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Prevalence of Ectoparasite Infestations and Diversity in the South-South Geopolitical Zone In Nigeria: A Pharmacotherapuetic Approach.

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ABSTRACT

Ectoparasitic infestation is one of the major veterinary problems affecting livestock industries globally, as it significantly reduces production Efficiency, and costs of acaricides used in its control are enormous and run into billions of dollars worldwide. Ectoparasites including lice, ticks, mites and flies are economically serious parasites that play important roles in the transmission of certain pathogens, due to their usual habit of blood sucking and wound licking. Infested animals keep poor physical condition and develop unthrifty, anemic appearances, skin discoloration and greasy hair, which adversely affect the economic production. This study aims to investigate the prevalence of ectoparasites infestations and diversity in the South-south geopolitical zone in Nigeria and to institute a conventional intervention. A total of 4617 livestock of different breeds, husbandry and sex were surveyed for ectoparasites identification from November 2012 to November 2013. Ectoparasites identified were ticks (11399), mange mites (5555), lice (5248) and flies (2167) The investigators deduced that a high prevalence and diverse fauna of ectoparasites could potentially hamper the productivity of livestock in the study area, hence serious attention is warranted.

Keywords: Eectoparasites, Livestock, South-South, Nigeria.

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INTRODUCTION

Ectoparasites are economically serious parasite causing skin diseases by the species of lice, ticks, mange mites, houseflies etc.; the infections are among the major veterinary diseases causing serious economic loss to the small scale farmers, the tanning invention and livestock industry as a whole in Nigeria. Livestock such as cattle, sheep, goats and pigs are worldwide important sources of human food and different economically important goods such as leather and/or wool [1]. Although Nigeria depends heavily on the oil industry for its budgetary revenues, Nigeria is predominantly still an agrarian society, with activities of crop production, and animal husbandry; owned mostly by rural dwellers rather than by commercial companies. Livestock are often reared in masses and in monocultures, which are highly attractive for many ectoparasites; and besides most of the livestock rearers are resource poor and might not be able to afford the conventional acaricides[2]. These losses result from reduced performance of the animals due to blood loss, irritation and pest nuisance, given that the infested animals maintain repulsive physical conditions and develop unthrifty, anemic appearances, skin discoloration and greasy hair.

Indirectly, diseases affecting cattle and humans may be transmitted by external parasites of livestock [3]. Many ectoparasites harm the health of their hosts by blood sucking (e.g., ticks, mite, simuliids, midges, biting flies, fleas, lice, bugs, etc.) [4]. Mites cause a lot of damage to hides of livestock by denuding the hair of the hides and forming scabs on the hide. They are also responsible for predisposing the animal to bacterial and fungal infestation and other parasitism, including screw worm attack caused by wounds due to bites in the animal skin with gross infestation [5]. Ectoparasites are known to cause havoc to livestock through sucking of blood which potentate the animal to tendencies of anaemia, abortion, lower milk production, respiratory disease, stunted growth, general unthriftness, respiratory disease, increased susceptibility to other diseases and death of livestock [6] . To the same degree, while the hog louse has also been implicated in the transmission of diseases such as the swine pox, eperythrozoonosis, and African swine fever [7] , other ectoparasites also act as vectors of various diseases; e.g., ticks may transmit stages of Babesia and Theileria, Rickettsiales, Anaplasma; several bacteria and viruses (e.g. Crimean Congo fever); which all may introduce severe diseases or even death (Raether and Harder 2008; Mehlhorn 2008;) [8 & 9] . Likewise mites have been found to be the intermediate host of tapeworms that infest domestic animals such as cattle, sheep and goat which is transmitted to humans as one of the neglected tropical diseases of Africa.

Although studies may have been conducted on some aspects of ectoparasites prevalence in

various parts of the country, however, little is known regarding the prevalence of ectoparasites in the South-South region of Nigeria, and the situation of ectoparasites-borne diseases in animals have been partially documented in this vicinity. Considering the limitation of information on ectoparasitic infestation of domestic and farm animals in and around these areas with the importance of livestock wealth in the national economy, it is on this premise that our interest is aroused to investigate the prevalence of ectoparasite infestations and diversity in the South-south geopolitical zone in Nigeria and to devise a means for mitigation for an effective remedy

MATERIALS AND METHODS

Study setting:

The target group of this livestock investigation consisted of mainly cows, pigs, goats and sheep selected from cattle rearing ranches, livestock markets and pens where cattle are being kept on arrival from the northern part of Nigeria in the South-south geopolitical zone in Nigeria. The South-south geopolitical zone is a major precinct in Nigeria and it is also among the world's major wetlands; with one of the largest mangrove ecosystems and a major territory of the global diversified industrial activities related to oil and gas exploration. It is the treasure base of the nation, comprising of six states in the federation, with miscellaneous industrial implementations linked to oil and gas exploration, which attract agglomeration of residents that have the greatest potential for significant increases in domestic consumption of livestock productivity.

Study design:

We randomly selected cows, pigs, goats and sheep between the ages of (≤ two years) denoted as young, adult (> two years to six), and old (> six years), who were resident at the cattle rearing ranches, livestock markets and pens. The estimated age was by dentition, proprietors/ranch attendants were also asked about animals' age whenever possible; sex and breed were recorded and the animals were grouped into male and female. Screening procedures identify livesttock that were at sufficient risk to warrant a diagnostic test for ectoparasitic infestation with immediate intervention. These were herds imported into Nigeria from neighboring countries with potential for transmission and spread of ectoparasites in transit and on grazing sites. Proprietors of the pens ranches and market stands received a focused group lecture and interview and were questioned about knowledge of livestock skin infestations and treatment, and the risks that their herds were exposed to, if left undetected and untreated. A short structured questionnaire on personal biodata, and history of acaricides spraying, and housing of animals was administered to the participating proprietors/ranch attendants.

Data collect ion and training of data collectors:

Data collection took place at farms, cattle rearing ranches, livestock markets and pens. A team of principal research investigators comprising of a veterinary doctor, an agriculturial economist, a clinical epidemiologist/research analyst, and animal health assistants went to each animal and followed a standard protocol for the physical examination and collection of compulsory samples. The animal health assistants were also trained in data collection and all questionnaires and data collection tools were piloted over about 12 months during the set-up phase of the project in the South-south region. Color code marker was used to identify and link samples to individual animals to avoid duplication of samples obtained. At the diagnostic field laboratory in the study centers, data were downloaded from the hand held device to a database and cross-checked against the paper records and any discrepancies resolved with the principal research investigators and animal health assistants that collected the data and samples.

Ectoparasite Sampling Technique and Preservation:

A cluster of 4617 livestock, with a breakdown of 2770 cows, 870 pigs 510 goats and 467 sheep of different breed, husbandry and sex were inspected for the presence of ticks, lice, mange mites and flies. A thorough epidemiological investigation was performed using a semi-structured questionnaire including the animal level variables such as age, sex, health status and rearing system. Age was determined by asking the owners/farm attendants and by visual inspection and also by dentition whenever possible. Animals were categorized based on age as young (≤ two years), adult (> two years to six), and old (> six years).

Eectoparasites were collected from the animals within top line (mid-dorsal surface), (midway between the withers and the pelvis), and withers, around each eye, right and left ear, cheek, muzzle, sternum, dewlap, udder, neck and under tail and feet of the animals; when required, small hairbrush dipped in ethanol was used for the collection of ticks and were examined. Likewise, all body part surface of the examined animals was inspected to detect for the presence of adult lice glued on the skin; parting the hairs counter wise against their natural direction for the detection of ectoparasites was utilized. Lice and ticks were picked with tweezers or forceps, their presence, location, and intensity were recorded and then placed in screwed bottle containing 70% methanol and labeled for sex, breed, date of collection, areas of origin and type of animal husbandry for later identification according to the keys provided by Soulsby [10] and Kaufmann [11] . The point of attachment was smeared with ethanol and adequate precautions were taken to preserve the mouth parts and appendages of the ectoparasites during collection. Deep skin scrapings from the margin of the lesion on the animals with clinical signs of mange were

collected in universal bottles having 10% formalin. Animals which were found positive for at least one parasite was considered positive for ectoparasites infestation. Earwax and skin scrapings were examined for the presence of mange mite species and was done based on their morphological characteristics (Soulsby, 1982; Kaufmann;) [10 & 11] . Flies were collected in traps and baits placed around the animals and were recorded. Data obtained was recorded appropriately and ectoparasites index determined for each animal by counting live ticks, lice, mange mites and flies within specific body regions of the animal. Ectoparasites were preserved in 70% alcohol in clean, well-stopper glass vials which were labeled properly. Color code marker was used to identify and link samples to individual animals to avoid duplication of samples obtained. Data on management practices including housing and history of acaricide spraying were also collected.

Data analysis:

The data was analyzed using SPSS v.15. Chi-square test was applied to determine the association of factors at $P \leq 0.005$. The proportion of animals infested with ectoparasites and the number of parasites detected was computed in percentage and recorded.

Ethical Approval and Consent:

Prior to commencement of study, standardized description of goals and procedure of study, data uses and protection for Animal Protection Rights were provided in both written and verbal form to all designated proprietors of cattle rearing ranches and pens and livestock markets, where cattle are being kept on arrival from the northern part of Nigeria before slaughter. The National Institutes of Health guidelines for care and use of animals and Guidelines on Ethical Standards for Investigation of Experiment in Animals (NIH, 1985) were followed. Proprietors were free to decline participation, or opt out completely and withdraw their livestock at any given time during the investigation without reprimands.

RESULTS AND DISCUSSION:

A cluster of 4617 livestock with a breakdown of 2770 (60.00%) cows, 870 (18.84) pigs 510 (11.04%) goats and 467 (10.11%) sheep, of different breed, husbandry and sex were investigated for the presence of ticks, lice, mange mites and flies. The age and sex specific mean range is (≤ two years) denoted as young, adult (> two years to six), and old (> six years), Table I

Table I: Age and sex–specific of animals investigated N = 4617

Age Groups	**Cows N =**	**2770**	**Pigs N =**	**870**	**Goat N =**	**510**	**Sheep N =**	**467**
Age Status	Male %	Female %:	Male %	Female %:	Male %	Female %:	Male %	Female %:
(A) ≤ 2Yrs (Young)	204(7. 36)	352(12.70)	106(12.18)	121(13.90)	70(13.72)	69(13.52)	63(13.49)	68(14.56)
(B) > 2Yrs -6Yrs(Adult)	670(24.18)	704(25.41)	130(14.94)	278(31.95)	68(13.33)	108(21.17)	66(14.13)	90(19.27)
(C) > 6 Yrs (Old)	401(14.47)	439(15.84)	122(14.02)	113(12.98)	107(20.98)	88(17.25)	70 (14.98)	110(23.55)
Total	1275	1495	358	512	245	265	199	268

Prevalence distribution of ectoparasites genera &percentage of the animals surveyed in each state of the geographycal location is captioned in Tables II.

Table II: Prevalence Percentage of Ectoparasite In Livestock Surveyed By Geographycal Location N = 4617

South-South States/Capital	**Animals Tested In Each Region N = 4617**	**Ticks Genera Collected From Animals N = 11399**	**Mites Genera Collected From Animals Studied N = 5555**	**Lice Genera Collected From Animals Studied N =5248**	**Flies Genera Collected From Animals Studied N = 2167**
Akwa Ibom State/Uyo	Cow 387(13.97)/	1008(14.92)	412(12.40)	215(13.55)	78(12.80)
	Pig122(14.02)	213(12.52)	110(13.15)	293(11.53)	87(12.85)
	Goat 47(9.21)	200(13.28)	98(14.16)	58(12.00)	90(14.85)
	Sheep 41 (8.78)	221(15.32)	94(13.31)	96(15.02)	40(14.54)
Bayelsa State/Yenegoa	Cow 431(15.56)	989(14.64)	466(14.03)	221(13.93)	82(13.46)
	Pig129(14. 82)	261(15.35)	132(15.78)	394(15.51)	97(14.32)
	Goat 56(10.98)	197(13.08)	102(14.73)	67(13.87)	88(14.52)
	Sheep 77(16.48)	241(16.17)	105(14.87)	90(14.08)	45(16.36)
Cross River State/Calaber	Cow 505(18.23)	1130(16.73)	699(21.04)	294(18.53)	120(19.70)
	Pig 146(16.78)	303(17.82)	148(17.70)	528(20.78)	125(18.46)
	Goat 127(24.90)	279(18.53)	128(18.49)	91(18.84)	113(18.64)
	Sheep 117(25.05)	233(16.15)	152(21.53)	111(17.37)	56(20.30)
Delta State/ Asaba	Cow 497(17.94)	1021(15.12)	511(15.38)	250(15.76)	108(17.73)
	Pig138(15. 86)	260(15.29)	144(17.22)	475(18.70)	119(17.57)
	Goat 96(18. 82)	257(17.07)	110(15.89)	82(16.97)	107(17.56)
	Sheep 60 (12. 84)	290(20.11)	99(14.02)	101(15.80)	38(13.81)
Edo State/ Benin City	Cow 662(23. 89)	2003(29.66)	900(27.10)	407(25.66)	155(25.45)
	Pig 220(25.28)	457(26.88)	209(25.00)	636(25.03)	160(23.63)

	Goat 152(29. 8)	398(26.44)	165(23.84)	130 (26.91)	146(24.09)
	Sheep 137(29.33)	353(24.47)	171(24.22)	160(25.03)	70(25.45)
Rivers State/ Port Harcourt	Cow288 (10.39)	601(8.90)	333(10.02)	199(12.54)	66(10.83)
	Pig115(13.21)	206(12.11)	93(11.12)	214(8.42)	89(13.14)
	Goat 32(6.27)	174(11.56)	89(12.86)	55(11.38)	62(10.23)
	Sheep 35 (7.49)	104(9.70)	85(12.03)	81(12.67)	26(9.45)

Animals Infected With Ticks Genera: Cows = 2692*:Pig s= 789*:Goats =464: Sheep=429* , Animals Infected With Mites Genera: Cows = 2501*: Pigs = 749*: Goats=469 : Sheep=437* , Animals Infected With Lice Genera: Cows = 995*: Pigs = 862*: Goats = 334: Sheep =420* ,Animals Infected With Flies Genera: Cows = 534*:Pigs = 632 *: Goats = 486 : Sheep =209*

The present study revealed that an overall sum of 2692(58.38%) cows, 789 (17.08%) pigs, 464 (10.04%) goats, 437(9.46%) sheep were infested with ticks Table III.

Table III Frequencies and Percentage of Ectoparasites Identified In Livestock Surveyed N= 4617

Parameters	**Cows N = 2770**	**Pigs N = 870**	**Goat N = 510**	**Sheep N = 467**	**P Value**
Ecotoparasites	Cow Infected = 2692 /Tick Spicie collected N= 6752	Pigs Infected = 789 /Tick Collected = 1700	Goat Infected = 464 /Tick Collected =1505	Sheep Infected = 429 /Tick Collected = 1442	(P= 0. 005)
Ticks: Species:	Prevalence %	Prevalence %	Prevalence %	Prevalence %	
Boophilus decoloratus	859(31.01) /1929(26.56)	215(24.71)/ 517(30.41)	98(19.21)/ 375 (24.91)	82(17.55)/ 276(19.14)	(P= 0. 005)
Amblyoma variegatum	619(22.34)/ 1510 (22.36)	144(16.55)/ 471(27.70)	85(16.66)/ 203(13.48)	62(13.27)/ 215(14.90)	(P= 0. 005)
Amblyoma lepidium	344(12.41)/ 706(10.45)	0	63(12.35)/ 227(15.08)	51(10.92)/ 101(7.00)	(P= 0. 005)
Hyalomma rufipes	180(6.50)/ 559(8.27)	0	0	60(12.84)/ 309(21.42)	(P= 0. 005)
Hyalomma truncatum	137(4.94)/ 601(8.90)	0	65(12.741)/ 310(20.59)	41(8.78)/ 100(6.93)	(P= 0. 005)
Rhipicephalus appendiculatus	211(7.61)/ 634 (9.38)	430(49.42)/ 712(41.88)	90(17.64)/ 245(16.27)	64(13.70)/ 240(16.64)	(P= 0. 005)
Rhipicephalus evertsi evertsi	180(6.50) / 512(7.58)	0	63(12.35)/ 145(9.63)	47(10.06)/ 110(7.62)	(P= 0. 005)
Hamephyalis leachii	162(5.84)/ 301(4.45)	0	0	22(4.71)/ 91(6.31)	(P= 0. 005)
Mites: Species:	Cow Infected = 2501 /Mite Collected N= 3321	Pigs Infected = 749 /Mite Collected = 836	Goat Infected = 469 /Mite Collected N =692	Sheep Infected = 437 /Mite Collected N =706	
Demodex bovis	986(35.59)/ 1247 (37.58)	341(39.19)/ 397(47.48)	178(34.90)/ 196(28.32)	101(21.62)/ 156(22.09)	(P= 0. 005)
Sarcroptes scabiei	511(18.44)/ 590(17.76)	408(46.89)/ 439(52.51)	69(13.52)/ 95(13.72)	85(18.20)/ 132(18.69)	(P= 0. 005)
Chrioptes bovis	489(17.65)/ 806(24. 26)	0	63(12.35)/ 81(11.70)	71(15.20)/ 99(14.02)	(P= 0. 005)

Psorotus ovis	314(11. 33)/ 411(12. 37)	0	82(16.07)/ 199 (28.75)	97(20.77)/ 211(29.88)	(P= 0. 005)
Psoroptes cuniculi	201(7.25)/ 267(8.03)	0	77(15.09)/ 121(17.48)	84(17.98)/ 108(15.29)	(P= 0. 005)
Lice Species:	Cow Infected = 995 / Lice Collected: 1586	Pigs Infected 862/Lice Collected : = 2540	Goats Infected = 334 /Lice Collected = 483	Sheep Infected = 420 /Lice Collected = 639	
Haematopinus suis	0	805(92.52) 2419 (95.23)	0	0	(P= 0. 005)
Damalina bovis	551(19.89)/995 1007(63.49)	0	45(8.82)/101(20.91)	201(43.04)/ 297(46.47)	(P= 0. 005)
Haematopinus eurysternus	156(5.63)/ 268 (16.89)	57(6.55) 121(4.76)	150(29.410)/167(34.57)	118(25.26)/ 210(32.86)	(P= 0. 005)
Linognathus vituli	288(10.40)/ 311(19.60)	0	139(27.25)/ 215(44.51)	101(21.62)/ 132(20.65)	(P= 0. 005)
Flies Species:	Cow Infected = 534 /Flies Collected =609	Pigs Infected = 632 /Flies Collected/677	Goats Infested =468/Flies Collected =606	Sheep Infected = 209/ Flies Collected = 275	
Musca domestica	375(13.53)/ 434(71.26)	359(44.32)/ 388(57. 31)	149(29.21)/ 178(29.37)	93(22.05)/ 108(39.27)	(P= 0. 005)
Tabanuss spp	159(5.74)/ 175(28. 73)	273(17.58)/ 289 (42.68)	337(66.07)/ 428(70.62)	116(24.83)/ 167(60.72)	(P= 0. 005)

Results from this study constitute the first documented information on ectoparasites of veterinary importance in the South-south geopolitical zone of Nigeria and it is of paramount importance in the formulation of appropriate control strategies against ectoparasites in livestock. This study was prompted by an apparent increase in the occurrence of ectoparasites and manges in the South-south geopolitical zone in Nigeria, and therefore the need to obtain an accurate estimate of its prevalence and examine the role of the commonly practiced traditional management system of livestock industries. The overall prevalence of ectoparasites in the present study is 24369 grouped in their specific genera of ticks 11399(46.77%), mites 5555(22.79%) lice 5246(21.53%) and flies 2167(8.89%), this result is in harmony with the ectoparasites prevalence in Ethiopia livestock by Makelesh (2010), Shiferaw & Abebe (2006) and Solomon et al (2007) [12-14]. The contrast between the present and earlier findings can be explained by the fact of variation of geographical location of experimental area, topography, the composition of soil type and humidity, lack of control group of population and most importantly, the changed climatic condition of the earth.

Tick Genera: A total of 11399 adult ticks grouped into five genera and eight species were collected. *Boophilus decoloratus 3097* (27.16%), *Amblyomma variegatum* 2399 (21.04%), *Amblyomma lepidium* 1034 (9.071%), *Hyalomma rufipes* 868(7.61%), *Hyalomma. Truncatum*1011 (8.67%), *Rhipicephalus appendiculatus* 1831(16.06%), *Rhipicephalus evertsi evertsi* 767(6.72%) and *Hamephyalis leachii* 392 (3.43%), were proportion of tick species collected and is depicted in Table III. *Boophilus decoloratus* was the predominant tick species followed by *Amblyomma variegatum in a descending order of magnitutde*, while *Hamephyalis leachii was the* least. This is in in agreement with previous studies of Makelesh (2010) [12], Shiferaw and Abebe (2006) [13] and Solomon et al (2007) [14], who reported the predominance of *B. decoloratus.* Ticks are also reported to transmit pathogens that cause some human diseases such as lyme diseases, ehrliciosis, babesiosis, rocky mountain spotted fever, tularemia and tick borne relapsing fever [14]. This observation supports the fact that the genus *Boophilus decoloratus* occupies a wide range of climatic and ecological zones in different habitats throughout the sub Saharan region. On the contrary this is in variance with other scholars Ica et al. (2007) [15], Omer et al. (2007) [16], Szabo et al. (2007) [17], who reported the predominance of *Hyalomma* spp., *Amblomma* spp. and *Haemaphysalis* spp. respectively.This variation between the current and previous studies can most probably be attributed to differences in agro-ecology of study sites, management and breed of the study livestock (Szabo et al., 2007) [17].

Results revealed that cows and sheep had higher ticks infestation than goats. The rationale might be that goats are known to graze less and graze just within the homes as compared to sheep and cattle that graze far into the bush; hence they come in contact with more vegetation and subsequently more ectoparasites. The result is in synchrony with that of Stachurski & Lancelot (2006) [18], who recorded about 90% *Amblyomma variegatum* infestation on cattle attached to interdigital areas as they return in the evening from pasture. *Boophilus* and *Amblyomma* tick species were the most common and were collected mainly from neck and shoulder regions of the animal body. Likewise *Hyalomma* tick species were common on udder and dewlap body parts of the animals but *Rhipicephalus* spp. and *Hamephyalis* tick specie were collected from tail areas of the animals' body.

Mite Genera: The summation of animals infested with mites are as follows: Cow 2501(54.16%), pigs 749(16.22%), goat 334(7.23%), sheep 437(9.46%). Five species of mange mites totaling 5555 were identified in this survey viz: *Demodex bovis*1996 (35.93%), *Sarcroptes scabiei 1256 (26.61%), Chrioptes bovis* 986(17.74%), *Psorotus ovis* 821 (14.77%), *Psoroptes cuniculi 496 (8.92%),* illustrated [Table III]. *In this survey Demodex bovis was the* highest mite in the study group followed by *Sarcroptes scabiei, while Psoroptes cuniculi was the least. Mite i*nfestation was observed around udder, scrotum and limbs at the base of the tail. *Chrioptes bovis was* significant, as the male animals infested with *Chrioptes bois* were noted with serum exudation and thickening of the skin characteristically at the base of the tail. Cattle affected by sarcoptic mange lose grazing time and do not gain weight as rapidly as do uninfected cattle. Mites have been found to be the intermediate host of tapeworms that infest domestic animals such as cattle, sheep and goats [19]. Infestation of *Demodex bovis* was remarkably high in the females community especially the pregnant ones, than their male counterparts; as was observed significantly with a P value of ($p< 0.005$) higher. It can also be hypothesized that higher levels of prolactin and progesterone as well as stresses of lactation and pregnancy make female animals more susceptible to parasitic infestations [20]. Cattle affected by sarcoptic mange lose grazing time and do not gain weight as rapidly as do uninfected cattle. Mange produced by this mite can be severe because the mite burrows deeply into the skin, causing intense itching. Considering the importance of skin and hides as a source of foreign currency to the investors, the prevailing ectoparasites mainly in different cattle breeds reared in the South-south zone requires attention in order to minimize the spread of infestation and increase income earnings of farmers and small scale holders whose livelihood is dependent on their animals.

Lice Genera: The number of animals infested with lice is cow 995(21.55%), pigs 862(99.08%), goat 334(65.49%) and sheep 420(89.93%); Table III. Four lice species surveyed in the study area summed up to 5248 with a break down of *Haematopinus suis* 2419 (46.09%); *Damalina bovis* 1405 (26.77%); *Haematopinus euryternus* 766 (14.59%) and *Linognathus vitulii 658 (12.53%). Haematopinus suis* ranked the highest in the number of lice recorded in all the animals studied and it infested mainly pigs. The findings is in corroboration with other scholars [21] , who argued that hog louse is a major ectoparasites of pigs all over the world [22]. The hog louse has also been implicated in the transmission of diseases such as swine pox, swine flu viruses, eperythrozoonosis, and African swine fever [23 & 24]. During the course of this study, pigs were so overwhelmed with lice that in severe cases the pigs tended to shake their head or ears vigorously, which we denoted as 'shaking head syndrome'during the survey.

Fly Genera: Animals infected with flies genera are cows 534(11.56%), pigs 632 (11.36%), goats 486(10.52%) and Sheep 209(4.52%). A total 2167 adult flies comprising of *Musca domestica* for cows 434 (20.02%), for pig 388 (17.90%) for goat 178 (8.21%) and for sheep 108(4.98%). *Tabanuss spp.* for cows 175(8.07%), for pigs 289(13.33%), for goat 428 (19.75%) and for sheep 167(7.70%). Flies act as vectors and are of veterinary importance because they can mechanically transmit bacteria and viruses from one animal to another, directly in the case of biting flies or indirectly by contaminating feeds. Flies can also transmit infections from one animal in a farm to another if they are less than 3km (2 miles) apart [25]. The findings are similar to those of other scholars [26], who proposed that flies both the biting and sucking flies were identified from animals in different husbandry system and are known vectors of similar agents of disease, of the Bluetongue virus serotype 8, which overwhelmed cattle and sheep [27].

Table IV: Prevalence of Mixed Infection In Animals Surveyed

Mixed Ecotoparasites	**Cow % N= 2770**	**Pigs % N = 870**	**Goat % N = 510**	**Sheep % N = 467**	**P= .005**
Ticks, Mites, Lice & Flies	980(35.37)	113(12.98)	107(20.98)	155(33.19)	P= .005
Ticks, Mites & Lice	310(11.19)	289(33.21)	46(9.01)	34(7.28)	P= .005
Ticks, Mites & Flies	341(12.31)	111(12.75)	37(7.25)	19(4.06)	P= .005
Mites, Lice & Flies	129(46.57)	231(26.55)	0	15(3.21)	P= .005

There was an overall mixed infestation in all the animals studied, as most of the subjects were infested with more than one genera of ectoparasites and also different species in the same animals. The incidence and mean burden of ectoparasite infestation was also breed related, as mixed infestation of ticks, mites, lice & flies were found relatively higher in cows and sheep

than the rest of the animals with a P value of "(P = 0.005)" "Table VI". The mixture of mites, lice and flies was the least in all the animals surveyed.

Table V: Treatment History of Acaricidal/Alternative Therapy on Animals Studied N = 4617

Treatment History	Cow%N=2770	Pigs % N = 870	Goat % N = 510	Sheep % N = 467
Number Treated	241(10.61)	88(10.11)	_	_
Number Not Treated	2529 (91.29)	782(89.88)	510(100)	467(100)
Total	2770	870	510	467

History of acaricide/alternative treatment was recorded in the animals which divulged that out of the 2770 cows surveyed, only 241(10.61%) was recorded as having history of acaricide/alternative therapy while, 2529(91.29%) had a zero history of acaricide/alternative therapy. For pigs, only 88(10.11%) had history of acaricide/alternative therapy while 782(89.88) had no history of acaricide/alternative therapy; the entire goats and sheep flock had a zero history of acaricide/alternative therapy. This could be a rationale for the high number of the ectoparasitic infection in the study as is illustrated in"Table V", which described the acaricide/alternative treatment parameter that was outstandingly significant in the study. Perhaps even those that were treated with acaricide/alternative therapy could have been cross contaminated due to congested housing and bedding.

Intervention:

Free acaricidal therapy, (Avermectin) Ivermectin 1ml per 50 kilogram (kg), was administered to participating livestock that tested positive during follow up session. Proprietors were encouraged to provide cleaner environment and also to decongest and decontaminate beddings and stall for their livestock. Both human and animal health education was conducted for all livestock keepers within the studied area. They were advised to use simple alternative therapy in form of disinfectants like dettol or izal to treat wounds on their animals where they cannot afford the conventional acaricides. The uses of acaricides were also demonstrated and live stock owners were directed to obtain such chemicals in veterinary pharmacies within their area of domicile. Follow up showed a considerable reduction in rate of infestation by the ectoparasites.

CONCLUSION

This study has, through a thorough epidemiological sampling technique revealed the prevalence of various ectoparasites and their specific genera in livestock, with higher infestation rate of ticks, mites, lice and flies in a descending order of magnitude in the animals studied. The result of the study indicates that livestock were infested by ticks, mites lice and flies in the vicinity

investigated. The economic and health implications of these ectoparasites are enormous, deserving urgent attention by Government, policy makers and nongovernmental organizations to give both commercial and small scale livestock industry a better value for their livestock. All of these parasites have both pathogenic and zoonotic importance, it would be important to further characterize their known pathogenicity to human.

In recent years, the parasites are potential pathogens especially to the immunocompromised humans particularly those suffering from HIV/AIDS. Worthy of note fact is, while the hog louse has been implicated in the transmission of diseases such as the swine pox, eperythrozoonosis, and the African swine fever, other ectoparasites like ticks also act as vectors of various diseases such as the Babesia and Theileria, Rickettsiales, Anaplasma and the Crimean Congo fever lyme diseases, ehrliciosis, babesiosis, rocky mountain spotted fever, tularemia and tick borne relapsing fever to mention but a few, all of which may introduce severe diseases or even death in human. Likewise mites have been found to be the intermediate host of tapeworms that infest domestic animals such as cattle, sheep and goat which is transmited to humans as one of the neglected tropical diseases of Afirca. Given that livestock ectoparasitic infestation continues to remain a vicious cycle in the vulnerable community, an apt attention to save the endangered species is deemed absolutely necessary. In the South-south geopolitical zone of Nigeria, the prevalence of HIV/AIDS is relatively high and it would therefore be important to determine the prevalence of these parasites in humans and their origin. For a rational and sustainable control program, a comprehensive knowledge on the epidemiology of parasites, and how they relate to a given climate and management merit a prerequisite. It would therefore be important to determine the relationship between the occurrence of the parasite and environmental factors.

Several caveats are noteworthy. The investigators believe it is unlikely that a study of this magnitude could ever be conducted in Nigeria, given the level of knowledge deficits relatively common in the proprietors'/livestock traders, regarding universal livestock screening and ethical constraints for animal subjects, and fear of making our research findings public which could affect their investments.

Access to sites, bad roads, poor transportation facilities to and from the livestock centers and level of illiteracy were some of the limitation we encountered. These were partially overcome by providing free acaricidal therapy to each participant during each session after sample collection, of which a subsequent follow up survey showed a considerable reduction in rate of infestation by the ectoparasites.

AUTHORS CONTRIBUTION:

Onyeachonam FCO, Aburoma HLS and Okuduwor AA, implemented the study design, involved in the acquisition of data and data analysis over the past 12 months. Aburoma HLS drafted the original text. All authors revised the manuscript, read and approved the final manuscript.

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