Cytochrome Oxidase I (COI) Gene based Indentification of Indian Blow Flies (Diptera: Calliphoridae): A Review

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I. INTRODUCTION

Forensic entomology is the analysis of insect evidence for forensic and legal purposes [1]. The most important task in the forensic investigation is the estimation of the minimum time since death [2,3]. Forensic entomology is the branch of forensic science in which information about insects is used to draw conclusions when investigating legal cases relating to both humans and wildlife, although the term may be occasionally expanded to include other arthropods as well. Insects can be used in the investigation of a crime scene both on land and in water [4-8]. The majority of cases where entomological evidence has been used are concerned with illegal activities which take place on land and are discovered within a short time of being committed. Gaudry et al. [9] commented that in France 70% of cadavers were found outdoors and of these 60% were less than 1 month old.

II. HISTORY OF FORENSIC ENTOMOLOGY

In China (13th century), insects were first used in a forensic context. A farmer had been killed in a rice field with a sharp weapon. All the suspects were asked to assemble together and were told to place their sickles on the ground. No obvious evidence could be seen, but one sickle attracted numerous blow flies, apparently because of invisible traces of blood on the blade. The owner of the sickle, when confronted with this entomological evidence, confessed to the killing [10].

The applications of forensic entomology are numerous, encompassing any situation that may involve an interaction between insects and other arthropods, and the law. Therefore, the utility of the field is categorized under three separate headings: urban, stored product and medico legal forensic entomology [11,12].

Urban forensic entomology generally deals with the interaction of insects with man-made structures and other aspects of human society and may include the infestation of buildings by termites, cockroaches etc. [11], and the breeding of flies in livestock and similar facilities [13].

The stored product aspect of forensic entomology involves the infestation of stored commodities by insects. Infestations may include the harvesting and storage of crops and subsequent invasion by an insect pest and domestic invasion of kitchen products. This aspect also encompasses the infestation of food sold by retailers to the public, which may result in prosecution and substantial fines [13].

III. COI GENE BASED IDENTIFICATION OF BLOW FLIES IN INDIA

Khullar et al. (2016) phylogenetically analyzed six species of Indian blowflies on the basis of 350 bp region of mitochondrial COI gene. They found the interspecific variation of 0.1% to 13.5% between all the species. Intraspecific variation was maximum in Lucilia sericata (0.06%) and minimum in Lucilia ampullaceal (0.01%). Phylogenetic tree was constructed using UPGMA method and it showed bootstrap value of 64% to 100%.

Priya Bhaskaran and Sebatian (2015) amplified and analyzed 545 bp fragment of COI gene of Lucilia sericata and concluded that COI gene is excellent for the blow fly species identification. They also showed phylogenetically that L. sericata is showing 99.3% similarity with L. cuprina and 99% with that of Hemipyrella ligurriens because three species are closely related to each other.

Archana et al. (2016) have done the DNA barcoding of COI gene of Musca domestica, Chrysomya megacephala, Hydrotaea capensis, Hermetia illucens, Sarcophaga ruficornis and yielded 658 bp region. They also morpgologically identified all the specimens and then supplemented with DNA analysis. Phylogenetic tree was constructed using Neighbour-Joining method with 1000 bootstrap support in MEGA 4 software.

Bajpai et al. (2013) studied genetic variability and phylogenetic relationships among three species of blow fly on the basis of sequences obtained from the COI gene and control region. They revealed that there was very little genetic divergence between these species. Phyloegenetic trees for COI and control region were constructed using maximum parsimony method.

Sharma and Singh (2015) phylogenetically analyzed two species of blow flies by using sequences of COI gene. They found the intraspecific variation of <1% in the samples of Chrysomya megacephala and 0.0% in Chrysomya rufifacies. They analyzed 480 bp region of COI gene and found sequence divergence among the taxa ranged from 0 to 12.2% with the same species having a divergence ranging from 0 to 1.1% for C. megacephala and 0 to 1.5% for C. rufifacies- the former showed 11 variable base positions, mostly in the third codon position.

VI. CONCLUSION

It is evident from the foregoing discussion that the status of forensic entomology in India is quite encouraging and it is desirable to focus on this field in future. A lot of work still has to be done in India to make this field good enough to be utilized in the medico-legal investigations. So, future workers are highly encouraged to choose this field as their main research endeavor in near future.

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