

Insecticide residues: A novel tool for forensic entomotoxicologyNarne Kavya¹, J.P Purwar², Sapna¹, Mood Suguna³**Introduction**

While many are familiar with the negative impact of insects that cause damage to crops resulting in yield losses. But there are some insects like silkworms, bees etc. are beneficial. In addition, some insects like blow flies provide good evidences in case of crime investigation. Most important part of crime investigation is evidence the cause of death which is sometimes difficult when the body recovered after many days after death. In such cases normal conventional samples such as body fluids, tissues and internal organs have become degraded and almost missed. In such case, insects can serve as an alternative source of evidence, helping to identify xenobiotics present in cadavers (Gosselin *et al.*, 2011). This interdisciplinary field is known as entomotoxicology.

Entomotoxicology derives its name from Greek roots: "entomon" meaning insect, "toxicos" meaning poisonous, and "logos" referring to the subject matter or study. In short it means study of xenobiotics that affect

insects. This term was used firstly by Pounder by adding adjective forensic which indicate definition of original term (Pounder, 1991). It merges field of toxicology with forensic entomology which is budding subject in case of investigations. It analyses the effect as well as presence of xenobiotics in insect found in crime area. By this we can estimate the pattern as well as time of drug usage particularly in cases related to death associated with toxins or poison (Chakroborty and Sharma, 2023). Scientists specified the term forensic entomotoxicology as utilization of insects and its specimens as a source of indirect toxicological evidence in absence of direct samples like urine, blood, tissues etc (Silva *et al.*, 2017). It divided into environmental forensic entomotoxicology, which emphasizes the utilizes insects as bioindicators of toxicants in environment and medicolegal forensic entomology, which focuses on using insects as proxy samples when dead bodies are too decomposed to provide toxicological samples.

This is good for the fish because plant

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roots and rhizobacteria remove nutrient from the water.

History

The earliest cases of forensic entomotoxicology recorded in China when farmer found murdered with sharp weapon. All suspects were made to place their sickles in ground. The murdered sickle which had remnants of blood attracted blow flies resulted in finding of murderer. First article related to it was identification of dead skeletonized body of a lady which has flies all over. These flies gave evidence of phenobarbital was found to be present in the body after sampling and analyses (Introna *et al.*, 2001). After that many toxicants like propoxyphene, barbiturates and cocaine etc were detected in insects found near suspected area in various investigations.

Insects as a tool for investigation

Following the death of an organism, the process of decomposition occurs, which typically categorized into fresh, bloated, decay, post-decay and skeletal stages (Bushby *et al.*, 2012). Many insects land over body due to various odours coming out from decomposing cadaver. Among all insects like blowflies are first to come to that place and oviposit on the carrion. From that eggs larvae will come out and feed on corpse. After that they become pupa, from which adult emerges. These pupal remnants usually left in soil which

in many instance serves as a sample for investigation. Other than pupal cases, larva, adults, exuviae and faecal matter also serves this purpose. Mostly insects belong to orders Diptera and Coleoptera are used of which *Calliphora* and *Lucilia* larvae are mostly studied. In previous studies xenobiotics like Morphine, nodiazepam, endosulfan, nicotine, cotinine were detected in *Calliphora sps* followed by cocaine, barbiturates in *Lucilia*, parathion, malathion in *Chrysoma* respectively.

Insect Sampling procedure and analysis

Insects present around different sites of body or site of carrion should be collected. This step is crucial as drug was distributed on different parts of corpse. Insects collected from different parts gives idea of concentration of xenobiotic distribution. For best statistical result minimum 30 insects of same stage and activity from each part of body is necessary. After that samples should be sterilized by immersing in 0.5 per cent sodium hypochlorite for 5 to 10 minutes followed by washing with distilled water. In case of inorganic xenobiotic samples should be crushed and heated at 650 degree centigrade for approximately 24 hours, followed by analysis using Atomic absorption spectroscopy, Atomic emission spectroscopy etc. where as in case of organic xenobiotic after crushing it should be added with internal standard solution followed by centrifugation

after homogenized with saline solution. Then it should be subjected to GC-MS, HPLC (Chophi *et al.*, 2019).

Conclusion

In a nutshell entomotoxicology opens a new gate of detecting clues in case of especially suspected murders. Thus offers a great role especially in cases where cadaver is almost decomposed leaving no tissues for sampling. But more research should be done in this area to frame a standardized protocol from sampling and analyses of insect's sample for getting proper results.

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