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Identification and morphological characterization of some species of beneficial insects from the region Amethi, UP, India

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Abstract
Insects form an important group of Animals which belongs to the phylum Arthropoda. They are basically characterised with three pairs of legs, two pairs of wings and three distinct body parts – head, thorax, and abdomen. The major beneficial insects are *Apis india* (Honey bee), *Bombyx mori, Tachardia lucca*. For detailed study on morphology and identification we have collected these species from the study area of district Amethi, U.P. India. This is the area from where limited information on beneficial insects was available in literature. During study period from July 2014 to August 2015, a total of 30 samples of selected species from the study area were collected. The samples were identified with the help of standard taxonomic keys and morphological features were recorded. After that these samples were preserved in 70% formalin solution for future reference. The detailed morphometry will be discussed in the paper.
To fulfil the knowledge gap, this study provides the detailed information on identification and morphology of *Apis indica, Bombyx mori* and *Tachardia lucca* for their better use and sustainable management.

Keywords: Identification, morphology, beneficial insects, Amethi U.P.

1. Introduction
Lepidopterans are regarded as one of the important component of biodiversity and are the second largest order among insects made up of approximately 1, 50,000 species so far known as per literature [1]. These include moth (Hetrocera) and butterflies (Rhopalocera) of which 70,820 are butterflies according to several reports. Apart from their aesthetic appeal, they are good pollinators. Butterflies are highly penetrating to environmental changes and are delicate creatures. Butterflies and moths offer good occasions for studies on population and community ecology [6]. The biodiversity, taxonomy, geographic distribution and status of many species of butterflies are relatively well known. Further, butterflies are good biological indicators of habitat quality as well as general environmental health as many species are strictly seasonal and prefer only particular set of habitats. The butterflies are one of the important and most commonly seen insects of the order Lepidoptera [1]. The order Lepidoptera is an economically important group of insects as their larvae exclusively feed on plants. This group is characterized by the high chromosome number and small size of chromosomes that make differentiation of the species difficult at the cytogenetic level. In India about 1,501 species of butterflies are present. Some of the species are easy to identify and categorize, while many other species are still unidentified.
There are over one million types of insects in the world. Most people's first thought of insect is "ew, gross!" or that insects are bad. However, only 5% percent of all insects are bad. That means that 95% of all insects are either good or neutral. A unbiased insect is one that isn't beneficial, but also doesn't cause any harm [2]. Good insects can be found in many different places. There are good insects in the garden, in the backyard, in the playground, in parks, and even in your home. Beneficial insects can be grouped into three groups: predators, pollinators, and recyclers. Predators are beneficial because they prey on and eat bad insects [3]. Pollinators help spread pollen and make flowers, fruits, vegetables, and other plants grow and spread. Recyclers are insects that decompose or break down waste and trash. Without these insects our trash, animal poop, and dead things would pile up all around us!
Although many studies on morphological, ecological and molecular attributes of several species of butterflies from all over the world are available, very little is known about the Indian species. Morphological identification of butterflies is usually based on the wing patterns. These factors make morphological criteria not a preferred way for a very accurate differentiation of these species. Various authors have identified butterfly's species by their morphology, but it's possible that some small invisible change in morphological characteristics may remain unnoticed [4]. The molecular techniques provide an important tool that ease the assessment of genetic diversity and facilitate genotyping, classification, inventorying and phylogenetic studies. There are many molecular techniques available such as restriction fragment length polymorphism (RFLP), random amplified polymorphic DNA (RAPD) and arbitrary fragment length polymorphism (AFLP) etc. to characterize the butterflies at molecular level.

Review of literature
Adrian Augusto Sosa Gomez Rolim, et-al, analysed that a 658-bp region of the mitochondrial DNA cytochrome oxidase subunit I gene was amplified using PCR and then sequenced. The five Lepidoptera species were distinguished by restriction enzymes Bpm I and MboI. RFLPs produced by Bpm I

endonuclease were useful to discriminate species from within Spodoptera. Josef Berger, et-al, proposed using the Pappenheim panoptic stain to identify different hemocyte populations of P. apterus. These results were the beginning building blocks of a knowledge base for our ongoing studies of the function of P. apterus hemocytes. As certain morphological characteristics are similar to mammalian blood cells which are used in hemotoxicological safety screening, the use of P. apterus as a new hematotoxicological biomodel was suggested. Andrea Bartolucci, et-al has study about the reproductive systems of both males and females contained the same structures as other Anastrepha species. From day 1 to day 3, there were no detectable differences between irradiated and fertile males. The growing region encompassed half the testis total length and there was no free sperm in the seminal vesicle. S. JOHNY concluded that the microsporidian isolate reported here is distinctly different from the other known species and was likely to be a new species.

Insect Lifecycles and benefits

Insects go through metamorphosis to become adults. Many insects completely change their size, shape and color as they go through their lifecycle. All insects start out as eggs. The egg hatches, and the insects go through a series of molts until they become adults. When an insect molts, it sheds its exoskeleton (or skin) and grows for a short period of time until their new exoskeleton becomes hard again. This is one reason why insects can never become as large as a dog. Another reason is because their exoskeleton is so hard and strong, it would crush them if they became too large.

Only the immature insects can molt. Once an insect becomes an adult it will no longer molt.

One way to tell the difference between adult insects and immature is to see if they have wings. Only adult insects have wings. If you see a small fly it is incorrect to call it a baby fly, because that is as big as it will ever get!

There are two different types of lifecycles that insects can go through. Insects either go through complete metamorphosis or incomplete metamorphosis. The type of metamorphosis or lifecycle an insect goes through depends on the type of insect.

Complete Metamorphosis has four different life stages. Egg, larva, pupa, and adult. An egg is laid, and a larva hatches from the egg.

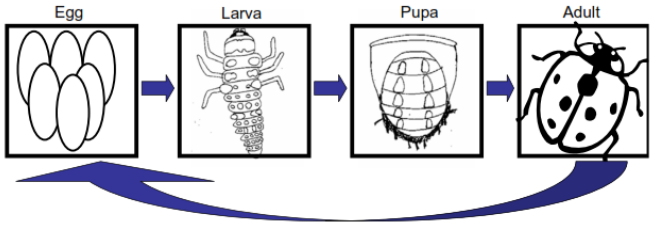

Fig 1: Complete Lifecycle Key

Incomplete metamorphosis has only three different life states. Egg, immature, and adult.

When an egg hatches, an immature emerges. The immature is similar to the adult, but is smaller and never has wings.

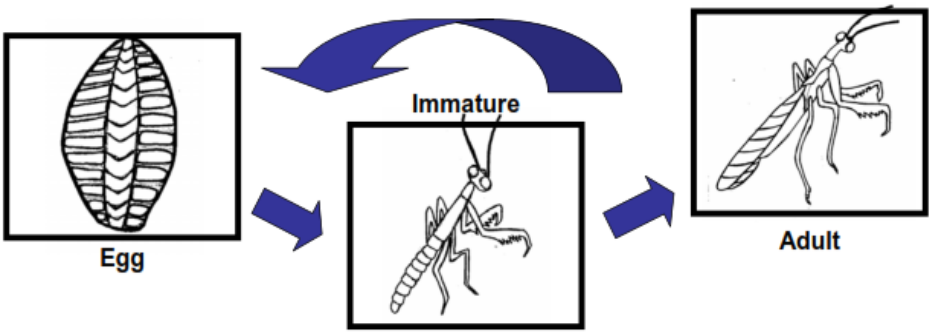

Fig 2: Incomplete Lifecycle Key

3.1 Medically Important Insects

Insects that transmit diseases, sting, or cause allergic reactions are medically important insects. Although the insects do not actually kill humans or animals, they can carry diseases that can kill. Entomologists who study these types of insects are called medical entomologists.

Mosquitoes are the deadliest animals in the world because of all the diseases they transmit. Only female mosquitoes suck blood, so only the females can transmit diseases. Mosquitoes pick up diseases from humans or animals when they feed on blood and transfer the disease to a new human or animal the next time they suck blood. Mosquitoes transmit diseases such as Malaria, Yellow Fever, and West Nile Virus. West Nile Virus can be found in Texas! Everyday, many people all over the world become sick or die of diseases that mosquitoes transmit. Mosquitoes also transmit diseases to animals such as West Nile Virus.

Fig 3: Mosquitoes

Red Imported Fire Ants are another medically important pest. Fire ants sting anything that stands in their way, including us! When a fire ant stings your skin, it always leaves little pustule or blister. Many people are allergic to fire ants. If they are

stung they can swell up around the bite, get a rash, or feel their throat tighten up until it is hard to breath. People who are very allergic to fire ants may even die if they do not get to a doctor in time! Some other insects that sting are bees and wasps. Many people are allergic to these insects also. Bees and wasps only sting if they feel like their queen, nest, or nest-mates are threatened. If you see a bee hive or a wasp nest, leave it alone! If you do not bother them, they will not bother you. Same thing goes for bees and wasps visiting flowers or flying around.

Fig 4: Red Imported Fire Ants

3.3 Role of Insects in Agriculture

Many insects are serious pests of agricultural crops and livestock, transmit diseases and cause great losses to mankind. On the other hand, there are beneficial insects including insect predators and parasitoids that can be used for biological pest control, pollinators, insects involved in soil building and nutrient cycling, etc. and some insects can be valuable sources of chemicals and medicines. Collection, identification and characterization of insects and mites that impact Indian agriculture and biosecurity, including pests of crops, alien invasive species, biological control agents for insect pests and weeds, species of quarantine significance, and beneficial insects such as silkworms and lac insects is of fundamental importance to increasing the productivity of Indian agriculture and allied sectors such as sericulture, apiculture and lac farming. In spite of its rich insect diversity, the Indian insect fauna has not been documented in its entirety and even economically important groups, including agricultural pests, are taxonomically very poorly known. For utilization and conservation of our beneficial insects, first they need to be taxonomically characterized. The Convention on Biological Diversity (CBD) emphasizes the need for identification and monitoring of the components of biodiversity besides organizing and sharing the gathered information. The governments of the world recognizing the CBD have affirmed the existence of a 'taxonomic impediment' to the sound management and conservation of biodiversity.

Removal of this impediment is a crucial step in the proper implementation of the Convention's objectives by member countries (Prathapan *et al*., 2006). As a signatory to the CBD, India has to fulfil its obligations for biodiversity inventorization and monitoring, for which a strong foundation in taxonomy is vital.

Result Analysis

Insects in biodiversity hotspots of India like the Western Ghats, northeaster region, national parks and wildlife sanctuaries, etc. have not been surveyed in depth so far. Insect taxonomists have a large clientele, from applied entomologists, students and researchers in entomology, to amateur naturalists, and ultimately to the general public. For an Indian insect taxonomist, spending time producing user-friendly taxonomic work for a broad audience takes time away from basic taxonomic research that is of immediate use to a specialist and of use to everyone in the future. To balance these conflicts, it is necessary to develop different kinds of taxonomic products catering to the needs of both amateur naturalists and specialists. The internet has evolved as a viable medium for publication of information on insects in the form of online catalogues, checklists, factsheets and image galleries supported by full taxonomic details. Advances in digital imaging technologies have made it possible to capture minute morphological features useful for identification. Collection and characterization of agriculturally important insects and other arthropod biodiversity including pests, bioagents, honey bees and other pollinators, lac insects, silkworms, vectors, dung beetles, veterinary pests, etc. and preparation of field identification guides on priority. Taxonomic characterization of at least 12,000 species including rare and new insect fauna needs to be carried out on a war footing. Creation of a repository of genetic resources of agriculturally important insects with desirable attributes from different geographical regions of the country which will help research workers, students and farmers for future study and utilization. Efforts will be made to conserve quality beneficial organisms *ex situ* through a network of institutions in different parts of the country and to ensure their utilization for increasing crop productivity by developing mass production techniques for important resources like predators and parasitoids.

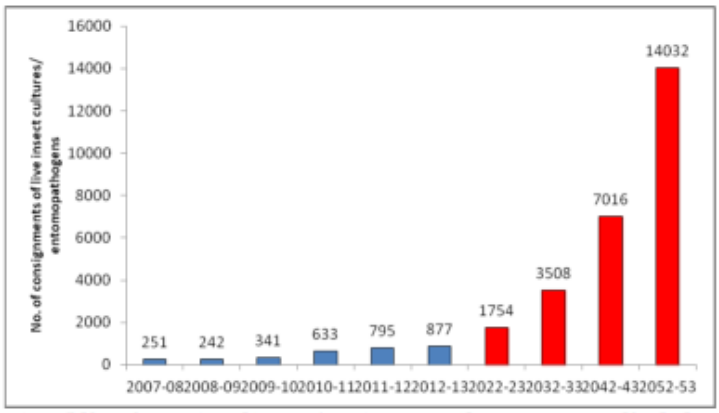

Fig 4: Consignments of live insect cultures/ entomopathogens supplied during the last five years (blue bars) and anticipated demand from 2020 to 2050 (red bars)

Conclusion

From above different studies it has been concluded that conservation of ecologically and environmentally significant species of butterflies needs proper identification. The morphological method of identification needs large number of experts and time but the molecular techniques are much efficient in proper identification within short period of time. Molecular techniques include restriction fragment length polymorphism (RFLP), random amplified polymorphic DNA (RAPD) and arbitrary fragment length polymorphism (AFLP) etc. to characterize the butterflies at molecular level. RAPD

marker is well suited for use in the large sample throughout systems required for population genetics. These techniques are also useful in insect phylogeny areas like the detection of genetic variation among populations as well as the identification of closely related species. Molecular techniques have also been used to clarify phylogenetic relationships among parasitic insects and relationship between parasites and predators. Insect species identification or differentiation based on morphological characteristics of undifferentiated phases, such as eggs or small larvae, can be inaccurate. Therefore, additional molecular characterization, based on the nucleotide sequence of the first portion of the mitochondrial COI gene, was used in this study.

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