Microhabitat characteristics determine the succession of Histeridae on carcass

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Jasvinder Kumar, Department of Zoology, Panjab University, Chandigarh. Dr. Ranjana Jaiswara, Department of Zoology, Panjab University, Chandigarh, Dr. Meenu Wats, Department of Zoology, DAV College Sector-10, Chandigarh.

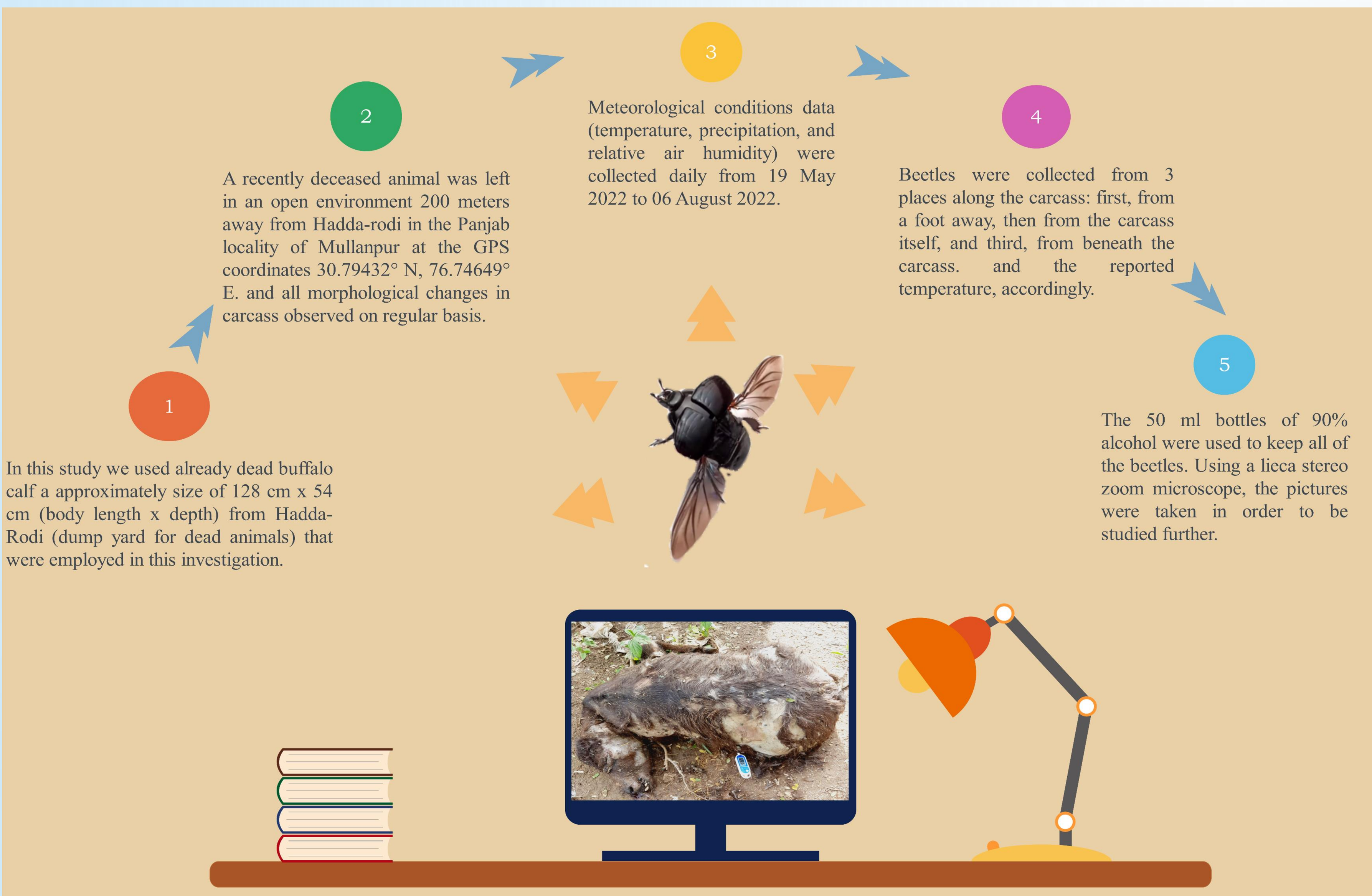
ABSTRACT

The succession of insects on the carcass assists in determining the post-mortem interval (PMI). Experts estimate PMI using blowfly maggots. In terrestrial ecosystems, decomposing cadavers act as ephemeral resources. However, numerous other insects are particular to carcass decomposition stages, such as Histeridae, Dermestidae, Cleridae. Scarabaeidae. Silphidae, and staphylinidae, we found that the coleopterans that accompany the blowflies are Histeridae beetles throughout our study. They feed on dipteran eggs, maggots, and decaying or rotting carcasses. Their populations are entirely dependent on the stages of decomposition of carcasses and the populations of maggots in carcasses.

In the early phases of decomposition, a few countable Histeridae can be found on carcasses. However, after the bloated stage. their populations increased exponentially in the active decay stage but progressively declined. There were fewer Histeridae found on the remains, however, because maggots pupate in damp environments, certain Histeridae are also found under the soil to feed and reproduce. Instead, the temperature of the corpse, the temperature beneath the carcass, and the ambient temperature all significantly change during the stages. In contrast to all of this, identifying forensically significant Histeridae beetles has a greater impact on the study and helps in comprehending the diversity of species and distribution. For this study, we collected around 5290 Histeridae beetles from the genera, *Saprinus, Hister, Pachylister, Atholus, Merohister*, etc,

Keywords. Forensic entomology, Histeridae, Ecology, Succession, Post-mortem interval (PMI), forensic science, insects, forensic death investigations, PMI estimations, India

METHODOLOGY



INTRODUCTION

By utilising arthropods that interact with the carcasses, forensic entomology aids in the investigation of death. Diptera are the first to witness a death, and the life cycles of these insects may be used to estimate the post-mortem interval time (min-PMI), or the time that passes between the moment of death and when a corpse is recovered. The current cadaveric entomofauna and corpus movement from the crime scene to other sites both contribute to determining the cause of death and the location of death. According to Cornaby (1974), cadavers emit a variety of gases that attract Diptera and Coleoptera arthropods, which conduct reproduction and utilise the corpse as food for their growth. In our work, we focus on Histeridae beetles, which eat flies' eggs and larvae directly. Arthropod activity and various decomposition phases are interdependent. The cadaveric entomofauna is influenced by a variety of environmental conditions, including temperature, humidity, and rainfall. We are unable to determine the precise minimal post-mortem if these elements are ignored (Eberhardt & Elliot 2008). Taxonomic identification, succession of Histeridae beetles on corpses, and observation of different phases of carcass decomposition are among the goals of this research.

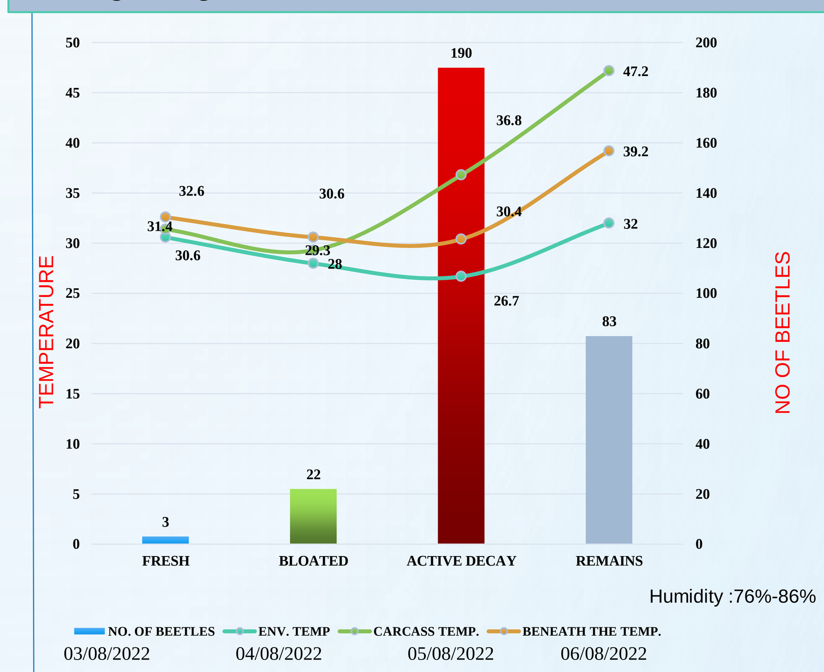


Fig. 3. No. of Histeridae beetles associated with different stages of decomposition and ambient, internal carcass temperature and beneath the carcass temperature.

STAGES OF DECOMPOSITION	DECOMPOSITION TIMELINE	AMBIENT TEMPERATURE	CARCASS INTERNAL TEMPERATURE
FRESH	0-1	35.5	37.2
BLOATED	2	30.5	32.2
ACTIVE DECAY	3-4	32.6-31.7	34.8-33
ADVANCED DECAY	5-6	31.5-33.3	33.6-42
REMAINS/DRY	7	29.9	29.9

Table-1. Stages of decay and associated ambient and internal carcass temperatures in summer monsoon season. (23/07/2022 to 29/07/2022)

STAGES OF DECOMPOSITION	DECOMPOSITION TIMELINE	AMBIENT TEMPERATURE	CARCASS INTERNAL TEMPERATURE
FRESH	0-1	30.6	31.4
BLOATED	2	28	29.3
ACTIVE DECAY	3	26.7	36.8
ADVANCED DECAY			
REMAINS/DRY	4	32	47

Table-2. Stages of decay and associated ambient and internal carcass temperatures in summer monsoon season. 03/08/2022 to 06/08/2022,

STAGES OF DECOMPOSITION	DECOMPOSITION TIMELINE	AMBIENT TEMPERATURE	CARCASS INTERNAL TEMPERATURE
FRESH	0-1	29.1	33.1
BLOATED	2-3	28.9-27	27.7
ACTIVE DECAY	4	31.2	36.1
ADVANCED DECAY	5	32	36
REMAINS/DRY	6	30	30

Table-3. Stages of decay and associated ambient and internal carcass temperatures in summer monsoon season. (29/07/2022 to 03/08/2022)

FRESH	BLOATED	ACTIVE DECAY	ADVANCED DECAY	REMAINS/DRY
Saprinus splendens	*Saprinus splendens,* *Saprinus caerulescens*	*Saprinus splendens,* *Saprinus caerulescens,* *Saprinus optabilis,* *Atholus bimaculatus,* *and 4 more* *Saprinus sp.* *Merohister* *sp.*	*Saprinus splendens,* *Saprinus caerulescens,* *Saprinus sp.* *Merohister asoka*	*Atholus sp,* *Merohister* *sp.* *Saprinus splendens*

Table-4. Family Histeridae species attracted to buffalo calf carcass during summer monsoon season.

RESULTS

HISTERIDAE ON DIFFERENT DECOMPOSITION STAGES

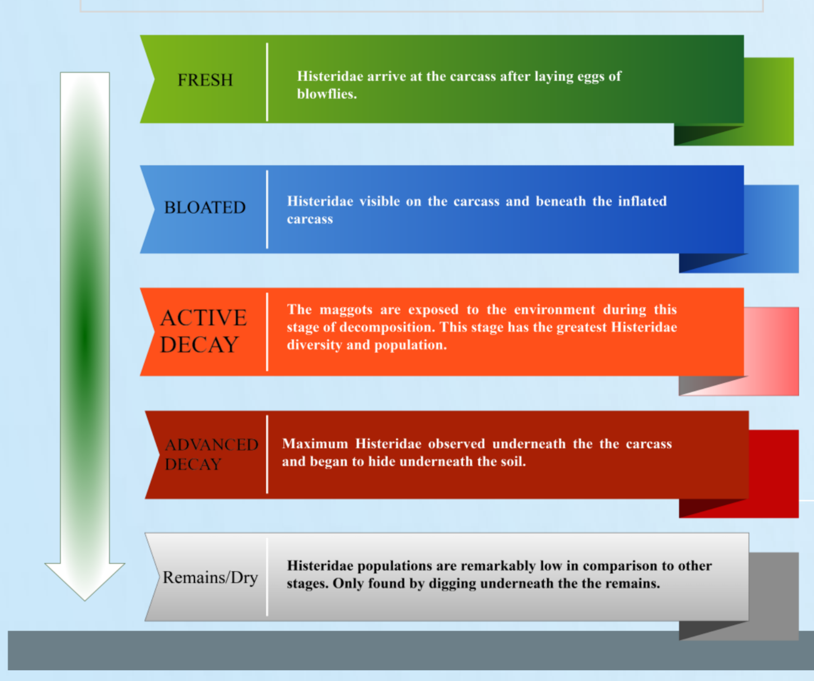
Fresh stage: The temperature of the carcass begins to drop virtually to that of the surrounding air. However, the temperature underneath the carcass was higher than both the ambient and carcass temperatures.

Bloated stage: The discoloration of the carcass, the bloating, and the hair loss are all noticeable. The temperature of the carcass has been recoded to be about one degree higher than the ambient temperature, while the temperature beneath the carcass has been found to be between four and seven degrees higher

Active decay stage: Maggots were found across the body, and cracks appeared as a result of inflation. A strong odor of decomposition permeated the area. A dark liquid is released from the carcass, and the temperature of the carcass is two or three degrees higher than the ambient temperature. Skin and bone begin to separate. The temperature of the carcasses was three to four degrees higher than the surrounding air. During this time, insect activity is at its peak, and a diversity of insects were seen

Advanced decay: Removing flesh off the extremities. The odor is modest and the bone became evident. Maggots began migrating to the damp area

Remains/Dry: All the bones were exposed, eventually leaving behind undigested intestinal waste.



email id. Jas_k10@yahoo.com, Jas_k10@pu.ac.in JASVINDER KUMAR

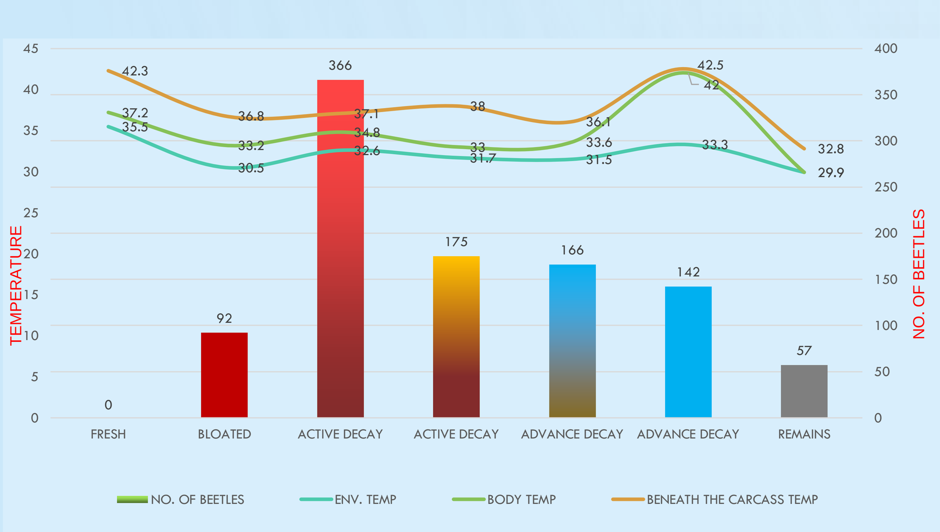


Fig.1. No. of Histeridae beetles associated with different stages of decomposition and ambient, internal carcass temperature and beneath the carcass temperature.

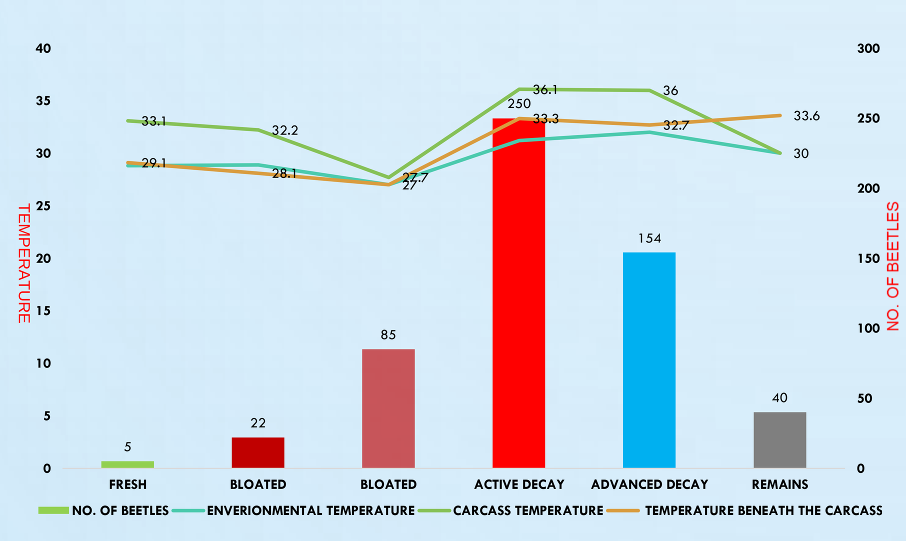


Fig.2. No. of Histeridae beetles associated with different stages of decomposition and ambient, internal carcass temperature and beneath the carcass temperature.

CONCLUSIONS

The buffalo calf was completely decomposed within four to seven days, and five decomposition stages were observed i.e., fresh, bloated, active decay, advanced decay stage and remains. The main causes of the degradation were bacterial activity and the activity of insects. Our emphasis was on the succession of beetles on carcasses. We draw the conclusion from our observations that temperature and humidity have a higher influence on decomposition. Decomposition accelerates at high temperatures and humidity levels. The diversity and abundance of beetles were at their peak during the active decay stage. The succession of insects on carcasses can give us information about PMI. When a body is found in an open environment, entomological data can be used to estimate the time since death.

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