SPECIMENS KNOWN AND UNKNOWN:
INSIGHTS FROM A DAY AT FRI

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On Friday, October 18th 2024, we made our way to the Forest Research Institute located in Dehradun. Upon our arrival, we were guided to the Forest Entomology Division. Little did I know that we were about to meet Dr Arun Pratap Singh, the author of "Butterflies of India" field guide, which I have relied on numerous times over the years. Meeting him in his office was a wonderful experience. He shared insights about this division, which once had over 140 scientists but has now shrunk to just 12. It was eye-opening to imagine an entomology department with so many scientists, especially given the current state of entomological research in the country, where only a few scientists are working on this incredibly biodiverse group of animals. Among those focusing on invertebrates, much of the research is limited to taxonomy rather than exploring the fascinating questions of adaptations, biogeography, and evolution.

Prior to our visit to FRI, I observed two very similar beetles that had comparable morphological characteristics. However, their limb endings and antennae were entirely different, which made me wonder: what drives the selection of such diverse traits? Another striking example arose during this visit with Dr. Singh. He showed us two peacock pansies (*Junonia almana*) in his collection. At a glance, they looked similar, as the upper side is typically visible when pinned. However, on closer examination, I noticed that one had a significantly different wing shape from the other. When I asked about this, Dr. Singh explained that one is the wet season form, while the other is the dry season form. Although I was aware of such forms, I hadn't realized that they existed in peacock pansies.



Later that day, I read a paper on the reasons behind these differences and how seasonal polyphenisms are selected. The paper discussed the factors influencing seasonal polyphenism in tropical butterflies. One intriguing detail I hadn't known before was that many butterflies use cues such as photoperiod, humidity, and temperature during the larval stage to determine which morph the larva will metamorphose into. Key differences between the wet season form (WSF) and the dry season form (DSF) of a particular butterfly species include eye spots, cryptic colouration on the underside, and wing shape. In the wet season form, spots are conspicuous and the colours and patterns are not particularly cryptic. In fact they can even appear aposematic in some instances. Conversely, the dry season form displays reduced or absent spots, more cryptic patterns on the underside and wing shapes that often mimic leaves to maximize camouflage.



Ypthima huebneri, the Common Four Ring, has small eye spots on the fringes of its wings.



Peacock Pansy, Wet Season Form.
The dry season form has no spots on the underside but features a line running through the centre and pointed wings to mimic a leaf.

When it comes to eye spots, it's interesting to note that the smaller spots along the edges of the underside can cause a predator to bite away from the vulnerable body region, while the large eye spots on the upper side (usually hidden at rest) can startle a predator, provoking a withdrawal response. There is also a balance between eye spots and crypsis; the spots shouldn't be too conspicuous but should still effectively deter predators.

Diving into the reasons for these seasonal adaptations: during the dry season, butterflies are generally less active, often entering periods of aestivation or semi-quiescence, making it advantageous to maximize crypsis.

Large eye spots on the upper side, which remain hidden unless needed, can help startle predators during an attack. In contrast, during the wet season, with abundant food and active mating, butterflies are more active. Complete crypsis may not be as effective in this scenario, so aposematism and eye-like spots on the underside serve to deter predators. In the case of the peacock pansy, the dry season form develops a leaf-like wing shape, and the underside loses its spots.

ater, Dr Singh showed us his books on the unique roles of each butterfly species in Uttarakhand, which were both inspiring and filled with novel research.



Erebus ephesperis has large eye spots to deter predators

LWe also viewed their butterfly collection which was stunning—brimming with lifers and fascinating stories. Additionally, there was a relatively new moth collection which was assembled through recent projects that estimated the distribution of moths in the Shivaliks. Following this, we were briefed on their research regarding sal borers (*Hoplocerambyx sp.*).

We were then led to the museum, where we saw numerous British-era collections and skeletons from a wide variety of mammals. Unfortunately, we couldn't view the institute's larger collection due to ongoing renovations

We then visited the museum's ground floor, crossing a courtyard filled with hundreds of swifts, and entered a beautiful gallery showcasing entomological specimens and historically significant equipment. A special moment for me was seeing the Kaiser-i-Hind butterfly (*Teinopalpus imperialis*)—a remarkably rare species. Although it was an old specimen that no longer displayed its true colours, I've heard stories of people mistaking it for a green plastic wrapper until it took flight, revealing its iridescent green hue.



The Common Banded Peacock *(Papilio crino)* belongs to the same family as the Kaiser-i-Hind *(Teinopalpus imperialis)* and displays a similarly iridescent green wing coloration

We also saw a few moths, including one particularly interesting specimen with ocelli-like markings on its wings. These markings were transparent and lacked scales which was unusual. Reflecting on how and why this might have evolved, it seems that transparency could reduce the cost of wing pattern production while also aiding in predator deterrence. The transparency might create an illusion of movement in the ocelli, mimicking real eyes. Afterwards, we returned to the bus and made our way back to WII.

About the Author:
Shreyas Prashant is an M.Sc. Wildlife Science student at WII. He is interested in fundamental ecological and evolutionary questions. His writings are inspired by the various field experiences - in the intertidal zones of Mumbai, studying butterflies in Arunachal Pradesh and Brahminy Kites in Karnataka, and field excursions in Uttarakhand.
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