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STUDY OF FLY BORNE PARASITES (BRACHYCERA) : A REVIEW

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Abstract

Fly borne parasites are the term of the relation between some species of flies and some species of parasites that transmitted by and cause damages, harmful and disease to the host. The transmission of pathogen may be biological or mechanical. This bibliographical survey reviewed more than106 references that deal with flyborne parasites biologically about 20 references; internally about 7 references; mechanically about 19 references. Some authors revealed to mix between internal and external transmission of parasites by flies That is, a group of flies (several species) transport a number of intestinal parasites (several species) without specialization; in about 7 references. Brachycera insects may parasites directly as Blowflies that show holometabolous life cycle and causing myiasis in human and animal as same. This important topic was served and recoded by 45 references. The current review discusses the direct and indirect effects of Brachycera, Diptera, (biting & non biting) flies and provides an overview of existing literature on the parasites they can transmit with their references.

Key words: Brachycera, non-biting flies, Protozoa, Diptera, flyborne.

Introduction

Brachycera is suborder of the order Diptera. It contains 120 families. The main characters of Brachycera are revealed by Sukontason *et al*., (2006) first: ultrastructure of adhesive device or the pulvilli. Second: pad- like structure between the tarsal claws of the legs through scanning electron microscopy.

Intestinal parasites and protozoa pathogen are carried by non-biting flies like house flies, blow flies and flesh flies. (Fetene & Worku, 2009 and Gatechew *et al*., 2007). Fly borne may be transmit the human protozoa (Graczyk *et al*., 2005); and animal metazoan parasites (Forster *et al*., 2009) mechanically, that related to the behavior of these flies which are predators or scavengers. Due to these characteristics, several studies have been aimed at the flyborne parasites and their related diseases. Forster *et al*., (2007) demonstrated the potential of these flies (synanthropic flies) like, *Musca, Sarcophaga, Calliphora, Fannia, Lucilia* and *Stomoxys*, as vectors for the transmission of pathogenic microorganisms.

The current review discusses the direct and indirect effects of Brachycera, Diptera, (biting & non biting) flies and provides an overview of existing literature on the parasites they can transmit with their references.

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Materials and Methods

This bibliographical survey reviewed more than106 references that deal with flyborne parasites in all the world by searching in different references as: books, Web of Sciences Master Journals, Google scholar, ResearchGate, Academia, Publon, ...ect.

The references were arranged in chronological order from oldest to newest in tables as the methods of transmission that biologically, internally, mechanically and mix between them; in addition of direct parasitism to the host.

Results and Discussion

This bibliographical survey reviewed more than106 references that deal with flyborne parasites from the oldest reference Owen, (1914) to the newest reference Rezende *et al*., (2019). These references were categorized according to the methods of transporting insects to parasites. When biologically about 20 references and about 14 species of parasites (Table 1); internally about 7 references, 15 species of parasites (Table 2); mechanically about 19 references, 22 species of parasites (Table 3). Some authors revealed to mix between internal and external transmission of parasites by flies That is, a group of flies (several species) transport a number of

Table 1: Parasites associated with Brachycera insects biologically.

Insect family	Insect genus	Insect species	Parasite group	Parasite genus	Parasite species	Reference
Glossinidae	*Glossina*	sp.	Protozoa	*Trypanosoma*	*brucei*	Owen, (1914)
				Trypanosoma	*congolense*	
				Trypanosoma	*vivax*	
Tabanidae	*Chrysops*	*discalis*	Protozoa	*Trypanosoma*	*theileri*	Francis & Mayne, (1921)
Glossinidae	*Glossina*	sp.	Protozoa	*Trypanosoma*	*rhodesiense*	Lamborn, (1933)
Tabanidae	*Tabanus*	*thoracinus*	Protozoa	*Trypanosoma*	*congolense*	Poulton,(1934)
Tabanidae	*Chrysops*	*distinctipennis*	Nematoda	*Leo*	*leo*	Weyer & Zumpt, (1941)
Glossinidae	*Glossina*	sp.	Protoza	*Trypanosoma*	*theileri*	Zumpt, (1949)
Tabanidae	*Tabanus*	*rubidus*	Protozoa	*Trypanosoma*	*evansi*	
Tabanidae	*Tabanus*	*striatus*	Protozoa	*Trypanosoma*	*evansi*	
	Haematopota	sp.	Nematoda	*Leo*	*leo*	
	Chrysops	*dimidiate*	Nematoda	*Leo*	*leo*	
	Chrysops	*silacea*	Nematoda	*Leo*	*leo*	
Muscidae	*Musca*	*domestica*	Protozoa	*Toxoplasma*	*gondi*	Wallace,
	Chrysomya	*megacephala*	Protozoa	*Toxoplasma*	*gondi*	(1971)
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Trypanosoma*	*evansi*	Kadhim ,(1980)
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidium*	*parvum*	Graczyk *et al*., (1999)
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidium*	*Parvumwairi*	Clavel *et al*., (2002)
				Cryptosporidium		
Muscidae	*Muscina*	*stabulans*	Protozoa	*Herpetomonas*	*mariadeanei*	Yoshida *et al*., (2007)
Muscidae	*Stomoxys*	*calcitrans*	Nematode	*Habronema*	*microstoma*	Traversa *et al*., (2008)
Muscidae	*Stomoxys*	*calcitrans*	Nematode	*Habronema*	*microstoma*	Yarmut *et al*., (2008)
Muscidae	*Stomoxys*	*Calcitrans*	Protozoa	*Trypanosoma*	*brucei*	Mohammed
Glossinidae	*Glossina*	*fuscipes*	Protozoa	*Trypanosoma*	*brucei*	*et al*., (2010)
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidium*	*parvum*	Hadi, (2011)
			Protozoa	*Cryptosporidium*	*muris*	
			Protozoa	*Cyclospora*	*cayetanensis*	
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Trypanosoma*	sp.	Hadi & Al Amery, (2012)
			Protozoa	*Babesia*	sp.	
			Protozoa	*Theileria*	sp.	
			Nematoda	Microfilaria	sp.	
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Trypanosoma*	*evansi*	Baldacchino *et al.*, (2013)
			Protozoa	*Trypanosoma*	*brucei*	
			Protozoa	*Trypanosoma*	*congolense*	
			Protozoa	*Besnoitia*	*besnoiti*	
			Protozoa	*Leishmania*	*tropica*	
			Nematoda	*Onchocerca*	sp.	
			Nematoda	*Dirofilaria*	sp.	
			Nematoda	*Habronema*	*microstoma*	
			Rickettsia	*Anaplasma*	*marginale*	
Calliphoridae	*Chrysomya*	*albiceps*	Nematoda	*Ascaris*	*lumriciodes*	Hadi, (2013a)
	Chrysomya	*megacephala*	Nematoda	*Strongyloides*	*stericoralis*	
			Nematoda	*Trichuris*	sp.	
			Cestoda	*Taenia*	sp.	
			Protozoa	*Cryptosporidium*	*parvum*	
			Protozoa	*Cryptosporidium*	*muris*	
			Protozoa	*Cyclospora*	*cayetanensis*	
Muscidae	*Musca*	*domestica*	Protozoa	*Toxoplasma*	sp.	Hadi, (2013b)
Tabanidae	*Ancala*	sp.	Protozoa	*Trypanosoma*	*congolense*	Taioe *et al*., (2017)
	Atylotus	sp.	Protozoa	*Trypanosoma*	*theileri*	

Insect family	Insect genus	Insect species	Parasite group	Parasite genus	Parasite species	Reference
	Haematopota	sp.	Protozoa	*Trypanosoma*	*brucei*	
	Philoliche	sp.	Protozoa	*Babesia*	*bigemina*	
	Tabanus	sp.	Protozoa	*Theileria*	*parva*	
			Protozoa	*Besnoitia*	sp.	
			Nematoda	*Leo*	*leo*	

Table 5: Brachycera insects parasites directly and cause Myiasis.

Insect family	Insect genus	Insect species	Reference
Calliphoridae	*Cochliomyia*	*hominivorax*	Zumpt, (1965)Khalil, (1986)Erdmann & Khalil, (1986)Paraluppi *et al*., (1996)Maldonado & Centeno, (2003)
Calliphoridae	*Chrysomya*	*bezziana*	Zumpt, (1965)Paraluppi *et al*., (1996)Maldonado & Centeno, (2003)
Calliphoridae	*Cochliomyia*	*macellaria*	Zumpt, (1965)Paraluppi *et al*., (1996)Maldonado & Centeno, (2003)
Calliphoridae	*Calliphora* *Chrysomya*	*vicinarufi facies*	Teich and Myers, (1986)
Calliphoridae	*Lucilia*	*caesar*	McClellan,(1932)
Calliphoridae	*Lucilia*	*cuprina*	Fine & Alexander, (1934)Paul *et al*., (2009)Tantawi *et al*., (2010)Kingu *et al*., (2012)Sanderman et al., (2014)
Calliphoridae	*Lucilia*	*illustris*	Leclercq, (1990)
Calliphoridae	*Lucilia*	*sericata*	Baer, (1931)Barnard, (1977)Sherman *et al*., (1995)Prete, (1997) Mumcuoglu *et al*., (2001)Chambers et al., (2003)Horobin *et al*.,(2003) Bexfi *et al*., (2004)Horobin *et al*.,(2005)Kerridge *et al*., (2005) Huberman *et al*., (2007a)Huberman *et al*., (2007b)Barnes *et al*., (2010) Ceøovský *et al*.,(2010)Kawabata *et al*.,(2010)Nigam *et al*., (2010) Ceøovský *et al*.,(2011)Kruglikova & Chernysh, (2011)Brown *et al*., (2012) Peck & Kirkup, (2012)Pritchard *et al*., (2012)Telford *et al*., (2012)
Calliphoridae	*Phormia*	*regina*	Baer, (1931)Horn *et al*., (1976)Robinson, (1933)Reames *et al*.,(1988)
Calliphoridae	*Protophormia*	*terraenovae*	Leclercq, (1990)Nuesch *et al.,* (2002)
Sarcophagidae	*Wohlfahrtia*	*nuba*	Grantham-Hill, (1933)Al-Misned, (2002a)
Sarcophagidae	*Wohlfahrtia*	*vigil*	Robert &Davies, (2002)
Sarcophagidae	*Sarcophaga*	*cistudinis*	Knipling, (1937)
Sarcophagidae	*Bercaea*	*cruentata*	Al-Misned, (2000)
Sarcophagidae	*Parasarcophaga*	*ruficomis*	Al-Misned, (2002b)
Sarcophagidae	*Sarcophaga*	*bullata*	Dacko, (2011)
Muscidae	*Musca*	*domestica*	Grantham-Hill, (1933)

intestinal parasites (several species) without specialization; in about 7 references, 15 species of parasites (Table 4).

Some of authors revealed to the internal transmission of parasites by flies which their gut contents were found to carry more intestinal parasites than the body surface of flies. The current study counted about seven references that deal about internally transition of parasites by flies, that arranged in chronological order from oldest to newest. Table 2.

Ingestion and defecation of parasites is one of the potential routes of contamination and maintained for a certain periods of time, (Crosskey & Lane, 1993). In addition of the mechanical transmission by the external flies' surface body was discussed by many authors and researchers as in Table 3. Another authors, revealed to mix the methods of transmission under the title: external and internal transmission parasites by different species of flies together that belong to different genus and different families as in Table 4. The synanthropic insects such as flies have feeding mechanisms and filthy breeding habits make them efficient vectors and transmitters of human enteric protozoan parasites, (Majewska, 1986). Flies have ability to transmit eggs, cyst and oocyst by regurgitation within 30 minute of ingestion, (Dipeolu, 1977).

And therefore, flies are concern the source of human food contamination with the pathogens they carry when landing on it.

The external surface of flies body contain hairs; It can transport parasites that stick to hair while standing on dirt, that called Mechanical transmission. (Graczyk *et al*., 2000). This type of transport has been the focus of attention of many researchers, and the current study

Table 2: Parasites associated with Brachycera insects biologically.

Insect family	Insect genus	Insect species	Parasite group	Parasite genus	Parasite species	Status of parasites	Reference
Muscidae	*Musca*	*domestica*	Nematode	*Ancylostoma*	*caninum*	larvae	Oyerinde, (1976)
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidium*	*parvum*	Oocyst	Thaddeus *et al*., (1999)
Muscidae	*Musca*	*domestica*	Protozoa	*Giardia*	*lambilia*	Cyst	Doiz *et al*., (2000)
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidium*	sp.	Oocyst	Al-Kailani *et al*., (2001)
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidium*	*parvum*	Oocyst	Hadi, (2011)
			Protozoa	*Cyclospora*	*muris*	Oocyst	
			Protozoa	*Cyclospora*	*cayetanensis*	Oocyst	
Sarcophagidae	*Sarcophaga*	*africa*	Nematode	*Trichuris*	sp.	Egg	Hadi, (2013c)
			Nematode	*Toxocara*	sp.	Egg	
			Nematode	*Ascaris*	*lumbrecoides*	Egg	
			Protozoa	*Cryptosporidium*	*parvum*	Oocyst	
			Protozoa	*Cryptosporidium*	*muris*	Oocyst	
			Protozoa	*Cyclospora*	*cayetanensis*	Oocyst	
			Protozoa	*Thieleria*	sp.	Schizont	
			Protozoa	*Trypanosoma*	sp.	promastigot	
Muscidae	*Musca*	*domestica*	Nematode	*Ascaris*	sp.	Egg	Khamesipour *et al*., (2018)
			Nematode	*Trichuris*	sp.	Egg	
			Nematode	Hookworms	sp.	Egg	
			Protozoa	*Entamoeba.*	sp.	Cyst	

counted 19 references in this area, Table. 3.

Brachycera insects may parasites directly as Blowflies that show holometabolous life cycle; Female blowflies can deposit up to 2000 eggs in the mucous membrane of eyes, lips, ears and open wound in the warm – blooded animals; these eggs hatch to larvae (maggots) show vermiform appearance and necrophagous habits, (Donato & Liria, 2016); that causing myiasis in human and animal as same. This important topic was served and recoded by many researchers as in Table 5.

Some authors revealed to the index D, in particular with the introduced modification, would offer a useful measure of the potential disease transmission of the blowflies as Maldonado & Centeno (2003), they recorded the most important species in their area: *Calliphora vicina*, *Chrysomyia megacephala*, *Phaenicia sericata*, *Sarconesia chlorogaster*, *Chrysomyia albiceps*, *Chrysomyia macellaria*, *Musca domestica* and *Phaenicia cluvia*; without aimed to the species of parasites that transmission, so this information could be used to focus the effort toward the control of proper species.

Some authors used recent technique for detection of parasites from flies, as polymerase chain reaction assay (PCR) like: Clavel *et al*., (2002) who detected of Cryptosporidium DNA in *Musca domestica* by polymerase chain reaction assay specific for the 18S rRNA gene of *C. parvum* and *C. wairi*. As well, Mohammed *et al*., (2010) who detected of two species : *Trypanosoma brucei gambiense* and *T. b. rhodesiense* in two species of flies: *Glossina fuscipes* and *Stomoxys calcitrans* using (PCR) technique.

Because of the importance of this topic on economic projects in the field of animal husbandry or poultry, the authors discussed ways to control of the species of synanthropic flies, (Rezende *et al*., 2019 and Caleffe *et al*., 2019). Moreover, some researchers have touched on biological control that more suitable than chemical pesticides since it leaves no residue in nature and is harmless to human health, (Parra, 2002).

Because of the importance of this topic on public health in all community, the author (Hadi, 2009) discusses the special way (Detergents) to control of the some species of insects as flies.

Conclusion

The current study reviewed the relationship between flies (Brachycera) and the parasites that transmitted biologically or mechanically from the

Table 3: Parasites associated with Brachycera insects mechanically.

Insect family	Insect genus	Insect species	Parasite group	Parasite genus	Parasite species	Reference
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Trypanosoma*	*evansi*	Bouet & Roubaud (1912)
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Leishmania*	*tropica*	Berberian, (1938)
Sarcophagidae	*Sarcophaga*	*libiali*	Cestoda	*Echinococcus*	*granulosus*	Heinz & Brauns, (1955)
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Besnoitia*	*besnoiti*	Bigalke, (1968)
Muscidae	*Musca*	*domestica*	Protozoa	*Giardia*	*lambilia*	Kasprzak and Majewska, (1981)
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidum*	*parvum*	Sterling *et al*., (1987)
				Giardia	*lambilia*	
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Trypanosoma*	*evansi*	Mihok et al., (1995)
				Trypanosoma	*vivax*	
				Trypanosoma	*brucei*	
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Trypanosoma*	*evansi*	Sumba et al., (1998)
				Trypanosoma	*congolense*	
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidum*	*parvum*	Graczyk *et al*., (2000)
Muscidae	*Musca*	*domestica*	Protozoa	*Entamoeba*	*histolytica*	Pai *et al*., (2003)
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidum*	*parvum*	Graczyk *et al*., (2005)
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Besnoitia*	*besnoiti*	Lie'nard *et al*., (2010)
Muscidae	*Musca*	*domestica*	Protozoa	*Entamoeba.*	*histolytica*	Hadi, (2011)
			Protozoa	*Entamoeba*	*coli*	
			Protozoa	*Iodamoeba*	sp.	
			Nematoda	*Ascaris*	*lumbrecoides*	
			Nematoda	*Ascaridia*	sp.	
			Nematoda	*Strongyloides*	sp.	
			Nematoda	*Habronema*	sp.	
Muscidae	*Stomoxys*	*calcitrans*	Protozoa	*Trypanosoma*	*evansi*	Baldacchino *et al.*, 2013
			Protozoa	*Trypanosoma*	*vivax*	
			Protozoa	*Trypanosoma*	*brucei*	
			Protozoa	*Trypanosoma*	*cogolence*	
			Protozoa	*Besnoitia*	*besnoiti*	
			Protozoa	*Leishmania*	*tropica*	
			Nematoda	*Habronema*	*microstoma*	
Calliphoridae	*Chrysomya*	*albiceps*	Nematoda	*Ancylostoma*	*duodenal*	Hadi, (2013a)
Calliphoridae	*Chrysomya*	*megacephala*	Nematoda	*Ascridia*	sp.	
			Nematoda	*Ascaris*	*lumriciodes*	
			Nematoda	*parascaris*	*equirum*	
			Nematoda	*Strongyloides*	*stericoralis*	
			Nematoda	*Strongylus*	sp.	
			Nematoda	*Trichostrongylus*	sp.	
			Nematoda	*Toxocara*	*canis*	
			Cestoda	*Taenia*	sp.	
			Protozoa	*Entamoeba*	sp.	
			Protozoa	*Iodomaeba*	*butschlii*	
Muscidae	*Musca*	*domestica*	Protozoa	*Entamoeba*	*histolytica*	Nwangwu *et al*., (2013)
			Nematoda	Hookwarm	*sp.*	
			Nematoda	*Ascaris*	*lumbrecoides*	
			Nematoda	*Trichuris*	*trichiura*	
Fanniidae	*Fannia*	*scalaris*	Protozoa	*Entamoeba*	*coli*	Ogunniyi *et al.*, (2015)
Muscidae	*Musca*	*domestica*	Protozoa	*Entamoeba*	*histolytica*	
Muscidae	*Calliphora*	*stygia*	Cestoda	Hookwarm	sp.	
	Calliphora	*vicina*	Nematoda	*Strongyloides*	*stercolaris*	

Insect family	Insect genus	Insect species	Parasite group	Parasite genus	Parasite species	Reference
	Lucilia	*illustris*	Nematoda	*Ascaris*	*lumbrecoides*	
	Tricholioprocta	*hardyi*	Trematoda	*Fasciola*	*hepatica*	
	Sarcophaga	*haemorrhoidalis*	Cestoda	*Taenia*	*sp.*	
	Musca	*vetustissima*	Nematoda	*Enterobius*	*vermicularis*	
	Hermetia	*illuscens*	Cestoda	*Echinostoma*	*sp.*	
Muscidae	*Musca*	*domestica*	Acari	*Macrocheles*	sp.	Rezende
			Acari	*Fuscoropoda*	sp.	*et al*., (2019)
Sarcophagidae	*Sarcophaga*	*africa*	Trematoda	*Paramphistomum*	sp.	Hadi, (2013c)
			Nematode	*Ascaris*	*vitulorium*	
			Nematode	*Strongyloides*	*westri*	
			Cestoda	*Taenia*	sp.	

literatures and references. Many groups of parasites were recording as Protozoa, Nematoda, Cestoda, Trematoda and Acari; In addition of parasitism of some species of flies directly attached by their larvae and cause Myiasis.

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Table 3: Parasites associated with Brachycera insects mechanically.

Insect family	Insect genus	Insect species	Parasite group	Parasite genus	Parasite species	Reference
Calliphoridae	*Chrysomia*	*megacephala*	Nematoda	*Ancylostoma*	*duodenale*	Harris & Down, (1946)
			Nematoda	*Trichuris*	*trichiura*	
			Nematoda	*Ascaris*	*lumbrecoides*	
			Cestode	*Hymenolepis*	*diminuta*	
Muscidae	*Musca*	*domestica*	Nematoda	*Toxocaris*	*leonine*	Goddeeris, (1980)
			Nematoda	*Ancylostoma*	*caninum*	
			Nematoda	*Trichuris*	*trichiura*	
			Cestode	*Hymenolepis*	*diminuta*	
			Cestode	*Dipyledium*	*caninum*	
			Cestode	*Taenia*	*hydatigena*	
			Cestode	*Taenia*	*pisiformis*	
			Cestode	*Taeniarhynchus*	*saginatum*	
Calliphoridae	*Chrysomya*	*megacephala*	Nematoda	*Ascaris*	*lumbrecoides*	Sulaiman *et al*., (1988)
Calliphoridae	*Chrysomya*	*rufifacies*	Nematoda	*Trichuris*	*trichiura*	
Sarcophagidae	*Sarcophaga*	*sp.*	Nematoda	*Necator*	*americanus*	
Muscidae	*Lispe*	*leucospila*				
Calliphoridae	*Lucilia*	*cuprina*				
Muscidae	*Musca*	*sorbens*				
Muscidae	*Musca*	*domestica*	Protozoa	*Cryptosporidum*	*parvum*	Szostakowska *et al*., (2004)
			Protozoa	*Giardia*	*lamblia*	
Muscidae	*Musca*	*domestica*	Protozoa	*Chilomastrix*	*mesnili*	Nmorsia *et al*., (2006)
Fanniidae	*fannia*	*scalaris*	Protozoa	*Cryptosporidum*	*parvum*	
Calliphoridae	*Chrysomya*	*putoria*	Protozoa	*Entamoeba*	*histolytica*	
Muscidae	*Ophyra*	*leucostoma*	Protozoa	*Isospora*	*belli*	
			Nematoda	*Ascaris*	*lumbricoides*	
			Trematoda	*Dicrocoelium*	*hospes*	
			Nematoda	*Enterobius*	*vermicularis*	
			Nematoda	*Hookworm*	*sp.*	
			Nematoda	*Strongloides*	*stecoralis*	
			Nematoda	*Trichuris*	*trichiura*	
Calliphoridae	*Chrysomya*	*rufifacies*	Nematoda	*Ascaris*	*Lumbrecoides*	Getachew *et al*., 2007
Muscidae	*Musca*	*domestica*	Nematoda	*Trichuris*	*trichiura*	
Muscidae	*Musca*	*sorbens*	Cestoda	*Hymenolepis*	*nana*	
Calliphoridae	*Lucilia*	*cuprina*	Cestoda	*Taenia*	*sp.*	
Sarcophagidae	*Sarcophaga*	sp.	Nematode	*Strongyloides*	*stercoralis*	
Calliphoridae	*Calliphora*	*vicina*	Protozoa	*Entamoeba*	*histolytica*	
Sarcophagidae	*Wohlfahrtia*	sp.	Protozoa	*Entamoeba*	*dispar*	
			Protozoa	*Entamoeba*	*coli*	
			Protozoa	*Cryptosporidium*	*sp.*	
			Protozoa	*Giardia*	*lamblia*	
Muscidae	*Musca*	*domestica*	Nematoda	*Ascaris*	*lumbrecoides*	Fetene & Worku, (2009)
Muscidae	*Musca*	*sorbens*	Nematoda	*Trichuris*	*trichiura*	
Calliphoridae	*Chrysomya*	*rufifacies*	Nematoda	*Strongyloides*	*stercoralis*	
Calliphoridae	*Chrysomya*	*bezziana*	Cestoda	*Hymenolepis*	*nana*	
Calliphoridae	*Lucilia*	*cuprina*	Cestoda	*Taenia*	sp.	
Calliphoridae	*Calliphora*	*vicina*	Protozoa	*Entamoeba*	*histolytica*	
Sarcophagidae	*Wohlfahrtia*	*magnifica*	Protozoa	*Entamoeba*	*dispar*	
			Protozoa	*Entamoeba*	*coli*	
			Protozoa	*Cryptosporidium*	sp.	
			Protozoa	*Giardia*	*lamblia*	

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