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Insect Barcode Information System

Maria Pratheepa*, Sushil Kumar Jalali, Robinson Silvester Arokiaraj, Thiruvengadam Venkatesan, Mandadi Nagesh, Madhusmita Panda & Sharath Pattar

National Bureau of Agriculturally Important Insects, Post Bag No. 2491, H.A. Farm Post, Hebbal, Bellary Road, Bangalore – 560 024, Karnataka, India; Maria Pratheepa - Email: mpratheepa@gmail.com; Phone: + 91 080 23511982; Fax: +91 080 23411961; *Corresponding author

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Abstract:
Insect Barcode Information System called as Insect Barcode Informática (IBIn) is an online database resource developed by the National Bureau of Agriculturally Important Insects, Bangalore. This database provides acquisition, storage, analysis and publication of DNA barcode records of agriculturally important insects, for researchers specifically in India and other countries. It bridges a gap in bioinformatics by integrating molecular, morphological and distribution details of agriculturally important insects. IBIn was developed using PHP/My SQL by using relational database management concept. This database is based on the client–server architecture, where many clients can access data simultaneously. IBIn is freely available on-line and is user-friendly. IBIn allows the registered users to input new information, search and view information related to DNA barcode of agriculturally important insects.This paper provides a current status of insect barcode in India and brief introduction about the database IBIn.

Availability: http://www.nabg-nbaii.res.in/barcode

Keywords: Insect barcode database; genomic tools; barcode generation; molecular taxonomy; DNA barcode

Background:
Insects are the most abundant life forms on earth comprising about 1 million species (> 50% of life forms present on earth). Statistical data from the world conservation union for the Year 2010 **[1]**, showed that there are 62,305 million vertebrates species, 1,305,250 million species of invertebrates, 321,212 million species of plants and others are of 51,563 million species. Among the invertebrates, insects represent around 1 million species. India, occupying about 2% of global space, is among the top ten mega diversity nations of the world in terms of insect diversity, with about 7.10% of the world insect fauna. Ghorpade (2010) **[2]** provided an estimate of 54346 described species of insects belonging to 27 orders from India, with nearly as many species yet to be discovered. Species identification of insects is an important and difficult task as they are more diversified. DNA barcode refers to the identification of a species, by use of short conserved DNA sequences from the specific mitochondrial gene CO1 (Cytochrome Oxidase 1) **[3].** Hebert *et al*. (2003a**)** **[4]** focused this discussion by proposing that DNA barcoding system for animal life could be based upon sequence diversity cytochrome c oxidase subunit 1 (CO1) gene. They established that diversity in the amino acid sequences coded by the 5′ end of this mitochondrial gene was sufficient to reliably place species into higher taxonomic categories (from phyla to orders). As such, insects provide a challenging test for the ability of CO1 diversity to resolve species boundaries **[5]**. The cytochrome c oxidase I, 16S, 18S, and elongation factor-1α genes have been widely used and are informative across a broad range of divergences in insects **[6]**. The internal transcribed spacer 2 (ITS2) is another phylogenetic marker useful for higher level systematic analyses **[7]**. A 658-bp region (the Folmer region) of the mitochondrial cytochrome c oxidase subunit I (COI) gene was proposed as a potential 'barcode' **[8]** as these sequences are highly conserved across species. Thus DNA Barcode forms an additional master key to classify the insect fauna of earth. Compilation of DNA barcode of agriculturally important insects in the form of database is will

be useful for entomologists across the world. Keeping this in view, an insect barcode database named "Insect Barcode Informática (IBIn)" was developed under the project National Agricultural Bioinformatics Grid (Insect Domain) by the National Bureau of Agriculturally Important Insects, Bangalore, India. The database access path is: http://www.nabg-nbaii.res.in/barcode/. **Figure 1** is the flow diagram of the database architecture and (**Figure 2)** is the web page of IBIn database.

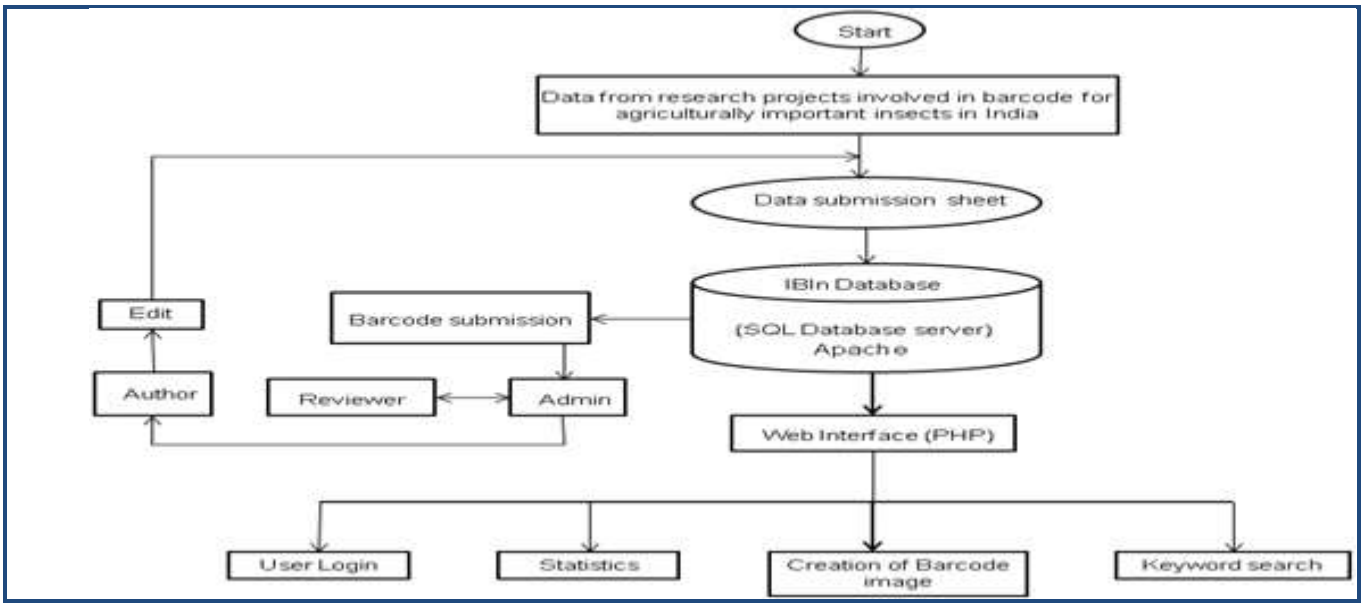

Figure 1: Flow diagram of IBIn database

Figure 2: Web page of IBIn

Methodology:

Network and Programming Architecture

IBIn was developed based on two tier client–server architecture, where many clients can access data simultaneously. The volume of insect barcode data is enormous and needs a dedicated data server. The server is located at NBAII, Bangalore with high performance computing facility. IBIn database has been developed in MySQL and Apache 2 web server as an interface between the user and the server. PHP has been used for developing programs for login facility, viewing of barcode information related with agriculturally important insects, submission of barcode, generation of barcode image, reviewing process of new barcode entries by experts and etc.

National accession number and creation of barcode image

A national accession number will be assigned after the successful submission of each barcode entry and a unique barcode image will be created as per the standardization of BOLD (Barcode of Life Database) **[9]** and the record will be stored in IBIn. The color code used in barcodes are as follows: A in Green (0,255,0), G in Black (0,0,0), T in Red (255,0,0) and C in Blue (0,0,255).

Submission of a barcode data in IBIn

Researchers can log onto the web site, http://www.nabg-nbaii.res.in/barcode/ and can submit a barcode record by clicking the *Register Barcode* button. A national accession number (Indian accession number) will be assigned automatically after the successful submission of each barcode record. The required information for submission of the barcode records are: Order, Family and Species of the insect for which the barcoding has been done; Place, State and Country from where the insect was collected; Longitude and Latitude of the location; Barcode Marker (name of the gene), Source (reference), Author name and Institute address, Nucleotide sequence and the image of the insect. Once the submission of barcode record is done, a unique barcode image will be automatically created. Immediately after the submission of the barcode record, E-mail alerts will be sent automatically to the experts through database administrative members for reviewing and approving of the new barcode entries. After approval of the new barcode records, the record will be updated on IBIn database.

Statistics:

At present IBIn database has 171 barcode records. A comparative statistical information of the insect Barcodes done in India as well as in the world will be dynamically generated in the form of pie charts in IBIn database.

Conclusion:

Insect Barcode Informática (IBIn) can be one of the best database and ideal platform for the entomologists working on the barcoding of insects in India and other countries. Researchers can view and submit their nucleotide sequences by logging onto this web site http://www.nabg-nbaii.res.in/barcode and barcode will be generated automatically and the record will be stored into the database.

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