Proceedings of the National Conference on Modern Trends in Zoological Research

ISBN No. 978-81-909551-8-8

MOLECULAR BARCODING AND PHYLOGENY ANALYSIS OF Bradinopyga geminata (ODONATA: LIBELLULIDAE) USING CYTOCHROME OXIDASE SUBUNIT I GENE SEQUENCE

Jisha Krishnan E. K., Akhilesh V. P. and Sebastian C. D.* Molecular Biology Laboratory, Department of Zoology, University of Calicut, Kerala * drcdsebastian@gmail.com

Abstract

Odonates are aquatic palaeopterous insects consists of dragonflies and damselflies. *Bradinopyga* is a genus of dragonflies in the family Libellulidae, having brown eyes, grey thorax and abdomen with black and white markings, usually seen perched on compound walls, boulders etc. Here we report the partial sequence of PCR amplified mitochondrial cytochrome oxidase subunit I (COI) gene of *Bradinopyga geminata* using Sanger's method. The database analysis revealed the 468 bp long fragment of *Bradinopyga geminata* (KM096995) showed 99% sequence similarity to *Bradinopyga geminata* (GJX306648) found in Tamil Nadu. The geographical isolation may act as an evolutionary tool for the reported 1% of sequence divergence. The translational product yielded 160 aminoacid length and the peptide blast of the conceptual nucleotide sequence showed 100% similarity to COI gene of *Nesciothemis farinose* (AGN27992), a Libellulidae species. Thus it can be attributed that both nucleotide blast and peptide blast confirmed the taxonomical status of *Bradinopyga geminate* (KM096995) as a Libellulidae member. The constructed phylogenetic tree revealed its close evolutionary relationship with other Odonate species.

Key words: Odonates, Bradinopyga geminata, Molecular systematics, Mitochondrial DNA, Cytochrome oxidase I gene, DNA barcoding

INTRODUCTION

Odonata is one of the ancient groups of large invertebrates consists of three groups: Anisoptera (dragonflies), Zygoptera (damselflies), and Anisozygoptera. Adult odonates are medium to large in size, often conspicuous and brightly colored insects and are aerial predators hunting by sight. Emiliyamma *et al.*, (2007) reported 137 species and subspecies of Odonata spread over 79 genera, 12 families and 31 subfamilies from Kerala. They are widely used in the studies of morphology, behavior, ecology and evolution (Corbet *et al.*, 1999). *Bradinopyga geminata* is a genus of Libellulidae family commonly known as 'Granite ghost'. It is a medium sized grey dragonfly having brown eyes, grey thorax and abdomen with black and white markings. Adults are common along small pools of water or small stagnant water bodies nearby agricultural fields. It is geographically distributed in is a widespread species all over India, Sri Lanka and Thailand.

Molecular systematics is one of the most rapidly expanding fields in biology and yet our understanding of pattern of molecular evolution remains relatively superficial. Analysis of molecular data has proven to be important for understanding phylogenetic relationship, examining population structure within a species and assigning unknown specimens. The use of molecular characters for speedy identification of unknown organisms has been proved to be useful and highly effective. Among these techniques, the analysis of mitochondrial DNA is particularly useful in discriminating between closely related species. DNA barcoding is a novel system designed to provide rapid, accurate, and automatable species identification by using short, standardized gene regions as internal species tags.

Mitochondrial DNA has been one of the most widely used molecular markers for phylogenetic studies in animals because of its simple genome structure (Avise, 2004). The fact that mt DNA represents maternal haploid and accumulates nucleotide substitution 5-10 times more rapidly than nuclear, makes it suitable for examining population and subpopulation structures among related taxa. Among insects, the maximum number of mitochondrial genome has been characterized in order Diptera. Cytochrome oxidase I (COI) gene is one of the most important protein encoding genes of mt DNA and has been utilized in the studies of molecular evolution and classification of species. It provides an ideal species identification marker in insects due to lack of introns, simple alignment, limited exposure to recombination and availability of robust primer

4. STOP LOSS ORDER

"The Stop-loss order" is used to prevent loss so much worse, if the price moves in a direction not allegedly/turn with our analysis. This type of order is installed after we open the order with any type of order, and will continue to apply until the stop-loss order is repealed or our trading position is covered.

CONCLUSION

The general level of prices of cryptocurrencies in India is on the high side. Market rates are relatively higher by as much as 5 to 10 percent compared to the global average. This means that Indians can only get involved in peripheral participation in crypto trading as far as international crypto exchange platforms are concerned. Lack of large-scale mining facilities especially with regard to Bitcoin has been identified as a reason for this. Also, strict government restrictions on international money flow also make it significantly difficult for Indians to transact with many of the large foreign crypto exchange platforms. The emergence of local platforms has helped to alleviate this issue to some extent as it is now a little easier for lower income citizens to gain access to cryptocurrencies.

The Reserve Bank of India (RBI) has been consistent in warning citizens of the risk associated with cryptocurrencies. The RBI has released several statements since 2013 calling Bitcoin and other cryptocurrencies a Ponzi scheme as well as a bubble. The bank has also issued statements detailing the potential negative security, financial, and legal ramifications of crypto investments, calling on citizens to be wary. *In 2017*, reports began to emerge that the RBI and the government were considering establishing regulations on the cryptocurrency market. The Government does not consider crypto currencies legal tender or coin and will take all measures to eliminate use of these crypto assets in financing illegitimate activities or as part of the payment system," Mr Jaitley said during his speech. "The Government will explore use of block chain technology pro-actively for ushering in digital economy," he added.

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