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RESEARCH PAPER

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Ectoparasite species diversity and prevalence in pigs (*Sus scrofa domesticus*) within delta central senatorial district, Delta State, Nigeria

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ABSTRACT

This study assessed and documents the prevalence and species diversity of ectoparasites in pigs reared within Delta Central Senatorial District, Delta State, Nigeria. The study sampled pig farms and slaughter houses for a period of twelve (12) months. Seven hundred and forty one (741) pigs were examined by close inspection, parting of hair against natural direction and forceful detachment across knee, ears, thigh and under arms. Ectoparasites encountered were collected and stored in universal sample bottle and preserved using 70% alcohol. Morphological characterization and identification of ectoparasites was carried out using the standard guide. The result recorded 55.7% prevalence of ectoparasites in the study area. Six species of ectoparasites encountered and their prevalence include *Rhipicephalus* (*Boophilus*) *microplus* (27.2%), *Cimex lectularis* (20.9%), *Hyalomma truncatum* (18.3%), *Amblyomma variegatum* (14.6%), *Necrobia violacea* (11.7%) and *Boophilus decoloratus* (7.3%). Male recorded higher prevalence (67.1%) than female (32.9%). General prevalence of 515(64.5%) was recorded for rainy season while dry season recorded 283(35.5%) prevalence. From the results of ectoparasite abundance, local breed recorded significantly lower proportion of 89(11.6%) compared to exotic/hybrid which accounted for 709(88.4%). The results from this study affirms that ectoparasites are prevalent in pigs, which has the potential of causing mechanical and physical damages to pigs. Thus, the need for effective and prompt tackle the burden of ectoparasites in pigs in order to reduce and subsequently curb their negative effects is paramount to boost pork production.

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INTRODUCTION

Arthropod is considered the most divers' group of organisms with representative species found in different environment acting as ectoparasites, insect pest and vector of diseases (Lamarre *et al.,* 2015). Their activities as ectoparasites have been associated with several economic losses in animals including pig (Dogo *et al.,* 2010). Infestation caused by ectoparasites can result to considerable losses economically to farmers due to reduction in productivity, skin diseases and mortality. Ectoparasites including lice, ticks, fleas with representative species such as *Rhipicephalus* sp., *Amblyomma* sp., *Psoroptes* sp., *Lignognathus* sp., *Bovicola* sp., *Boophilus* sp.

(Adugna and Tsegay, 2019; Insyariati *et al.,* 2024; Samson and Temesgen, 2023) among others are reported to cause a wide range of health problems such as mechanical tissue damage, irritation, inflammation, hypersensitivity, abscesses, weight loss, lameness, anaemia, and in severe cases death of infested animals with the consequent socioeconomic implications (Nyangiwe and Horak, 2007; Ofukwu *et al.,* 2008). Also, ectoparasite infestations results in reduction of wool quality, milk production, meat supply, losses from culling and high cost of treatment and prevention of infestation.

They are also responsible for great pre-slaughter skin defects, resulting in downgrading and rejection of small ruminant skins. According to tanneries reports, skin defects due to ectoparasite effects cause 35% of sheep and 56% of goat skin rejections (Kassa, 2006). Moreover, ectoparasites are known to have zoonotic importance and be capable of transmitting several types of disease pathogens from animals to animals and from animals to human due to their blood sucking habit (Apanaskevich *et al.,* 2018). The hard tick species are obligate blood-sucking ectoparasites with some pathogenic importance, especially in subtropical and tropical regions (Pavela *et al.,* 2016). These established the facts that ectoparasites cause severe economic losses to farmer, the tanning industries, and the country in general (Yakob, 2014).

However, there have been recent developments in the socioeconomic significance of small ruminants in food security and poverty alleviation in resource-poor farming communities. Hence, there is need to study the prevalence and diversity of ectoparasites associated with pigs, in order to document their diversity and possible effects associated with their presence in these animals. This study therefore document the prevalence and species diversity of ectoparasites in pigs reared within Delta Central Senatorial District, Delta State, Nigeria.

MATERIALS AND METHODS

Study area

The study was carried out across Delta Central Senatorial District, Delta State, Nigeria. It lies between latitudes 5°09¹ and 6°03¹ North Longitudes 5°30¹ and 6°12¹ East with estimated population of approximately 2,032,707. The climate within the area is characterized as rainy and dry seasons with tropical climate, rainforest vegetation and mangrove vegetation. The inhabitants of the selected areas are involved in different occupations which include farming, trading, commercial transportations, artisans and civil service among others (Ede *et al.,* 2024; Ejemeyovwi, 2019; Lemy and Egwunyenga, 2017).

Study design

The study is a cross-sectional observation research, aimed at determining the prevalence of ectoparasites of pigs within the study area. Weekly visits were made to the selected locations across the study areas for a period of twelve (12) months for sampling to collect ectoparasites.

Pig farms and slaughter houses were mapped out and used for the collection of samples throughout the study period.

Collection and preservation of ectoparasites

Pigs encountered during the study were physically examined for the presence of ectoparasites. The skin of pigs encountered were examined thoroughly by close inspection and their hair were parted against their natural direction for the occurrence of ectoparasites. Species of ectoparasites (tick) encountered were collected by forceful detachment following the method of Mukhtar *et al.* (2018). Fleas and lice were collected by combing the skin of the pigs continuously. Specific areas such as knee, ears, and thigh and under arms were thoroughly observed for the presence of ectoparasites. Species of ectoparasites collected were stored in universal sample bottle and preserved using 70% alcohol solution. Samples were tagged based on sex and season of collection for the purpose of documentation and result analysis.

Identification of ectoparasites species

Morphological characterization and identification of ectoparasites was carried out using the standard guide of Walker *et al.* (2003). Observation of ticks was done using magnifying hand lens and microscope. The identification and classification of species of flea and lice was carried out directly under the dissecting microscope (AmScope) using standard identification manual of Mathison and Pritt (2014). Further confirmation of species based on classification was carried out by Entomologist at the Department of Animal and Environmental Biology, Faculty of Life Sciences, University of Benin, Benin City, Nigeria.

Statistical analysis

Data of ectoparasite species encountered were encoded in Microsoft Office Excel (Version 2016) spreadsheet to facilitate data summation and appropriate data cleansing was carried out.

Descriptive statistics such as percentage, frequency and mean intensity were computed to summarize the data. Analysis of Variance (ANOVA) was used to assess statistical significant difference in the prevalence of ectoparasites across sex, breed and season.

RESULTS AND DISCUSSION

Overall prevalence and abundance of ectoparasites in pigs

A total of Seven hundred and forty one (741) pigs were examined for the presence of ectoparasites (Table 1). From the 741 examined, four hundred and thirteen (413) pigs were positive for at least one ectoparasite. This represent 55.7% prevalence of ectoparasites in the study. Among the pigs positive for at least one ectoparasite, six different species of ectoparasites were identified. Based on category, the ectoparasites encountered were both fleas and ticks.

Species of flea encountered include *Cimex lectularis* Family Cimicidae of the Order Hemiptera and *Necrobia violacea* (Beetles) Family Claridae of the Order Coleoptera while tick species encountered include *Amblyomma variegatum* Family Ixodidae of the Order Ixodida, *Boophilus decoloratus* Family Ixodidae of the Order Ixodida, *Hyalomma truncatum* Family Ixodidae of the Order Ixodida and *Rhipicephalus microplus* Family Ixodidae of the Order Ixodida (Table 1). The prevalence and occurrence of these species of ectoparasites recorded in this study conforms to the occurrence of the species in pigs and other animals. The study of Ofukwu and Akwuobu (2010), Adugna and Tsegay (2019), Agu *et al.* (2020) and Ozioko *et al.* (2021) across Nigeria.

Percentage prevalence, abundance and intensity of individual species of ectoparasites encountered showed that tick species *Rhipicephalus* (*Boophilus*) *microplus* was the most abundant species which accounted for 27.2% prevalence with mean intensity of 1.19 and relative abundance of 27.19, this was followed by flea species *Cimex lectularis* which accounted for 20.9% prevalence with mean intensity of 1.38 and relative abundance of 18.30. Consequently, *Hyalomma truncatum* recorded 18.3% prevalence with mean intensity of 0.14 and relative abundance of 18.30, *Amblyomma variegatum* recorded percentage prevalence of 14.6% with mean intensity of 1.22 and relative abundance of 14.66, *Necrobia violacea* recorded 11.7% prevalence with mean intensity of 1.31 and relative abundance of 11.65 while *Boophilus decoloratus* was observed to be the least prevalent ectoparasite species encountered with 7.3% prevalence and mean intensity of 1.57, relative humidity 7.27 respectively. Generally, the overall mean intensity for the prevalence of ectoparasite in the study was 6.81 (95% Cl) (Table 1). The percentage prevalence of ectoparasites of pigs of 55.7% recorded in this study was higher compared to the 26.1% recorded by Elom *et al.* (2021) from pigs in Abakiliki, Ebonyi State, Nigeria. The results were also higher compared to the 50.75% prevalence of ectoparasites of local pigs at Emene Town Area in Enugu State, Nigeria reported by Odo *et al.* (2016). Similarly, Mohammed *et al.* (2024) recorded lower percentage prevalence of 35.6% of ectoparasites of pigs slaughtered in Southern part of Gombe State, Nigeria.

Table 1. Prevalence and relative abundance of ectoparasite species in pigs reared in different environment

Ectoparasites	Number examined (n=741)	Number of pigs infected by species (n=413)	Number of ectoparasites encountered (n=798)	Percentage prevalence (95% Cl)	Relative abundance (95% Cl)	Mean intensity (95% Cl)
Fleas						
Cimex lectularis	741	121 (29.3)	167	20.9	20.93	1.38
Necrobia violacea (Beetles)	741	71 (17.2)	93	11.7	11.65	1.31
Ticks						
Amblyomma variegatum	741	96 (23.2)	117	14.6	14.66	1.22
Boophilus decoloratus	741	37 (8.9)	58	7.3	7.27	1.57
Hyalomma truncatum	741	113 (27.4)	146	18.3	18.30	0.14
Rhipicephalus microplus	741	183 (44.3)	217	27.2	27.19	1.19
Total	741	538	798	100%	100%	6.81

Prevalence and abundance of ectoparasites of pigs reared in different environment based on sex

The study surveyed at total of seven hundred and forty one (741) pigs comprising of four hundred and fifty three (453) males accounting for 61.1% of the total pig population samples and two hundred and eighty eight female pigs which accounted for 38.9% of the total population of pig samples. From the study, of the four hundred and thirteen (413) pigs positive for ectoparasites, male accounted for two hundred and seventy seven (277) with prevalence of 67.1% while female accounted for one hundred and thirty six (136) which recorded prevalence of 32.9%. This showed a statistically significant different (*p*-0.807) (Table 1). The high prevalence based on the results could be as a result of the population of pigs sampled as male pigs were sampled more than female pigs as a result of the fact that male pigs and other animals are mainly slaughtered more frequently than females due to several factors, including breeding practices, meat quality and considerations (Daszkiewicz and Gugolek, 2020). Also, males are easily replaced in terms of breeding, as females are usually kept aside for continuous breeding which gives preferences to higher rate of slaughtering of male pigs and other ruminant animals including poultry. Accordingly, Kagira *et al.* (2013) reported that male pigs had higher prevalence rate of ectoparasites compared to female pigs which could be attributed to pig origin and other economic factors.

A total of seven hundred and ninety eight individual ectoparasite species were encountered belonging to six groups of parasites. Four hundred and ninety one (491) individual species were recorded for male pigs accounting for 61.5% of the total ectoparasites encountered while three hundred and seven (307) individual species accounting for 38.5% of the total ectoparasites were encountered in female pigs. Statistical significance (*p*-0.049) was observed between the prevalence in male and female based on individual species prevalence (Table 2). The results showed that male recorded higher prevalence of ectoparasites across most of the species encountered. *Cimex lectularis* (n=167) recorded

100 (59.9%) for male pigs and 67 (40.1%) for female pigs with statistical significance at *p*-0.448, *Necrobia violacea* (n=93) recorded 64 (68.8%) for male pigs and 29 (31.2%) for female pigs with statistical significance at *p*-0.693, this was also similar for *Amblyomma variegatum* (n=117) which recorded 72 (61.5%) for male pigs and 45 (38.5%) for female pigs with statistical significance at *p*-0.635, *Hyalomma truncatum* (n=146) recorded 87 (59.6%) for male pigs and 59 (40.4%) for female pigs with statistical significance at *p*-0.609. While *Rhipicephalus* (*Boophilus*) *microplus* (n=217) recorded 142 (65.4%) for male pigs and 75 (34.6%) for female pigs with statistical significance at *p*-0.980. However, female pigs recorded higher prevalence of ectoparasites for *Boophilus decoloratus* (n=58) with male pigs accounting for 26 (44.8%) while female pigs accounted for 32 (55.2%) with statistical significance at *p*-0.081 respectively (Table 2).

Table 2. Prevalence and abundance of ectoparasites of pigs reared in different environment based on sex

Ecto-parasites	NE (n=741)	TNOI (n=413)	Cl (n=167)	Nv (n=93)	Av (n=117)	Bd (n=58)	Ht (n=146)	Rm (n=217)	TEE (n=798)	P (0.05)
Male	453 (61.1)	277 (67.1)	100 (59.9)	64 (68.8)	72 (61.5)	26 (44.8)	87 (59.6)	142 (65.4)	491 (61.5)	0.049
Female	288 (38.9)	136 (32.9)	67 (40.1)	29 (31.2)	45 (38.5)	32 (55.2)	59 (40.4)	75 (34.6)	307 (38.5)	Sig.
P (0.05)		0.807	0.448	0.693	0.635	0.081	0.609	0.980		
	741	413 (55.7)	167(20.9)	93(11.7)	117(14.6)	58(7.3)	146(18.3)	217(27.2)	798	

Cl= *Cimex lectularis*, Nv= *Necrobia violacea*, Av= *Amblyomma variegatum*, Bd= *Boophilus decoloratus*, Ht= *Hyalomma truncatum*, Rm= *Rhipicephalus microplus*, Total ectoparasites encountered=TEE, Number examined=NE, TNOI= Number of pigs infected

Table 3. Comparative prevalence and abundance of ectoparasites based on season, breed and sex

Ectoparasites encountered	Season		*p*-value	Breed		*p*-value	Sex		*p*-value
	Rainy	Dry		Exotic	Local		Male	Female	
Fleas									
Cimex lectularis	123(23.9)	44(15.4)	0.972	153(21.6)	14(15.7)	0.979	100(59.9)	67(40.1)	0.448
Necrobia violacea (Beetles)	65(12.6)	28(9.9)	0.723	85(12.4)	8(9.0)	0.914	64(68.8)	29(31.2)	0.693
Ticks									
Amblyomma variegatum	64(12.4)	53(18.7)	0.993	101(14.2)	16(18.0)	0.981	72(61.5)	45(38.5)	0.635
Boophilus decoloratus	37(7.2)	21(7.5)	0.708	53(7.5)	5(5.6)	0.862	26(44.8)	32(55.2)	0.081
Hyalomma truncatum	97(18.9)	49(17.3)	0.541	129(18.2)	17(19.1)	0.994	87(59.6)	59(40.4)	0.609
Rhipicephalus microplus	129(25.0)	88(31.2)	0.155	188(26.5)	29(32.6)	0.995	142(65.4)	75(34.6)	0.980
Total	515(64.5)	283(35.5)		709(88.4)	89(11.6)		491	307	

Comparative prevalence and abundance of ectoparasites of pigs based on season, breed and sex

Seasonal variation of ectoparasites prevalence in pigs within the study area showed revealed that rainy season had higher prevalence and abundance of ectoparasites presence in pigs compared to dry season (Table 3). General prevalence of 515(64.5%) was recorded for rainy season while dry season recorded 283(35.5%) prevalence respectively. Based on individual ectoparasite species prevalence, *Rhipicephalus microplus* was the most prevalent for both rainy and dry season with 129(25.0%) for rainy season and 88(31.2%) for dry. However, the results were statistically significant (*p*-0.155). *Cimex lectularis* recorded 123(23.9%) prevalence in rainy season and 44(15.4%) prevalence in dry season (*p*-0.972), *Necrobia violacea* recorded 65(12.6%) prevalence for rainy season and 28(9.9%) prevalence for dry season (*p*-0.723), *Amblyomma variegatum* recorded 64(12.4%) prevalence for rainy season and 53(18.7%) prevalence for dry season (*p*-0.993), *Boophilus decoloratus* recorded 37(7.2%) prevalence for rainy season and 21(7.5%) prevalence for dry season (*p*-0.708) followed by *Hyalomma truncatum* which recorded 97(18.9%) prevalence for rainy season and 49(17.3%) prevalence for dry season with statistical significance (*p*-0.541) respectively (Table 3).

The results showed that there were significant variation (*p*-0.05) between species prevalence across the breeds of pigs encountered during the study (Table 3). From the results, local breed recorded significantly lower proportion 89(11.6%) compared to exotic/hybrid which accounted for 709(88.4%). Consequently, ectoparasite species encountered based on breeds of pigs showed that there was statistically significant (*p*-0.05) variations across the various ectoparasites in relation to breeds. *Cimex lectularis* recorded 153(21.6%) prevalence for exotic breeds and 14(15.7%) prevalence for local breeds with statistical significance (*p*-0.979), *Necrobia violacea* recorded 85(12.4%) prevalence for exotic breeds and 8(9.0%) prevalence for local breed with statistical significance (*p*-0.914), *Amblyomma variegatum* recorded 101(14.2%) prevalence for exotic breed and 16(18.0%) prevalence for local breeds with statistical significance (*p*-0.981), *Boophilus decoloratus* recorded 53(7.5%) prevalence for exotic breeds and 5(5.6%) prevalence for local breeds with statistical significance (*p*-0.862), *Hyalomma truncatum* recorded 129(18.2%) prevalence for exotic breed and 17(19.1%) prevalence for local breeds with statistical significance (*p*-0.994) followed by *Rhipicephalus microplus* which recorded 188(26.5%) prevalence for exotic breeds and 29(32.6%) prevalence for local breeds with statistical significance (*p*-0.995) respectively (Table 3). Higher prevalence of ectoparasites in rainy season compared to dry season could be attributed to several factors such as humidity, temperature which usually favours the growth, development and survival of these parasites (Lawal *et al.,* 2017). Also, the rainy season favours breeding sites and such environmental conditions ensures the proliferation of these arthropods and insect which finds convenient and effective breeding sites.

CONCLUSION

The findings from this study documented the species diversity of ectoparasites and their prevalence in pigs reared within different localities in Delta Central Senatorial District of Delta State, Nigeria. The diversity study showed that tick and flea are the dominant arthropods with species including *Cimex lectularis, Necrobia violacea, Amblyomma variegatum, Boophilus decoloratus, Hyalomma truncatum* and *Rhipicephalus* (*Boophilus*) *microplus* acting as ectoparasites were encountered and documented across the pigs sampled during the study.

Sex based analysis showed that male recorded higher prevalence of ectoparasites across most of the species encountered. However, female pigs recorded higher prevalence of ectoparasites for *Boophilus decoloratus*. Ectoparasites prevalence in pigs within the study area revealed that rainy season had higher prevalence and abundance of ectoparasites presence in pigs compared to dry season. Based on breeds, it was observed that local breed recorded significantly lower proportion compared to exotic/hybrid.

The results from this study affirms that ectoparasites are prevalent in pigs, which has the potential of causing mechanical and physical damages to pigs. This in turn has economic effect of the animals by causing poor health conditions, leading to high cost of farming and reduced meat production. The need for effective and prompt tackle the burden of ectoparasites in pigs in order to reduce and subsequently curb their negative effects is paramount to boost pork production.

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