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Seasonal changes in the distribution of pig carrion entomofauna in Southeastern Nigeria

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Abstract

Forensic entomology applies the study of insects colonizing decomposing remains to estimate Postmortem Interval (PMI), aiding coronial investigations in resolving suspicious deaths across varying seasons. This study investigated the entomofauna associated with pig carcasses (*Sus scrofa L.*) in southeast Nigeria during wet and dry seasons. Decomposing carcasses were monitored, and insect specimens at different developmental stages were collected using sweep nets and pitfall traps, then preserved in 70% ethanol for identification. A total of 91 species belonging to 38 families across 10 insect orders were recorded from both seasons. Complete skeletonization occurred within 31–36 days during the dry season and 37–48 days during the wet season. Statistical analysis revealed no significant difference in overall insect abundance between wet and dry seasons ($p>0.05$; 0.21). However, a significant variation was observed in insect assemblages across decomposition stages, from fresh to dry decay ($p<0.05$; 0.04). Although seasonal variation was not pronounced, shifts in microenvironmental factors influenced insect succession patterns. These findings highlight the potential of entomofaunal evidence in estimating PMI under varying seasonal conditions, thereby providing valuable baseline data for forensic investigations in Nigeria.

Introduction

In tropical areas, seasonality related to rainfall influence organisms during wet and dry seasons. Differences in species abundance, activity, and species richness are also evident in the seasonal heterogeneity of every region. Voss *et al* (2009) reported that differences in the abundance of species of blowflies during two seasons in Peru were a result of weather influence. Carrion insects are impacted by the season, with specific peaks in activity, abundance, and species richness (Tantawi *et al* 1996).

The insects that colonize corpses vary in species depending on the bioclimatic zone in which the remains are found. Each zone has different habitat types, vegetation, soil pH, soil type, flora and fauna, altitude, and climatic conditions that affect the species of insects present. Decomposition is also affected by the time of year and the location in which the remains are found (Anderson 2001). Many fly species vary in abundance depending on the season and even the time of day. The presence or absence of sunlight or shade can influence which insect species will colonize a corpse.

Insects are indeed practically without exception intimate witnesses of the post-mortal phase of humans, right from the moment of death on, and sometimes even before. Unless preventive measures are taken, insects, mostly blowflies (Calliphoridae family), colonize the corpse within an hour after death, rapidly starting oviposition (Catts and Haskell 1990). Above 12°C, in our region, species of Calliphora and Lucilia are predominant, and they are almost everywhere (Catts and Haskell 1990). Later, other insect groups arrive, including members of other flying families, and species of Coleoptera, Hymenoptera, and Lepidoptera (Catts and Haskell 1990).

Season and carcass micro-environment are factors influencing the insect species composition and succession patterns during decomposition (Wilson and Wolkovich 2011).

Seasonal effects that occur within the same area can influence insect abundance. Bourel *et al* (1999) found a considerable difference in blowfly colonization of rabbit carrion from one year to the next. The report showed that these species did not arrive until day three and did not lay eggs until day five. In the following year, the activity of these species differed in terms of oviposition. Voss *et al* (2009) reported that the season directly affects the insect's composition. Generally, studies have shown that the assemblage of vertebrate and invertebrate scavengers differ significantly due to season (Burkepile *et al* 2006; DeVault *et al* 2011). The seasonal differences in abundance and activity of blowflies are evident and can be useful in estimating the time of death. Generalizations about seasonality must, therefore, be applied carefully in forensic situations since many factors can alter this type of evidence (Catts 1992).

Tantawi *et al* (1996), Benecke, (2004), Catts and Goff (1992) and Wolff *et al* (2001) reported that external factors, such as environmental factors significantly influence the decomposition rate of carrion carcasses, since the attraction of insects to carcasses will depend on the stage of carcass decomposition.

This study aimed to examine how seasonal changes (wet and dry seasons) affect the diversity, distribution, and successional patterns of carrion-inhabiting insects during the decomposition of pig carcasses in southeastern Nigeria, with a view to providing baseline data for forensic investigations in the region.

Materials and methods

Study Area

The study was carried out in Abakaliki, in Ebonyi State Southeast Nigeria. It lies on the latitude 6º 22′N and longitude 8º 66′E. The study was conducted in two open grasslands around Presco Campus Mgbabo Communities of Ezza North Local Government Area and two forest sites of Amike Aba Community of Abakaliki LGA. The two areas are the intersection of each other with a swampy rice farm and forest bed as demarcation. The areas were chosen based on their slopes and heterogeneity in demarcation with patches of grasses, uniformity in cover, sunlight, anthropogenic activities, forest beds and chains of pools and streams, and floral composition. The forest was characterized by rings of water flow, and higher plant cover (trees, shrubs and herbs). The average yearly temperature is between 23-38ºC in the forest and between 20 -35°C in the grassland in wet seasons and marginally higher in the dry seasons between 28-40°C while the precipitation is between 800-1500mm. The average elevation is 216m above sea level. The coordinates of the studied areas are 6º 19′ 32. 21″ N Latitude and 8º 4′ 45.90″E longitudes for site 1, 6º 20′ 41.19″N latitudes and 8º 4′ 42.94″E longitude site 2, while that of the Forest in site 3 were latitude 6º 19′ 23.43″N and longitude is 8º 4′37.71″E and site 4 latitude is 6º 19′ 20.84″N and longitude is 8º 42.04″E. The longitude and latitude data were collected from Arc Geographical Information System (GIS) version 10.6.

Ecologically, Abakaliki lies in a rainforest with an annual rainfall value of 800 to 1500mm. Abakaliki has two seasons, the dry and wet seasons. The dry season is characterized by a deep harmattan and hot temperatures between November to January, while the wet season is characterized by high rainfall and cloudy weather with an average temperature of 20-35°C. The contrasting sites are demarcated by foot pathways with grass, trees, canopy trees, and rice swamps transversing the back of the grassland.

Experimental animals and analysis

The pigs were purchased from Nwazunku Integrated Farms and Umebe Farm College with proven health conditions. The pigs were shot transversely with a bullet of 2nches at the midbrain by an officer from the homicide Department of the Nigerian Police Force at about 1200hrs in the wet season and repeated in the dry season. This was done to investigate murder cases of unknown gunshots. The entire process was monitored, and five decomposition stages were set up for each carcass using the stage criteria set by Anderson and VanLaerhoven (1996) and Payne (1965), namely, the Fresh, Bloat, Active Decay, Advanced Decay, and Dry/Remains. It was necessary to record insect colonization and to study the decomposition of each carcass from as close to the point of death as possible. Therefore, the day of death of the pigs was recorded as Day 1. Each pig carcass weighed between 25 and 51kg.

These carcasses were then placed in cages on steel grid cages staked on the ground. Carcasses were protected in cages made with wire gauze to minimize interference by further scavengers. Each cage was 1.22m x 0.76m x 0.76m and was placed 100m away from the other. Each cage was supported by a steel-hinged lid for easy access to each carcass for sampling.

Collection and identification of insects

Insects on the carcass were collected from the moment of death until the carcass was only bones and skin. Photographs were taken and notes of the physical changes observed were recorded; insects were sampled twice daily (7.00am and 4.00pm) during the study period.

Samples of insect larvae and adults collected during the routine daily observation were sorted into taxonomic groups in the Applied Biology Laboratory, Ebonyi State University, Abakaliki and transported to the Insect Museum Centre Institute of Agricultural Research, Ahmadu Bello University Zaria for identification.

Data analyses

The generated data were analyzed using ANOVA to determine significant differences in decomposition stages across seasons and sites. Correlation analysis was used to compare micro-environmental variables across sites and seasons using SPSS version 21. The graphs were plotted using Microsoft Excel, 2016.

Ethical Clearance

This research followed ethical clearance from the Animal Welfare Committee, Ebonyi State Directorate of Veterinary Services, Ministry of Agriculture, Abakaliki, Ebonyi State, with approval number EBMA/VS20/017P. The use of a pig for this research was approved to be sacrificed for this study, with strict adherence to the best ethical practices.

Results

Table 1 shows the colonized carrion insects in the wet season. Identified insect were classified into 9 orders, 28 families, and 66 species. The majority of the insect taxa were from the Family Calliphoridae, which were the early colonizers and were the first to start the decomposition process, and continued till skeletonization. The largest order of insects was Diptera, followed by Coleoptera and Hymenoptera, while the least family was Libellulidae in the Order Odonata. The frequency of insect colonization was in relation to the stage of carrion decomposition. The insect order colonized showed that Diptera were highest in occurrence, with 11 families and 29 species.

Table 2 shows the colonized carrion insects on pig carrion in the dry season. The insects collected were classified into 7 orders, 28 families, and 41 species. Calliphoridae collected in this season were 11 species and was the highest in occurrence among the decomposition stages of the carrion. The Order

Orthoptera had the fewest families and species, with one each observed in the dry season.

Table 3 shows the effects of microenvironmental variables among the decomposition stages in relation to the wet season. The analysis revealed that there was a significant difference between PBT (p<0.05=0.000) and LMT (p<0.05=0.000) among the decomposition stages at (p<0.05=0.00). The frequency of insect colonization was related to the stage of carrion decomposition. Colonization by insect order showed that Diptera were the highest in occurrence, with 11 families and 29 species.

Table 1: Insects colonized on pig carrion during the wet season in southeastern Nigeria

Order	Families	Genus/species
Diptera	Caliphoridea	*Phumosia pseudolucilia* (Villen)
		Stomorhina sp.
		Rhyncomya undulata (Mall)
		Vanemdenia africana (Peris)
		Chrysomyia. chloropyga (Weid)
		Chrysomia regalis (Rob-desv)
		Chrysomia albiceps (Weid)
		Tricyclea analis (Mall)
		Phurnosia rufescens (Villen)
		Rhyncomya tetropsis
		Tricyclea sp. (Mall)
		Stasisia anthropophaga (Grumber)
	Pipunculidae	*Eudorylas mutillatus* (Loew)
	Stratiomyiidae	*Pecticus polyxanthus* (Speiser)
		Meristomeringina mimetes (James)
	Sarcophagidae	*Sarcophaga exuberans* (Pandelle)
		Sarcophaga inzi (Currans)
		Senetainia albifrons (Rond)
		Helicobia calicifera (Bottcher)
	Muscidae	*Musca domestica* (Linn)
		Musca confiscata
	Syrphidae	*Eumerus* sp.
		Lathyrophthalmus trizonatus (Bigot)
	Bombyliidae	*Exoprosopa* sp.
Dermaptera	Forficulidae	*Nala lividipes* (Dufor)
Hemiptera	Pentatomidae	*Solenostethium liligerum* (Thanb)
	Nabidae	*Arbela confuse* (Harr)
Coleoptera	Carabidae	*Dichaetochilus vagans* (Vagans)
		Lonchosternus politus (Gory)
		Anlacoryssus acciculatus (Dej)
	Histeridae	*Hister* sp.
		Hypocacculus buqueti (Mars)
	Staphylinidae	*Philonthus* sp.
		Diatrechus bicolor (Bernh)
	Tenebrionidae	*Derosphaerus* sp.
	Chrysomelidae	*Estcouritiana bifasciata* (Jac)
		Liliocerus livida (Dalm)
	Scarabaeidae	*Adoratus* sp.
	Cleridae	*Corynetes analis* (KL)
	Buprestidae	*Sphenoptera* sp.
	Gryllidae	*Phaenophilaecris* sp.
		Gryllus bimaculatus (Deg)
		Gymnogryllus sp.
		Gryllode sigillatus (Walk)
		Platygryllus brunneri (Saussure)
	Dermestidae	*D. maculates* (Fab)
		D. frischii (Klug)
		Acanthoplistus sp.
	Acrididae	*Epistaurus succineus* (Krauss)
	Tetrigidae	*Phloeonatus masalensis* (Grant)
Hymenoptera	Formicidae	*Dorylus affinis* (Emy)
		Camponotus sericeus (Fab)

Order	Families	Genus/species
		Camponotus perrisi (For)
		Componotus acvapimensis (Mayr)
		Camponotus maculatus (Fab)
		Myrmicaria strita (Stilz)
		Pheidole sp.
		Messor gala (Emy)
	Braconidae	*Microdus* sp.
Lepidoptera	Acraeidae	*Acraea anacreen* (Trim)
Heteroptera	Pentatomidae	*Hotea subfasciata* (Westw)
		Aspongopus viduatus (Form)
	Noctuidae	*Plusia furcifera* (Walk)
		Bareia oculigera (Guen)
	Pyralidae	*Udea* sp.
Odonata	Libellulidae	*Crocothemis divisa* (Baumann)

Table 2: Insects colonized on pig carrion to dry season in southeastern Nigeria

Order	Family	Genus/species	
Diptera	Muscidae	*Musca domestica*	(Linn)
		Musca confiscate	(Speiser)
		Pyrellia scintillans	(Bigot)
		Hennigmyia sp.	
	Simulidae	*Simulium auerosimile.*	(Pom)
	Sarcophagidae	*Sarcophaga inzi*	(Currans)
		Sarcophaga exuberans	(Speiser)
	Calliphoridae	*Chrysomyia albiceps*	(Weid)
		Brachycera laxenecera	(Linn)
		Auchemeromyia sp.	
		Isomyia sp.	
		Chrysomyia regalis	(Rob)
		Chrysomyia albiceps	(Weid)
	Tabanidae	*Tabanus triquetrornatus*	*(Carter)*
	Stratiomyiidae	*Acrodesmia* sp.	
	Drosophilidae	*Zaprionus vittiger*	(Coq)
	Asilidae	*Promachus trichozonatus*	(Loew)
		Storthyngomerus sp.	
Coleoptera	Hydrophilidae	*Allocotocery seriata*	(Reg)
	Chrysomelidae	*Cryptocephalus lowii*	(Suffer)
		Lema affinis	(Cik)
	Scarabaeidae	*Onthorphagus* sp.	
	Dermestidae	*Dermestes frischii*	(Klug)
	Histeridae	*Dermestes maculates*	(Fab)
	Formicidae	*Hister* sp.	
		Necrubia ruficipes	
Hymenoptera			
		Crematogaster sp.	
		Dorylus affinis	(Emy)
		Camponotus perrisi	(For)
		Camponotus sericeus	(Fab)
		Camponotus maculates	(Fab)
	Sphecidea	*Philanthus triangulum*	(Fab)
	Apidae	*Nomia* sp.	
Hemiptera	Reduviidae	*Rhinocori rapax*	(Stal)
	Pentatomidae	*Cyclopetta* sp.	
Heterocera	Noctuidae	*Callopisteria* sp.	
	Pyralidae	*Udea* sp.	
Dictyoptera	Blattidae	*Blattella* sp.	
		Deropeltus sp	
		Pycroscelus sp.	
Orthoptera	Gryllidae	*Melanogryllus* sp.	

Table 4 showed the effects of microenvironmental variable among the decomposition stages in the dry season. This showed that there was a significant difference between the decomposition stages on the variables at in PBT ($p<0.05=0.00$), LMT ($p<0.05=0.00$). However, difference in ST was not significant ($p>0.05=0.056$). The PBT, ST and LMT were high at certain decomposition stage in this season that in wet season (Figure 1). There was no LMT recorded during fresh stage of decomposition, no PBT recorded during decay stage of decomposition.

Table 3: Effects of micro-environmental variables in decomposition stages in the wet season in southeastern Nigeria

Decomposition State	AMT (°C)	AMH (%)	MT (°C) Mean±SD	MH (%)	PBT (°C)	ST (°C)	GT (°C)	LMT (°C)
Fresh (0-2)	27.10±2.4	79.00±7.8	30.72±1.5	81.50±7.9	30.20±4.7[c]	24.94±1.9	28.77±2.1	0.00±0.0[a]
Bloat (2-5)	30.50±1.7	75.25±6.6	32.12±4.8	82.75±2.5	29.525±3.8[c]	25.02±3.5	27.40±2.3	31.72±2.6[b]
Active (6-7)	23.45±16.4	77.50±14.5	30.97±5.3	83.75±11.0	31.00±2.0[c]	24.35±4.2	28.35±4.3	36.50±3.5[b]
Advance (7-12)	30.70±2.5	74.25±17.3	35.52±7.1	85.00±5.7	14.725±17.0[b]	26.72±1.7	26.05±2.0	33.4±3.0[b]
Dry decay (≥20)	31.92±2.61	69.75±8.8	34.77±0.8	77.25±10.1	0.00±0.0[a]	19.62±12.3	28.575±2.3	7.32±14.7[a]
Total	28.73±7.5	75.15±11.	32.82±4.5	82.05±7.7	21.09±14.4	24.135±6.0	27.83±2.7	21.79±16.6

Columns with similar superscripts had significant differences on the decomposition stages from fresh stage to dry decay stage. **Note:** AMT – Ambient temperature, AMH – Ambient humidity, mt – Maximum temperature, MH – Maximum humidity, PBT – Pig body temperature, ST – Soil temperature, GT – Ground temperature and LMT –Larval Mass temperature.

Table 4: Effects of micro-environmental variables on decomposition stages in the dry season in southeastern Nigeria

Decomposition state	AMT (°C)	AMH (%)	MT (°C)	MH (%)	PBT (°C)	ST (°C)	GT (°C)	LMT (°C)
Fresh (0-2)	29.67±1.0	4.00±35.6	30.70±3.3	66.75±19	37.47±3.6[c]	24.25±3.1[a]	24.25±5.6	0.00±0.0[a]
Bloat (2-4)	28.17±1.4	60.75±26	32.75±3.8	74.25±5.7	32.60±2.9[c]	26.00±3.3[a]	25.40±2.0	7.00±14[a]
Active (4-7)	31.15±2.9	54.50±22	32.25±3.0	67.00±3.4	25.45±6.7[c]	25.85±2.3[a]	25.50±4.1	39.85±4.3[c]
Advance (8-13)	29.32±1.0	60.50±11	33.10±3.3	68.25±8.1	13.00±15[b]	23.00±2.1[a]	26.75±7.2	33.2±5.5[b]
Dry decay (13-46)	31.62±3.7	74.75±6.7	33.12±4.3	60.75±22	0.00±0.0[a]	129.00±21[b]	24.25±3.7	28.10±0.1[b]
Total	**29.99±2.4**	**59.10±23**	**32.38±3.3**	**67.40±13**	**21.70±15**	**45.72±64**	**25.03±4.4**	**21.63±17**

Columns with similar superscripts had a significant difference in the decomposition stages from the fresh stage to the dry decay stage. **Note:** AMT – Ambient temperature, AMH – Ambient humidity, mt – Maximum temperature, MH – Maximum humidity, PBT – Pig body temperature, ST – Soil temperature, GT – Ground temperature, and LMT –Larval Mass temperature.

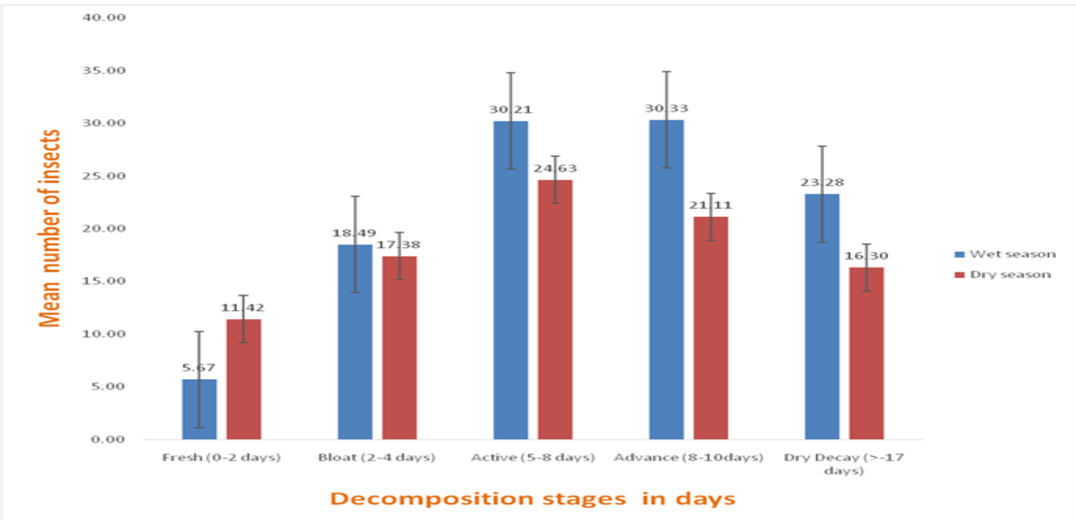

Figure 1. Decomposition stages on the carcasses during the wet and dry seasons in southeastern Nigeria.

Discussion

Most of the insect taxons were from the Family Calliphoridea (blowflies), which were the early colonizers and were the first to start the decomposition process while some continued their scavenging activities till skeletonization such as the beetles. The frequency of insect colonization was responsive to the stage of carrion decomposition. The insect order colonization showed that Diptera were high in abundance with eleven families and twenty-nine species. This was followed by

Hymenoptera with two orders and nine species. The seasonal differences in abundance and activity of insects are evident and can be useful in estimating the time of death known as Postmortem Interval (PMI). This is mostly useful for carrions found years after death since blowfly pupal cases and cast beetle skins can be dated to estimate the season of such death (Uhuo *et al* 2019). Centeno *et al* (2002) reported that seasonal patterns of arthropods occurring on sheltered and unsheltered pig carcasses in Buenos Aires Province were seemingly higher in dipterans and coleopterans than other taxa.

The pattern of insect colonization on pig carrion during the dry season revealed relatively high colonization by Diptera. High colonization by blowflies was also recorded during the dry season. This was caused by high adverse microenvironmental variables such as high temperature resulting in rapid carcass degradation, high larval mass on the orifice, with a high number of adult insects during the dry season. The high colonization was first observed after the bloat stage of decomposition in both seasons and progressively became high during the advanced and active stages of decomposition. Nina *et al* (2014) reported that carrion decomposition is dependent on the composition of insect scavengers and usually records a higher composition of insects at the bloating and active stage of decomposition than other stages of decomposition.

However, there was a difference in the colonization pattern of certain other species with the season of the carcass where it was observed that high dynamics in environmental conditions had a strong influence. The study revealed that the colonization was higher in the wet season than in the dry season. The insect colonization differences observed among the decomposition stages in comparison with changes during wet and dry seasons could be associated with fluctuations in the environmental variables with seasons and this could form reasons for the changes in the insect colonization pattern observed in the study. Calliphorids and sarcophagids had higher colonization potential because they have a higher larval mass which dispels and out-compete other insect groups in the decayed process, and they were the first in attendance to start oviposition and larviposition before other insects during the decomposition process. This finding agrees with Wilson and Wolkovich, (2011) who reported a low number of insects during snow while a high number of insects was recorded in summer during the active stage of carcass decomposition.

The decomposition stages of carcasses in wet and dry seasons showed that decomposition processes were prolonged in the active decay stage (5-9 days) and advanced decay stages (9-13 days) in both seasons. This is because these two stages were characterized by heat period, decreased ambient humidity, and high temperature, which availed high larval mass emergence and fast development of adult insects emerging from the pupal stages. The observed decomposition stages that are with low insect colonization in the dry season were at the active decay of decomposition and this could be attributed to low humidity and hot air temperature recorded in the middle of the season. This also might have prevented further insect activities from carcass colonization to producing second-generation insects. This agreed with the findings of Yardany *et al* (2014) in Columbia that the advanced stage lasted 8-14 days because of high humidity and low larval mass. Ekrakene and llobal (2011) in Nigeria and Rosina *et al* (2013) in Ghana reported that the dry season had averagely shorter decomposition process in all the stages of decomposition when compared to the wet season.

The wet season in the present study had longer decomposition processes than the dry season. This could describe the type of weather encountered during this season, which was characterized by high ambient humidity, optimum temperature, wet soil, and the humid nature of the floristic components that support insect abundance with attendant delay in decomposition as observed in this season. This finding disagrees with the reports of Joy *et al* (2002), Watson and Carlton (2003), Tabor *et al* (2004) in Southwestern Europe, Janyra *et al* (2004) in Brazil, Matuszewski *et al* (2008) in Southwestern Virginia and Benbow *et al* (2013) that dry season carcasses experienced a speedy rate of decomposition with low attendant pattern while wet season had slow decomposition but with a high attendant record which mummified at the active decay stage due to high moisture content suitable for insect reproduction.

The decomposition processes at all stages were irregular, especially during the dry season due to the changing nature of micro-environmental variables such as ambient temperature and humidity. However, irrespective of seasons (wet and dry) dry decay stage of decomposition in all the sites generally recorded the longest decomposition period (>17 days) when the carcasses attained skeletonization and mummification, while the fresh decay was recorded as the shortest decomposition period in the decay process irrespective of season. There was no difference in the decomposition stages between the dry and wet seasons. The number of insects per decomposition stage showed that a geometrical insect fauna increase started at the late active decay stage and progressed to the advanced decay stage. The latent increase in fauna colonization was witnessed within these stages with a high abundance of various insect species. Therefore, the carrion stage of decomposition affects the number of insect colonization patterns in each period. This agrees with Centeno *et al* (2002) in Argentina, Lee *et al* (2004) in Malaysia, and Benbow *et al* (2013), who recorded some differences in insect communities among seasons.

The green vegetative cover (grasses and tall trees), and high moisture that were imminently observed in some deposition sites may have contributed to the high abundance of insects, especially in Site 3, which was characterized by several agricultural activities and waste dump sites that attracted several flies. This agrees with the findings of Francis (2013) in Nigeria, who worked in a habitat that consisted of a bracket pool with a slightly embedded slope into the forest with different insect assemblages and low colonization patterns. Uhuo *et al* (2024) reported that waste dump sites attract insects of different kinds, which could assist in colonization. Meritt *et al* (2000), Keiper and Casamatta (2001) in London, Carter *et al* (2007), Fiedler *et al* (2008) in Germany, and Devault *et al* (2011) similarly reported that carcasses along riffle and pool habitats supported a large proportion of insects and other macroinvertebrate assemblages. Rosenlew and Roslin (2008) and Nina *et al* (2014) similarly opined that the variations in environmental conditions change the composition of carrion species, and there was a clear difference in the composition of carrion insects found between forest interiors, forest edges, urban, and agricultural habitats.

Conclusion

Insect colonization and decomposition of carrion can provide useful information to determine the time after death in cases of suspicious murder in contrasting seasons. On account of this study, insects as an important group of invertebrates in the decomposition process of carrion were taxonomically identified, with potential evidence that most are considered with forensic values due to their behaviour and role in the decay process. This concept has identified some taxons to be opportunist, predatory, and adventive, which use carrion for the elongation of their life cycle, while some of them serve as a resource pulse to them.

The consistent observation of calliphorids, sarcophagids, formicids, and dermestids from the first stage of decomposition in both seasons is proof to forensic investigators about the estimation of time since death using their life cycle stages as a witness. Therefore, these insects mentioned can enhance the estimation of the time at which a dead body was colonized, giving evidence of time since death and associated events at the cause of death seasonally.

The findings from this study showed that seasonal variables are significant keys to determining the status of the decomposition of carcasses and the colonization process of the insects in the southeast, Nigeria. Thus, these factors influence the decay process, colonization, and abundance pattern of the carrion entomofauna. The varying degrees of exposure to different seasons influence the oviposition and succession of some insects, although many insects were observed at the carcasses.

Conflict of Interest

The authors declare no conflict of interest.

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