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SURVEY ON ARTHROPOD ECTOPARASITES ON GOATS AND DOMESTIC FOWLS IN VUNANIA, NAVRONGO, GHANA

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ABSTRACT

Traditional free-range rural animal production system which forms an integral part of farming systems, in almost all rural communities in Ghana is characterized by mismanagement, malnutrition, theft, predation, diseases and parasites infestation resulting in high mortality and low productivity. This study assessed the types and degree of ectoparasites infestation and their distribution on the body parts of goats and domestic fowls in Vunania in order to generate a data set that could help in formulating strategies for their control in the area and its environs. Ten houses were randomly selected and adaptive sampling was employed for the selection of neighbourhood units for sample collection. Fifty goats and fifty domestic fowls of any age, one each from each house, were randomly selected for screening for ectoparasites using hand picking and brushing. The ectoparasites collected were transferred to laboratory for processing and identification. About 76% of the studied goats and 84% of domestic fowls were infested with ticks, fleas, and mites respectively, while lice were recorded in domestic fowls only. The estimated populations of ectoparasites of all kinds on goats and domestic fowls were 4,110 and 9,688, respectively. In goats, the ears and underside of limbs were preferred by ticks and mites while fleas were common around the neck and back regions of the body. In domestic fowls, lice and fleas were distributed almost on all the body parts, although fleas preferred the vent. Lice were, conversely, found around the neck, back, and the chest. Ticks particularly liked the underside of limbs, the chest and the wings. The presence of the ectoparasites calls for stringent control efforts to curtail their health effects and more research to ascertain their negative effects on the livestock industry in the study area.

Keywords: Arthropod, ectoparasite, goat, domestic fowl, free-ranging production system.

INTRODUCTION

Ghana's Traditional rural animal production systems are mainly based on free-range. The indigenous animals mostly reared are sheep, goats, pigs, poultry and cattle. It is an essential agricultural activity of almost all rural communities and is an integral part of the farming systems and needs low inputs. Livestock rearing provides scarce animal protein as meat and eggs; farm yard manure, prestige and act as a reliable source of petty cash (FAO, 1987). Animal production at the local level fulfills a number of other functions. These include the use of domestic animals and poultry for performance traditional ceremonies and festivals.

The importance of rural poultry and livestock in the national economy of developing countries and improving the nutritional status and income of many smallholder farmers and landless communities is highly rated (Creavey, 1991; FAO, 1987). Strategic increases in the productivity of rural livestock greatly assist in poverty alleviation; improve household food-security and protein intake of both urban and rural dwellers ((Kitalyi, 1998). Unfortunately, livestock production is not rated highly in the third-world national economies because of the lack of measurable indicators. Production levels of rural poultry and animals in many African countries fall far below desirable levels (Calnek *et al*., 1997). In many cases, weight gain, number of eggs per fowl and number of offspring per year are very low, while mortality rates are relatively high. Several reasons, including mismanagement of animals, malnutrition, disease and parasite infestation, theft and predation account for the high mortality and low productivity (Awuni, 1990; Calnek *et al*., 1997).

Animal health is one of the factors that affect the efficiency with which domestic livestock convert food into animal protein for human consumption (Horst, 1996) and income for the farmers. Among the numerous animal health problems is the prevalence of arthropod ectoparasites and their impacts on farm animals (Byford *et al*., 1992; Nnadozie, 1996).

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Diverse and highly adapted species of ectoparasites of veterinary importance inhabit the external body surfaces of these animals (Loomis, 1978). Some of the parasites live permanently on their hosts or they may occupy the host's nest and immediate environment, and visit the body of the host periodically. The mechanisms by which the parasites seek, identify, establish and maintain contacts with their host are sophisticated and complex (Byford *et al*., 1992; Combes, 2001). Some ectoparasites that affect sheep, goats, dogs, cattle and fowls include ticks, lice, mite, flies and fleas (Adene and Dipeolu, 1975). Although these ectoparasites are not critical limiting factors, their presence can affect productivity in these animals and the economics of production (Haward and James, 1979). Another study, Permin and Hansen (1998) and Ruff (1999) reported that parasitism causes reduced growth, reduced egg and milk production, emaciation, anaemia and mortality. Permin *et al*. (1997) indicated that the prevalence of ectoparasitic infestations in village chicken flocks is close to 100% and in most cases individual birds can harbour more than one parasite species. Currently, there is paucity of information regarding ectoparasites of local livestock in the study area. There is also the need to constantly assess the status of village livestock production constraints and dynamics of their interaction. As cofactors in livestock diseases, their prevalence is essential in understanding the epidemiology of such diseases and the design of their control measures.

Control of ectoparasites is, therefore, one of several important ways of improving productivity of the livestock and poultry industry (Drummond *et al*., 1988) in the study area and Ghana as a whole. Hence there is the need for informed knowledge on the bionomics of these ectoparasites and their activities. Unfortunately, in the Kassena-Nankana East Municipal Assembly of Ghana and, in particular, Vunania, research on ectoparasites of domestic livestock has been fragmentary leading to a dearth of knowledge on ectoparasite infestation in goats and domestic fowls, although it is generally known that parasitic infestation is one of the common causes of mortality of domestic livestock. This study, therefore, assessed ectoparasites infestation and their distribution on the body parts of goats and domestic fowls in Vunania with a view to generating a dataset that could help in formulating strategies for ectoparasites control in the area and its environs.

MATERIALS AND METHODS

Study area

Vunania, the study area, is about 5 km from Navrongo along the Navrongo-Kolgo road. The main occupation of the inhabitants of 1,474 people is subsistence farming. As at 2012, there were 180 houses or compounds with a total population of 560 goats and 1,205 domestic fowls (Nii: personal communication). Navrongo, the nearest big town, has mean minimum and maximum temperatures of 19.4 and 35.6°C, respectively. The area is usually under the full influence of the harmattan winds from November to January. The single rainy season lasts for 4 months from July - October (Navrongo Metrological Station, 2012).

Selection of houses and study animals

In total, 10 houses were selected for the study following Sampath (2001) methods. First, the numbers of all the houses were written on pieces of paper. The papers were then folded, put in a box and shaken for them to mix well. Ten pieces of paper, representing 10 houses, were randomly picked from the box without replacement. The adaptive sampling method of Thompson (1990) was subsequently employed to select neighbourhood units or houses using the initial 10 houses. In this method, the initial 10 houses selected were each entered for screening of the study animals for the presence of ectoparasites, and whenever ectoparasites were found, additional 4 houses in the neighbourhood of that house to the north, south, east and west were selected for data collection as well. Ectoparasites were found in all the initial 10 houses, thus, giving a total of 50 houses. In each study house, one each of domestic fowl and goat were randomly selected for screening for ectoparasites.

Screening of study animals for ectoparasites

The study animals were screened for ectoparasites using the following techniques employed by Hall (2006).

Hand-picking

With the aid of light surgical gloves, the ectoparasites were hand-picked by systematically searching the various body regions of the study animals. Ectopareasites obtained from the different animals, as well as the different body regions were kept separately in 70% alcohol in labeled collecting tubes for identification and counting.

Brushing

With this method, each study animal was placed on a piece (about 2 yards) of white calico and the ectoparasites systematically brushed off the feathers (for domestic fowls) and hair (for goats) unto the calico. The ectoparasites were recovered from the calico by dipping the finger into 70% alcohol and tapping gently with the finger. The ectoparasites were then detached into labeled collecting tubes. Macroparasites which fell on the white calico were easily hand-picked into the collecting tubes. Ectopareasites from the different animals, as well as the different body regions were kept separately for identification and counting in the laboratory. The study animals were also examined for their general condition. Signs of ill-health due possibly to parasite infestation were recorded.

Data analysis

The total populations of the various ectoparasites in domestic fowls and goats in the study area were estimated using the following formulae by Thompson (2001):

$$T = N\mu;\ \mu = {}^{1}/_{n}\sum_{i=1}^{n} w_i,\quad w_i = {}^{1}/_{mi}\sum_{i=1}^{m_i} y_i,\quad \text{where}$$

- w_i = mean number of observations in a network;
- yi = variable of interest (ectoparasites);
- mi = number of housing units in a network
- N = the usual finite population
- T = estimated population of ectoparasites.

RESULTS

The ectoparasites found on domestic fowls from April to June comprised ticks, fleas, lice and mites, while those on goats were ticks, fleas and mites. The numbers of each type of ectoparasites found on the study animals are summarized in tables 1 and 2. Through observation, many of the domestic fowls infested by ticks were severely sick, while some majority of them died. Also, during survey, the level of ticks' infestation increased from the end of April to the end of June.

Of the 50 goats and domestic fowls examined, 38 (76%) goats and 42 (84%) domestic fowls were infested with arthropod ectoparasites. Approximately 34.2, 60.5 and 5.3% of goats were infested with ticks, fleas and mites, respectively (Fig. 1). Among tick species that infested goats, 69.2, 7.7 and 23.1% were *Rhicepicaphalus bursa*, *Boophilus annulatus* and *Ornithodoros lahorensis*, respectively. Also among flea species that infested goats, 65.2 and 34.8% were *Ctenocephalides felis felis* and *Tunga penetrans*, respectively. Only two goats were infested with *Sarcoptes scabiei*. Also, of the 42 domestic fowls infested with ectoparasites, 7.2, 21.4, 47.6 and 23.8% had been infested by mites, fleas, ticks and lice, respectively (Fig. 2). The tick species found were *Argas persicus* and *Ornithodoros* sp., while flea species identified were *Echidnophaga gallinae* (stickfast flea) and *Xenopsylla* sp. Lice found were *Menapon gallinae* and *Goniodes gallinae*, while mites were mainly the scaly leg mite.

The estimated arthropod ectoparasite populations on goats and domestic fowls in Vunania are shown in table 2. The populations of arthropod ectoparasites of all kinds in goats and domestic fowls were 4110 and 9688, respectively. The ectoparasite load per goat was 0.66 ± 0.13, 1.62 ± 0.15 and 5.04 ± 0.71 for ticks, fleas and mites respectively, giving a total of 7.32 ± 0.72 parasites per goat. The total parasite load on domestic fowls was 8.04 ± 0.49 parasites per fowl, and this comprised 1.82 ± 0.15, 1.52 ± 0.16, 1.84 ± 0.17 and 2.86 ± 0.49 parasites per fowl for ticks, lice, fleas and mites, respectively. Generally, domestic fowls had heavier infestation of ectoparasites of all kinds than goats except mites (Tables 1 and 2).

Table 1. Total Number of Ectoparasites.

Ectoparasites	Number (and %) of ectoparasites in 50 each of the study animals	
	Goats	Domestic Fowl
Ticks	32 (8.7)	91 (22.7)
Lice	0 (0.0)	75 (18.7)
Fleas	83 (22.6)	92 (22.9)
Mites	252 (68.7)	143 (35.7)
Total	367	401

The distribution of ectoparaites on the body regions of the study animals is shown in figures 1 and 2. The body regions of domestic fowls infested by ticks were basically the underside of the limbs, the chest, the wings and the legs. Lice were commonly found on the crop, back, neck and legs. For fleas, their main location was the vent, although they could also be found around the legs, back and underside of limbs (Fig. 1). Tick infestation on the ears and underside in goats was high (Fig. 2). Similarly, two goats had their ears infested by mites. The fleas

Table 2. Estimated populations of ectoparasites on goats and domestic fowls in Vunania.

Category	Animal name	Estimated ectoparasites population
General ectoparasites population	Goats	4110
	Domestic fowls	9688
Specific ectoparasites population		
Fleas	Goats	930
	Domestic fowls	2241
Mites	Goats	2822
	Domestic fowls	3446
Lice	Domestic fowls	1711
Ticks	Goats	358
	Domestic fowls	1976

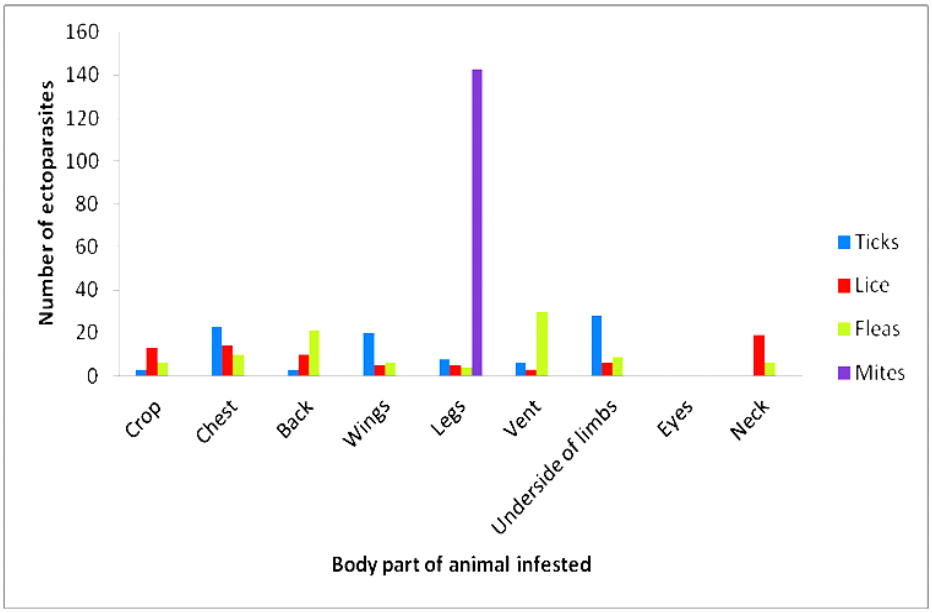

Fig. 1. Distribution of ectoparasites on the body regions of domestic fowls.

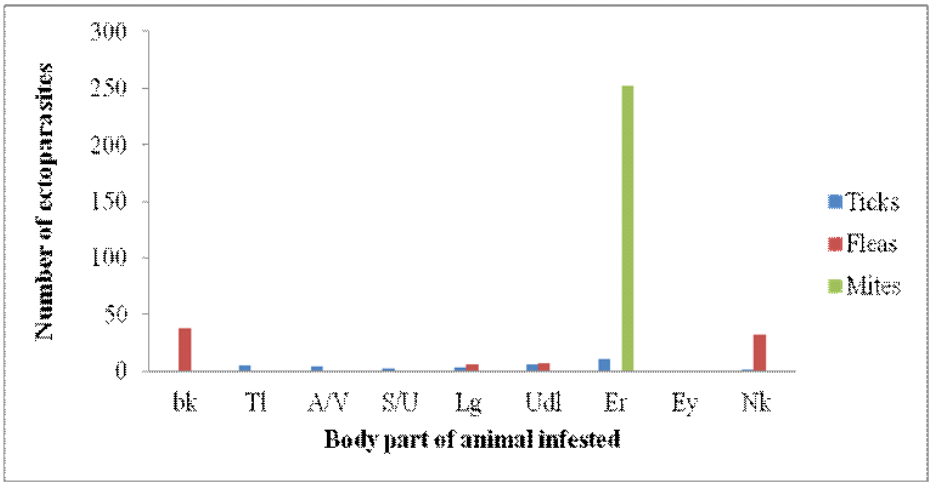

Fig. 2. Distribution of ectoparasites on the body regions of goats.
Key: bk = back, Tl = tail, A/V = anus/vulva, S/U = scrotum/udder, Lg = leg, Udl = underside of limbs, Er = ears, Ey = eyes, Nk = neck

identified in goats were more limited to the back and neck regions.

DISCUSSION

This study revealed that arthropod ectoparasites really infested domestic livestock to a large extent in Vunania. Out of 50 goats and 50 domestic fowls surveyed, 76 % of goats and as high as 84% domestic fowls were infested with external parasites with overall populations of 367 and 401, respectively.

Generally, the distributions of ectoparasites on the body regions of goats and domestic fowls in Vunania are consistent with the findings of Hall (2006) in Gognia in the same district. During the study, the numbers of ectoparasites recorded, particularly ticks, increased markedly from the end of April to that of June. This may be attributed to the increase in rainfall at the time, suggesting that rainfall influences the development, survival and activity of these organisms. This is in accordance with the work of Mohammad and Ali (2006) and Hall (2006) who found tick activity to be high from June to August in the tropics. Again, with the increment in the moisture content, many of the domestic fowls examined showed a high level of infestation by ticks, lice and fleas in the community.

With regards to ticks, *R. bursa* was more common on goats followed by *O. annulatus* while in domestic fowls,

A. persicus predominated. These tick species are most common in the tropics according to literature. Domestic fowls were more infested than goats and majority died as was observed by Drummond *et al*. (1981, 1988). Some farmers explained that the death of their fowls could be attributed to the presence of the ectoparasites, particularly ticks and lice. It was observed that many of the ticks engorged so much blood from the animals that any attempt to remove them from the animals resulted in their crashing.

The engorging females of certain ticks, feeding on the neck or near base of skull of their hosts (birds and animals), inject venom that produces paralysis which may be fatal if the tick is not removed. Apart from their annoyance due to their blood sucking activity, some serve as vectors of numerous arboviruses (encephalitis, haemorrhagic fever); various rickettsiae (spotted fever, tick typhus fever, Q fever and protozoan causing cattle fever that is transmitted transovarially and few bacteria (tularaemia) to man, other mammals and birds. Tick infestation of domestic livestock could result in reduction in milk and meat production and death due to exsanguination. For instance, *Dermacentor andersoni* Stiles can withdraw 1.7-2 ml of blood in an act of engorgement resulting in tick-host anaemia and possibly death. Tick-borne lesions can lead to dermatosis (inflammation, itching, swelling and ulceration at site of bite; or skin ulceration and lesions resulting from improper or partial removal of tick mouthparts). Envenomization which is the inoculation of toxic salivary fluids at site of bite resulting in severe systemic disturbances has been reported. Besides, ticks infestation can predispose their host to myiasis and secondary bacterial infections such as piroplasmoses (babesiosis, rickettsioses) through the bite injuries (Service, 1996). Hence they were assumed to be responsible for the death of the domestic fowls.

In 1999, Ruff reported that mites cause crusted scabies known as sarcoptic mange in goats, sheep and rabbits, and scaly-leg in birds. Mites also cause painful bite, irritation and dermatitis. Ectoparasitic adult fleas' diet consists solely of blood. Although most species of fleas have one or two favourite species of hosts, they are not entirely host-specific. For example, cat and dog fleas, *Ctenocephalides felis felis* and *C. f. canis*, will readily feed on human. Stick-fast fleas attack skin around eyes, the wattles and comb and other bare spots of poultry. Ulceration and wartlike swellings often results in blindness and death due to starvation. Fleas account for more than half of all dermatological conditions requiring medical or veterinary assistance, and even a single flea bite to a hypersensitive animal or person may cause intense itching, irritation, allergic reaction, dermatitis and loss of blood (Koutinas *et al*., 1995).

Contrary to other studies that found lice such as *Damalina caprae, Haematopinus* spp. and *Linognathus setnosis* in goats (e.g. Mohammad and Ali, 2006; Hall, 2006), no lice were found in goats in the present study. Lice require the presence of hair or feathers for development and survival (Cameron, 1938), and this explained their prevalence in domestic fowls in the study area. Their absence on goats could probably be due to the nature of the hair coat and climatic factors. Poultry lice infest ducks, turkeys and guinea fowls when housed with chicken and attack horses' stables nearby. They frequently obtain blood by gnawing through the skin or by rupturing the quills of pin feathers and feeding on barbs and barbules. Their biting and feeding behaviour cause irritation or itching. Affected poultry become restless thereby affecting its feeding habits, proper digestion; egg production is greatly reduced and development retarded (Peter, 1995).

The present study clearly demonstrated that ectoparasites are abundant in free-range livestock production system in Vunania. It showed that animals in the extensive system, particularly poultry harbour ectoparasites of some kind throughout the year with particular high parasitic loads during the warm, wet season. It also revealed that ectoparasites receive less attention probably in all production systems in the district as there is no documentation for arthropod ectoparasites in Vunania. But these ectoparasites are of great economic importance. They cause anaemia due to blood loss, serve as vectors of animal diseases and pathogens, act as intermediate hosts for a range of helminthes such as *Heterakis gallinarum,* as well as causing direct harm to their hosts. Similar reports were made by Loomis in 1978. To minimize this problem, application of suitable pesticide routinely and particularly just prior to the warm, wet season is recommended in the extensive system of animal production. Further research to assess the impact of these parasites on the health and production performance of the free-range domestic animals including cost effectiveness of control strategies and thorough education of the smallholder farmers are suggested.

CONCLUSION

From the survey, ticks, fleas, lice and mites were identified as the major ectoparasites of domestic animals in the Phylum Arthropoda in the Kasena-Nankana East Municipal of the Upper East Region of Ghana, especially in Vunania. These parasites are considered to have a high infestation rate in the affected animals. Their presence should be considered serious regarding their negative effects on domestic livestock, especially small ruminants and poultry. Majority of the domestic fowls infested by ticks were sick, while some died as a result of the infestation. This calls for more attention in the control of ticks on fowl flocks in the Kassena-Nankana East Municipal of the Upper East Region. Climatic conditions,

national economy and that of individual farmers, and the relevance of livestock production call for more research efforts. Information about ectoparasites prevalence has become necessary since these parasites also parasitize humans especially those who work in close contact with the animals. Ectoparasites infestation is not taken seriously by the farmers, and this calls for intensification of extension work to be carried out, if control of ectoparasites can succeed in the area. Further studies are also needed to estimate the economic losses caused by these parasites and to formulate measures for their control, while intensive education on the negative effects of ectoparasites and how to control them is needed if animal production is to be stepped up in the district.

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