB. First description of the male of Philometroides acreanensis and phylogenetic assessment of Philometridae (Nematoda: Dracunculoidea) suggest instability of some taxa. Parasitology Interational. 2019; 69: 30-38.
16) Blasco-Costa I, Cutmore SC, Miller TL, Nolan M. J. Molecular approaches to trematode systematics: 'best practice' and implications for future study. Systematic Parasitology. 2016; 93: 295–306.
17) Benesh DP. Autonomy and integration in complex parasite life cycles. Parasitology. 2016; 143: 1824–1846.
18) Ødegaard F. How many species of

arthropods? Erwin's estimate revised. Biological Journal of the Linnean Society. 2020; 71(4): 583–597.

19) Duvallet C. Data detectives, self-love, and humility: a research parasite's perspective. GigaScience. 2020; 9: 1–5. doi: 10.1093/gigascience/giz148.

20) Zuo S, Kania P, Mehrdana F, Marana M, Buchmann K. Contracaecum osculatum and other anisakid nematodes in grey seals and cod in the Baltic Sea: Molecular and ecological links. Journal of Helmintholog. 2018; 92(1): 81-89. doi:10.1017/S0022149X17000025.

21) Bolyen E, Rideout JR, Dillon MR, et al. Reproducible, interactive, scalable and extensible microbiome data science using QIIME 2. Nat Biotechnol 2019; 37(8): 852–857.

22) Koster J, Rahmann S. Snakemake-a scalable bioinformatics ¨ workflow engine. Bioinformatics 2018; 34(20): 3600.

23) Torres-Guerrero E, Quintanilla-Cedillo MR, Ruiz-Esmenjaud J, Arenas R. Leishmaniasis: a review. Flooo Research. http://dx.doi.org/10.12688/f1000research. 11120.1

24) Ozkeklikci A, Karakus M, Ozbel Y, et al.: The new situation of cutaneous leishmaniasis after Syrian civil war in Gaziantep city, Southeastern region of Turkey. Acta Trop. 2017; 166: 35–8.

25) https://en.wikipedia.org/wiki/Leishmaniasis

26) Khezzani B, Bouchemal S: Demographic and spatio-temporal distribution of cutaneous leishmaniasis in the Souf oasis (Eastern South of Algeria): Results of 13 years. Acta Trop. 2017; 166: 74–80.

27) Dianne L, Bollache L, Lagrue C, Franceschi N, Rigaud T. Larval size in acanthocephalan parasites: influence of intraspecific competition and effects on intermediate host behavioural changes. Parasites Vectors. 2012; 5: 1–7.

28) Lucio H, Freitas-Junior, Eric Chatelain, Helena Andrade Kim, Jair L. Siguera-Neto: Visceral leishmaniasis treatment: What do we have, what do we need and how to deliver it? Int. J. for Parasitol.: Drugs and Drugs Resistance. 2012 (2): 11-19.

29) World Health Organization (WHO). Lymphatic filariasis (Fact sheet no.102).WHO,(2015).

30) World Health Organization. WHO Global Programme to Eliminate Lymphatic Filariasis: Progress Report for 2000–2009 and Strategic Plan 2010–2020; World Health Organization: Geneva, Switzerland.(2010).

31) Ramaiah K, Ottesen EA. Progress and impact of 13 years of the global programme to eliminate lymphatic filariasis on reducing the burden of filarial disease. PLoS Negl. Trop. Dis. 2014; 8: e3319.

32) Chandy A, Thkur AS, Singh MP, Manigauha A. A reveiw of neglected tropical diseases: filariasis. Asian pacific Journal of Tropical Medicine. 2011; 4(7): 581-586.

33) Genchi C, Rinaldi L, Cascone C, Mortarino M, Cringoli G: Is heatworm disease really spreading in Europe?: Vet. Parasitol. 2005 : 24: 137-148.

34) https://www.cartercenter.org/resources/pdfs/health/lf/lymphatic-filariasis-life-cycle.pdf

35) Mala-Maria S-B, Gina VS. A NOTE ON THE PRESENCE OF PHILOMETRID FISH PARASITES IN ROMANIA, WITH EMPHASIS ON Philometroides sanguineus (Rudolphi, 1819). AgroLife Scientific Journal. 2020; 9(2): 313-318.

36) Cholewiński M, Derda M, Hadaś E. Parasitic diseases in humans transmitted by vectors. Annals of Parasitology. 2015; 61(3): 137–157. doi: 10.17420/ap6103.01

37) Beugnet F, Clalvet Monfray K: Impact of climate change in the epidemiology of

Vector borne Diseases in domestic carnivores. Comparat. Immunol. Microbiol. and Infect. Dis. 2013; 36(6): 559 - 566.

38) Leite AB, Lima AR, Leite RB, Santos RV, et al. Assessment of family and neighbors of an individual infected with Wuchereria bancrofti from a non-endemic area in the city of MaceiÃ³, Brazil. Braz J Infect Dis. 2010; 14(2): 125-128.

39) Hyman P, Atterbury R, Barrow P. Fleas and smaller fleas: Virotherapy for parasite infections. Trends in Microbiology. 2013; 21(5): 215–220. doi:10.1016/j.tim.2013.02.006

40) Lambertucci JR. Acute schistosomiasis: clinical, diagnostic and therapeutic features. Revista do Instituto de Medicina Tropical de Sao Paulo. 1993; 35(5): 399–404.

41) Lackey EK, Horrall S. Schistosomiasis. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan.

42) https://www.cdc.gov/parasites/schistosomiasis/biology.html

43) Rinaldi G, Young ND, Honeycutt JD, Brindley PJ, Gasser RB, Hsieh MH.J Infect Dis. 2015; 211(6):861-869. PMID: 25240172. doi: 10.1093/infdis/jiu527.