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Ectoparasites of cattle and their control strategies

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Ectoparasites are organisms which inhabit the skin or outgrowths of the skin of another organism(the host) for various periods and may be detrimental to the latter. Arthropods, mainly flies,mites, lice and ticks represent the most economically important group of cattle ectoparasites. Many of these ectoparasites(lice)are host specific while others (ticks)parasitize a wider range of hosts. Many ectoparasites are known to be vectors of pathogens,which they generally transmit to hosts while feeding or (occasionally)defaecating. Ectoparasites are reported to cause wide range of pathogenic effects such as anaemia, detrimental immune reactions(hypersensitivity),irritability, dermatitis,skin necrosis, secondary infections, focal haemorrhages, blockage of orifices(ears,etc) and exsanguinations(occasionally). Domestic animals are susceptible to ectoparasite infestations which lead to substantial economic losses to livestock industry. Therefore, it is necessary to control parasitic infestations to minimize the production losses, sustaining reproduction and for optimum livestock productivity. Thus, the strategic control of ectoparasites is of great significance.

Common ectoparasites of cattle

Ticks

Ticks belong to the Order Ixodoidea of Class Arachnida. Ticks are classified in 2 families as follows- Argasidae(soft ticks) and Ixodidae(hard ticks). Of the genera of Ixodidae species- *Boophilus, Rhiphicephalus, Hyalomma, Amblyomma, ,Haemaphysalis* are important pests to livestock and other domesticated animals primarily in the tropical and subtropical regions of the world. After engorging, mated adult females drop off the

host to lay their eggs on the ground and die after laying one batch of eggs. Ticks are responsible for severe losses due to tick worry,blood loss, damage to hides and udder, or mortality and debility caused by transmitted disease organisms like *Babesia, Theileria, Anaplasma* etc.

Flies

Many species of Diptera (two-winged insects, or true flies) are ectoparasites because they are hematophagous i.e. bite to feed on blood or cause nuisance to the animals. Examples of common ectoparasitic flies affecting cattle health and production causing economic damage are – Horn fly(*Haematobia irritans*), Buffalo fly (*Haematobiaexigua),* Stable fly(*Stomoxys calcitrans*), Face fly(*Musca autumnalis)* and Horse fly(Tabanus sp.).The families Calliphoridae (blow flies) and Sarcophagidae (flesh flies) include several species which adversely affect domestic animals. While the larvae (maggots) of most of these flies feed on animal carcasses, those of several species are facultative or obligate parasites in living tissues. Such parasitism of live animals by fly larvae is termed 'myiasis'. Similarly, larvae of members of the family Oestridae (bot flies) cause obligate myiasis. Different body regions are typically attacked by different fly larvae and gastro intestinal, urogenital, ocular, nasopharyngeal, auricular or cutaneous myiasis may result.

Mites

Mites belong to the subclass Acarina and the class Arachnida. They are permanent residents upon the host and have limited survivability in the environment. They have exploited an incredible array of habitats and because of their small size most go totally unnoticed. Their presence may provoke an inflammatory response leading to intense itchiness, further tissue damage and bacterial infections. Cattle mites feed on lymph, blood and sebaceous secretions which they scavenge from the skin surface or obtain from epidermal lesions. All life-cycle stages are found simultaneously on the host and spend their entire lives in intimate contact with their host. Infestation by mites can result in severe dermatitis known as mange. Sarcoptic mange, or scabies, caused by *Sarcoptes scabieivar. bovis*, a skinburrowing mite, is highly contagious and zoonotic, causing intense pruritus and papules. If left untreated the skin thickens, forming large folds, and the entire outer body surface can be affected in a few weeks. *Psoroptes ovis* is a nonburrowing mite causing psoroptic mange that pierces the skin to imbibe the fluids emanating from the wound which can form a thick crust. Psoroptic mange cause exudative dermatitis, alopecia, and intense pruritus that can kill untreated calves. *Chorioptes bovis*, the chorioptic mange mite, typically inhabits the skin surface of the tail and lower legs and therefore the condition may be called tail, foot, or leg mange. Chorioptic mange is comparatively less pathogenic to cattle than sarcoptic or psoroptic mange. *Demodex bovis* is the most common of three Demodex species that can infest the hair follicles and sebaceous glands of cattle. Cases of demodectic mange occur frequently during late winter and early spring, lesions are susceptible to secondary

bacterial infection. Young cattle appear to be more susceptible to heavy infestations, which can also result in hide damage.

Lice

Lice, representing the insect order Phthiraptera, are relatively small with a dorsoventrally flattened body, and are morphologically divided into sucking and chewing groups. *Bovicola bovis*, commonly known as the cattle biting louse, is the chewing louse associated with cattle. The main species of cattle sucking lice are: *Haematopinus eurysternus*, or short-nosed cattle louse, *Linognathus vituli*, or long-nosed cattle louse and *Solenopotes capillatus*, or little blue cattle louse. Sucking lice are hematophagous and typically have a narrow, pointed head, whereas biting lice feed on skin and hair and have a broad head. Some sucking lice of livestock are known to transmit pathogens. Examples include swinepox virus transmission to pigs by *Haematopinus suis*, and transmission of *Anaplasma marginale* and the skin fungus *Trichophyton verrucosum* by various species of cattle lice.

Control of ectoparasites in cattle: Current status and future strategies

The drugs and chemicals used against ectoparasites known as ectoparasiticides. Most ectoparasiticides act as neurotoxins at central nervous system synapses,axons or neuromuscular junctions leading to spastic or flaccid paralysis. Various modes of application are available for administration of ectoparasiticide such as dips, sprays, pour-ons, spot-ons, dusting powders and ear tags. The choice of ectoparasite treatment or control technique is influenced by the pathogenesis of the dermatosis produced, the mode of action, efficacy of drugs available and critically the life cycle and habits of the parasite. The consumer convenience is an important factor in product choice. An array of delivery systems has historically been available viz. powders, aerosols, sprays, shampoos, rinses, dips, spot-ons, mousses, injectables, oral tablets or liquids, and impregnated collars. However, the safety, efficacy, and ease of use of the newer spot-on, injectable, and oral application systems have rendered many of the older application technologies essentially obsolete.

Ectoparasiticides can be delivered to the parasite by topical preparations (applied to host's coat) and systemic preparations (injectables). Different classes of ectoparasiticides most commonly used are organochlorines (Lindane, Methoxychlor etc. as dust, spray, pour on, back rubber),organophosphates (Malathion, Dichlorvos etc. as dip, spray, pour on), carbamates **(**Carbaryl,Propoxur etc. as dip, dust, spray), formamidines **(**Amitraz as dip, spray), pyrethroids (Cypermethrin, Permethrin, Deltamethrin etc. as dip, spray, spot on, pour on), macrocyclic lactones(Ivermectin,Doramectin- subcutaneous injection). Synergists are generally not considered toxic or insecticidal, but are used with insecticides to enhance their activity. They are used primarily to potentiate the activity of pyrethrum or pyrethroids. Piperonyl butoxide and N-octyl bicycloheptene dicarboxamide are common synergists.

However, the overuse and misuse of ectoparasiticides selects for resistance to the veterinary drug in the product and can be hazardous to animals, food, and the

environment. For example, extensive use of acaricides has resulted in resistance particularly in one-host tick *Boophilus microplus* to almost all currently used acaricides whereas in multi-host ticks (*Hyalomma anatolicum anatolicum*) it is less widespread. Strategies that can prevent or delay resistance include- appropriate selection of ectoparasiticide, their rotations and mixtures, resistance monitoring. The efficacy of specific compounds can vary against target species, and resistance to insecticides may develop in specific locations, especially with incorrect use, such as subdosing or with prolonged and repeated product use. Therefore, product labels should be carefully read.

Integrating chemical, non chemical, biological and mechanical methods for successful pest management is the key to sustainable and economical animal husbandry. The use of chemical compounds is still the basic procedure for controlling most ectoparasites but various methods are being developed to act in addition to, or in synergy with these products so as to enhance the efficacy and reduce the adverse effects of these compounds. These methods are – ecological control (modification of the environment of the pest), mechanical control(use of insect traps,repellents),biological control (predation,parasitism,action of pathogens,etc) and genetic control(genetic manipulation, hybridizations). Methods to control cattle ectoparasites in organic farms are being developed such as use of liquid enzymes (liquid enzyme spray works by physically breaking down the exoskeleton of the insect, use of diatomaceous earth and organic plant oils (oils kill parasites by clogging up the pores that deliver oxygen to their bodies.

The preventive practices are more important for the management of ectoparasites. These practices include selecting species and types of cattle suitable for local conditions and resistant to endemic parasites, providing adequate nutrition, establishing housing with proper pasture conditions, observing sanitation practices to minimize predisposing conditions for ectoparasitoses and keeping stress low. Research on livestock genomics is being applied which facilitate the breeding of cattle resistant to ectoparasites, especially ticks. In addition, biotechnology-enhanced sterile insect technique approaches are being enabled by advances in ectoparasite genomic science. Sterile insect technique is a method of biological control where large number of sterile insects are released. The released male insects upon mating with female does not produce offsprings, thus reducing the next generation population. Thus, integrated pest management can be used to help control external parasite and pest populations, including flies, lice and cattle tick. Examples of this include utilising dung beetles to break down faecal pats to reduce the eggs laid by fly populations, the use of a specialised fly trap to remove buffalo flies from cattle by exploiting the natural behaviour of the flies to move towards light, and the detection of natural predators or diseases (viruses and fungi, for example) which can be used to reduce the pest population.

CONCLUSION

The total dependence on a single method of control has proved to be non- sustainable and cost ineffective in the long term. Hence, in order to become practically and

ecologically sustainable, a combination of treatment and management is necessary to control parasitism so that it will not cause economic loss to livestock keepers. Hence, the control measures need to be based on integrated pest management.

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