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INSTANCES OF CAMOUFLAGE (MIMICRY) OBSERVED ON THE FERGUSSON COLLEGE HILL

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ABSTRACT: Mimicry is basically a similarity of one organism to another which protects one through its effect on the behavior of the operator (third party). This similarity can be in appearance, behaviour, sound, scent or location. It is however important to note that the mimics are found in the same area as their models. In most cases, mimicry is advantageous to the mimic and harmful to the receiver. It may have beneficial, detrimental or no effect on the fitness of the model too. This project was aimed to observe and record various instances of mimicry in the area encompassed by the Fergusson College campus. Most of the visits were made in the morning hours, from 07:30 hours to 11: 00 hours and few were made in the evening hours, from 18:30 hours to 19:30 hours. For identification various identification keys were used, such as: Introduction to the Identification of Insects and Related Arthropods (P.M. Choate, 2003), Key to Insect Orders (Colorado State University) and the field guide Birds of the Indian Subcontinent (Grimmett, Inskipp, Inskipp). It was inferred that order Orthoptera that of the Grasshoppers was the most abundant order. The least observed individuals were Plant Hoppers and Spotted Owlets belonging to the orders Hemiptera and Strigiformes, this could possibly be due to the greater degree of camouflage that they exhibit. The number of individuals may vary according to the season and time of visits. We carried out the survey in the months of December and January.

KEYWORDS: Mimicry, Mimic, Model, Camouflage.

INTRODUCTION

Mimicry is an evolutionary process occurring when a group of organisms have evolved to share common perceived characters with another group. This group of animals which shares characters with another group is called 'mimic' while the group with which it shares these characters is called 'model'.

Mimicry is related to camouflage in which a species resembles its surroundings or is otherwise difficult to detect while mimicry is the act that resembles the real animal as another. Camouflage is a means of external coloration present in most of the animals that especially blends with the appearance of the surroundings in which the animal lives. Camouflage is an adaptation that helps the animal to be unnoticed by the other animals, especially predators. Camouflage has three major means of achieving it, namely:

MIMESIS

It is a type of camouflage where the animal is seen as another object, for example, leaf insect.

CRYPSIS

Animal blends in with the environment in such a way that it is almost impossible to spot. Animal often changes body colour.

DAZZLE

This phenomenon has been serving the animals to be protected as well as being unnoticed or distracted. In this project we have focused on the camouflage aspect of mimicry. The study of camouflage has a long history in biology, and the numerous ways of concealment and disguise found in the animal kingdom provided Darwin and Wallace with important examples for illustrating and defending their ideas of natural selection and adaptation. Thus, various forms of camouflage have become classical examples of evolution (Stevens et al 2009).

Animals use camouflage to make detection or recognition more difficult, with most examples associated with visual camouflage involving body coloration. However, in addition to coloration, camouflage may make use of morphological structures or material found in the environment, and may even act against senses other than vision (Ruxton 2009). In nature, some of the most striking examples of adaptation can be found with respect to avoiding being detected or recognized, with the strategies employed diverse, and sometimes extraordinary. Such strategies can include using markings to match the colour and pattern of the background, as in various moths (Kettlewell 1955), and to break up the appearance of the body, as in some marine isopods (Merilaita 1998). Camouflage is a technique especially useful if the animal can change colour to match the background on which it is found, such as can some cephalopods (Hanlon & Messenger 1988) and chameleons (Stuart-Fox et al. 2008). Further remarkable examples include insects bearing an uncanny resemblance to bird droppings (Hebert 1974) or fish resembling fallen leaves on a stream bed (Sazima et al. 2006), to even making the body effectively transparent, as occurs in a range of, in particular, aquatic species (Johnsen 2001; Carvalho et al. 2006). Examples such as leaf mimicry in butterflies helped convince Wallace (1889), for example, of the power of natural selection. Other strategies may even stretch to the use of bioluminescence to hide shadows generated in aquatic environments (Johnsen et al. 2004), and include ‘decorating’ the body with items from the general environment, such as do some crabs (Hultgren & Stachowicz 2008). This diversity of camouflage strategies is a testament to the importance of avoiding predation, as this is surely one of the most important selection pressures an organism can face. Concealment represents one of the principal ways to do so.

METHODOLOGY

In this project we aimed to observe and record various instances of mimicry in the area encompassed by the Fergusson College campus. For identification we used identification keys such as: Introduction to the Identification of Insects and Related Arthropods (P.M. Choate, 2003), Key to Insect Orders (Colorado State University) and the field guide Birds of the Indian Subcontinent (Grimmett, Inskipp, Inskipp).

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ABOUT THE STUDY SITE

Fig.1 Google Map Image

The vast campus is dotted with beautiful trees and is flanked by the famous 'Fergusson hill' to its west, also popularly called the 'Hanuman hill'. The college ground is set in sylvan surroundings and the old bungalows and college buildings, built in the Gothic style, are well spread out, with the hostels and canteen occupying suitable locations. The botanical garden with its greenery and flowering plants, near the entrance gates of the college, are the lungs of the campus.

From the 37 acres (150,000 m2) leased out by the DES in 1891, the college expanded to 65 acres (260,000 m2) by the time of Independence. The road that runs along the college is named after it and is one of the busiest in Pune. The campus extends until the slopes of a hillock, popularly called Fergusson Hill, which is where we carried out the survey.

OBSERVATIONS

In the course of our visits we were able to find several instances of camouflage in both birds and insects. They are as follows:

ARTHROPODS

1. Grasshopper (Order: Orthoptera, Sub-order: Caelifera)

Fig.2a and 2b-The type of camouflage exhibited by this specimen can be classified as a blending type.

The colouring of different species of grasshopper are often dependent on their environment. Grasshoppers are terrestrial insects. Many species are adapted to green

fields and forests, and blend in well there to avoid predators. Others have adapted to drier, sandy environments and blend in well with the colours of dry dirt and sand. Size of the grasshopper depends on the species. Smallest grasshoppers are only 0.5 inches long. Larger species can grow to 5 inches in length. Females are longer than males. The Color of the body provides camouflage and it depends on the habitat. Grasshoppers can be green, brown, greyish and ochre in colour. Main predators of grasshoppers are primates, birds, lizards, snakes, rodents and large insects. The specimen observed in fig. 2a and 2b camouflages in the dry, brown grass thus protecting itself from the predators.

2. Unidentified Caterpillar

Fig.3a and 3b- The type of camouflage exhibited by this specimen can be classified as a disguise type of camouflage.

The ventral side of this specimen in fig 3a and 3b resembles the colour of the blade of the grass, making it difficult for predators such as birds to spot it easily. The type of camouflage exhibited by this specimen can be classified as a disguise type.

3. Ants (Order :Hymenoptera)

Fig-4a and 4b - The type of camouflage exhibited by this specimen can be classified as a blending type.

Ants have evolved from wasp-like ancestors. Ants form colonies that range in size from a few dozen predatory individuals living in small natural cavities to highly organised colonies that may occupy large territories and consist of millions of individuals. Ants thrive

in most ecosystems and may form 15–25% of the terrestrial animal biomass. The above specimen was seen on the bark of a tree with its abdomen mimicking the colour of the bark, probably to avoid attack by the predators.

Fig.5-The type of camouflage exhibited by this specimen can be classified as blending type

4. Stick Insect (Order: Phasmatodea)-The Phasmatodea are an order of insects, whose members are variously known as stick insects, walking sticks or stick-bugs, phasmids, ghost insects and leaf insects. The type of camouflage exhibited by this specimen can be classified as blending type. Their natural camouflage can make them extremely difficult to spot. Phasmatodea can be found all over the world in warmer zones. They are terrestrial organisms. Phasmids can be relatively large, ranging from 1.5 centimetres (0.59 in) to over 30 centimetres (12 in) in length. Females are longer than males. Some have cylindrical stick-like bodies, while others have flattened, leaflike shapes. The thorax is long in the winged species, since it houses the flight muscles, but is typically much shorter in the wingless forms. Where present, the first pair of wings is narrow and cornified, while the hind wings are broad, with straight longitudinal veins and multiple cross-veins. The body is often further modified to resemble vegetation, with ridges resembling leaf veins, bark-like tubercles, and other forms of camouflage.

5. Dragonfly (Order:Odonata)

Fig 6a and 6b-The type of camouflage exhibited by this specimen can be classified as blending type.

This odonate is called the Granite Ghost (Bradinopyga geminate)because it blends with the surroundings such as granite rocks, pavements, stone boulders and walls. It is grey in colour, with grey eyes and the abdomen is grey with black/white/grey marbling pattern.

This morphology helps it to perfectly blend with the surrounding being practically invisible. The adaptation to urban environments is not just in the camouflage. It feeds on mosquitoes and larvae which are abundant in urban buildings. The Genus Bradinopyga has four main species of which B. geminata is endemic to India. Other species are endemic to Africa.

6. Jumping Spider (Order:Araneae)

Fig 7a and 7b-The type of camouflage exhibited by this specimen can be classified as blending type.

As the common name suggests, a jumping spider can jump quite well, achieving distances over 50 times its body length. Look at their legs, however, and you'll see they don't have strong, muscular legs. To leap, salticids quickly increases the blood pressure to their legs, which causes the legs to extend and propel their bodies through the air.

Some jumping spiders mimic insects, like ants. Others are camouflaged to blend into their surroundings, helping them sneak up on prey.This particular specimen can be seen mimicking the pattern of the bark of the tree thus can be classified as a blending type.

7. Plant hopper (Order:Hemiptera)

Fig 8-The type of camouflage exhibited by this specimen can be classified as a blending type.

The plant hopper does not resemble a jumping spider from the human point of view,but from the point of view of its prey this insect resembles a jumping spider, particularly the eyes. This also explained why the planthopper only moves sideways, forwards

and backwards but seldom turns around. For if it turns, the mimicking will fail.

The jumping-spider-mimicking may help the planthopper to avoid some predators, such as ants and even the jumping spiders. We did see the Zenodorus orbiculatus prey on ant. In addition to this, it can be seen that the colour of the body closely matches that of the bark.

8. Grasshopper (Order: Orthoptera, Sub-order: Caelifera)

Fig 9-The type of camouflage exhibited by this specimen can be classified as a blending type.

This type of camouflage seen in grasshoppers resembles the colour and pattern of the floor of a wooded area with fallen leaves, seeds, fruits, and branches. This type of camouflage can be classified as a blending type of camouflage.

9.Mantis (Order:Mantodea)

Fig. 10a and 10b-The type of camouflage exhibited by all three specimens can be classified as blending type.

The praying mantis mimics plants in order to hide from predators and prey. It can easily blend into an environment of leaves, sticks or flowers. Mantises can be green, brown or a

combination of colors to match their environment. It will molt every few weeks, and can then take on the colors of its natural surroundings. A praying mantis might even mimic the charred remains of sticks, weeds and grass after a fire. Swaying repetitively from side to side is a common camouflage behavior of the praying mantis. It might be used to mimic the swaying movement of vegetation in the wind.

BIRDS

10. Spotted Owlet (Order:Strigiformes)

Fig.11 The type of camouflage exhibited by this specimen can be classified as a blending type.

Owls and Owlets are well known for their camouflage. They are raptorial birds that feed on insects and small vertebrates and are mostly active at night. During the day, they usually stay hidden in trees.

Coloration is the tool that owls use for safety during the day. The colors of their feathers and shapes of their bodies enable owls to be camouflaged during the day while they rest. As they sit motionless in a branch, they are able to blend into the twigs and branches, blending into the habitat around them. Even on their eyelids, most owls have a pattern or striping, so that while they sleep they are hidden.

When threatened, owls often stay still rather than take flight. This stillness enables them to take advantage of their camouflage. To hide themselves further, owls elongate their bodies, pull in their feathers to reduce their silhouettes, raise their ear tufts (if they have them), and close their eyes. This posture is thought to be the best for blending into the surroundings. Owls can also move the feathers around their faces. By flattening or spreading their feathers, they can make their eyes appear larger or make them seem to disappear against a tree. In addition to this some owlets and owls have feathers with jagged edges that break up their outline,making it difficult for their prey to spot them.

11. Rose-ringed Parakeet (Order:Psittaciformes)

Fig 12-The type of camouflage exhibited by this specimen can be classified as a blending type.

Parrots and Parakeets, as many other animals, use pattern and color variation as a means of camouflage. The purpose for bold patterns and vivid colors is to disrupt the outline of an animal's body. As the predator's eyes follow the contours of what they believe to be the body of the prey, a color or pattern change will draw the eye sharply to the left or right, disrupting the image. Some brightly colored parrots tend to have green, yellow or blue undersides that blend into the scenery in the dim forest lighting from below, and rely on this pattern and color disruption for safety from above.

In fact, everything about a parrot's coloring is completely deceiving. Many vibrantly colored feathers do not actually contain what appears to be their predominant color at all, but are instead the product of a trick of lighting. Some colors absorb light, others reflect it, and by making use of the Tyndall effect, which is an illusion created using light, the same illusion that makes the sky appear blue when it is not, parrots have evolved to host the coloring that makes it safest in its natural habitat.

12. Coppersmith barbet (Order:Piciformes)

Fig 13-The type of camouflage exhibited by this specimen can be classified as blending type.

Barbets are brilliant green birds that chiefly feed on Banyan, Peepul, and other wild figs, various drupes and berries, and the occasional insect, caught in aerial sallies. They use camouflage to blend into their background by mimicking the colour of leaves. The colors of a bird's plumage are its first camouflage defense. Shades of brown, buff, rust, black, gray and white can help a bird blend into its surroundings effectively, and many bird species have developed specific colors that match their habitats in different seasons or different geographic regions.

RESULT AND DISCUSSION

In nature camouflage is considered as one of the most common anti-predator strategies, (Quicke 2017) , (Ruxton et al 2004), (Bates 1862) , (Wickler 1968). Camouflage is an act of masking or concealment and there are different ways of exhibiting it like by changing colour or patterns to match the background, or for masking edge information display of disruptive colouration , decepting as a non-target object, (Ruxton et al 2004) , (Pasteur G 1982), (Stevens et al 2008), (Wickler 1968) (Mugleston J, et al 2016).We observed that the most abundant order observed was that of the Grasshoppers namely Orthoptera. The least observed individuals were Plant Hoppers and Spotted Owlets belonging to the orders Hemiptera and Strigiformes, this could possibly be due to the greater degree of camouflage that they exhibit.The number of individuals may vary according to the season and time of visits.

The specimens observed during the survey have been compared in the following chart:

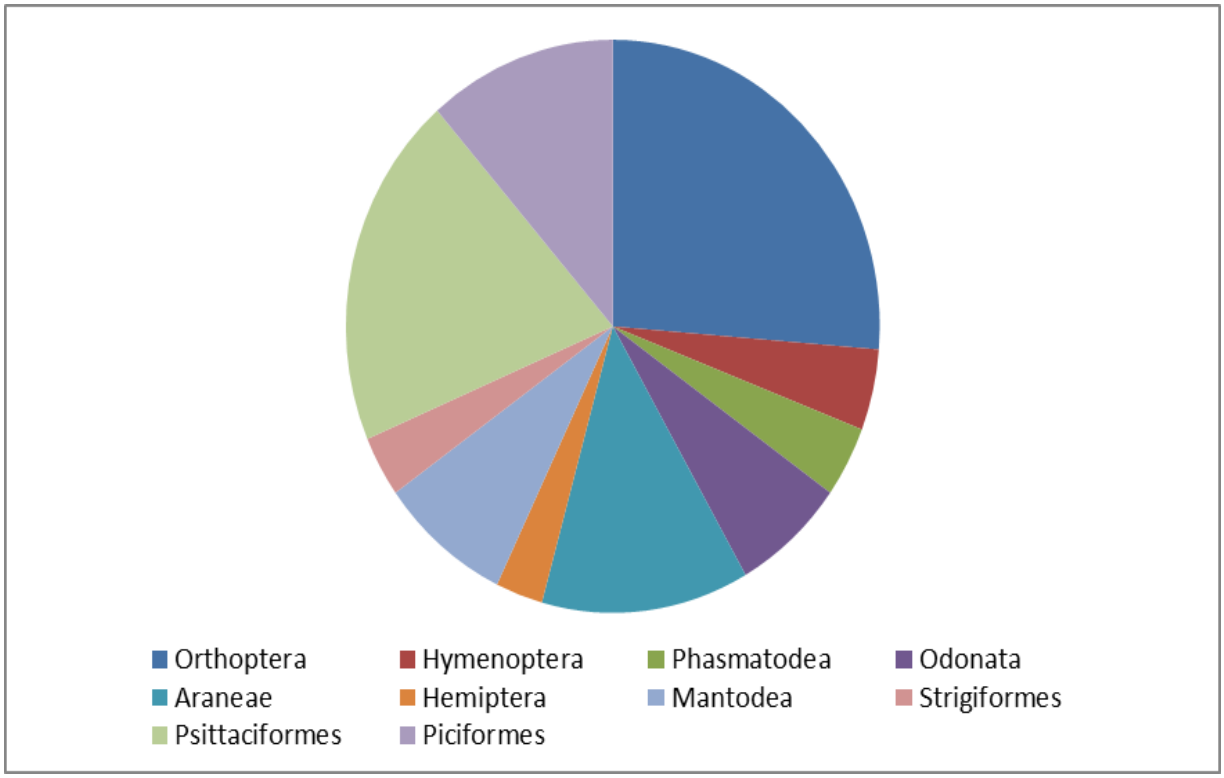

Fig.14 - Distribution of mimicking organisms observed

Note: One ant colony (Hymenoptera) was considered as one unit.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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