



A Review on Forensic Entomology

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Abstract:-

Entomology is the study of insects that deal with distribution, classification and physiology and morphology of the insects. Insects are dominant species in environment that's have many beneficial role for environment. One of the most important roles of entomology in crime detection called forensic entomology. Forensic entomology is the study of insects and other arthropods that are used to detect the crime science and estimate the time between death and corpse discovery known as PMI (Post mortem interval). Dipterans flies are the most dominant species that are involve in forensic science. Sarcophagidae and Calliphoridae are the most important forensically species, with the help of succession pattern of these flies on dead bodies easily calculate the time of death. In India forensic entomology have very few research work so forensic entomology is thrust area for research purpose. Now a day's crime increase in society day by day and the mostly three questions arise when, how, and where the crime happened so forensic entomology try to solve this problems.

Keywords: -PMI (post mortem interval), Sarcophagidae, Calliphoridae, Medico-legal.

Introduction:-

Forensic Entomology is an emerging field in sciences, where the insects feeding on corpses are studied for detect the criminal issues. It has become a crucial tool in criminal investigations. Medico Crime branch of Forensic entomology is an emerging field in Forensic Sciences, where the insects feeding on corpses are studied. The involvement of the present scenario, the role of forensic entomologist is very important in crime detection. Increased instances of forensic entomologists are being involved in criminal investigations, as part of the forensic team. This has the necessity for a rise in awareness of emerging sciences like forensic entomology and its applications in forensics, with the help of maggot age and maggot length easily estimate the PMI.

The study of the application of insects, and their arthropod relatives that inhabit decomposing remains and which successively aid in medico-criminal investigations is understood as forensic entomology.

According to Smith (1986), the two groups are found to be more important for the purpose of forensic entomology. They are mainly from the species of the Diptera (flies) and Coleoptera (beetles). Hence, the present work is an attempt to document flies of Sarcophagidae & Calliphoridae visiting on Carrion, their ecology, biology and identification to generate a pioneer base line data for the forensic use. And following studies on forensic entomology is being studied in Laboratory of public health entomology, Department of zoology at Mohan lal sukhadia university, Udaipur.

REVIEW OF WORK:-

Insects are ubiquitous in nature and it's almost inevitable that they're going to be related to a criminal offense scene, either because it's a neighbourhood of their natural habitat or because they need been introduced or interested in it. Since publication of the primary manual of forensic entomology (Smith, 1986) there has been a surge of interest within the subject and major efforts are made to extend the robustness of the interpretation of insect evidence. These activities have been reviewed extensively (Amendt et al.).

Forensic entomology is one of the important breakthroughs to investigate the criminal investigation by the help of flies (Sarcophaga). Over the past 15-20 years many research work has done in the field of forensic entomology and many species of forensic importance have been discovered. We reviewed many recent advances concerning these strategies and considered the potential impediments to their development, including the challenge of obtaining regulatory approval and community acceptance in forensic entomology. The first observation on insect and other Arthropod as forensic indicators were documented in Germany and France during mass exhumations by Hoffman (2009) recognized as cofounders of the discipline. Between 1883 to 1898 Megnin in France published a series of articles dealing with Medico-Criminal Entomology. In Canada, Jonston and Villeneuve observed corpse, exposed to air. They agreed with Megnin that Arthropod succession occurred in a regular order but found the intervals between successions to be shorter in Montreal than in Paris. Understanding of this language began with the work of European pioneers, Bergeret (1855) who emphasized the importance of faunal studies from dead bodies' during investigation. Studied the fauna of dead bodies with special reference of Diptera and also compared the insect fauna of American with that of Europe. Knipling (1936) record the comparative analysis of genus Sarcophaga and also provide the identification key.

Kamal (1958) investigated the effect of controlled temperature and humidity on the life history, rate of development and other biological activities of both adults and immature of thirteen species of flies, representing nine genera with the families of Sarcophagidae and Calliphoridae. He also studied the nutritional aspects of larval forms with special emphasis on how the quantity of food affect life span, rate of growth and size of both individuals and populations.

Payne (1965) observed that frozen pigs attracted Sarcophagi's within five minute after being taken from the freezer and eggs of Calliphoridae were deposited “: while the carcasses were still partially frozen. House observed that interrelations between an insect diet, metabolism, and environmental temperature can affect the rate of maturation. Abasa (1970) studied the reproductive biology of *Sarcophagi tibialis* (Diptera- Sarcophagidae) and observed the copulation was possible with or without prior access by flies to a protein meal, adult emergences from pupae were high and the larval medium not effect on the flies emerging. Cornaby (1972) observed that adults and larvae of Calliphorodae and Sarcophagidae and adult Formicidae and Scarabaeidae are most important in reducing (Lizard/ toad) carcasses to dry skin stage. He identified 172 species, which are important reducers of carrion. Denno and Cothran (1976) studied the competitive interactions and ecological strategies of Sarcophagid and Calliphorid flies inhibiting rabbit carrion. They artificially reduced the Calliphorid populations' density by selectively interfering with oviposition and noticed that Sarcophagid population density increased six fold. They could conclude that the competition from Calliphorid was the principal factor limiting the population size of Sarcophagids. Williams (1983) described a method for determining the true of hatching of blow fly larva on a corpse with respect to temperature. Lord & Berger (1983) suggested a protocol for the collection and preservation of arthropod specimens from a corpse and the immediate vicinity. Nishida (1984) developed exact growth tables and growth curves for seven species of blow flies and flesh flies at 150C, 200C. On the basis of this study, moulting pupation or emergence of each species at different temperature could be calculated. “The body and the decomposers are telling us what happened if we can only understand the language. It has long been observed that insects associated with vertebrate carrion display PMI dependent process (Hall-1993). Post Mortem changes in a body depend upon many factors and PMI can be a difficult factor to determine. Introna et al. (1991) observed that different species were active during summer seasons. *Calliphora*, *Livida*, *Calliphoravivora* and *Cucilailustria* were observed only during springtime while *Phaenkiasericata* and *Sarcophagasarracenioides* were observed only during summer seasons. They also calculated the developmental time the species encountered during and summer season. Anderson (1996) observed *Calliphoravomitorea* to determine time of decapitation. Varatharajan. (2000) studied the broad area of forensic entomology as a detective tool for forensic science like estimate the Post Mortem Interval (PMI), cause of death and place of death. Sumodan et al. (2002) define the application and limitation of forensic entomology in India. Gurner et al. (2007) performed study to work out relative abundance and seasonality of forensically important blow flies in rural North Central Florida using pig carcasses as models for human bodies.

Jeffery (2007) studied the application of DNA based methods in Forensic Entomology and observed the identification of insects by molecular level. (2007) in their study reported the clearing technique used to pale the integument of fly puparia, thereby allowing observation of the anterior end (second to fourth segments) and the profile of the posterior spiracle, which are important clues for identification. Heo et al. (2007) identify the species that are unique to certain habitats allows dipterans to be used as a geographical indicator, which is useful in cases where the body has been moved.

Mulieri et al. (2008) recorded temporal changes to flesh fly species (Diptera: -Sarcophagidae) abundance simultaneously at monthly intervals during a year in a woodland and in grassland in a nature reserve to Buenos Aires, Argentina. During the sampled year, they collected 1305 flesh flies from 18 different species.

Segura et al. (2009) observed the succession pattern of cadaverous of forensic important in Colombia. They examined the succession of insects colonizing three pig (*Sus scrofa*) cadavers. In total 5981 arthropods were collected during decomposition, 3382 adults and 2599 immature eggs, belonging to 10 orders and 27 families. Abdul – Rassoulet al. (2009) collected adult Dipterous flies monthly from exposed animal carcasses in Baghdad city. Their results showed that flies could be collected all over the year but with narration their population density in different seasons. Bharti (2009) generated Life tables for two forensically important flies *caliphoravicina* and *muscadomesticanebulo* at varying temperatures. These findings would be helpful in legal investigations. Vasconcelos (2010) studied the occurrence of forensically flies (Order Diptera) on fourteen cadavers taken into the Institute of Legal Medicine, in Pernambuco, Brazil, according to the conditions of decompose body and the pattern of colonization by forensically important insects.

Bharti (2011) updated checklist of blowflies (Diptera: -Calliphoridae) is provided herewith. This has been carried due to some recent shuffling, new records, new species and erroneous placement of taxa in earlier reported lists. Now, from India 9 subfamilies, 30 genera and 119 species of calliphoridae from India. Amendt (2011) studied the application and limitation of forensic entomology. Senta Niederegger (2011) observed the forensic flies growth rate for estimation of PMI. Interspecific morphological similarities, however, complicate species determination. And also observe the Muscle attachment site (MAS) patterns for identification of forensically important flies.

Goyal (2012) studied to determine the time since death in cases of decomposed bodies and observed the calculated the Post Mortem Interval (PMI). Singh (2012) in Punjab and Rajasthan studied the ultra-

morphological characteristics of immature stages of a forensically important flies *Para Sarcophaga* (Fabricius) (Diptera:-Sarcophagidae). Verma (2013) recorded the study of *Chyrosomarififacies* from India for forensic importance.

Singh et al.(2016) analysed the ecological succession pattern of Diptera on the carcass of laboratory bred rats. Singh (2016) analysed the identification key forensically important blow flies from India. Singh and Sharma (2016) studied the forensic entomology in India have observed that very few work are available for molecular study of Calliphoridae and Sarcophagidae.

Sunkeret al(2018) studied the factor that affect the Arthropod succession pattern on of dead animal. Jyotiet al.2019. Studied the incidence and succession of forensically important insects associated with goat fish and observed the 125 species of Sarcophagidae, Calliphoridae, Muscidae from Himachal Pradesh.

Gemmellare(2019)analysed the molecular identification techniques for forensically important insects. Bhaskaranet al.(2019) observed the forensically important insects and their biology on fish and evaluate the attraction preference toward the postharvest stage of fish.

IMPORTANCE & BENEFITS OF STUDY-The status of forensic entomology in India is quite encouraging and it is desirable to focus in this field, with the rapid increase in crime, simple rapid method of investigation using insects would be a welcoming research. A lot of work still has to be done to make this field good enough to be utilized in medico legal investigation. Forensic Entomology in India is in its infancy state and very few researchers are pursuing their research in this field. Very few works have been documented if we survey the literature. Mecanzie (Indian medical gazette 1889) did earliest work. Few researchers have done research on various aspects (Singh and Greenberg 1994, 1984, Kashyap and pillai 1989, Bharti and Singh 2000, 2003). There are many applications of forensic entomology encompassing any situation that may involve an interaction between insects and other arthropods and the law.

Insect are ubiquitous evidence that are generally associated with the live and dead body. When did the victim die and is a crucial question in case of untimely death and needs lots of complicated procedure to be followed. Estimation of time since death also known as PMI (POST MORTEM INTERVAL) is very crucial to investigate. The role of entomologists who can detect and solve the death mystery with the help of certain insects visiting the crime is very important for solving the mystery of death. They can easily detect the all information related to crime like time, place and cause of death with the help of forensically important insects visiting on carrion. The correct sampling and proper interpretation of the visiting insects on carrion can provide valuable information in forensic science and can be very useful for forensic department in preparing crime investigation report. According to the succession pattern and maggot age

of flies can easily investigate the time of death and place of death because insects are mostly prefer the corpse and decomposing body as their food source and habitat .

CONCLUSION: -Forensic entomology is new innovative tool for solve the criminal activities because in recent time crime increase day by day like murders, suicide so in that conditions forensic entomology try to estimate the time of death , place of crime and many other legal issue. Since PMI is one of the important aspects in crime detection and with the help of insects PMI can be calculated very easily. PMI can be estimated only within first 72 hours of death by observing eggs, 1st, 2nd3rd instar larvae, puparia and adult flies. So the present work will provide a data on larva, pupa and adult involved in crime detection. The correct sampling and proper interpretation of the visiting insects on carrion can provide valuable information in forensic investigations. The present work is an attempt to prepare the pioneer data on Calliphoridae and Sarcophagidae visiting on carrion because these dipterans flies are most possible crime detectors.

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