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Review Article

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Review on Importance, Diagnosis and Control Methods of Ectoparasites

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Abstract

Ectoparasites are highly adapted group of organisms that inhabits external body surfaces of the vertebrate hosts. They affect animals to different degrees depending on nutritional status, immunological condition, body condition, age, sex of the host and other factors such as season, intensity of the parasites, and rearing system. Etoparasites are important vectors of protozoan, bacterial, viral and rickettsial diseases. Ectoparasite infestation of domestic animals is of great economic and social importance inflicting direct harms such as blood loss, myiasis, skin inflammation, pruritus, toxic and allergic responses, and annoyance and indirect harms such as disturbance, self-wounding, and social nuisance to the host. Ectoparasite infestations can be diagnosed by several methods. These include; skin scrap examination, hair examination, acetate strip examination, biopsy and histopathology, serological diagnosis, faecal examination and collection of free living stages of ectoparasites. Skin scrap and acetate tape strap method are the most commonly used techniques. It is of great importance to control ectoparasites as they are nuisance to both the attendants and the animals. It can be done by using methods such as chemical control, biological control, immunological control, modelling and forecasting, sterile insect technique, using of resistant animals and integrated parasite management. However itis largely based on chemicals even thoughthe alternative control methods exist which lead to emergence of on-going resistance to the chemicals and contamination of the environment that can consequently pose harm to living beings. Therefore it is important to identify and to use appropriate diagnostic and control methods to overcome the problem.

Keywords: Biopsy, ectoparasites, histopatholoy, immunological, infestation**,** myiasis

1. Introduction

Ectoparasites are diverse and highly adapted group of organisms that inhabits the external body surfaces of vertebrates or integument of its host and feeds on dead skin cells, tissue fluids, blood, and/or lymph (Hanafi-Bojd *et al*, 2007). Ticks and mites are important ectoparasites because of their voracious blood feeding activity and their acting as a vectors of various diseases causing agents both in human and livestock. Ectoparasites may have variety of direct and indirect effects on their hosts (Petney *et al*., 2007; Ohaeri and Ugwu, 2011)**.** They can affect the animals to different degrees based on nutritional status of the host, its immunological condition and parasite intensity. In extreme cases, the parasites can also lead to death of host animals (Urquhart *et al.*, 1996).

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The presence of external parasites on the host is termed as infestation. Presence of external parasites on the host is termed as infestation. The association between arthropod ectoparasites and vertebrate hosts may take on variety of forms. They may live permanently on their host or may occupy the host's nest/immediate environment and visit the body of the host periodically. In either of these cases, there is a close dependency on the host for various life sustaining resources (González *et al*., 2004; Gross *et al*., 2005).

Despite a benefit of close association with the host, there is considerable variation in the amount of time spend on the host by various types of ectoparasites. Some ectoparasites including many species of lice are highly dependent on the host live having continuous association with host throughout their life cycle (Wall and Shearer, 2001). However, majority of ectoparasites have only intermittent contact with their hosts and are free-living for the major portion of their life cycles. Many species of mite are highly host specific in that only one host species is exploited and in some instances, the parasites can exist only on one defined area of the host. There are also other species that have ability to exploit a wider range of hosts (Desta, 2004).

The host provides a number of important resources for the ectoparasites. Most vitally, the host supplies different source of food which may be blood, lymph, tear/sweat or the debris of the skin, hair or feather. In addition to this, the host also provides the environment on which the parasites live and transportation from place to place and from host to host for the parasite (Wall and Shearer, 1997).

Ectoparasitic infestation can be diagnosed either directly or indirectly. Direct diagnosis involves identification of potentially infested animal based on the presence of clinical signs, finding of active lesion, isolation and identification of the causal ectoparasite. If the diagnosis is not obvious from the history and clinical examination, several diagnostic laboratory tests can be used to assist in making probable etiological diagnosis and to provide a rational basis for therapy. The tests selected should be based on the most likely diagnostic possibilities and their cost effectiveness (Houston *et al*., 2000). Indirect diagnosis involves detecting the presence ofectoparasite by-products such as feacesor specific antibodies produced by the host in response to exposure (Bates, 2012).

In making a diagnosis of ectoparasitic infestation it is important to have an idea of the parasite involved and its life cycle. This can be achieved by direct collection of the parasite or its faeces. Permanent ectoparasites such as lice can easily be found attached to the skin, but visiting parasites such as biting flies are found on the skin for only a short period of time and diagnosis is often made by implication (Wall and shearer, 1997; Desta, 2004). A number of different methods are available to prevent and/or treat ectoparasites (Agrawal and Gupta, 2010).Chemical control is still the basic procedure for controlling most ectoparasites though various methods are being developed to act in addition to or in synergy with these products to enhance the efficacy and reduce the adverse effects of insecticides (Cuisance *et al*., 1994).

Biological control using pathogens has also received growing recent attention(Rose and Wall, 2009). Genetic control (sterile insect technique) is often considered as a part of biological control. However, it does not use other living organisms or changes in biotype to destroy the parasites. It is very specific, non-pollutant and has no adverse effect on other animals (Itard, 1989). Vaccination is also very important ectoparasite control method. Commercial tick vaccines for cattle based on the *Boophilus microplus* Bm86 gut antigen have proven to be a feasible tick control method that offers a cost-effective, environmentally friendly alternative to the use of acaricides (Pruett, 2002). Due to their effects, the control of livestock ectoparasites is therefore of great importance from the animal health and the economic point of view. To control the parasites understanding the diagnostic and control methods are very important.

Therefore, the objective of this seminar paper is:

- To give an overview of control and diagnostic methods of ectoparasites

2. Literature review

2.1. Classification of ectoparasites of veterinary importance

Arthropods having veterinary importance are divided into two major groups namely the Insecta and the Arachnida classes. Within class arachnida, mites and ticks are of the most important ectoparasites and class insecta includes lice, flies, fleas and bugs (Fisher, 2007; Williams, 2010). Most ectoparasites are temporary or permanent parasites, found either in or on the skin, with the exception of some flies whose larval stages may be found in the somatic tissues of the host animals (Urquhart *et al*., 1997).

Veterinary ectoparasites can be classified according to the body site they occupy, the rigour of the host association and the duration of host association. Thus, ectoparasites may be internal, burrowing into the host tissues/living in the body cavities or external living on the host skin for various periods (Williams, 2010). The rigour of host association includes facultative associations and obligatory associations. In case of facultative associations, the parasite can survive and develop in absence of hosts while in the obligatory association, hosts are absolute requirements for the parasite. The duration of association between the parasite and host can vary considerably some being permanently dependent on host and others only visiting the host for short period of times (Taylor *et al*., 2007).

2.2. Factors affecting prevalence of ectoparasites

The prevalence of livestock ectoparasites is the result of a complex interaction of factors such as parasite and host abundance, host susceptibility, climate and, critically, farmer husbandry and intervention strategies, all of which change seasonally in space and time (Wall *et al*., 2011).It can vary depending on factors such as age, season, sex, nutritional status, rearing system, body condition and in some species coat colorof the animals. Ectoparasite infestation is more prevalent in older animals; in female animals; in animals with poor nutrition; in animals with poor body condition; in free range system and in summer season (Fentahun *et al*., 2012; Onu and Shiferaw, 2013). Color affects the occurrence of ectoparasites in dogs significantly in that dogs with dark or black hair coat being more exposed than those with white or light coat colors(Bahrami and Delpisheh, 2010; Rony *et al.*, 2010).

2.3. Importance of ectoparasites

Ectoparasites could live on, puncture, burrow or attach onto the surface of their host causing discomfort, annoyance, weight loss, loss of condition, reduction in milk production and irritation of the skin, which subsequently leads to ulceration and secondary infections. These result in negative effect on animal welfare, animal husbandry, and general quality of animal production (Colebrook & Wall, 2004; Uttah *et al*, 2012). Ectoparasites play an important role in the life of domestic ruminants; not only because of the damage they cause to them directly, but also because of the important diseases they transmit when they live and feed on the animals (Onu and Shiferaw, 2013).Thus, ectoparasitic infestation is one of the major veterinary problems affecting livestock industries in many parts of the world (Willadsen, 2006).

Ectopararasites commonly ticks, mites, lice and ked are important parasites because of their disease transmission, blood feeding habit and skin damage in most of the livestock population (Tadesse *et al*., 2011). Ectoparasites of ruminants cause blood loss and very heavy infestations result with severe anaemia. Moreover, they are the most important vectors of protozoan, bacterial, viral and rickettsial diseases (Radostits *et al*., 2007). All ectoparasites cause intense irritation to the skin, the extent depending on the parasite involved (Fentahun *et al*., 2012).

2.3.1. Damage to host

Ectoparasites have significant impact on the health, well-being and productivity of their vertebrate hosts. This impact can be either direct through tissue damage and blood loss or indirect, through their role as mechanical and biological vectors of viral, bacterial, protozoa and helminthpathogens that can cause considerable economic and welfare problems (Desta, 2004; Radostits *et al*., 2007). According to Wall and Shearer (2001), these direct and indirect harms caused by ectoparasites on the host includes; blood loss, myiasis, skin inflammation and pruritus, toxic and allergic responses (caused by antigen and anticoagulant in the saliva of blood feeding arthropod), disturbance, self-wounding, social nuisance and transmission of pathogens acting as vector.

In general, ectoparasites can debilitate domestic animals by causing anaemia, detrimental immune reactions, irritability, dermatitis, skin necrosis, low boy weight gains, secondary infection, focal haemorrhages, blockage of natural orifices such as ears, inoculation of toxins and occasionally exsanguination (Hopla *et al.*, 1994).

2.3.2. Economic importance

Ectoparasites of ruminants cause serious economic losses through mortality of animals, decreased production, down grading and rejection of hide and skin (Tefera and Abebe, 2004; Kebede, 2013; Onu and Shiferaw, 2013). Ectoparasitic skin diseases of domestic ruminants caused by lice, sheep keds, ticks and mange mites are among the major diseases that result serious economic loss. Losses caused by these parasites result from exsanguination, toxicosis, arthropod-borne diseases, and reduced animal production and performance. Parasitic infestations often lead to decreased appetite. The reduced amount of feed ingested by parasitized animals may also be digested less efficiently than by non-parasitized animals. In addition, the presence of parasites may increase metabolic rate, reducing the amount of metabolizable energy available for production (Byford *et al*., 1992).

2.4. Diagnosis of ectoparasite infestation

2.4.1. Hair examination/Trichography

Trichography is useful diagnostic method used when sites close to the eyes are affected or the lesions are very painful. Positive hair plucks may render skin scrapings unnecessary in areas that are difficult to scrape such as the eye lids, peri-ocular area, muzzle or feet. However, only a positive result is diagnostic and negative result necessitates skin scrapings (Mueller, 2005). Small number of hairs can be collected by grasping with the finger tips or rubber covered hemostat forceps and epilating completely or by coat brushing. Then, the hairs are placed on a microscopic slide, mounted in a mineral oil such as liquid paraffin, covered with cover slip and examined under low power objective microscope for evidence of ectoparasites (Houston *et al*., 2000; Desta, 2004). Eggs of some parasites such as lice and *Cheyletiella spp* may be found attached to the hair shaft and adult ectoparasites such as lice and various mites, may be found attached to the hair shaft. The hair bulb and lower third of the hair shaft should be examined for evidence of follicular mite *Demodex*(Wall and Shearer, 2001).

2.4.2. Skin scraping

Skin scraping is used primarily to determine presence or absence of mites (Kahn, 2010). It provides a sample of skin elements for diagnosis of ectoparasites. Before the skin is scraped, the hair should be clipped (Houston *et al*., 2000) and the scrap should be taken from multiple sites of the edge of the lesions by holding a scalpel blade or other sharp instrument at a right angle to the skin and scraping off the outer surface of the skin. For mite species that burrow into the skin, the scraping must be deep enough to cause a small amount of blood to ooze from the site. The presence of blood at the site of scraping indicates that the depth is adequate to collect any infesting ectoparasites (Anderson *et al*., 2002). A drop of mineral oil or glycerol can be placed on the blade to help hold the skin scrapings during the procedure. Skin scrapings that contain dead mites, large amounts of skin flakes/scabs or large amounts of hair should be processed further. It has to be digested by 10% KOH, centrifuged and examined (Smith and Sherman, 1994; OIE *Terrestrial Manual*, *2*013).

There are two types of skin scrapings which are superficial and deep. Superficial skin scraping is used to identify surface mites such as *Cheyletiella*, *Chorioptes* and sometimes short body *Demodex*mites (Atopica, 2010). It provides information from the surface of the epidermis and it does not cause capillary bleeding (Kahn, 2010). Deep skin scraping is useful in the diagnosis of burrowing mites such as *Sarcoptesscabiei* and *Demodex* spp., especially long body *Demodex* mites (Wall and Shearer, 1997). It collects material from within the hair follicle (Kahn, 2005). For deep skin scraping, firmly lifting and squeezing the skin before taking the scraps is important. Sampling should result in capillary bleeding. For both superficial and deep skin scrapping methods, the sample scrapped is mixed with a drop of paraffin oil on a glass slide, a cover slip is applied and the slide is examined under 4X or 10X magnification power(Coyner, 2011).

2.4.3. Acetate strip examination/acetate tape preparation/cellophane tape preparation

Acetate tape impression is used to examine superficial ectoparasites (Houston *et al*., 2000). It is important diagnostic technique to demonstrate the presence of lice or mites that live primarily on the surface of skin like *Cheyletiella spp*. It is also useful for short-bodied *Demodex* mites and occasionally for *Sarcoptes* mites as a larger surface area can be sampled very quickly (Mueller, 2005).

A direct impression technique uses clear sticky tape to collect epidermal debris from the surface of the skin. To do the test, the tape is pressed several times sticky side down onto the skin; a ribbon of mineral oil is placed on a glass slide; the adhesive surface of the tape is placed on a glass slide and examined under microscope (Hendrix, 1998; Mueller, 2005).

2.4.4. Collection of free living ectoparasites

Mobile free living mites, ticks and fleas can be extracted from bedding, nests and fecal material by careful search or by shaking the material through sieves of decreasing mesh-size. They may also be swept from vegetation using a hand net. However, the most commonly used method for collecting ticks is a blanket drag. This is a woolen blanket or cotton towel about1m square, attached to a bar at one side. The drag is pulled across low lying vegetation and questing ticks attached to the cloth (Wall and Shearer, 2001).Adult flies can be collected using hand nets, usually consisting of a deep bag of fine mesh netting with a circular wire stiffened opening on a pole. Flies may be picked off as they visit their host or baits of rotting carrion or feces, using either a hand net or more simply by inverting a glass tube over them as they feed or rest (Desta, 2004).

2.4.5. Biopsy and histopathology

Skin biopsy is useful diagnostic technique used to identify lesions consistent with ectoparasites. The biopsy specimens should be obtained from primary lesions and ideally should include the junction of normal and abnormal skin tissue. Areas with minimal skin tension should be chosen (Anderson *et al*., 2002). Biopsy samples can be collected for histopathology, which is particularly useful where the parasites are found deep in the skin (Fisher, 2007). Although these indirect techniques are not as useful as direct identification for the diagnosis of ectoparasite dermatosis, they may be valuable in some circumstances such as insect and arthropod bite lesions (Wall and Shearer, 1997).

2.4.6. Serological diagnosis

Enzyme linked immunosorbent assay (ELISA) techniques have been developed to monitor *Psoroptes* infestations of sheep, cattle and non-domesticated animals, but none is in routine use. However, there are ELISAs in routine use by researchers for detection of *Sarcoptesscabiei* (OIE, 2002). Researchers have shown that *Sarcoptesscabiei* and *Psoroptesovis* infestations cause measurable specific antibody responses in hosts, namely pigs, sheep, dogs, and camels (Lower *et al*., 2001; Falconi *et al*., 2002; Lowenstein *et al*., 2004). This makes possible serological detection of sarcoptic and psoropticmanges. Recombinant antibodies for *S. scabies* and *P. ovis*are commercially available and they seem to give more consistent test results than whole mite preparations (Wells *et al*., 2012; OIE, *2*013).

2.4.7. Faecal examination

Faecal examination can also be used to diagnose ectoparaasites even though it is most of the time not practical. Animals that chew or lick skin may have ectoparsites such as *cheyletiella* and *Sarcoptes* species in their faeces (Houston *et al*., 2000).

2.5. Control of ectoparasite infestations

2.5.1. Chemical control

The control of ectoparasite is largely based on the use of chemicals (Natala and Ochoje, 2009). Three main chemical groupings have been used as the basis for the common ectoparasiticides. These include organochlorines, organophosphates and synthetic pyrethroids. Other groups such as carbamates (primarily in poultry), formamidines, triazines, benzyl benzoate and natural plant products like pyrethrin can also be used (Taylor *et al*., 2007). The avermectins and milbemycins have been shown to have a high activity against a range of ectoparasites and are increasingly used for control of the parasites. There are also compounds which affect the growth and development of insects. These compounds are called Insect growth regulators (IGRs). Based on their mode of action they can be divided into chitin inhibitors, chitin synthesis inhibitors and juvenile hormone analogues. Insect growth regulators are widely used for flea control in domestic pets and for blowfly control in sheep but have limited use in other host species (Urquhart *et al*., 1997).

Table1: Major drugs used for ectoparasites control (Foreyt, 2001; ESGPIP, 2010).

Generic name	Trade name	Targeted Parasites	Application
Organophosphates			
Chlorfenvinphos	Supona	Ticks, lice, flies, mites	Dip, spray
Chlorpyrifos	Dursban 26 E	Ticks, lice, horn flies	Dip, spray, pour on, dust, back rubber
Coumaphos	Co-Ral/ Asuntol	Fleas, flies, keds, lice, ticks,cattle grubs, mites	Dip, spray, pour on, dust, feed additive
Diazinon	Neocidol	Flies, lice, keds, ticks	Dip, dust, spray
Crufomate	Roulene	Flies, lice, mites, ticks	Dip, spray, pour on
Dichlorvos	Vapona	Flies	Resin granules, resin strips, spray
Dioxathion	Delnav	Flies, keds, lice, ticks, mites	dip, spray, back rubber
Fenchlorphos	Korlan-ronnel	Flies, lice, mites, ticks	Dust, oral, spray, back rubber, pour on
Fenthion	Tiguvon, Baytex	Cattle grubs, keds, lice, bow flies	Spray, pour on, spot on

Malathion	Cythion	Fleas, flies, lice, keds, mites, ticks	Dip, dust, spray
Phosmet	Prolate	Flies, lice, cattle grubs, ticks	Spray
Tetrachlorvinphos	Rabon-stirophos	Fleas, flies, lice, ticks	Dust, spray
Carbamates			
Carbaryl	Sevin, Vioxan	Fleas, flies, lice, mites, ticks	Dip, dust, spray
Organochlorines			
Lindane		Flies, keds, lice, mites, ticks	Dust, spray, pour on, back rubber
CHC	Hexachloran	Mites, lice, ticks, flies	
Methoxychlor	Marlate	Flies, keds, lice, mites, ticks	Dust, spray, back rubbe r
Toxaphene		Flies, keds, lice, mites, ticks	Dip, dust, spray, back rubber
Diamidines			
Amitraz	Mitaban, Baam,	Ticks, mites, lice	Dip, spray
Pyrethrins and Pyrethroids			
Cypermethrin	Curatick	Ticks, horn, face flies	Dip
Fenvalerate	Ectrin	Flies, ticks	Spray, car tags
Permethrin	Ectiban/Expar	Flies, lice, mites, ticks	Dip, spray
Deltamethrin	Cooper	Flies, tsetse fly	
IGR			
Methoprene	IGR	Flies	Feed additive
Avermectins			
Doramectin	Dectomax	Sucking lice, grubs, Psoroptes, *Sarcoptes*	SC or IM (0.2 mg/kg)
Eprinomectin	Ivomec-Eprinex	Lice, horn fly, *Sarcoptes*, *Chorioptes*, grubs	Pour on (0.5 mg/kg)
Ivermectin	Ivomec	Lice, mites, cattle grubs	Oral, SC/ IM (0.2 kg/kg)

2.5.2. Ecological control (physical, barriers, trapping)

Physical control refers to non-chemical, non-biological methods that make the environment unsuitable for the entry or survival of ectoparasites. These usually work by modifying some aspects of the parasites environment, on or off the host, either to increase ectoparasite mortality or to reduce its fecundity. In general, these techniques serve to reduce or suppress parasite populations, rather than bring about their total elimination (Wall and Shearer, 2001).

Most of physical control methods may be classified as passive (e.g. fences, trenches, traps, inert dusts, and oils) or active (e.g. mechanical, impact, and thermal treatments)**(**Gullan and Cranston, 2005).

Removing of dung regularly from pasture or feed lots, removal of moist bedding and straw, food wastes, heaps of grass cuttings, pasture spelling and rotational grazing may significantly reduce abundance. For example, effective manure management and disposal can reduce fly populations by as much as 50% in cattle feedlots (Bram, 1994).Physical barriers such as fine mesh screens on window, plastic strips on milking parlour doors or blow tassels can also be used for protection from flying insects.

Traps have been developed for control of *haematobiumirritans*, stable flies, face flies, tsetse flies, screw worms (*C. hominivorax*) and sheep bow flies (*L.sericata and L. cuprina*) (Wall and Shearer, 1997; Kahn, 2010). A screw worm adult suppression system (SWASS) has been used to attract *C. hominivorax* in North Africa (Wall and Shearer, 1997, 2001).

2.5.3. Biological control

Biological control involves the use of natural control agents such as predators, pathogens and competitors to reduce abundance of the target vector (Otranto and Wall, 2008). The use of biological pathogens like nematodes, bacteria, fungi and viruses offer particularly interesting approach to ectoparasite management (Hogsette, 1999). For example, the common bacterium, *Bacillus thuringiensis* has been used on sheep in small-scale field tests for the prevention of blowfly strike in Australia and for other ectoparasites including lice of poultry, sheep body lice and buffalo fly. However, so far the use of *B. thuringiensis*has not achieved wider field application. House fly and stable fly control with parasitic wasps on feedlots has been also shown to be highly effective (Gough *et al*., 2002; Wall, 2007).

A fungal pathogen, *Metarhizium anisopliae* (Van der Geest*et al.*, 2000; Briggs *et al*., 2006) and entomopathogenic nematodes such as *Steinernema carpocapsae*, *Steinernema riobrave*, *Steinernemafeltiae* and *Heterorhabditisbacteriophora (*James *et al*., 2010) are also used for control of *Bovicolabovis* and *Bovicolaovis* respectively.

2.5.4. Immunological control/ vaccination

Vaccines comprising parasite gut wall antigens showed greatest promise for ticks. Vaccinated host develops antibody (Ab) directed against the parasite's gut wall. The parasite ingests theAb in the blood and dies as a result of the Ab binding to intestinal epithelium. However, no effective commercially available vaccine has been developed to date (Wall and Shearer, 2001).

A recent advance of great importance has been the production of a promising vaccine against *Rhipicephalus (Boophilus) microplus.* The immunizing agent is concealed tick antigen derived from crude extract of partially engorged adult female ticks. It stimulates the production of Ab that damages tick gut cells or drastically reduce their reproductive potential (Kahn, 2010).

Tick vaccines containing recombinant Bm86 antigen preparations were registered in several Latin American countries and Australia. Use of these commercial vaccines in the field has been reported in Cuba, Australia, Mexico, Colombia and Brazil (de la Fuente*et al*., 2007).Various types of vaccines are being developed for use against ectoparasites. They have been used for control of ticks (*B. microplus and Boophilus annulatus*), mites (*psoroptes ovis)*, cattle grubs (*Hypoderma lineatum and Hypoderma ovis*) and hematophagous flies (buffalo fly, *Haematobia irritants exigua*, *Lucilia cuprina* and *Chrysomia bezziana*)(Pruett, 2002).

2.5.5. Modelling and forecasting

Given the complexity of the multiple effects of climate on parasite, hosts and husbandry patterns, often the only way to attempt to capture this intricacy and predict future disease patterns with rigor, is through the use of models (Wall *et al*., 2011). Models may be of particular value in predicting seasonal patterns of abundance of particular ectoparasites andtheir economic consequences. The development of such predictive models may allow veterinarians, entomologists and farmers to use ectoparasiticides prophylactically (Wall and Shearer, 2001).

2.5.6. Sterile male release technique

Sterile insect technique is more effective control method when the target population density is very low (Morel, 1989).This technique involves sterilization of individuals with a natural population for release using chemo-sterilants or ionizing radiations (Itard, 1989). Huge number of pupae are mass reared on semi-artificial media and exposed to the sterilizing effect of cobalt 60. The resulting sterile male flies are released over large areas where they compete with wild males for available females (Radostits *et al*., 2007). A large number of sterilized males should be released in given area so that they have a higher probability than normal males for mating with the female flies. When a female is inseminated by the sterile male, the spermatozoid fail to pair with ovules and the female can no longer reproduce (Itard, 1989;Radostits*et al*., 2007).

3. Conclusion and Recommendations

Ectoparasitism is recognized as an important public health threat affecting both animal and human welfare. The presence of ectoparasites in/on animals creates a multitude of health risks to both the host animals and to the humans. They cause direct and indirect harms to the hosts which can pose severe economic losses. Thus, it is of great importance to control ectoparasitesas they are nuisance to both the attendants and the animals. Accurate diagnoses of the type of ectoparasites that are infesting the animals with an understanding of the period of proliferation are essential for the effective control. Skin scraping and acetate tape preparations are the most common diagnostic methods of ectoparasites. Control of ectoparasites primarily rests on the use of chemicals Ectoparasiticides are easy to apply, long lasting, inexpensive, efficacious, rapidly suppress the parasites population and do not require area wide application for protection. However, this can result in ongoing problems of resistance to the chemicals, residues in the animals and the environment, environmental contamination and undesirable effects on human health. In contrast, biological control requires more intensive management and producer education, does not rapidly suppress the pest population and must be applied area wide to ensure continued parasite control. Sterile insect technique is very specific, non-pollutant and has no adverse effect on other animals. Integrated control and new technologies, such as the development of vaccines both against ectoparasites and the disease they transmit showed some hope for the future to reduce the frequency of insecticide treatment and delay the development of resistance. Integrated ectoparasite control reduces side effects of ectoparaciticides by applying integration of the control methods. At present, non-insecticidal techniques tend to be relatively expensive when compared to most insecticides.

Based on the above conclusion, the following recommendations are forwarded;

- For diagnosis of ectoparasite infestations the test selected should be based on the most likely diagnostic possibilities and their cost effectiveness.
- Integrated parasite management should be better used to control and eradicate some important ectoparasites.

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