International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST

# Characterization and Identification of Insects and Study of their Economic Importance in Adverse Climatic Conditions in India

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**Article Info**

Volume 9, Issue 5
Page Number : 634-643

**Publication Issue**

September-October-2022
Pages : 606-611

**Article History**

Accepted : 10 Oct 2022
Published : 30 Oct 2022

**ABSTRACT**

The abundance and presence of insects are ubiquitous. They have adapted to survive in all kinds of environments and feed on any substance with nutritional value. Though we have mostly labeled insects as pests but in parts of Asia, insects like ants, crickets, grasshoppers, etc, are essential food sources. The majority of insects dwell widely in warm and moist places but can also be found in extreme climates like the arctic woolly bear moth of arctic regions. Insects make a crucial part of our ecosystem with important functions they carry out, such as pollination, soil aeration, and feeding on harmful pests hence regulating their growth. With these functional weapons, they make the perfect economic tool for the food, pharmaceutical, and agricultural industries. Let's have a look at the commercial aspect of insects in our lives and how we benefit from them.

Keywords : Insects, Ubiquitous, Economic Tool, Benefit

## I. INTRODUCTION

Information provided by an insect characterization and identification system (ICIS) is essential for preserving biodiversity and, more specifically, for controlling pests. Such a system also has economic significance, as it allows us to better regulate the populations of insects that are both beneficial and harmful; the former can be used to boost crop yields and curb disease transmission, while the latter can be eradicated entirely. ICIS include more than just a camera; rather, they include three main parts. Insects are identified, characterised, and then either selected as helpful or eliminated as detrimental. The fields of entomology and agricultural and medical sciences stand to benefit greatly from this impending shift. Humans' interests, needs, and behaviours have changed throughout time. This story is about a revolution that is radically altering the way people live. The shifts may be seen all across the globe and in every sector of society. These shifts are a natural part of the human experience, but they will have far-reaching consequences in the fields of agriculture and medicine. Technology (information and communication technologies) has played an increasingly important role in the evolution of the agriculture sector in recent decades. The idea of globalisation has made today's agricultural world less mysterious. The most crucial consideration for achieving success in the areas of agricultural productivity and health sciences development in a global context is competitiveness. Making the correct

choice at the right moment is the secret to success, as the old adage goes. As with every choice, an entomologist needs data to make the best call. So, it's safe to say that identifying and characterising anything is an info-system-reliant procedure. This data structure may be built manually or with the help of a computer programme. An accurate understanding of the consequences of information systems is crucial for effective decision making in agriculture. When it comes to the characterization and identification of insects, an efficient and successful information system is one that shortens the process while also lowering the associated costs, complexity, and data redundancy. When designing an information system, it's important for designers to keep in mind potential efficiency boosters. We use cameras and a computer to gather data, and we call that system the ICIS. This is a well-thought-out method for gathering all the information relevant to entomological research and then organising, analysing, and sharing that knowledge. Over the course of its evolution, the ICIS study model will go through a number of distinct stages. It's helpful since it provides data that is essential for the current stage of research. The ICIS model provides greater details on the important success elements for identifying and characterising each stage of a study's life cycle.

Identification of insects relies heavily on close observation, as does most of our everyday life. The observer gathers data, examines it (perhaps comparing it to other field notes) and then makes a judgement. Having a healthy dose of awe for the important role insects play in our ecology is a must if you want to spend any amount of time studying insects. In this way, you may learn to appreciate the little things in life, even if you're not an insect expert. The insect kingdom has some of the greatest species richness and abundance on Earth. To put it bluntly, if insects suddenly stopped providing the essential (and free) services they provide every day, humanity would not be long for this world. We rely on insects for our health and nutrition because they filter our water, pollinate the flowers that grow one-third of our food, digest our garbage, and recycle our dead animals. Insects are often misunderstood and underappreciated despite their vital role in the environment. In order to identify the common morphospecies to taxonomic order and to create vouchers and specimens for microbiological analysis, the collections will be classified into morphospecies (individuals with similar morphology and are presumably members of the same species). The only method for the insect hosts to be connected to the bacteria inside them is via the use of vouchers, which are duplicates of the insects that will be checked for microbes. If one looks closely enough, they will note that the sizes of the species in the samples vary from very tiny to enormous. Do some men and females belong to the same species, or are they mixed? It's more likely that two seemingly different specimens are really from the same species if they were obtained in the same area. The sheer diversity of insect species, however, makes it challenging to settle on a single scientific name for them all.

**Economic Importance of Insects:-**

The majority of members of the Class Insecta are beneficial to humans in addition to plants and other animals, which contradicts the common perception that insects pose a threat. The literature that was evaluated by the researcher revealed this information. The researcher makes an attempt to elucidate in this section on a few of the most significant ways in which civilization has profited from the insects.

Pollination Services Provided by Insects

Insects and Their Role in Biological Control: Predators and Role Players

Bio-indicators Comprised of Insects

Insects as Sources of Production

## II. REVIEW OF LITERATURE

**Dunnphy GB. and R.A. Nollan( 2000)**

Describe the several ways that parasitoids may attack their hosts. The manner in which the eggs of each species of parasitoid are deposited stands out as the most striking difference between them. It is more common for species of fly and nematode to deposit microtype free-roaming eggs close to or inside the microhabitat of the host than for them to wait for the caterpillar to arrive at their egg-laying spot. Because of this, it is simpler for flies and nematodes to avoid coming into confrontation with one another, and the influence of behavioural defence mechanisms is reduced. The use of behavioural approaches has shown to be particularly effective in controlling parasitic wasps, which need to make physical contact with their host in order to sting and/or oviposit. Because wasps may quickly kill or shock their prey by thrashing and biting, these insects often hunt immature caterpillars that are still in their first instar.

**J. L. and Felton, G. W., 2001:-**

Reproductive output, along with development time and lifespan, are the core parameters of an organism's life history. Together, these three parameters allow us to predict an individual's fitness and, by extrapolation, the growth rate of a population. Ultimately, natural selection should act to maximize fitness and consequently these life history traits will respond in a correlated fashion.

**Dhaliwal GS and Arora R (2001)**

The results highlight how difficult it is to provide an accurate estimate of the total effect that climate change will have on insect pests that feed on plants. As seen by the reported diversity in responses, for example between agricultural and forest pests, efforts to prevent negative consequences of climate change need to target particular species while taking into consideration the complex ecological and evolutionary reasons driving their reactions. This is necessary in order to prevent the negative effects of climate change.

**XNorris, K. & Evans, M.R. (2000)**

Oxidative stress may not only contribute to the additional cost of high levels of reactive oxygen species (ROS), but it may also contribute to associations between traits that diverged at different times and are therefore unlikely to be subjected to direct trade-offs between competing functions. This is because oxidative stress may contribute to associations between traits that diverged at different times. During prenatal and postnatal development, a number of environmental factors, such as pollutants and foods, as well as internal factors, such as oxidative metabolism, respiratory burst, and purine catabolism, may contribute to an increase in oxidative stress.

distinguished from other types of arthropods by their distinctive six-legged body plan.

## III. MATERIALS AND METHODS

**Statistical Technique:-**

- The proper authorizations will be obtained before to research. After then, samples will be picked based on the criteria for inclusion.

**Collection Mounting and Preservation Techniques:-**

- Knowing habits of insects makes collection much simpler. Before you start collection, stand and watch the insects for a while. See how pollen loving insects sit on the flower. Some like bees go from flower to flowers without wasting little time. Others like, butterflies, some moths and many flies love the warmth of Sun and spend much of their time just basking, either quite still, or slowly opening and closing the wings. On the other hand, hovers are able to remain poised in the air, apparently motionless but the wings moving at very high rate.
- The leaves and stems of the plant shelter many insects. Underneath the leaves clusters of eggs can be seen or hanging pupae as well as many insects. On foliage a number of adult insects may be seen some of which are carnivores and look for a prey. Insects that fly can be easily caught by

the net, but smaller insects that keep still or hideaway are more difficult to collect.

**General Collection:**

For making general collection one should search the follows places

1. **Scrub land:** With low bushes of different species, long and short grasses.
2. **Open hill side:** At this place the insects are not as crowded together as in scruby land. At hillside most of the collection is done on the tree trunks or on the ground at the foot of the trees. Bigger insects can be stalked and trapped. The new forest is a good locality and tremendous local variation in the number of insects can be seen.
3. Grass Land: It can be looked at following places.

**A. Low Land Pasture:** It has a much varied insect fauna. The number of individual insects may be mainly butterflies with an occasion bee or beetles. Most of the insects are hidden in the grass or around its root. Sweeping is the best way to the collect them.

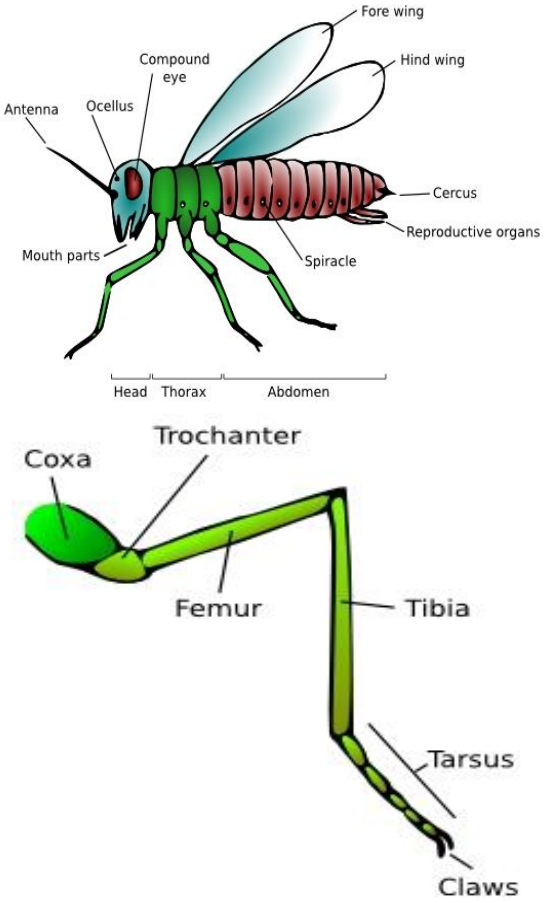
**B. Open down land:** Has a fauna of its own. Flowers are usually plentiful, and there are more insects than on many lush pastures. Butterflies are the common insects at this place.

**C. Heath land:** Has fewer flowers but more scope for sand living, fossorial insects, especially Hymenoptera and beetles.

**D. Limestone fells:** They have very poor grass where the species of scale insects can be collected.

All these are more general way of collecting in daylight, but there are other places where you may look for a special and some peculiar fauna. All kind of rubbish and debris have their own insects as rotting and decaying are part of natural cycle. Insects play an important role in this process. These are

1. Animal dung: Attracts many insects to lay eggs and to use it as food for their larvae.
2. Parasitic insects: Parasitic insects can be caught on the wing by as waiting near a bait animal, such as cow, dog, horse, monkey etc




**In this picture shows the generalized structure of an insect leg**

Each part of the thorax has its own pair of walking legs, therefore the thorax has a total of three sets of walking legs. Legs often have a very unique architecture; nevertheless, this morphology is typically altered to perform certain activities, such as swimming or holding prey. The majority of adult insects are equipped with two sets of wings, one set located on each of the insect's second and third body segments. The veins are what provide the wings their structural support, and their pattern may be used to determine distinguishing traits about the animal.

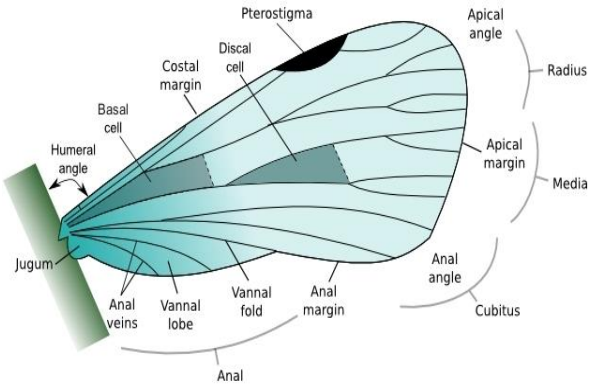



**Figure : -** Representation of different shapes of insect's body

**Catching and Trapping of Insects: -**

After finding and observing the insects, next step is to obtain someof them for further study either dead or alive. For catching insects some equipment's are required such as nets, aspirators and tubes etc. There are varioustypes of nets used for collecting different insects, but the best collection is doneby a general purpose net that suits their need.

**NETS:**

An insect may be captured by net in the following ways

1. Insects in the pond and streams can also be captured by net.
2. Sweeping the net mouth through grass or soft hertiae to upset insects and capture them in the net lag.
3. By stalking the insects until it settles, and them dropping the mouth of the net over it.
4. By catching it in flight
5. By beating, that is holding the net beneath bushes and beating the foliage with a stick so that insects fall into the net

**Materials needed for collecting:-**

- Equipment bag
- Several clean baby food jars
- Several kill jars with killing agent
- Tweezers
- Insect net
- Pencil
- Notebook

**Why Are Insects Important?**

However, despite their unfavourable reputation, insects are really rather fascinating. There are millions of different species, and they may be found in almost every habitat on Earth. They may be little, but their impact is huge. Did you know that a leaf-cutting ant can lift 50 times its own weight?

Beyond their obvious coolness, why should we care about insects? Insects play crucial roles in our food cycle as pollinators of agricultural crops, direct consumers of plant matter in certain regions, and decomposers of organic matter 27–29. The harm insects may do to people makes them significant as well. There are insects that may transmit illness, and there are insects that can destroy our food supply. We are going to examine the good and bad ways in which an insect influences our economy today. Insect management by humans will also be covered.

**Classification of Insects Using Color-Based and Shape-Based Descriptors:-**

Insects make up the vast majority of Earth's animal population. Insects have more varieties than any other group of terrestrial animals combined. Predators, herbivores, hosts, and decomposers are only some of the possible insect diets; despite this, there is little variation in outward appearance among these groups. Arthropods, of which insects are a part, have bodies that may be sectioned off into a head, a torso, and an abdomen. The thorax joins the body at the chest to the trunk at the abdomen. However, for certain kinds of insects, the three parts may join together. Insects stand apart from other animals because their wings and legs are joined to their thorax. A broad variety of insects use their antennae, which are attached to their heads, to detect chemical and mechanical stimuli.


In this picture shown of insect samples Coleoptera, Diptera, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, Orthoptera, etc. are only few of the orders based on wing structure (pteron). It's possible that the many orders of insects have distinct life cycles, each with its own potentially harmful phases and forms of destruction. The following is a table describing several bug species:

| Order of insect | Their characteristics | Theirs damaging stage of photos |
|---|---|---|
| **Coleoptera-**<br>Weevils and Beetles | There are four phases in a life cycle: the egg, the larva (grub), the pupa, and the adult.<br>• The wings of these insects are covered with protective coverings. The fragile dorsal abdominal wall and the membranous rear wings are protected by the hardened forewings. | The larva known as 'grub' is the damaging stage.<br>  |
| **Diptera**-<br>Mosquitoes, black<br>Flies<br>and flies | • There are four phases in a creature's life cycle: the egg, the pupa, the larva (maggot), and the adult.<br>• These insects have mouth parts that can both pierce and suckle. | Adult and maggots<br>  |
| **Hymenoptera--**<br>wasps,<br>bees,<br>ants,<br>saw<br>flies, etc | • The structures of their mouths are optimised for the task of chewing. Certain animals have a long proboscis formed in their mouths for sucking honey and other liquids. The stages of their life cycle are: egg, larva, pupa, and adult. Four clear, membranous wings cover the back of an adult.<br><br>Males do not have stings, but females always do. | Adults and Larvae<br>  |
| **Hemiptera-**<br>scale insects, hoppers<br>and aphids,<br>bugs | • These insects' wing shapes and sizes may vary widely (heteroptera) or be completely uniform (homoptera) (heteroptera). The | Adults and Nymphs |

| | | |
|---|---|---|
| | term "nymph" is used to refer to the juveniles of this species, who look very much like their parents.<br>• Eggs, nymphs, and adults are all part of the life cycle.<br>• The mouth portions of these pierce and sucking types.<br><br>• The forewings of insects in this group are rigid towards the base and membranous elsewhere. |  |
| **Orthoptera-**<br>Crickets,grasshoppers and locusts | • The nymph stage is also known as the "hopper" stage. These insects include grasshoppers, crickets, and locusts. In contrast to grasshoppers, whose antennae are small, crickets' are lengthy. They can both bite and eat using their jaws.<br>The front wings of insects in this clade are often constructed in a parallel fashion.<br><br>• The life cycle consists of an egg, a nymph, and an adult. | Adults and Nymphs<br>  |
| **Lepidoptera**<br>Butterflies and moths | • The adult moth has sucking mouthparts called haustellum, while the caterpillar, the stage responsible for most of the damage, has gnawing mouthparts.<br>• There are four distinct phases in the life cycle: the egg, the larva (caterpillar), the pupa, and the adult.<br><br>They have enormous, magnificent wings coated in scales, and they have two sets. | Caterpillar<br>  |
| **Isoptera-**<br>termites | • The life cycle consists of three stages—the egg, the nymph, and the adult—and these insects have a well-established social hierarchy | Workers feed on cellulos |

| | | |
|---|---|---|
| | composed of a queen, a king, and soldiers and workers. These are also referred to as "social insects" for this reason. The nymph phase is the longest in the life cycle. As they mature, nymphs first become labourers and then warriors. |  |

## IV. RESULTS AND DISCUSSIONS

### Species collection and identification

Before constructing the histogram, the colour picture is converted from RGB (Red-Green-Blue) space to HSV (Hue-Saturation-Value) format. Because of this, just the colour and saturation of the light source are considered. Similar distributions of hue and saturation histograms are seen when analysing data from the same species. GLC approximation of image properties related to second-request metrics, such as entropy, connectivity, homogeneity, and liveliness. After 10 minutes on crushed ice, silkworms were swabbed with 70% alcohol and had a tiny incision made on each abdominal limb before being introduced to hemocyte washing solution (HWS). The hemolymph was diluted by adding 4 ml of HWS to 1 ml of hemolymph (0.2 ml per larva) and centrifuging the mixture at 1000 g for 5 minutes. After being cleaned as described above, the sediment hemocytes were gently suspended in 5 ml of HWS. Hemocyto metre was used to count the number of hemocytes.

### Specimen Preparation

After collection, the samples are returned to the lab for further processing. While pinning or point mounting each specimen was the mainstay of this process, many unique specimens need more care. Most of the wasps and flies (Diptera) will be distilled into liquor. Since their bodies are so delicate, drying them in the air usually causes them to shrink. These will next be chemically dried with HMDS (hex methyl disilizane), a technique that produces high-quality specimens. Then, they might be adhered to various focal areas. Obtaining and cataloguing such a massive assemblage of insects will be a herculean task, but all specimens will be clearly labelled with identifying information.

## V. SUMMARY & CONCULSION

There are more than a million different kinds of insects. This suggests that insect populations have increased around the world due to successful adaptation to different environments. This means that insects are present 24/7/365, all throughout the globe. Furthermore, insects are subjected to a wide range of environmental challenges in the wild. Reactive oxygen species are produced in response to these environmental stresses (ROS).

Because of these individual differences, it is reasonable to assume that insects will react to oxidative stress in unique ways depending on their morphology, size, diet, and tolerance of environmental changes. As a result, we expect see a wide variety of responses to this kind of pressure among insects. It is my hope that research into the oxidative stress response in different insect species will provide light on how insects have evolved to thrive in a wide variety of habitats. As a result, it's important to investigate how different insect species react to oxidative stress. Each insect species, I believe, has its own unique mode of defence against reactive oxygen species.

For my thesis review, I am looking for work on the oxidative stress response in insects. Therefore, I am excited to see such a wide range of insect species represented in the research presented in this Special Issue. Similar to physics, evolutionary and behavioural ecologists use theory to guide their experiments when studying life cycle evolution.

Here we discuss the several approaches taken in machine vision learning to the problem of insect detection and classification on the basis of parameters such as colour, form, and other morphological characteristics. There are benefits and drawbacks to both approaches of insect detection. It seems that colour histogram is the most effective way for identifying and categorising insect species. This is due to the fact that the colour histogram employs the SIFT extraction feature to characterise the insect picture. A histogram is calculated for each of the picture squares that make up the captured image. There have been a lot of research on oxidative stress in social insects, but ours may provide light on why none of them have provided a clear picture. More crucially, we demonstrate that the 20 genes associated to oxidative stress that we examined in this work are expressed in various patterns depending on species, and this is true even after controlling for any changes in effects due to the investigation of different organs. The differences in gene expression across species seem to be far larger than those between subgroups of the same species, such as castes or age groups. Researchers found similar results when looking at carbonyl buildup, showing that carbonylated proteins may be used as a predictor of senescence in certain species but not in others due to differences in how they handle oxidative stress.

This pattern, if it continues, should be reflected in the expression of genes that are involved in the regulation of oxidative stress, according to our theory. In light of these observations, we came up with the notion that the anti-oxidative systems of different social insect species, even those that are closely related to one another, would be distinct from one another. It is possible that this is the reason why so few genes with a conserved role in understanding species-specific senescence in social insects have been uncovered up to this point. If our idea is correct, the genes that are responsible for the antioxidant system and how it is controlled in social insects will not be shared by all animals but rather will be specific to each species.

## VI. REFERENCES


[1]. Andziak B., and Buffenstein R.. 2006. Disparate patterns of age-related changes in lipid peroxidation in long-lived naked mole-rats and shorter-lived mice,. Aging Cell 5:525–532

[2]. Becker, P.H.et al.(2008). Senescence rates are determined by ranking on the fast-slow life-history continuum.Ecol. Lett., 11, 664–673

[3]. Chown SL, and Terblanche JS (2011). Water loss in insects: An environmental change perspective. Journal of Insect Physiology 2011; 57(8):1070-1084.

[4]. Colley M.R. and Luna J.M., Relative attractiveness of potential beneficial insectary plants to aphidophagous hoverflies, Environ. Entomol., (29), 1054-1059 (2000)

[5]. Contreras, H.L. and TJ. Bradley ( 2010). Transitions in insect respiratory patterns are controlled by changes in metabolic rate. J. Insect Physiol., 56: 522-528.

[6]. Costantini D. 2008. Oxidative stress in ecology and evolution: lessons from avian studies,. Ecol. Lett. Vol 11 pp:1238–1251

[7]. Criscuolo. (2014). Mitochondrial uncoupling prevents coldinduced oxidative stress: a case study using UCP1 knockoutmice. J. Exp. Biol. 217:624–630

[8]. Daies, Brooks, G.A. & Packer, L.(1982). Free radicals and tissue damage produced by exercise.Biochem. Biophys. Res. Commun., 107, 1198–1205.

[9]. Dhaliwal GS and Arora R(2001). Integrated pest management, Kalyani Publishers, Ludhiana, p 427-429

[10]. Dhaliwal, G. S. and Ram Sing, (2005), Host Plant Resistance to Insects, Concepts and Application, pp. 263-296

[11]. Dunnphy GB. and R.A. Nollan( 2000). Response of eastern hemlock looper hemocytes to selected stages of Entomophthora egressa and other foreign pthesis,. J. Invert. Pathol.,36:71-84.

[12]. E. M. Costo neto, "Consideration on the man/insect relationship in the state of Bahia, Brazil," in Ethnocsience, M. F. Elisabeth and M. C. Jacqueline, Eds., pp. 95–104, 2003

[13]. Evans, C.J. and U. Banerjee(2003). Transcriptional regulation of hematopoiesis in Drosophila,. Blood Cells Mol. Dis., 30: 223-228.

**Cite this article as :**

Vikash Singh, Imran Khan, Saleem Ahamad, "Characterization and Identification of Insects and Study of their Economic Importance in Adverse Climatic Conditions in India", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 5, pp. 634-643, September-October 2022.
Journal URL : https://ijsrst.com/IJSRST523102129