Research Article

Temporal Dynamics of Insect Fauna in Indoor Decomposing Chicken Carcass in Gujrat, Pakistan

Memoona Mehndi[1]*, Ujala Mehndi[2], Kiran Aftab[1] and Razia Iqbal[1]

[1]Department of Zoology University of Gujrat, Gujrat, Pakistan; [2]Govt Zamindar Post Graduate College, Gujrat, Pakistan.

Abstract | Forensic entomology employs scientific methods to determine the time of an organism's death by analyzing insect communities as biological indicators. For this purpose, in the present study, insect fauna was identified from the restricted carcass of the broiler chicken (*Gallus gallus domesticus*) in Gujrat, Pakistan, from March 31st to May 1st, 2024. The decomposition of a carcass has been divided into 5 stages: fresh, bloat, active decay, advanced decay, and dry. The research identified six insect species of three orders, including accidental, necrophagous, necrophilous, and omnivorous types. The Blow fly (*Chrysomya rufifacies;* Calliphoridae), Flesh fly (*Sarcophaga peregrina; Sarcophagidae*), House fly (*Musca domestica; Muscidae*), and Fruit fly (*Drosophila melanogaster;* Drosophilidae) are all in the same order of insects, known as Diptera. The Dermestid beetle (*Dermestes lardarius*; Dermestidae) was included in the order Coleoptera. The yellow paper wasp (*Polistes flavus*; Vespidae) was included in the order Hymenoptera. *Sarcophaga Peregrina* first arrived at the carcass and began reproduction. *Dermestes lardarius* and *Musca domestica* adults, larvae, and pupae dominated the later stages (active decay, advanced decay, and dry) of decomposition. *Drosophila melanogaster* and *Polistes flavus* adult's spotted at the dry stage. The study found that decomposition rates were faster on sunny days, and fewer species were observed at lower temperatures, providing practical applications in forensic investigations. Therefore, we were examining the succession of forensically important insects on Gallus gallus domesticus carcasses within the local environmental conditions of Gujrat, Pakistan. In this instance, the insects observed serve as a regional model for postmortem interval (PMI) estimation. While we demonstrate significant differences between avian and human decomposition, several insect taxa have been reported to colonise both forms of decomposition, providing a basis for justifying animal models in forensic entomology.

Received | July 16, 2025; **Accepted** | September 07, 2025; **Published** | October 08, 2025
***Correspondence** | Memoona Mehndi, Department of Zoology University of Gujrat, Gujrat, Pakistan; **Email:** memoonaali1122@gmail.com
Citation | Mehndi, M., U. Mehndi, K. Aftab and R. Iqbal. 2025. Temporal dynamics of insect fauna in indoor decomposing chicken carcass in Gujrat, Pakistan. *Biologia (Lahore),* 71(2): 53-62.
DOI | https://dx.doi.org/10.17582/journal.Biologia/2025/71.2.53.62
Keywords | Chicken decomposition, Temporal dynamics, Insect faunal succession, Forensic entomology, Indoor, Gujrat, Pakistan

Introduction

Gujrat is a district in the Pakistani province of Punjab. It is geographically located between the Chenab and Jhelum rivers, with its headquarters in the city of Gujrat. It consists of three tehsils: Sarai Alamgir, Kharian, and Gujrat. It has a hot semi-arid climate, with hot summers, a brief rainy season, and cool winters. Gujrat is situated at approximately 32.57° North latitude and 74.08° East longitude. The city has an altitude of 283 meters (928 feet) above sea level (Pakistan Bureau of Statistics, 2017).

The investigation of arthropods, particularly insects found on dead bodies, can be instrumental in criminal investigations. This field of study is forensic entomology (Collins, 2001). Insects are often the first organisms to discover and colonize a dead body. Entomologists frequently employ insects and other arthropods associated with carrion to investigate violent crimes (Bonacci *et al*., 2016). The first documented case was in 1235 AD in China, where flies' attraction to blood was used to solve a murder investigation (Goff, 2000; Benecke, 2001).

A range of biological signs, such as livor mortis, algor mortis, rigor mortis, alterations in the body's chemical composition, cellular decomposition, and microbial activity in the remains, can be used by pathologists to calculate the post-mortem interval (PMI). However, fter around 72 hours post-mortem, these measures start to lose their validity (Henssge *et al*., 1995). In contrast, insect-based methods for calculating PMI, particularly in the later stages of breakdown, are considered substantially more reliable (Kashyap and Pillai, 1989).

Initially designed as a scientific tool for estimating the postmortem interval (PMI), forensic entomology has undergone significant expansions over the years to include a variety of applications, including determining the circumstances of the death (e.g. locality of death, evidence of possible relocation of the body based on arthropods), and performing toxicological analysis of insect tissues. These arthropods, with flies (Diptera) and beetles (Coleoptera) being of particular importance to the decomposition process, and their predictable life cycles and behaviours, can provide important information regarding the time since death as well as characteristics of the death scene (Amendt *et al*., 2007; Tomberlin and Benbow, 2015). Insect succession on dead and decomposing bodies provides an authentic indicator of time since death and becomes the most predictive variable towards the later stages of decomposition. PMI can be determined for weeks and even months after death by examining the species present and their stages of development (Catts and Goff, 1992; Wells and LaMotte, 2017). In addition, entomological data can occasionally indicate whether cadaver transport or disturbance has occurred postmortem by examining what type and/or stage of insects are inhabiting the body (Anderson, 2015).

Insect colonization is temperature and humidity dependent. Geography as well as seasons can affect the rate of insect colonization and its pattern (Tarone and Sanford, 2017). These factors not only influence the timing of decomposition, but also the presence and behaviour of insects on remains. It is well established in the literature that environmental conditions influence both the decomposition process and the appearance of insect species on remains (Tomberlin *et al*., 2011; Benbow *et al*., 2015). The decomposition rate is faster in tropical climates, and species that dominate the ecological community may be different than those in temperate environments, which emphasises the necessity of carrying out research focusing on a specific location (Campobasso *et al*., 2001). Blow flies and flesh flies usually arrive first and lay eggs; they are followed by beetles, which demonstrate predictable successional patterns (Lord, 1990).

It can also tell us about the dietary history of insects found on or in a body (especially maggots) to detect whether an individual had been exposed to drugs or poisons before death. This is possible because toxic substances and proteins produced by microbial colonization, which are ingested by insects, persist in insect tissues long after tissue-specific molecules have degraded away (Goff and Lord, 2001).

With forensic entomology, getting a very precise estimate of postmortem interval (PMI) is possible, especially for cadaver discoveries greater than 72 hours after death. With the ability to connect a suspect to the crime scene at the same time of death, that is convicting evidence (Bansode *et al*., 2025). In estimating PMI, of course, a researcher must understand local insect succession and environmental factors, which can differ from region to region. Insect succession and its relationship to environmental factors such as temperature, and accessibility of insects to the decedent, are some of the major factors that have been studied as involved in insect colonisation and development. So, for this study we focused on the entomofauna associated with closed, carcass decomposition of *Gallus gallus domesticus* (chicken) carcasses, and further examined insect succession based on stages of decomposition and along with the environmental conditions and ecosystem factors of Gujrat, Pakistan for forensic purposes specific to the region.

Materials and Methods

Research site

The research was carried out in the region of Gujrat city, Pakistan, particularly in the laboratory of the University of Gujrat. The study was conducted over 31 days, stretching from March 31 to May 1. A third-floor room of a university as a place for the carcass. This room also had a window, so it allowed the environment in (to a limited extent) but kept away most of the insects.

Experimental animal

The broiler chicken (*Gallus gallus domesticus*) (n=3), which weighed about 1.5 to 2 kg were obtained locally, served as the experimental model. Their plumage were white. The carcasses were transferred to the experimental site immediately after death. The room was mostly insect-free, and no other procedures were used to facilitate or preclude environmental exposure.

Field protocols

The study took place in the summer. During the whole experimental time, launch precepts were laid in an indoor atmosphere where chicken carcasses were selected. The death of the chickens happened organically; no drugs or chemicals were used. Great care was taken not to disturb the bodies during sampling. Daily observations, photographs, and environmental measurements (temperature and humidity) were recorded during the decomposition period. Insect samples were collected, and insect decomposition rates were recorded daily in these observations.

Sample collection and preservation

Adult and immature insects were sampled from the carcasses and surrounding environment on selected collection days. We collected all catchable insects, with particular emphasis on documenting the life cycles of flies and beetles (Supplementary Figure 1). Traps allowed easy access to adult flies, and the top section of the trap where adults were found was removed. The arthropods, including beetles and larvae, were manually collected with forceps in the lab and then preserved in 70% ethanol for further identification.

Data and statistical analysis

The recorded data was statistically evaluated to determine the insect diversity and abundance in relation to decomposition stages and temperature changes. The categorical data i.e., the decomposition stages and type of decaying insect species were recorded at regular intervals while the numerical data was statistically evaluated using SPSS software. Shannon-Wiener Index (H') and effective species number (ESN) was calculated, to quantify the evenness and richness of decaying insect species on the carcass and to interpret species equivalent, species meaningfully contributing to spoilage respectively. One-way ANOVA was conducted to compare the mean abundance of each family across the decomposition stages, followed by Post-Hoc Tucky test. All values were recorded in triplicates and standard deviation was calculated to access data variability ($p \leq 0.05$). Further, Spearman's rank correlation was used to determine the effect of carcass temperature over the abundance of insects.

Results

Forensic catches

From indoor chicken corpses, six species, including scavengers, decomposers, and accidental insects, were collected throughout the 31 days, from March 31, 2024, to May 1, 2024, for the current study, as shown in Figure 1.

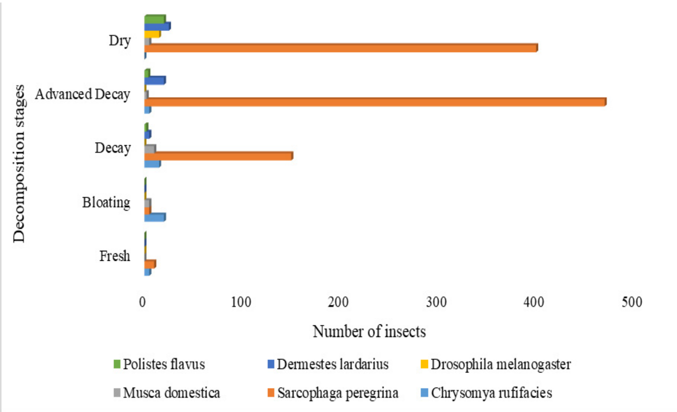

Figure 1: *Distribution of insect fauna in different decomposition stages.*

Six types of insects, both forensic and non-forensic, representing three orders and six families, were collected from carcasses kept indoors. Among the forensic insects, flesh flies were the most frequently observed throughout the investigation (Table 1). They accounted for 80% of all collected insects and

Table 1: *The number of specimen of insect species were collected from the restricted broiler chicken (Gallus gallus domesticus) carcass during 5 different decomposition stages (fresh, bloated, active, advanced, dry), Gujrat, Pakistan, from 31st March to 1st May 2024.*

Order of insects	Family	Species name	Common name	Number of insects
Diptera	Calliphoridae	*Chrysomya rufifacies*	Blow flies	1
Diptera	Sarcophagidae	*Sarcophaga peregrina*	Flesh flies	470
Diptera	Muscidae	*Musca domestica*	House flies	15
Diptera	Drosophilidae	*Drosophila melanogaster*	Fruit flies	1
Coleoptera	Dermestidae	*Dermestes lardarius*	Dermestid beetles	5
Hymenoptera	Vespidae	*Polistes flavus*	Yellow paper wasp	2

Table 2: *Chronological record of temperature variations, insect diversity, and the stages of decomposition of a corpse from March 31 to May 1, 2024, showing the development of insects and their activities as the carcass progressed from the fresh to the dry stage.*

Date	Temp. (°C)	Insect Diversity Description	Decomposition stage
31-03-2024	30	None	Fresh stage
01-04-2024	30	Arrival of flesh flies	
02-04-2024	34	Tissues autolysis	Bloating stage
03-04-2024	35	Maggots appear	
04-04-2024	35	2nd instar appears	
05-04-2024	35	3rd instar appears	
06-04-2024	35	3rd instar appears	
07-04-2024	36	Maggots and blow flies	Active decay stage
08-04-2024	36	Unlimited maggots and beetles appear	
09-04-2024	35	Unlimited maggots	
10-04-2024	35	Unlimited maggots	
11-04-2024	35	Pupae	
12-04-2024	28	Pupae	
13-04-2024	28	Pupae	
14-04-2024	31	Excystment of pupae	
15-04-2024	32	Excystment of pupae	Advance decay stage
16-04-2024	33	Excystment of pupae	
17-04-2024	34	Conversion to flies	
18-04-2024	34	Conversion to flies	
19-04-2024	34	Adult house and flesh flies	
20-04-2024	35	Adult house and flesh flies	
21-04-2024	35	House and flesh flies	
22-04-2024	35	House and flesh flies	
23-04-2024	29	House and flesh flies	
24-04-2024	36	House and flesh flies	
25-04-2024	36	House and flesh flies and beetles	
26-04-2024	36	2nd generation of flies starts	Dry stage
27-04-2024	30	Maggots of flies, house flies, flesh flies, and dermestid beetles	
28-04-2024	35	Maggots of flies, house flies, flesh flies, and dermestid beetles	
29-04-2024	30	Maggots of flies, house flies, flesh flies, and dermestid beetles	
30-04-2024	32	House flies, flesh flies, dermestid beetles, wasps, and fruit flies	
01-05-2024	32	Collection of insects	

were the predominant dipteran species identified in the study. Upon analysis, Shannon–Wiener index was calculated as H′ = 0.25 and ESN of 1.28 indicated low diversity of decaying insect species with Sarcophaga peregrine (≈95% of individuals) dominated in carcass decay. It indicated that flesh flies dominates during early to mid-active decay in indoor settings, suppressing other fly populations. Following formula was used to calculate Shannon–Wiener index:

$$H = - \Sigma [(pi * \ln(pi))]$$

Seasonal phases of corpse disintegration

The chronological record of insect succession and decomposition stages of the carcasses over a one-month period (March 31 to May 1, 2024), highlighting temperature fluctuations, insect diversity, and decomposition progression, is presented in Table 2. Initially, during the fresh stage (March 31-April 1) at 30°C, no insect activity was observed until the arrival of flies on April 1. As the bloating stage (April 2-6) begins, with temperatures rising to 34–35°C, autolysis sets in, followed by the appearance of maggots and their development through 2nd and 3rd instars. The active decay stage (April 7-14) sees an intensification of decomposition, with large numbers of maggots and beetles present. By April 11, pupae begin to form, signaling the end of the maggot phase. The advanced decay stage (April 15-25) is marked by the excystment of pupae into adult flies from April 15, with blow and flesh flies becoming more prominent by April 25. During the final dry stage (April 26-May 1), a second generation of flies appears alongside wasps, dermestid beetles, and fruit flies, concluding with insect collection on May 1. Temperature fluctuates throughout the period, impacting the rate of insect activity and decomposition.

Stages of decomposition and insect colonization in corpse breakdown

Even as the process of breakdown and colonization by insects continued, it was often divided into distinct stages, each characterized by specific insect activity during that phase as shown in Figures 2 and 3.

The decomposition of corpses typically occurs in five stages:

Fresh stage (0-1 days after death): The fresh stage began immediately after death and continued until the onset of bloating, lasting for about 1 day. Considering everything we have established, our results have good support for patterns of insect occupancy across specific microhabitats (e.g., carrion, foliage, soil) following environmental changes. However, flies from the families Calliphoridae (blow flies) and Sarcophagidae (flesh flies) were the first to arrive at the carcass. These flies were observed crawling on the body and laying eggs or larvae (Figures 2A and 3A).

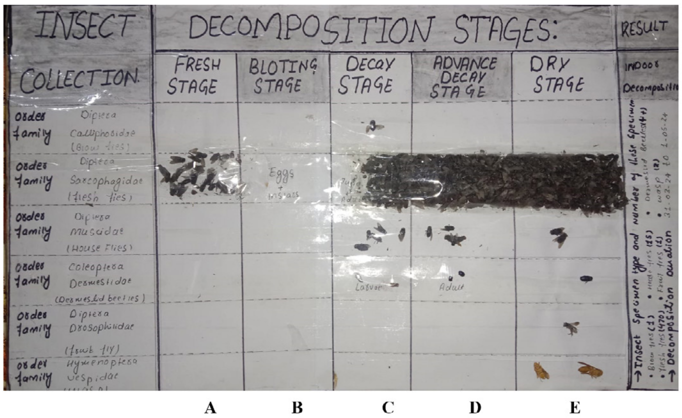

Figure 2: *Ecological Succession pattern and the insect fauna associated with Gallus gallus domesticus carcass decomposition stages.*

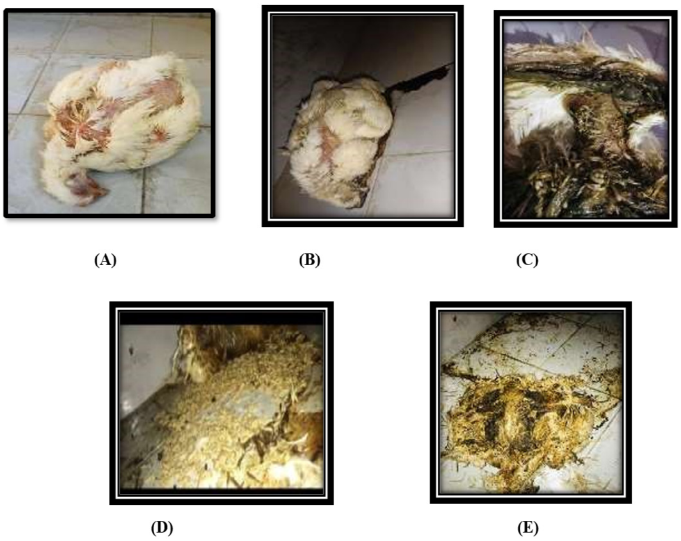

Figure 3: *Illustration of the key stages of decomposition-Fresh, Bloating, Active Decay, Advanced Decay, and Dry along with the corresponding insect activity observed at each phase.*

Bloating stage (5 days after death): After the initial fresh stage, the corpse enters the bloating phase, which lasts for approximately 5 days. The bloating stage marked the beginning of putrefaction and lasted until the release of gases produced by bacterial activity cause the body to swell and deflation of the abdomen. The bloating was primarily due to tissue autolysis and the activity of bacteria and fungi. The abdominal region exhibited noticeable swelling during this phase, and the insect activity was sustained (Figures 2B and 3B).

Active decay (8 days after death): The active decay stage starts around day 8. During this period, the body experiences rapid breakdown as tissues are consumed by insects and microbes, and significant fluid loss occurs. In the active decay stage abdomen began to deflate, accompanied by the release of putrefactive gases. A strong cadaveric odor was evident during this period (Figures 2C and 3C). Insect colonization intensified, with the first observation of blowflies (Calliphoridae).

Additionally, third-instar larvae of dermestid beetles (Dermestidae), along with house flies (Muscidae) and fruit flies (Drosophilidae), were present in significant numbers.

Advanced decay (11 days after death): Following the active decay, advanced decay lasts approximately 11 days. At this stage, most soft tissues are decomposed, and the carcass is reduced to bones, hair, and cartilage.

During the advanced decay stage, the intensity of the odor began to diminish, as most of the soft tissue had decomposed. A predominance of coleopteran species was noted, and the insect fauna largely mirrored that of the active decay stage, with the exception of the blowfly (Calliphoridae), which was absent during this phase (Figures 2D and 3D).

Dry stage (6 days): Finally, the remains enter the dry stage, where only bones, skin, and some dried tissues persist, with the entire process lasting for about 6 days. In this phase, decomposition slows significantly. The final stage, the dry stage, was characterized by the complete absence of any odor (Figures 2E and 3E). The insect fauna during this stage was similar to that of the advanced decay stage. However, fruit flies and wasps were observed more frequently, while other species persisted in lower numbers.

These observations illustrate the clear succession of insect species throughout the decomposition process, with specific species dominating at different stages, corresponding to changes in the physical and chemical state of the carcass. Collectively, these findings visually verify the trajectory of insect colonizers between decomposition stages and furnish indispensable knowledge to forensic entomology, especially in establishing post-mortem intervals. One-way ANOVA was conducted to compare the abundance of insect fauna in different decomposition stages. The results indicated a significance difference in mean abundance among species (p=0.0067) as indicated in Table 3. Highest mean abundance was recorded for *S. peregrina* (M = 207.0), while the lowest was for Drosophila melanogaster (M = 3.0). Further, Post-Hoc Tukey test also showed that *S. peregrine* had higher abundance than other insect species (p<0.05), indicating flesh flies as dominant species during decomposition.

Table 3: *One-way ANOVA indicating differences in the mean abundance of insect species at different decomposition stages of chicken carcass.*

Source of variation	SS	df	MS	F	P value	F crit
Between groups	167962	5	33592.41	4.229	0.006	2.620
Within groups	190620.5	24	7942.521			
Total	358582.5	29				

All these stages will be shown in detail by scanning the QR code that is given at the end of this document.

Environmental temperature and insect diversity

Spearman's rank correlation analysis, as given in Table 4, indicates significant positive correlation between temperature and abundance of *S. peregrine* (ρ=0.568, P value= 0.027). *Musca domestica* and *Polistes flavus* also showed positive correlation with temperature (p< 0.05). However, no significant correlation of *Chrysomya rufifacies*, and *Dermestes lardarius* were observed. Figure 4 reveals the effect of the thermal environment on insect diversity over a long period of time. Our data reflected this entity's peculiar pattern: the number of insect species and their abundance increased only after the temperature exceeded some critical point. This indicates that the insects are more active on carcasses at elevated temperatures.

Table 4: *Spearman's rank correlation analysis.*

Species	Spearman rho (ρ)	P value
Chrysomya rufifacies	-0.184785	0.509704
Sarcophaga peregrine	0.568107	0.027145
Musca domestica	0.897369	0.000006
Drosophila melanogaster	0.339417	0.215840
Dermestes lardarius	-0.519424	0.047215
Polistes flavus	0.688474	0.004540

Links Researchers

Moreover, these trends have been confirmed statistically. Considering everything we have established, our results have good support for patterns of insect occupancy across specific microhabitats (e.g., carrion, foliage, soil) following environmental changes.

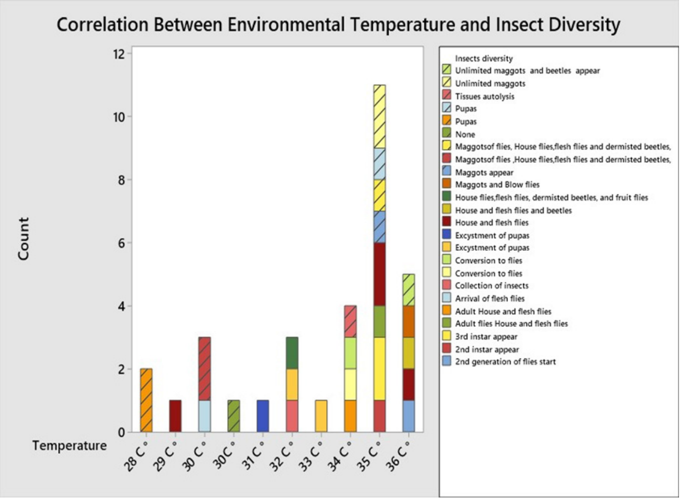

Figure 4: *Stacked bar charts illustrating the environmental temperature and insect diversity.*

Discussion

The outcomes of this study provide evidence that temperature and insect accessibility influence both decomposition rates and insect succession. During the 31-day study period, the order of insect colonization occurred in the expected way, and the temperature was found to be an important factor (Tarone and Sanford, 2017; Tomberlin *et al*., 2011). The second important aspect to consider in research is the access of insects to restricted and high-altitude places. As a place for the carcasses, decomposition is in a third-floor room of a university . The presence of flies of the families Calliphoridae and Sarcophagidae on bodies found on the 4th and 7th floors of a residential building in Penang, Malaysia (Kumara *et al*., 2010). This elevation (3rd floor) was selected to replicate documented cases of fly colonization in high-rise structures while maintaining experimental control, aligning with findings from Kumara *et al*. (2010) and Syamsa *et al*. (2012).

Insect succession and species dominance

The insect species seen during the study included blow flies, flesh flies, house flies, fruit flies, dermestid beetles, and yellow paper wasps, which correspond with the forensic insect colonization patterns (Byrd and Castner, 2019). Flesh flies (*Sarcophaga peregrina*) were the most dominant insect species, comprising nearly 80% of the total number of species collected. Such a high percentage of flesh flies is not surprising, as females are known to be the first to colonize corpses during forensic studies (Tomberlin *et al*., 2011). Blowflies are also known to be early arriving colonizers because they generally appear soon after death, which explains their emergence on April 7 when the fresh stage just commenced as stated before (Catts and Goff, 1992).

Given the rather scant population of blowflies and fruit flies, it is probable that some elements, such as the indoor environment, suppressed their activity and numbers. It has been reported that because of the indoor environment, less variety and density of necrophagous insects are found than in the field, where more kinds of insects are found assisting in the decomposition process (Benbow *et al*., 2015). Nonetheless, the occurrence of the dermestid beetles and wasps later, especially in dry stages, corresponds to their contribution to the destruction of remaining dried soft tissues and bones to complete the dismantling process (Wells and LaMotte, 2017).

Decomposition stages and insect activity

Regarding the order of events in the observed broiler chicken decomposition, it was according to the classic model of decomposition: fresh, bloated, active decay, advanced decay, and dry, with distinct insect activity correlating with each stage of development. The fresh stage (31 March–01 April) was not colonized by other arthropods. But quickly progressed into the bloated stage due to the presence of taphophilic insects. During this period, flies of the family Sarcophagidae and Calliphoridae become extremely important in the nesting process. The period framing dense corpse collapse lasted from April 7 to April 14, and was characterized by increasing insect activity, chiefly the activity of their larvae, be it maggots or beetles. The high temperatures (35–36 °C) witnessed during this stage might have contributed to the rapid development of the larvae as the insect's life cycle is impacted by the temperature of ambient air (Amendt *et al*., 2007). Partially mature insects were first spotted on the eleventh of April, thus marking the end of grub feeding and the action of encasing. In this case, it is worth focusing on the monitoring of the development of the insect as one of the ways of assessing postmortem intervals in cases where the body undergoes active decay. As for the more advanced decay stage, colonization by adult flies after full metamorphosis of pupae indicates the closing phase of the life cycle of maggots and that the adult stage of a fly is predominantly found. Coupled with the smell being faint and a decrease in soft tissue substance, this phase fits in known sequences of decomposition process whereby all existing tissue is eaten up by insects, and what is left are bones and cartilage (Tomberlin and Benbow, 2015).

The last of these three stages is classified as the Dry stage (April 26–May 1), and more specifically, generation number two of flies appeared, and wasps and dermestid beetles were present. These species are critically involved in consuming the remaining fresh organic material, especially in dry areas, and they feed on hair, dry tissues, and cartilage (Byrd and Castner, 2019). Their looks at this stage are identical to literature on forensic science, where they are described as secondary invaders that are involved in the later process of decomposition.

Temperature and insect colonization

Temperature turned out to be a decisive factor, caused by the decomposition rate and the replacement of species of insects. As observed from the stacked bar charts (Figure 3), there was a positive relationship between temperature and insect richness and density. Temperature increase from 30°C, at the fresh stage, to 36°C at the active decay stage promotes insect development and active movement among flesh flies and blowflies. The current study findings are in agreement with the literature, which has identified temperature as a crucial parameter regulating the dynamics of life cycles of necrophagous insects as well as its influence on the growth and colonization rates. The literature has long proven that there is a strong reliance on temperature information to estimate the postmortem interval in forensic entomology (Amendt *et al*., 2007). In this study, temperature changes were seen to affect insects: lower temperatures, which were recorded during the active decay stage on April 12–13, when the temperature was reduced to 28°C, support the temperature-insect hypothesis. It is for such reasons that work has been called for to build insect developmental rates by location, taking into account factors that affect climate and environment (Benbow *et al*., 2015).

Conclusions

This study examined insect succession and decomposition patterns, highlighting the influence of temperature, humidity, and access of insects to a dead body on the rate of decay. The decomposition of the carcasses of *Gallus gallus domesticus* has been divided into 5 stages: fresh, bloat, active decay, advanced decay, and dry; however, the shortest was the fresh (0-1day) stage and the longest was Advance decay (11days) stage. The collected insects were classified into six species across three orders. The majority of species, four in total, belonged to the order Diptera, while the orders Hymenoptera and Coleoptera each had only one species. Each species identified was associated with a distinct family within the three orders. The research identified insect species, Blow flies (*Chrysomya rufifacie*), Flesh flies (*Sarcophaga Peregrina*), House flies (*Musca domestica*), as important markers for estimating the postmortem interval (PMI), with *Sarcophaga peregrina* being the primary *Sarcophaga Peregrina* colonizer indoors. Early colonizers, particularly flies, had a greater chance of developing into adults compared to later-arriving species. In later stages, beetles *(Dermestes lardarius*) and yellow paper wasps (Polistes flavus) and Fruit fly (*Drosophila melanogaster*) were observed, but wasps were feeding on the corpse rather than laying eggs. Both flies and beetles preferred the active decay stage, but were present throughout all phases. This work fits into the growing literature calling for the development of more localized data for forensic entomology to improve the estimation of the PMIs where the current research is conducted (Wells and LaMotte, 2017).

Overall, the study found that indoor decomposition occurs more slowly than outdoors, with fewer beetles present in enclosed environments. This research marks a step toward establishing forensic entomology as a scientific discipline at the University of Gujrat, Pakistan, emphasizing the valuable role of entomologists in legal investigations. The findings can aid in future criminal cases in the region.

Acknowledgements

I acknowledge Department of Zoology, University of Gujrat, Pakistan for providing facilities required for the research.

Novelty Statement

This study documents indoor chicken carcass decomposition in Gujrat, Pakistan, linking insect succession with decomposition stages to provide a regional reference for Postmortem Interval (PMI) estimation and support the use of avian models in forensic entomology.

Author's Contribution

MM and UM conducted the research and wrote the manuscript.
RI, KI, and MSS reviewed, edited, and provided expert opinions on the manuscript.
All authors have read and approved the final version of the manuscript. Data authentication is not applicable.

Consent for publication
Not applicable.

Funding
Not applicable.

Ethics approval and consent to participate
Not applicable.

Patient consent for publication
Not applicable.

Supplementary material
There is supplementary material associated with this article. Access the material online at:

Generative AI and AI-assisted technology statement
No generative AI or AI-assisted tool was used.

Conflict of interest
The authors have declared no conflict of interest.

References

Amendt, J., Campobasso, C.P., Gaudry, E., Reiter, C., LeBlanc, H.N. and JR Hall, M., 2007. Best practice in forensic entomology standards and guidelines. Int. J. Legal Med., 121: 90–104. https://doi.org/10.1007/s00414-006-0086-x

Amendt, J., Krettek, R. and Zehner, R., 2004. Forensic entomology. Naturwissenschaften, 91: 51–65. https://doi.org/10.1007/s00114-003-0493-5

Anderson, G.S., 1995. The use of insects in death investigations: An analysis of cases in British Columbia over a five year period. Can. Soc. Forensic Sci. J., 28(4): 277–292. https://doi.org/10.1080/00085030.1995.10757488

Anderson, G.S., 1997. The use of insects in death investigations. Forensic Sci. Rev., 9(2): 91–108.

Anderson, G.S., 2015. Insect succession on carrion and its relationship to determining time of death. In: Byrd, J.H. and Castner, J.L. (eds.) Forensic entomology: The utility of arthropods in legal investigations. 2nd ed. Boca Raton: CRC Press, pp. 41–91.

Bansode, S., Morajkar, A., Ragade, V., More, V. and Kharat, K., 2025. Challenges and considerations in forensic entomology: A comprehensive review. J. Forensic Legal Med., pp. 102831. https://doi.org/10.1016/j.jflm.2025.102831

Benbow, M.E., Tomberlin, J.K. and Tarone, A.M., 2015. Carrion ecology, evolution, and their applications. Boca Raton: CRC Press. https://doi.org/10.1201/b18819

Benecke, M., 2001. A brief history of forensic entomology. Forensic Sci. Int., 120: 2–14. https://doi.org/10.1016/S0379-0738(01)00409-1

Bonacci, T., Vercillo, V., Brandmayr, P. and Tersaruolo, C., 2016. A preliminary investigation on sarcosaprophagous insects associated with buried bodies in Calabria (southern Italy). Egypt. J. Forensic Sci., 6(2): 110–115.

Byrd, J.H. and Castner, J.L., 2019. Forensic entomology: The utility of arthropods in legal investigations. 2nd ed. Boca Raton: CRC Press. https://doi.org/10.4324/9781351163767.

Campobasso, C.P., Di Vella, G. and Introna, F., 2001. Factors affecting decomposition and Diptera colonization. Forensic Sci. Int., 120(1–2): 18–27. https://doi.org/10.1016/S0379-0738(01)00411-X

Catts, E.P. and Goff, M.L., 1992. Forensic entomology in criminal investigations. Ann. Rev. Entomol., 37(1): 253–272. https://doi.org/10.1146/annurev.en.37.010192.001345

Collins, J., 2001. Cobuild English dictionary for advanced learners, 3rd ed. Glasgow: Harper Collins Publishers, pp. 514–616.

Goff, M.L. and Lord, W.D., 2001. Entomotoxicology: Insects as toxicological indicators and the impact of drugs and toxins on insect development. Forensic Sci. Int., 120(1–2): 42–47.

Goff, M.L., 2000. A fly for the prosecution:

How insect evidence helps solve crimes. Cambridge: Harvard University Press. https://doi.org/10.2307/j.ctv21hrgwk

Henssge, C., Madea, B., Knight, B., Nokes, L. and Krompecher, T., 1995. The estimation of the time since death in the early postmortem period. London: Arnold.

Kashyap, V.K. and Pillai, V.V., 1989. Estimation of postmortem interval in case of death due to burns using entomological evidence. Forensic Sci. Int., 40(3): 245–250. https://doi.org/10.1016/0379-0738(89)90182-5

Kumara, T., Disney, R., Hassan, A.A., Flores, M., Hwa, T.S., Mohamed, Z., CheSalmah, M.R. and Bhupinder, S., 2012. Occurrence of oriental flies associated with indoor and outdoor human remains in the tropical climate of north Malaysia. J. Vector Ecol., 37(1): 62–68. https://doi.org/10.1111/j.1948-7134.2012.00200.x

Lord, W.D., 1990. Case histories of use of insects in investigations. In: Catts, E.P. and Haskell, N.H. (eds.) Entomology and death: A procedural guide. Clemson: Joyce's Print Shop Inc., pp. 9–37.

Pakistan Bureau of Statistics, 2017. District census report of Gujrat. Islamabad: Government of Pakistan.

Syamsa, R.A., Ahmad, F.M.S., Zuha, R.M., Khairul, A.Z., Marwi, M.A., Shahrom, A.W., *et al.*, 2012. An occurrence of *Synthesiomyia nudiseta* (Wulp) (Diptera: Muscidae) from a human corpse in a high-rise building in Malaysia: A case report. Trop. Biomed., 29(1): 107–112.

Tarone, A.M. and Sanford, M.R., 2017. Is PMI estimation all that forensic entomology has to offer? J. Forensic Sci., 62(4): 832–839.

Tomberlin, J.K. and Benbow, M.E., 2015. Forensic entomology: International dimensions and frontiers. Ann. Rev. Entomol., 60: 237–257. https://doi.org/10.1201/b18156

Tomberlin, J.K., Mohr, R., Benbow, M.E., Tarone, A.M. and VanLaerhoven, S., 2011. A roadmap for bridging basic and applied research in forensic entomology. Ann. Rev. Entomol., 56(1): 401–421. https://doi.org/10.1146/annurev-ento-051710-103143

Wells, J.D. and LaMotte, L.R., 2017. Estimating the postmortem interval. Forensic Sci. Int., 278: 129–139.