

# BIONOTES

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## *Quarterly Research Newsletter of A Biologists Confrerie*

**Vol. 20, No. 4**

**Oct.-December, 2018**

### **QS India University Rankings**

#### **IITs dominate the first-ever list**

The Indian Institutes of Technology (IITs) dominate the first-ever standalone ranking of India's higher education institutions released by a UK-headquartered think tank. IIT Bombay tops the QS India University Rankings, with IIT Madras (3), Delhi (4), Kharagpur (5), Kanpur (6), Roorkee (9) and Guwahati (10) grabbing seven of the top ten slots.

Indian Institute of Science (IISc) in Bangalore comes in at second, with University of Hyderabad and University of Delhi among the others making a top-10 mark at seventh and eighth respectively.

"This is first-ever table, which is based on the same indicators of its parent BRICS rankings, evaluates the Indian Instt. through independent and international lenses," said Ben Sowter, Research Director at QS.

QS (Quacquarelli Symonds) describes itself as a global higher education (HE) think tank responsible for the world's most-consulted world university rankings.

Its the first-ever Indian edition of the rankings. The rankings include Public Universities, Private Universities and HE Institutions or Deemed Universities. Single fac-

ulty specialist institutions or single level institutions (eg. teaching principally at post-graduate level) are not included.

According to the analysis, 20 Indian institutions receive full marks in the 'Staff with PhD' category, the indicator designed to identify the extent to which institutions are cultivating a highly-qualified faculty body. In the research productivity indicator, nine institutions achieve a score between 98.4 and 100.

IIT Bombay, Madras, Delhi, Kharagpur, Kanpur and the University of Delhi enjoy 'outstanding regard' among the nearly 43,000 international employers surveyed, while IIT Bombay, IIT Delhi and the IISc Bangalore were the most voted by 83,000+ international academics polled.

On a metric-by-metric basis, other institutions that stand out for QS include the Institute of Chemical Technology Mumbai, which achieves the highest score of the QS' indicator of research impact, adjusted for faculty size.

It is followed by Shivaji University, Kolhapur and Tamil Nadu Agricultural University, Coimbatore achieving the perfect score in the Faculty/Student indicator.

*Date of Publication : 1st Dec., 2018*

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A Quarterly Newsletter for Research Notes and News  
on Any Aspect Related with the Life Forms

*Bionotes* articles are abstracted/indexed/available in the *Indian Science Abstracts*, *INSDOC*; *NISCAIR*; *Zoological Record*; *Thomson Reuters (U.S.A.)*; *CAB International (U.K.)*; *The Natural History Museum Library & Archives, London*; *Library Naturkundemuseum, Erfurt (Germany)* etc. and online databases.

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India: Individuals : Rs. 150/-  
Institutions : Rs. 700/-  
Abroad : US \$ 20/- (by sea mail).

Back Volumes are available @ Rs. 800/- in India.

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First page or part: Rs 250/-. Subsequent pages or part: Rs 200/- each. Add Rs 50/- for handling & despatch of the reprints by Regd. Mail. 50 copies of reprints will be supplied in lieu of above charges.

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Please send a Bank Draft/Multi City Cheque in name of 'A BIOLOGISTS CONFERENCE' payable at ALIGARH. **OR** Money Order to Dr. R.K. Varshney, on the address given below. For sending money by NEFT, Bank particulars are : United Bank of India, Aligarh Branch. IFSC Code : UTBIOALH547. A/c No. 1391010103494 of A Biologists Conference. Please inform us separately after NEFT Payment.

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## CONTENTS

(Vol. 20, No. 4)

	Page
QS India University rankings : IITs dominate the first ever list	107
Do you want to take over <i>Bionotes</i>	108
Research and Deficiency	108
Microbes colonise on Plastic : An interview with Ms. Jenna Jambeck, by <i>Sanjeev Shankaran and Tulika Rattan</i>	109
Man's evolved Avatar, by <i>Sheetal Shah</i>	110
Trees and their tall tales, by <i>Ruskin Bond</i>	111
Trip to Ladakh, by <i>Prateek Sadhu</i>	112
Microgreens or Vegetable Confetti, by <i>Priya Menon</i>	114
South Asian taxa in the book by Eliot & Kawazoe (1983) on <i>Lycaenopsis</i> blue butterflies (Lepidoptera : Lycaenidae), by <i>R. K. Varshney</i>	115
Butterfly diversity in the BNHS Nature Reserve, Goregaon, Mumbai (Lepidoptera : Rhopalocera), by <i>Raju Kasambe, Bhagyashree Grampurohit,</i> <i>Omkar Joshi and Priyadarshini Supekar</i>	118
On a collection of Moths (Lepidoptera) from Narsingharh Wildlife Sanctuary, district Rajgarh, Madhya Pradesh, by <i>S. Sambath</i>	122
Population fluctuation of phytophagous mite, <i>Bravipalpus californicus</i> (Acari : Tenuipalpidae) and predatory mite, <i>Paraphytoseius orientalis</i> (Acari : Phytoseiidae) infecting holy basil, <i>Ocimum basilicum</i> (Lamiaceae) at Narendrapur, Kolkata (West Bengal), by <i>S. K. Gupta and S. Mondal</i>	124
Extension of the known distribution of the Dingy Lineblue butterfly, <i>Petrelaea dana</i> (de Niceville, [1884]) to Bastar, Chhattisgarh (Lepidoptera : Lycaenidae), by <i>Anupam Sisodia</i>	126
Moth fauna of the Kheoni Wildlife Sanctuary, district Dewas, Madhya Pradesh, by <i>S. Sambath</i>	127
Range extension of the Bengal Spotted Flat butterfly, <i>Calaenorrhinus putra</i> in Mumbai, Maharashtra, by <i>Raju Kasambe</i>	130
Record of Chocolate Albatross butterfly, <i>Appias lycinda</i> in Thane Creek Flamingo Sanctuary, Mumbai (Maharashtra), by <i>Raju Kasambe</i>	131
New additions to the Mite fauna associated with Medicinal plants in South Bengal, by <i>S. K. Gupta and S. Mondal</i>	132
Editorial	108
Interview	109
Obituary	133
Notes and News	113, 114, 117, 121, 125, 129

## Editorial

### Do you want to take over *Bionotes* ?

Some of the readers might have noted that *Bionotes* is completing the 20th year of its publication with this issue. Regularly, every quarter, without exception. It is a landmark.

This issue is the 80th issue. While we celebrated its 10th, 25th, 40th, 50th and 75th issue, by declaring them as 'special issue', we haven't done so for the present 80th issue.

Not that we were not aware of the fact. We were, but did not declare it as a 'special issue', for the singular reason that these days we are not getting enough and significant manuscripts as earlier. Contributions to the *Bionotes* have become lesser and therefore, its annual membership has also dwindled. There may be more than one reasons for this trickle, but it is a reality and let us face it.

You can notice that the output has been affected.

The UGC first included *Bionotes* in its list of approved journals, and then after about a year dropped it from that list (alongwith about 4,500 other journals). They neither informed us when they included it the approved list, nor they informed us when they dropped it. So, we do not know the exact

reason of dropping. We are in the dark. But this topsy-turvy action of UGC must have affected the number of papers submitted to the *Bionotes*.

Besides, I personally felt the blow, when some of our dear representatives withdrew. We can not forget the help given by Dr. P. P. Kulkarni, Dr. Bulganin Mitra, Dr. Surendra Singh, Dr. Farman Khan and others. For different reasons they are not able to help us as earlier. It has affected the supply of manuscripts.

Change is the law of nature.

Hence, I am loud-thinking that should we hand over *Bionotes* to some other stronger hands, who may be willing to run it, individually or in a group, in future?

We hope there are biologists who may like to keep this rivulet flowing on.

I cannot deny that my advancing age is forcing me to these thoughts. I am touching 80.

We will provide all the details to a sincere proposal. Friends, please consider. —RKV

## Research and Deficiency

By citing figures like the number of engineering graduates or publications in scientific journals a nation produces, very little understanding is gained about a country's technological ability. It was, therefore, perhaps unsurprising that the latter became the focus of a parliamentary debate about India's scientific progress. Even by this narrow measure India fared poorly.

Minister of State for Human Resource Development said between 1993 and 2004, India was responsible for a miserly 2.16 per cent of articles in world scientific publications. The figure for China was 2.62 per cent. This figure quietly hid the fact that China's lead in the output of such publications has increased in recent years.

However, a more holistic assessment of innovation capability is needed. Recent studies by the World Bank and the Demos Foundation have shown India's science and technology base is a case study in schizophrenia.

On the one hand India has scores of world-class R&D centres established by foreign multinationals and a few Indian firms, largely pharmaceutical majors. These produce the bulk of the patents filed from and in India. In 2004 of the

1,911 patents granted in India, 1,147 were by foreign entities. On the other, there is a network of national laboratories, universities and government institutions that produce publications, file patents but have a terrible record of converting their work into commercial applications.

It is very well to say India punches above its weight in publishing papers on mathematics, but it reflects poorly on the national innovation system that almost no path-breaking technologies or scientific discoveries have been made in India for decades.

The Indian private sector has shown to contain pockets of world-class innovation. The government's R&D system, however, is less a network than a mosaic of fragmented entities that barely communicate with each other.

A number of reforms are needed. Among them: breathing new life into the R&D abilities of universities, providing incentives to commercialise research, and letting the private sector work more closely with government science and technology institutions. And none of these have ever been a significant part of parliamentary debate.

(Editorial in the *Hindustan Times*, New Delhi)

## Interview

## 'Microbes colonise on Plastic'

### An interview with Ms. Jenna Jambeck

SANJIV SHANKARAN and TULIKA RATTAN

'Beat Plastic Pollution' was the theme for 2018 World Environment Day. Jenna Jambeck, an environmental engineer teaching at University of Georgia (USA), researched the quantum of plastics that ends up in the ocean. She's now extending her research with a National Geographic grant.

**Q. What is the proportion of plastic in solid waste and how does it find its way into oceans?**

A. Plastic in solid waste is about 10-13% globally. We estimated how much is mismanaged globally, by which we mean inadequate waste management systems and litter. So that estimate for 2010 in terms of what was actually entering the ocean was 8 million tonnes of plastic. That's the big picture.

Some of it floats and some of it sinks. Marine life interacts with it in various ways. Sometimes it is ingested. There are microbes that colonise on plastic to make it smell like food to seabirds. These animals are potentially in our food web. We don't really know the impact. We are not sure of the human health impact at this point in time.

**Q. How many centuries does it take to degrade plastic that's settled in the ocean bed?**

A. We don't know because none of us has been around long enough. We know at the bottom of the ocean there's not a lot of microbial activity. For me, it's forever.

**Q. Plastic as material is essential to our way of living. Are there ways to make it more recyclable or replaceable?**

A. Partly why we see the leakage that we see is because it doesn't really have value at end of life. You could redesign products so that they are more valuable. The material can play a role too. Looking at alternative materials and product design is definitely one of the ways to change something. That alone is not the solution because we only have 9% recycling and 80% is ending up in the landfill or environment. And if you just switched over to recycling from the landfill but didn't reduce leakage, you wouldn't really have solved this problem. However, the reason we talk about recycling is because value of the material being recycled can increase, which tends to reduce leakage.

**Q. Why does India recycle a far higher portion of plastic as compared to the world average?**

A. This is just a hypothesis: There is a very large informal waste management sector here and that is something to be aware of when you are thinking of this issue. A lot of the waste gets picked informally. And there are higher recycle rates because it has value to someone.

**Q. As a society, we generate a lot of religious waste. How difficult do you think it will be to change this habit?**

A. It is very much about how people behave. If there is something about your culture that is important to everybody and you need to preserve it you'd want to think of a different material. Before the early 1900s we did not have plastic and culture has been around much longer.

**Q. Is microplastic the new fear as it is most likely to get into the human food web?**

A. Yes, because of its shape and, size. Most microplastic is coming from a larger plastic item that is breaking down into fragments. But microbeads are in the cosmetic products—face wash, body wash, even toothpaste. So, if you see polyethylene on the back of the container then it contains microbeads. Not every country in the world has banned it. So, that would be something good for citizens to be aware of, otherwise there will be a whole bunch of spherical microplastics ending up in the drain being washed off.

**Q. Have corporations begun to change the way plastic is being used to keep it within the cycle?**

A. The circular economy is certainly a concept that people are talking a lot about. Some corporations have really started to come forward to say we're going to make these commitments for recycled products, making sure it gets captured for recycling—sort of sharing the responsibility of managing the waste from their products which they hadn't been active in previously. This extended producer responsibility is a concept that people are taking up around the world.

**Q. What materials can replace plastic?**

A. We already have paper. There are polymers that are truly biodegradable. Right now in the market there are polymers that are compostable — which is different than totally biodegradable. Unfortunately, we have had some mislabelling of biodegradable plastic around the world. It is not in the market quite yet, but it is under development and very close to being on the market.

## Man's Evolved Avatar

### Cyborgs may be able to ward off the existential threat from Artificial Intelligence

SHEETAL SHAH

*Chairperson, Fellow Programme in Management at  
SP Jain Institute of Management and Research, Mumbai.*

In the movie *Avengers: Age of Ultron*, the Iron Man and Bruce Banner — a genius scientist when he wasn't playing Hulk—built an artificial intelligence system named 'Ultron' to help protect the earth. But Ultron—the peace-keeping programme embedded in a synthetic body—turned hostile, making it his mission to eradicate humans from the face of the earth. As earth's fate hung in the balance, the mightiest of Avengers had to come together to save the planet from complete annihilation.

Does this, another Marvel Comic story turned into a sci-fi Hollywood film, have, a semblance of realism? Perhaps yes.

A couple of years ago a unique experimental self-driving car was released on New Jersey roads, that was not coded or programmed by engineers. The car sensors were connected to a huge network of artificial neurons that processed data and delivered commands to the brake, steering wheel and other sub-systems. This car, developed by the chip maker NVidia, did not need any human intervention. It taught itself by watching other humans drive their cars.

With this technology referred to as deep learning, artificial intelligence is advancing to a level where systems become so intelligent that they surpass human capabilities and comprehension. And if this happens, as physicist Stephen Hawking has anticipated, "a super-intelligent AI will be extremely good at accomplishing its goals, and if those goals aren't aligned with ours, we're in trouble."

Elon Musk seems to agree. In a YouTube video on the subject he sounds an alarm bell: "if AI becomes smarter than a person, what do we do and what jobs will we have?" Will AI take over our world? How worried should the human race be? As per the World Economic Forum report published in 2016, about five million jobs will be lost to robots and automation by 2020.

These predictions may come to pass. But let's look at the man-machine debate more objectively. It's true that super-computers such as Watson can process data, recognise patterns and thereby learn by itself at a faster rate than a human brain. But such machine learning capabilities which are integral to AI require massive amounts of data.

Who creates this data? Most often than not, especially in greenfield areas, humans are the original creators. If there is no data, there is no AI. How does AI learn? It teaches itself by repetition, logical progression and sequencing that enables it to decipher higher level patterns at lightning speeds for problem solving and decision making. By that token, AI has phenomenal power to substitute repetitive tasks that require sequential logic.

A recent survey of how AI is likely to transform the workplace confirms this proposition. Decision makers in India indicated some of the jobs that could be outsourced to AI powered digital assistants: writing and responding to emails, entering timesheets, scheduling calendars and some routine accounting, billing and HR tasks.

Though AI can process billions of data points to arrive at an efficient decision in a blink of an eye, the contextual, emotional and intuitive aspects of the decision making still remains the prerogative of the human race. In fields that need creativity and out-of-the box thinking, human judgment will be hard to replace.

The perspective offered so far pitches man and machine in two different camps, with the debate focussing on who will reign supreme. But recent developments in the field suggest it doesn't have to be that way. There can be a third side. The merging of man-machine to create a powerful combined force.

Elon Musk has already founded a company called Neuralink, which is in the process of discovering an developing devices that can connect to the brain. Ray Kurzweil, a futurist and Google's AI guru, believes the world is experiencing one of the most peaceful times in history since World War II. While hunger rates are lower than what they were in the past, technology has lifted millions out of poverty and made it possible for three billion people to have smartphones.

He thinks the human race is at an evolutionary inflection point where man and machine will become one in the near future. Instead of being in separate camps and humanity living in existential fear of whether AI will take over our world, he believes "robots will go inside our brain and

(Contd. on page 126)

## Trees and their Tall Tales

RUSKIN BOND

When I first came to live in the hills, I had as my nearest neighbour a sturdy walnut tree. Every year, when the rain were over, it would produce a generous amount of walnuts. But before I could gather any, the small boys from a nearby village would be up the tree, helping themselves to the nuts. At that time, I was nearly forty, no longer agile enough to climb trees, so to the victors went the spoils! I'll say this for the boys, they did present me with the pocketful of walnuts before leaving.

That old walnut tree was one of the victims when a road was blasted through the grounds of the cottage I'd rented, and I had to move further up the hill. But almost every village in the lower Himalayas, from Kashmir to Kumaon, can boast of several handsome walnut trees, and I am surprised that there are not more of them, for we could be exporting walnuts instead of importing expensive walnuts from America and elsewhere.

The ancients (both in Asia and Europe) believed that the walnut was good for the brain, its kernel being shaped just like the human brain. Let's call it sympathetic medicine.

Almonds are therefore good for the eyes, cashew nuts for kidneys, coconut for head and hair, beetroots for the blood, and lady's fingers for—well, for ladies' fingers!

"Wouldn't you like fingers like this lovely lady's fingers we're having for lunch?" I asked a pretty young visitor.

"No" she said. "They're much too squishy."

Never mind. All our plants are good for something or the other.

•••

The grandmother and the neem tree had one thing in common: they hated waste. Granny thought it a sin to waste food when there were so many hungry children in the world, and I would be taken to task if I left any unpopular vegetable on my plate. Like her, the neem tree never wastes anything. Its leaves, its bark, its twigs, its seed pods, its oil, all have their uses. The bark is medicinal. The leaves contain a compound that repels insects. The twigs are used as tooth brushes. Oil from the seeds is used in soaps and moisturising creams. An all-purpose tree! Granny would have approved!

I remember walking down an avenue of neem trees on the outskirts of Meerut, many years ago. There had just been a heavy shower, and the road was covered with thousands of neem pods that had been brought down by rain. Now they

were being crushed by pedestrians, cyclists, pony carts, bullock carts. And as they were crushed, they combined with the rain to give out a fresh and invigorating aroma. That was over fifty years ago, but the memory of that heady fragrance remains with me.

•••

"My love is like a bean field in blossom...." So wrote the nature poet John Clare, and this was certainly a change from poets comparing their loves to delicate lilies and bashful roses. And a bean field gives you something in return for the love you bestow upon it.

The bean is a generous plant. You can eat the beans when they are green and succulent. Or when they are dry, you can eat the pods or legumes. Baked beans on toast! As a young man living alone in London, I survived on beans on toast for over two years; there wasn't much else that I could afford.

Here, in the lower Himalayas, the lovely green bean grows easily, the monsoon rains helping it along. For most of the year, the villages near Mussoorie are without water for irrigation, and they lie dry and fallow. But as soon as the rains break, there is considerable activity on the terraced field, and beans, peas, cucumbers, radishes, corn are soon turning the hillsides green with their foliage and produce. Even as I write, Beena is in the kitchen slicing up fresh green beans to make my favourite 'aloo-beans' sabzi. And tomorrow we will have red beans, rajma. And day after, white beans. Every day, the boys from Kolti, the nearest village, bring us fresh supply of beans. We now have a surfeit of them. I am beginning to look like a fat bean. I can't eat beans forever! Or maybe I can. They are full of goodness, the good earth's bounty. And for those who eat little or no meat, beans provide the necessary protein.

Long ago, during that bleak period in London, when I was living in a small attic room with one tiny window, I planted a bean in a small container of earth. I did not expect anything to come up. But a few days later, a small green shoot made its appearance, and before long I had a climbing bean for company; a reminder that outside the cities, there were still bean fields in blossom.

•••

(From the '*Musings from the Mountains*')

## Trip to Ladakh

### Food Ingredients that anyone ever thought possible

Chef PRATEEK SADHU

I've never been a fan of early morning flights, but travelling to Ladakh doesn't leave one with many options. I rush home after the night's service, pack my tools and head to the airport.

I'm exhausted, but full of nervous energy. This is the second time I'm heading to Ladakh in my adult life; memories flood back from the time my father was posted in a small village called Sanjak between Leh and Kargil. We would pluck apricots and apples straight from the tree; wood sorrel grew with wild abandon. The tastes of a dozen different herbs from the region have stayed with me, their names long forgotten.

I meet Ashish Shah at the airport, the photographer who had done one of our earliest shoots at Masque. His work speaks for itself and I remain in admiration of his skill, work ethic and general go-getter attitude. Ashish is my foraging buddy for the next five days, along with Mehdi, the most crucial of this unlikely trio; he's the one who will drive us around the deep interiors of Ladakh in search of sea buckthorn, apricots, and whatever else we can find.

#### Home, Sweet Home

We land in Leh, still only half awake, I open my eyes to the mighty Himalayas under whose lap I was born. I left Kashmir at a relatively young age, but the connect remains strong; stepping out of the plane feels like a homecoming of sorts. Our dear Mehdi, lucky him, is still sound asleep when we land, but gets us to our hotel where we spend the next day acclimatising to the altitude.

At dawn, we begin the drive to Nubra via Khardung La, the world's highest motorable pass. As Ashish clicks away, we drive past fields of a greyish-purple. Intrigued and with a sneaking suspicion of what we've stumbled across, we stop to explore. We wade into the fields and I stoop over to take a whiff; the familiar, floral scent hits me like a brick. Sure enough, we've stepped into a treasure trove of wild lavender, and I'm left awestruck by how incredible India really is. While we're looking West for infusions and scented bath bombs, this bounty lies untouched within our borders.

After making Mehdi promise to stop on our way back when I have my tools handy, we continue to Nubra. I look on to mesmerising views, the lavender playing on my mind—there are a thousand different tea and cocktail possibilities, or something with fish, perhaps? It's a rough drive to Turtuk, the village we're heading to in Nubra, but worth it: we're

welcomed by a vast jungle of sea buckthorn, the main reason we're here. The beautiful, tiny orange berry is a vitamin C tsunami and grows abundantly here, where locals use its thorny bushes largely for fencing.

We start the next day with steaming cups of *noon* — meaning salted chai — typical to the Ladakh and Kashmir area; the Ladakhi version is unique in that the butter is emulsified beforehand, different from the Kashmiri one I grew up drinking, but still a lifelong favourite.

We gear up to begin foraging. We've had to buy army gloves to protect ourselves from the thorns, and enlisted an extra three sets of local hands to help. We spend the next five hours settling into a steady routine: hold the stem, hit it with a stick, collect the falling berries. Of a target of 100 kilos, we manage 30.

As dusk falls, we call it a day and trek to the top of a nearby hill for some relaxation. However, in this land of endless surprises, we are met instead with views of endless buckwheat farms, their flowers in full bloom. In a month's time, they will be ready for harvest; until then, we sit back and breathe in the serenity, then dive in, wading through waist-deep fields until midnight.

#### Bring on the Baltis

The next day: more salted tea, more sea buckthorn. Hold the stem, hit the stem, collect the jewels. The locals chime in with traditional Balti songs and direct us towards a typical lunch in Baltistan: pancakes made from fermented buckwheat batter, eaten with dried buckwheat leaves and yoghurt. This is easily my most memorable meal of the trip, and I eat the same dish for two days straight.

The berries have thrown us a bit off schedule, and our hunt for apricots is delayed by half a day. We begin instead the following morning, walking up a hill to be met by a trio of delightful old ladies who run the apricot farms. They explain to us the different varieties they grow: one primarily to be eaten fresh, another to be dried, and a third used most often for chutneys and pickling. I spend the next four hours walking through the farms with them, taking notes on what to do once I get back home. My biggest concern is doing justice to the fruits; the challenge will be working them into dishes without bastardising their sweetness and natural flavour. Actually, scratch that—the primary challenge is to get all the produce back to Mumbai without damaging it.

I've carried an icebox with me, but one look at our

yield and I set off to buy more buckets. The berries are especially delicate, and unfortunately so are the buckets we find in tiny Turtuk; we'll have to repack them in a sturdier contraption once we get to Ladakh.

Another morning of *noon* chai and we set off, this time with tools handy. We make pit stops where the lavender grows thick, hopping out every now and then to cut it fresh. Once we arrive, the day is spent gorging on thukpa and momos and discussing how to incorporate all this brilliance into our new menu at Masque. Foraging and farming with your own hands creates an entirely new sense of responsibility towards your ingredients; my focus lies in creating unique plates that do justice to the produce.

#### Back on the Ground

Still, all the beauty in the world could not make me relinquish my hatred for an early morning flight. It's compounded this time by the 70 extra kilos I'm carrying back with me and the fact that I cannot use my credit card to pay for it thanks to technical issues. At 5 am, we scramble to find an ATM, rush back to the counter, and hop on the flight. I'm

eager to get back to the kitchen—with produce this delicate, every moment counts, and some amount of loss is inevitable. I head straight from the airport to Masque, where the team is ready and waiting to unpack the buckets for storage.

We spend the next four days running through trials and taste tests; not until day four do we succeed in getting our sea buckthorn ice just right. A delicate ring of it is set atop a light mousse of black pepper from the south, garnished with pine salt and fennel flowers. We begin running it on the menu that same night. The apricots will feature on our next, paired with duck, if all goes as planned.

#### Additional advice

1. Visit Balti Farm, an a-la-carte restaurant, in Turtuk that dishes up Balti dishes sourced almost entirely from its own orchards. (Source: Lonely Planet)

2. Take a short hike to Yarab Tso Lake on the way from Teggara to Panamik hot springs. (Source: TripAdvisor)

3. Stay at Desert Himalaya Resort, a comfortable campsite that has good dining options and snug tents with private bathrooms. (Source: Condé Nast Traveller)

## Pests in Aeroplanes

The case of bed bugs being found on Air India business class isn't the only time that pests have been flying high. Here's a roundup of other creepy crawlies who disrupted smooth flights.

### 1. Cockroaches

You know that good feeling officially sinking into your seat and just relaxing? Well, a New Zealand man didn't because he was left disgusted when he saw cockroaches running around on an Air New Zealand flight. He managed to kill a few and did a show and tell for the airline staff who were reportedly just not interested in the dead bug. But they did spray the plane on landing.

### 2. Wasps

Wasps are a major problem for aircraft taking off from Brisbane. Plastic covers are placed over gauges to prevent wasps from building hives in the probes, which they can do in under 20 minutes. While the wasps didn't get in this time, —a Malaysia Airlines flight had to return to Brisbane because of a pre-flight inspection failure that left the plastic covers on, causing an in-flight emergency.

### 3. Spiders

A Mississippi man had a Little Miss Muffet moment when he sat down on an American Airline flight in 2016. Marcus Fleming was bitten by a reclusive brown spider, and

the bite led to an infection which meant that Fleming had to have surgery or lose his thumb. The staff at American Airlines brushed off the spider bite as a mosquito bite and Fleming is seeking \$500,000 in damages.

### 4. Fleas

A father of two was looking forward to a holiday in America but thanks to British Airways, he may be once bitten, twice shy. Paul Standerwick was attacked by fleas after he and his son moved seats to get a better view while the plane landing. Only after he landed was he informed that the seats were vacated due to the pests. To compensate for the passenger's multiple bites, British Airways left the dad with a £50 voucher.

### 5. Snakes

A snake nearly made it on a plane. This is not the brief of a horror movie but something that happened at Miami International Airport in July this year. The Transportation Security Administration discovered a large python coiled inside an external hard drive tucked away discreetly inside a piece of luggage.

The live snake and its sneaky owner were both not allowed on their Barbados-bound flight. TSA put up a post and cheekily added, "Con conversationally, this python had not gone full monty. It was wearing a nylon stocking".

—Glynda Alves

## Microgreens or Vegetable Confetti

### Germinating and with upto 4 leaves

PRIYA MENON

Good things come in small packages. Well, that's true at least where microgreens are concerned. Power packed with nutrients, these seedlings are now garnishing dishes at star hotels, sold at grocery stores and being grown on windowsills.

Microgreens, or vegetable confetti, are seedlings of any herb or vegetable that has edible leaves, such as red cabbage, cilantro and mustard. However, they need to be harvested within seven days of germination, when a maximum of four leaves have sprouted.

After three decades of social service, when N Vidhyadharan decided to try his hand at agriculture in his one-acre plot close to Chenglepet, he was not happy growing just paddy and groundnuts. In June 2014, he began growing microgreens. "I grew arugula and red amaranthus. It is easy as you just need to plant them in shallow pots and they require little water and sunlight," says the 51-year-old, who then launched *Adhithya Microgreens*, supplying it to hotels in Chennai. "You can use it to garnish curries or add to omelettes," says Vidhyadharan, who stopped selling it last November but plans to start again by February as there is now a demand for it.

Seema Balakrishnan began growing it in her Velachery house after hearing of its nutritional benefits. "I mix it in salads, and use it as garnish. Each microgreen has its own flavour, which is a fresher and more enhanced version of what the adult vegetable tastes like," says the motivational trainer. You can also have a dish made entirely out of microgreens. For instance, garnet amaranth makes for an excellent

dish in itself.

With the growing demand, some supermarkets have begun stocking it. *Green Goblin*, a distribution company for exotic fruits and vegetables, delivers it to your doorstep. So you can get 50g of amaranth for Rs. 160, mustard for Rs. 150, and mixed lettuce for Rs. 190. "Everything is grown in our family-owned farms in Maharashtra and we ensure that the cold chain is not broken so that it is fresh," says Aditi Vasu, proprietor *Green Goblin*.

Dietician Meenakshi Bajaj says microgreens are low in calories, rich in vitamin B2, folic acid, minerals and antioxidants. "They are 40 times higher in vital nutrients than their mature counterparts," she says. "The red cabbage microgreen has 147mg vitamin C per 100g while the mature cabbage has 57mg." Microgreens also contain fat-soluble vitamins, A, E and K. "For maximum nutritional benefit add extra virgin olive oil or roasted gingelly oil seeds to the microgreen salad," says Bajaj.

The nutrient profile of the microgreen depends on that of the original vegetable. "Any microgreen will provide vitamin C. The adult requirement is 40mg per day but the least you can get is 20mg of vitamin C per 100gm of microgreens," says Bajaj. The radish microgreen has 126mg of anti-sterility vitamin E per 100g, whereas the adult requirement per day is only 15mg.

Only people with renal or heart ailments should refrain from consuming microgreens, says Bajaj. "If you are on potassium sparing diuretics, you should not eat it. But otherwise, any amount of microgreen you consume is good for the body," she says.

### *Homo erectus*

Laziness, paired with an inability to adapt to a changing climate, may have wiped out the *Homo erectus*, an extinct species of primitive humans, a study has found.

An archaeological excavation of ancient human populations in the Arabian Peninsula during the Early Stone Age, found that *Homo erectus* used 'least-effort strategies' for tool making and collecting resources.

"They really don't seem to have been pushing themselves," said Ceri Shipton, from the Australian National

University.

"I don't get the sense they were explorers looking over the horizon. They didn't have that same sense of wonder that we have," said Shipton.

This was evident in the way the species made their stone tools and collected resources.

This is in contrast to the stone tool makers of later periods, including early *Homo sapiens* and Neanderthals.

**South Asian Taxa in the Book by Eliot & Kawazoe (1983)  
on *Lycaenopsis* Blue Butterflies  
(Lepidoptera : Lycaenidae)**

R. K. VARSHNEY

A Biologists Confrerie,

Raj Bhavan, Manik Chowk, Aligarh (U.P.) - 202001.

Lycaenid or blue butterflies make up 30-40% of all butterfly species. In a comparatively recent head count, 144 genera of Lycaenidae were reported occurring in India and neighbouring countries (Varshney, 1997) [cited as 'Index' below]. Eliot & Kawazoe (1983) have revised its *Lycaenopsis* Group of taxa elaborately. Most of these are commonly referred to as the 'Hedge Blues'. From South Asian region 11 genera are reported in it.

Notes on these South Asian genera, species and subspecies, along with last's distribution in region, are reported here verbatim, since Eliot & Kawazoe is not available to many workers in the region. The nomenclature and distribution have been checked in notes, against a few other recent studies for the region, namely :

1. Protected Invertebrates - Butterflies, by Gunathilagaraj et al. (2000) [referred to as 'Prot. Invert.'].
2. Lepidoptera of Nepal, by Smith (2010) ['Lep. Nepal'].
3. Subspecies Catalogue - Lycaenidae, by Gupta & Majumdar (2012, 2013) ['Subsp. Cat.'].
4. Synoptic Catalogue - Butterflies of India, by Varshney & Smetacek (2015) ['Synop. Cat.'].
5. Naturalist's Guide - Butterflies of India, by Smetacek (2017) ['Natur. Guide'].

The account in Eliot & Kawazoe and then present author's notes for each genus follow.

Tribe POLYOMMATINI

Subtribe LYCAENOPTITI

[emended here as LYCAENOPTINA]

**(1) Genus *Oreolyce* Toxopeus**

1. *O. dohertyi* (Tyt.) - Naga Hills.
2. *O. vardhana* (M.)
- i. *O. v. vardhana* (M.) - NW. Himalaya: Kashmir to Naini Tal.

Notes : Index (1997: 101) reports it from Pakistan and Central and Eastern Nepal. Besides *O. vardhana nepalica* Forster, 1980, is reported from "SPK : Gusum Bng" (Lep. Nepal).

*Lycaenopsis quadriplaga dohertyi* is listed in the Wildlife Protection Act, 1972, which is referred as *Celastrina dohertyi dohertyi* in Prot. Invert.

**(2) Genus *Neopithecops* Distant**

1. *N. zalmora* (But.)
- i. *N. z. dharma* (M.) - South India (Nilgiris, Orissa).
- ii. *N. z. zalmora* (But.) - Kashmir to Bengal, Assam and Orissa.
- iii. *N. z. andamanus* Eliot & Kawazoe - Andaman Is. (widely), Nicobar Is. (Kar Nicobar).

Notes : Index shows *Neopithecops* occurring in Sri Lanka and Myanmar also. Natur. Guide gives distribution of *N. zalmora* as Sri Lanka to Gujarat, Odisha and Jammu & Kashmir to North-East India. Synop. Cat. records *N. z. dharma* from Gujarat to Kerala.

**(3) Genus *Megisba* Moore**

1. *M. malaya* (Horsfield)
- i. *M. m. thwaitesi* M. - South India as far north as Bombay and Poona.
- ii. *M. m. sikkima* M. - North India to N. E. India (Sikkim).
- iii. *M. m. presbyter* Fruh. - Andaman Is.

Notes : Index reports the genus in Sri Lanka, Kumaon, Orissa, Bengal and Nepal as well. Lep. Nepal shows *M. m. sikkima* in Sikkim and Nepal.

Subsp. Cat. gives distribution of *M. m. presbyter* in Andaman & Nicobar Is., and of *M. m. thwaitesi* in Orissa, W. Bengal (Kolkata) and Sikkim as well.

**(4) Genus *Lestranicus* Eliot & Kawazoe**

1. *L. transpectus* (M.) - NE. India (Assam, Khasi Hills).
- Notes : This genus is proposed as new in this book itself. *Lestranicus* is shown in Sikkim, Meghalaya, Nagaland, Manipur, Bangladesh, Nepal and Myanmar (Tenasserim Valley) in the Index. Range in Myanmar extends to Dawna Mountains and Ataran Valley.

Lep. Nepal spells the species as *L. transpecta*.

**(5) Genus *Udara* Toxopeus**

1. *U. dilecta* (M.)
- i. *U. d. dilecta* (M.) - NW. Himalaya, North India.
2. *U. placidula* (Druce)
- i. *U. p. howarthi* (Cantlie & Norman) - NE. India (Assam : Sibsagar and Manipur).
3. *U. singalensis* (Fd.) - South India.
4. *U. akasa* (Horsfield)

i. *U. a. mavisa* (Fruh.) - South India.

5. *U. selma* (Druce)

i. *U. s. cerima* (Corbet) - Assam.

6. *U. albocaerulea* (M.)

i. *U. a. albocaerulea* (M.) - Central Himalaya through NE. India (Dehra Dun).

Notes : *Udara* is the yet largest genus of *Lycaenopsis* Group. It ranges from Sri Lanka, India (throughout), Nepal, Myanmar and beyond, *vide* Index. Lep. Nepal has shown two species, *dilecta* and *albocaerulea*, in Nepal.

Subspp. Cat. has not included genus *Udara* and its species. Synop. Cat. has shown *akasa* in Kerala, Karnataka and Tamil Nadu; *albocaerulea* and *dilecta* in Himachal Pradesh to NE India; and *selma* in Assam to Arunachal Pradesh.

#### (6) Genus *Acytolepis* Toxopeus

1. *A. puspa* (Horsfield)

i. *A. p. felderi* Toxopeus - South India to as north as Bombay.

ii. *A. p. gisca* (Fruh.) - Northern India, Sikkim, and Andaman Is.

iii. *A. p. cyanescens* (de N.) - Car Nicobar and Central Nicobar Is.

iv. *A. p. prominens* (de N.) - South Nicobar Is.

2. *A. lilacea* (Hampson)

i. *A. l. lilacea* (Hampson) - South India, upto Nilgiris 3000'.

Notes : Index shows distribution of genus in Sri Lanka, Pakistan, India, Bangladesh, Myanmar and beyond. Lep. Nepal includes *A. p. gisca* in Nepal. Natur. Guide gives distribution of *puspa* in Afghanistan, Sri Lanka to Maharashtra, W. Bengal, Uttarakhand to NE. India. Synop. Cat. shows *lilacea lilacea* in Karnataka, Kerala and Tamil Nadu; and *puspa felderi* in Gujarat to Kerala.

Subspp. Cat. looks incomplete. It does not include *Acytolepis* and its species.

#### (7) Genus *Celatoxia* Eliot & Kawazoe

1. *C. marginata* (de N.)

i. *C. m. marginata* (de N.) - Central Himalaya to NE India (Sikkim, Darjeeling, Khasi Hills).

Notes : *Celatoxia* is described as a new genus in this book itself. Index shows the distribution of genus in South India: Nilgiris, Palni and Annamalai Hills and in Himalaya and NE. India: Kumaon, Sikkim, Darjeeling and Meghalaya; Nepal and Upper Myanmar : Karen Hills.

Synop. Cat. gives distribution of additional species *albidisca* (Moore) in Karnataka, Kerala and Tamil Nadu; and of *marginata* in Uttarakhand to NE. India. Lep. Nepal includes *marginata* in Nepal.

#### (8) Genus *Celastrina* Tutt

1. *C. argiolus* (L.)

i. *C. a. kollari* (Wd.) - W. Himalaya : Chitral to Kumaon (Kashmir).

ii. *C. a. iynteaana* (de N.) - Southern slopes of Himalaya, from Central region eastwards and on highlands of NE. India (Sikkim, Assam, Khasi Hills: Shillong).

2. *C. hersilia* (Leech)

i. *C. h. vipia* Cantlie & Norman - From Eastern Nepal to Sikkim, Assam (Mishmi and Naga Hills) 2-13000'.

3. *C. huegelii* (M.)

i. *C. h. huegelii* (M.) - W. Himalaya (Mussoorie, Naini Tal).

ii. *C. h. oreoides* (Evans) - Eastern Himalaya (Subansiri river).

4. *C. oreas* Leech

i. *C. o. oreana* (Swinhoe) - Assam : Khasi and Jaintea Hills (Cherrapunji, 4000').

5. *C. lavendularis* M.

i. *C. l. lavendularis* M. - Mountains of south and southwest India (Western Ghats).

ii. *C. l. limbata* (M.) - North to NE. India, Central Himalaya (Sikkim, Darjeeling, Parasnath Hill 4477').

Notes : Index includes two more species, *gigas* Hemming and *morsheadi* Evans in it. Prot. Invert. lists '*puspa lavendularis*' and *dohertyi dohertyi* in this genus [see *Oreolyce* above].

Lep. Nepal shows '*iynteaana*' and not *iynteaana* of Eliot & Kawazoe; besides *kollari*, *vipia*, *gigas*, *oreoides* and *limbata* in Nepal.

Synop. Cat. includes *gigas* and *huegelii* from Jammu & Kashmir to Uttarakhand; *lavendularis* from Karnataka, Kerala and Tamil Nadu; and *limbata* from Jharkhand as well.

Subspp. Cat. erroneously has not included *Celastrina* and its species.

It seems *argiolus iynteaana* Auct. should be considered valid and not '*iynteaana*' which is given by Eliot & Kawazoe. Name *iynteaana* is formed after the place of occurrence, that is 'Jyntia Hills' in Meghalaya. International Commission of Zoological Nomenclature should take notice of it.

#### (9) Genus *Callenya* Eliot & Kawazoe

1. *C. melaena* (Doherty)

i. *C. m. melaena* (Doherty) - Manipur, (Cachar River).

Notes : *Callenya* is also proposed as a new genus in this book by Eliot & Kawazoe.

Synop. Cat. reports *melaena* from Assam and Meghalaya, besides Manipur. Index shows *minima* Evans as a syn. of *melaena*. Also an additional species, *lenya* Evans, is shown in this genus from the region (Lenya Valley, South Myanmar), *vide* Index. Subspp. Cat. has not included this genus and its species, although it mentions to have consulted

Eliot & Kawazoe (1983).

(10) Genus *Notarthrinus* Chapman

1. *N. binghami* Chapman - NE. India (Assam : Shillong).

Notes : *Notarthrinus* is a monotypic genus. Index shows its distribution in Assam and North Myanmar.

Synop. Cat. shows *binghami* in Manipur and Meghalaya.

(11) Genus *Monodontides* Toxopeus

1. *M. musina* (Snellen)

i. *M. m. musinoides* (Swinhoe) - NE. India (Shillong).

Notes : The citation '*Celastrina musina*' is shown as a syn. of *Monodontides musina* in Subsp. Cat. and shows occurrence of *musinoides* in NE. India : Assam and Sikkim.

Synop. Cat. also shows it as Sikkim to NE. India.

A last word about '*Lycaenopsis haraldus ananga* Fd.', which is a stray occurrence at the Victoria Point, South Myanmar, and so reported in Prot. Invert. However, Index has clarified earlier that *Lycaenopsis* Felder & Felder, with type-species *ananga* Fd. & Fd. (syn. *Papilio haraldus ananga* Fd. & Fd.) occurs (rarely) in South Myanmar, but its main range is restricted to Sundaland (Indonesia).

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## ISRO to geo-tag all agri infra in the country

In order to keep a track of agricultural assets in the country through online recording and monitoring, the Centre has decided geotag all such infrastructure in a phased manner. The agriculture minister will sign a memorandum of understanding (MoU) with the Indian Space Research Organisation (ISRO) to do this particular job.

ISRO has assigned this task to the National Remote Sensing Centre (NRSC), Hyderabad. The NRSC will geotag (add latitude, longitude and location-specific information to photo/video) all the assets, using its 'Bhuvan' platform in association with states and Union Territories (UTs). 'Bhuvan' is the geo-platform of the country's space agency ISRO.

"The NRSC has already given training to the states / UT's Officials of Bihar, Karnataka, Odisha and Maharashtra on a pilot basis. Officials of other states / UT's are also being trained on specified dates, keeping in mind the upcoming MoU", said an official.

Under the MoU, the NRSC will geo-tag all agriculture assets which are created under the 'Rashtriya Krishi Vikas Yojna' (National Agriculture Development Plan), in different parts of the country. Such assets include seed processing units, seed farms, soil testing labs, bio-fertiliser production units, seed storage godowns, seed certification infrastructure, labs for production of bio control agents, state pesticide/residue testing labs, machinery to reduce post-harvest losses, poly houses / shade-nets and orchards among lakhs of such facilities across the country.

Besides monitoring of assets, the application of technology will also help in planning and execution of new agriculture infrastructure projects in a transparent manner. "The data collected could also be used by the farmers/entrepreneurs in planning their activities including best utilisation of available resources of a cluster, pack houses and cold storage among others in a particular district or region", said the official.

All information will be available on the Bhuvan mobile platform so that the geo-tagged assets can be monitored anytime from anywhere. The decision to geo-tag the assets is a testimony of how the space technology is increasingly being used in the country for not only visualisation of the assets but also for terrain mapping to undertake other developmental works like watershed and drought-proofing measures.

The NRSC is currently also geo-tagging the assets created under the MGNREGA in each gram panchayat. The move will not only check leakages but also help in effective mapping of terrain for future developmental works. Around 30 lakh assets are created annually across the country under the rural job scheme.

## Butterfly Diversity in the BNHS Nature Reserve, Goregaon, Mumbai (Lepidoptera : Rhopalocera)

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The primary aim of writing the present study is to document the diversity of butterflies found in the BNHS Nature Reserve and note their abundance. These observations can help in imparting environmental education to the students and citizens effectively, and also to implement strategies for conservation of butterflies in the Mumbai area.

### Study Area

BNHS Nature Reserve is a 33 acre and 35 guntha dense forest, located in Goregaon East in Mumbai, Maharashtra. The land was given to Bombay Natural History Society (BNHS) by the State Government of Maharashtra in 1983. A Conservation Education Centre (CEC) was established here by the BNHS in 1997. The forest land is nestled between the Dadasaheb Phalke Film City and Sanjay Gandhi National Park. BNHS conducts research and various environmental activities here. The Reserve also holds a 'Butterfly Garden' where specific larval host plants and nectar plants have been planted.

BNHS runs a Conservation Education Centre (CEC) which is situated in the BNHS Nature Reserve. The Reserve is a dense forest spread across 33 acres and 20 gunthas. It is nestled between the Dadasaheb Phalke Film City and Sanjay Gandhi National Park (SGNP).

The habitat here is mostly of the Tropical Dry Deciduous and Tropical Dry Evergreen Forest type. Much of the forest here is dominated by the *Tectona-Albizzia-Terminalia-Holarrhena-Firmiana-Dalbergia-Garuga-Grewia-Adina-Ficus-Madhuca-Caraya-Butea* and bamboo composition.

SGNP is home to various species of flora and fauna, including 25 species of mammals (including leopards), 275 species of birds and 172 species of butterflies (Kasambe, 2012). Many of the species seen in SGNP can be expected and seen in the BNHS Nature Reserve as well.

### Materials & Methods

Opportunistic visits were conducted along the six demarcated nature trails in the BNHS Nature Reserve and butterflies were noted and photographed. Total 120 species of butterflies were recorded during these visits on different trails. Abundance of butterflies was also taken into consideration.

Butterflies were observed opportunistically during the

course of 17 months i. e from November 2016 to March 2018. Most observations were taken along the six demarcated trails in the BNHS Nature Reserve and in the butterfly garden. Butterflies were photographed in field for identification purpose. No specimens were collected during the study period.

For identification of butterflies, books by Kehimkar (2008, 2016) and Kasambe (2016) were referred to. All butterflies were identified after taking photographs. For nomenclature we followed the latest catalogue by Varshney & Smetacek (eds.) (2015).

Butterflies were classified according to their abundance in five categories:

A—Abundant: Seen 80 - 90% of the times during visit in most habitats;

C—Common: Seen 60 - 80 % of the times during visit in most habitats;

U—Uncommon: Seen 40 - 60 % of the times during visit in most habitats;

R—Rare: Seen 20 - 40 % of the times during visit in most habitats;

VR—Very rare: Seen less than 20% of the times during visit in most habitats.

### Results & Discussion

Sharma & Chaturvedi (2006) have enlisted 138 species of butterflies from Mumbai region, which was based on various previous works. Kasambe (2012) enlisted 172 species in Sanjay Gandhi National Park, with additional records. Rodrigues (2012) has described 153 species in Mumbai and Patwardhan (2014) has reported occurrence of 142 species in SGNP. Gaonkar (1996) had reported 208 species in the entire Western Ghats stretch of Maharashtra.

Authors hereby report occurrence of the Bengal Spotted Flat *Celaenorrhinus putra* in Mumbai (Kasambe, see page 130). The butterfly was seen many times in the butterfly garden of the BNHS Nature Reserve. It is only reported from Sikkim to North-east India (Kehimkar, 2008, 2016; Varshney & Smetacek, 2015) and there are no published reports from south India (Gaonkar, 1996). However, the website (Bhakare et al., 2018) has many photographic records of the species

Table 1. Checklist of butterflies of the BNHS Nature Reserve, Mumbai.

	Common Name	Scientific Name	Abundance
<b>Family Hesperidae</b>			
1.	Malabar Spotted Flat	<i>Celaenorrhinus ambareesa</i>	U
2.	Common Spotted Flat	<i>Celaenorrhinus leucocera</i>	C
3.	Bengal Spotted Flat	<i>Celaenorrhinus putra</i>	U
4.	Tricolored Pied Flat	<i>Coladenia indrani</i>	U
5.	Common Small Flat	<i>Sarangesa dasahara</i>	C
6.	Golden Angle	<i>Caprona ransonnettii</i>	C
7.	Black Angle	<i>Tapena thwaitesi</i>	VR
8.	Chestnut Bob	<i>Iambrix salsala</i>	U
9.	Indian Palm Bob	<i>Suastus gremius</i>	U
10.	Vindhyan Bob	<i>Arnetta vindhiana</i>	C
11.	Conjoined Swift	<i>Pelopidas conjuncta</i>	C
12.	Small Branded Swift	<i>Pelopidas mathias</i>	C
13.	Blank Swift	<i>Caltoris kumara</i>	C
14.	Rice Swift	<i>Borbo cinnara</i>	C
15.	Parnara Swift spp.	<i>Parnara</i> spp.	U
16.	Grass Demon	<i>Udaspes folus</i>	U
17.	Common Redeye	<i>Matapa aria</i>	U
18.	Dark Palm Dart	<i>Telicota bambusae</i>	U
19.	Orange Awlet	<i>Bibasis harisa</i>	C
20.	Orange-tailed Awlet	<i>Bibasis sena</i>	VR
21.	Brown Awl	<i>Badamia exclamationis</i>	C
22.	Comon Banded Awl	<i>Hasora chromus</i>	C
23.	Moore's Ace	<i>Halpe porus</i>	VR
<b>Family Papilionidae</b>			
24.	Southern Bluebottle	<i>Graphium teredon</i>	R
25.	Common Jay	<i>Graphium doson</i>	U
26.	Tailed Jay	<i>Graphium agamemnon</i>	C
27.	Spot Swordtail	<i>Graphium nomius</i>	U
28.	Common Mormon	<i>Papilio polytes</i>	A
29.	Blue Mormon	<i>Papilio polymnestor</i>	C
30.	Lime Butterfly	<i>Papilio demoleus</i>	C
31.	Common Mime	<i>Papilio clytia</i>	U
32.	Crimson Rose	<i>Pachliopta hector</i>	C
33.	Common Rose	<i>Pachliopta aristolochiae</i>	A
<b>Family Pieridae</b>			
34.	Common Emigrant	<i>Catopsilia pomona</i>	C
35.	Mottled Emigrant	<i>Catopsilia pyranthe</i>	R
36.	Pioneer	<i>Belenois aurota</i>	R
37.	White Orange Tip	<i>Ixias marianne</i>	C
38.	Yellow Orange Tip	<i>Ixias pyrene</i>	A
39.	Great Orange Tip	<i>Hebomoia glaucippe</i>	A
40.	Common Wanderer	<i>Pareronia valeria</i>	A
41.	Striped Albatross	<i>Appias libythea</i>	R
42.	Common Gull	<i>Cepora nerissa</i>	A
43.	Common Jezebel	<i>Delias eucharis</i>	U
44.	Psyche	<i>Leptosia nina</i>	A
45.	Small Salmon Arab	<i>Colotis amata</i>	VR
46.	Spotless Grass Yellow	<i>Eurema laeta</i>	U
47.	Common Grass Yellow	<i>Eurema hecabe</i>	A
<b>Family Lycaenidae</b>			
48.	Indian Sunbeam	<i>Curetis thetis</i>	R
49.	Angled Sunbeam	<i>Curetis acuta</i>	R
50.	Red Pierrot	<i>Talicauda nyseus</i>	R
51.	Common Pierrot	<i>Castalius rosimon</i>	C
52.	Angled Pierrot	<i>Caleta deciduas</i>	C
53.	Banded Blue Pierrot	<i>Discolampa ethion</i>	R
54.	Yamfly	<i>Loxura atymnus</i>	R
55.	Monkey Puzzle	<i>Rathinda amor</i>	U

56.	Indian Red Flash	<i>Rapala iarbus</i>	VR	89.	Striped Tiger	<i>Danaus genutia</i>	C
57.	Indigo Flash	<i>Rapala varuna</i>	R	90.	Common Crow	<i>Euploea core</i>	A
58.	Common Silverline	<i>Spindasis vulcanus</i>	U	91.	Brown King Crow	<i>Euploea klugii</i>	A
59.	Long-banded Silverline	<i>Spindasis lohita</i>	R	92.	Common Nawab	<i>Charaxes bhārata</i>	U
60.	Plumbeous Silverline	<i>Spindasis schistacea</i>	VR	93.	Anomalous Nawab	<i>Charaxes agrarius</i>	R
61.	Common Lineblue	<i>Prosotas nora</i>	C	94.	Tawny Rajah	<i>Charaxes bernardus</i>	U
62.	Tailless Lineblue	<i>Prosotas dubiosa</i>	C	95.	Black Rajah	<i>Charaxes solon</i>	U
63.	Dingy Lineblue	<i>Petrelaea dana</i>	VR	96.	Common Evening Brown	<i>Melanitis leda</i>	C
64.	Leaf Blue	<i>Amblypodia anita</i>	U	97.	Bamboo Treebrown	<i>Lethe europa</i>	U
65.	Dark Cerulean	<i>Jamides bochus</i>	C	98.	Common Palmfly	<i>Elymnias hypermnestra</i>	U
66.	Common Cerulean	<i>Jamides celeno</i>	C	99.	Common Bushbrown	<i>Mycalesis perseus</i>	C
67.	Pea Blue	<i>Lampides boeticus</i>	A	100.	Tawny Coster	<i>Acraea terpsicore</i>	U
68.	Gram Blue	<i>Euchrysops cnejus</i>	U	101.	Common Leopard	<i>Phalanta phalantha</i>	A
69.	Malayan	<i>Megisba malaya</i>	A	102.	Commander	<i>Moduza procris</i>	C
70.	Common Hedge blue	<i>Acytolepis puspa</i>	A	103.	Common Sailer	<i>Neptis hylas</i>	A
71.	Zebra Blue	<i>Leptotes plinius</i>	C	104.	Chestnut-streaked Sailer	<i>Neptis jumbah</i>	A
72.	Plains Cupid	<i>Chilades pandava</i>	A	105.	Short-banded Sailer	<i>Phaedyma columella</i>	A
73.	Lime Blue	<i>Chilades lajus</i>	U	106.	Common Baron	<i>Euthalia aconthea</i>	C
74.	Dark Grass Blue	<i>Zizeeria karsandra</i>	C	107.	Gaudy Baron	<i>Euthalia lubentina</i>	C
75.	Tiny Grass Blue	<i>Zizula hylax</i>	C	108.	Baronet	<i>Symphaedra nais</i>	C
76.	Pointed Ciliate Blue	<i>Anthene lycaenina</i>	U	109.	Common Castor	<i>Ariadne merione</i>	C
77.	Forget-me-not	<i>Catochrysops strabo</i>	C	110.	Chocolate Pansy	<i>Junonia iphita</i>	A
78.	Peacock Royal	<i>Tajuria cippus</i>	R	111.	Lemon Pansy	<i>Junonia lemonias</i>	A
79.	Large Oakblue	<i>Arhopala amantes</i>	VR	112.	Peacock Pansy	<i>Junonia almanac</i>	U
80.	Cornelian	<i>Deudorix epijarbas</i>	R	113.	Yellow Pansy	<i>Junonia hierta</i>	U
81.	Common Guava Blue	<i>Virachola isocrates</i>	R	114.	Blue Pansy	<i>Junonia orithya</i>	R
82.	Common Acacia Blue	<i>Surendra quercetorum</i>	U	115.	Grey Pansy	<i>Junonia atlites</i>	C
83.	Grass Jewel	<i>Freyeria trochylus</i>	R	116.	Great Eggfly	<i>Hypolimnas bolina</i>	A
84.	Silverstreak Blue	<i>Iraota timoleon</i>	VR	117.	Danaid Eggfly	<i>Hypolimnas misippus</i>	U
85.	Apefly	<i>Spalgis epius</i>	R	118.	Blue Oakleaf	<i>Kallima horsfieldii</i>	A
<b>Family Nymphalidae</b>				119.	Common Five-ring	<i>Ypthima baldus</i>	R
86.	Blue Tiger	<i>Tirunala limniace</i>	C	<b>Family Riodinidae</b>			
87.	Glassy Tiger	<i>Parantica aglea</i>	A	120.	Double-banded Judy	<i>Abisara bifasciata</i>	C
88.	Plain Tiger	<i>Danaus chrysippus</i>	R				

from South India, including Mumbai (Maharashtra), Goa, Karnataka and Kerala.

Following species were photographed only once in the area: Silverstreak Blue *Iraota timoleon*, Plumbeous Silverline *Spindasis schistacéa*, Dingy Lineblue *Petrelaea dana*, Orange-tailed Awlet *Bibasis sena*, Moore's Ace *Halpe porus*, and Small Salmon Arab *Colotis amata*.

Total 120 species were found in BNHS Nature Reserve. The family-wise abundance was family Hesperidae: 23 species (19.16%); family Papilionidae: 10 species (8.33%); family Pieridae: 14 species (11.66%); family Lycaenidae: 38 species (31.66%); family Nymphalidae: 34 species (28.33%) and family Riodinidae: one species (0.83%). The unidentified *Parnara* sifs were considered as one species, as they cannot be identified easily based on external traits such as wing patterns. Their species-level identification is based largely on structures of the male genitalia.

The butterfly abundance was as follows: Abundant: 23 species; Common: 38 species; Uncommon: 30 species; Rare: 20 species and Very Rare: 9 species.

**Acknowledgements:** Sincere thanks to the Director BNHS, Dr. Deepak Apte, who encouraged for this study. Authors are also thankful for the following BNHS staff: Dilip Giri, Abhijit Malekar, Prakash Ghadshi, Hrishikesh Rane, Rajendra Pawar, Dasharath Lad, Ashish Yadav, Vinayak Giri, Krishna Pawar, Pritam Kadam, Ms. Sugandha Kasar and Ms. Ashatai Patil.

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### Shrinking Crow Population

"In the last decade, the population of house crows has declined at such an alarming rate that the bird is hardly seen in towns and cities these days. The day is not far when this species will completely go extinct", said Dr BM Arora, president of Association of Indian Zoos and Wildlife Veterinarians.

"When the number of sparrows started declining, both government agencies and NGOs carried out several surveys and studies. However, no attention was paid to dwindling population of house crows," added Dr Arora.

Former director of NGO Bombay Natural History Society (BNHS), Asad R Rahmani, said "Due to their innate characteristic of eschewing forests for villages and cities, crow species had buoyant coexistence with humans. However, with time, large scale urbanization meant human beings not regularly feeding birds. Now crows feed on worms and grains from agricultural fields. As this new food was toxic due to presence of pesticides, its consumption started resulting in deaths."

According to experts, crows feed largely upon the refuse of human habitat. The bird which is known to clean up the environment by eating the waste is facing existential problem as people offer or give food wrapped in polythene bags. Also, the bird's nesting space has shrunk with construction of multistorey buildings in cities as it also means that there was less open area. "Shraadh is deemed incomplete until a crow doesn't eat the food offered to it," said astrologer and religious preacher Pandit SJ Goswami.

## On a Collection of Moths (Lepidoptera) from Narsingharh Wildlife Sanctuary, district Rajgarh, Madhya Pradesh

S. SAMBATH

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Narsingharh Wildlife Sanctuary is one of the important sanctuaries situated in Rajgarh district, a smaller district which lies on the edge of northern edge of Malwa Plateau of Madhya Pradesh. This sanctuary situated between 23°35' and 23°40'N latitudes and 77°2' and 77°10'E. It lies on NH 12 (Jabalpur-Jaipur), about 70 km from Bhopal. It was notified by the Government of Madhya Pradesh on 25.01.1974 and final notification for the constitution of WLS was made on 04.05.1998. The total area of this sanctuary is 57.197 km<sup>2</sup>. The area of the sanctuary is mostly undulating with gravelly and lateritic soil. There are no perennial streams inside the sanctuary, only three tanks viz., Chidikhoh Suryavanshi talab and Matawala talab which carry water throughout the year. The Chidikhoh is the biggest and most useful tank for wild animals, located in the centre of the sanctuary whereas Suryavanshi and Matawala are situated in the southern boundary of the sanctuary, of not much use to wild animals because of disturbance around them.

The forests of the sanctuary are typical mixed dry deciduous type, degraded with poor quality. Tree species like *Acacia catechu* (khair), *Boswellia serrata* (salai), *Anogeissus pendula* (kardhai), *Lannea coromandelica* (moyan), *Terminalia alata* (saja), *Sterculia urens* (kullu), *Lagerstromia parviflora* (lendia) and *Diospyros melanoxylon* (tendu) are predominantly found in this sanctuary. Common shrub species also occur such as *Carissa spinarum* (karonda), *Lantana camara* (lantana), *Santalum album* (chandan) and *Annona squamosa* (sitaphal).

The fauna of the sanctuary is relatively small but rich. Wild fauna like panther, hyena, wild boar, nilgai, sambar, spotted deer, barking deer, jackal, common langur etc. These fauna are almost concentrated around the Chidikhoh tank.

Avifauna of the sanctuary includes peacock which is frequently visible to the observers. Other birds such as egrets, stork, ibis, eagle, kingfisher, lapwing, orioles, hornbill, woodpeckers, wildfowl, partridge, quails, parakeets, etc. are local birds of the sanctuary. Overall, 164 species of birds including migratory birds can be sighted here (Dwivedi, 2003). The commonly available reptilian fauna are cobra, krait, python and tortoise. Apart from the above fauna, no other fauna were reported from this sanctuary.

Field surveys were carried out during the year, 2012-2014 to study the Geometridae fauna of Madhya Pradesh. During the field survey conducted, few moths were collected in the night with the help of light trap installed at Chidikhoh, Andhiyar coupe and near main gate of Narsingharh WLS. The geo-coordinates of the survey localities of the sanctuary were also recorded simultaneously and presented in Table 1. The collected moths were then preserved and identified with the help of available literature, resulted 25 species belonging to 25 genera and 8 families in 5 superfamilies, presented in the Table 2. The Erebidae species outnumber other moth species of Geometridae, Crambidae, Noctuidae, Nolidae, Sphingidae, Bombycidae and Thyrididae. Further, extensive field survey would be adding more moths species of the sanctuary. All species of moths have been recorded and reported for the first time from this sanctuary.

**Acknowledgements:** The author is grateful to Dr. Kailash Chandra, Director, Zoological Survey of India, Kolkata for providing necessary facilities and encouragement. Sincere thanks are also due to the Principal Chief Conservator of Forests (WL), Bhopal, Madhya Pradesh, Divisional Forest Officer, Narsingharh Wildlife Sanctuary, and Forest Guard for extending support in the field during the field survey.

**Table 1. Geo-coordinates of survey localities of Narsingharh WLS, Madhya Pradesh.**

Locality	Latitude (N)	Longitude (L)
1 Forest Rest House, Narsingharh WLS	23°39.524'	077°05.555'
2 Kotra, Narsingharh	23°35.949'	077°07.560'
3 Narsingharh Fort	23°38.064'	077°63.801'
4 Andhiyar coupe	23°39.524'	077°05.555'
5 Compartment No. 19, Narsingharh WLS	23°38.730'	077°04.660'

Table 2. Moth fauna of Narsingharh Wildlife Sanctuary, district Rajgarh, Madhya Pradesh.

Species	Family	Subfamily
Superfamily: Thyridoidea Herrich-Schaffer, 1867		
1 <i>Banisia lobata</i> Hampson, 1882	Thyrididae	Striglininae
Superfamily: Pyraloidea Latreille, 1809		
2 <i>Parponyx fluctuosalis</i> Zeller, 1852	Crambidae	Acentropinae
3 <i>Pyrausta panopealis</i> Walker, 1859	Crambidae	Pyraustinae
4 <i>Palpita annulifer</i> (Inoue, 1996)	Crambidae	Spilomelinae
5 <i>Pleuroptya balteata</i> Fabricius, 1798	Crambidae	Spilomelinae
Superfamily: Bombycoidea Latreille, 1802		
6 <i>Ocinara</i> sp.	Bombycidae	Bombycinae
7 <i>Psilogramma menephron</i> Cramer, 1780	Sphingidae	Sphinginae
Superfamily: Geometroidea Leach, 1815		
8 <i>Thalassodes quadraria</i> (Guenee, 1858)	Geometridae	Geometrinae
9 <i>Chiasmia fidoniata</i> Guenee, (1858)	Geometridae	Ennominae
10 <i>Hyperythra lutea</i> Swinhoe Stoll, 1781	Geometridae	Ennominae
11 <i>Petalia medardaria</i> Herrich-Schaffer (1856)	Geometridae	Ennominae
12 <i>Antitrygodes cuneilinea</i> Walker (1863)	Geometridae	Sterrhinae
13 <i>Idaea</i> sp.	Geometridae	Sterrhinae
14 <i>Scopula pulchellata</i> Fabricius, 1794	Geometridae	Sterrhinae
15 <i>Traminda mundissima</i> Walker, 1861	Geometridae	Sterrhinae
Superfamily: Noctuoidea Latreille, 1809		
16 <i>Euproctis lunata</i> Walker, 1855	Erebidae	Lymantriinae
17 <i>Lymantria mathura</i> Moore, 1865	Erebidae	Lymantriinae
18 <i>Pandesma anysa</i> Guenee, 1852	Erebidae	Calpinae
19 <i>Grammodes geometrica</i> Fabricius, 1775	Erebidae	Erebinae
20 <i>Ophiusa triphaenoides</i> Walker, 1858	Erebidae	Erebinae
21 <i>Trigonodes hyppasia</i> Cramer, (1777)	Erebidae	Erebinae
22 <i>Carea angulata</i> Fabricius, 1793	Nolidae	Chloephorinae
23 <i>Westermannia superba</i> Hubner, 1823	Nolidae	Westermanniinae
24 <i>Chrysodeixis eriosoma</i> Doubleday 1843	Noctuidae	Plusiinae
25 <i>Spodoptera litura</i> Fabricius, 1775	Noctuidae	Noctuinae

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**Population fluctuation of phytophagous mite, *Brevipalpus californicus* (Acari: Tenuipalpidae) and predatory mite, *Paraphytoseius orientalis* (Acari: Phytoseiidae) infesting holy basil, *Ocimum basilicum* (Lamiaceae) at Narendrapur, Kolkata (West Bengal)**

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**Abstract**

Seasonal fluctuation of phytophagous and predatory mite on *Ocimum basilicum* at Narendrapur campus of R.K. Mission Ashram is dealt with in this paper.

**Introduction**

*Brevipalpus californicus* (Bank) is an important pest of holy basil, *Ocimum basilicum* L. causing browning, drying and defoliation of leaves. It occurs more severely during January-August and thereafter its infestation subsides. Another mite, *Paraphytoseius orientalis* (Narayanan et al.) was also found associated as predator with *B. californicus* on that host. Since no study has been made earlier regarding population fluctuation of these two mites, it was thought desirable to carry out a preliminary study in this regard and the results thereof are presented in this paper.

**Material and Methods**

For sampling of mite infested leaves, 10 basil plants of same age and maturity were selected at random in the Medicinal Plant Garden of Narendrapur and from each of the plant 10 leaves were plucked. As such, altogether 100 leaves were plucked and mite population was counted by examining those leaves under Stereo binocular microscope. Along with population count, the abiotic factors like the monthly mean

temperature and RH for the entire study period were recorded to correlate the population with these factors. The study period covered January - July 2016, as thereafter the population disappeared.

**Results and Discussion**

The initial population of *B. californicus* during January 2016 was 3.50 per leaf and that of the predatory mite (*Paraphytoseius orientalis*) was 6.91 per leaf. The temperature and RH during that period were 18.32° C and 67.50%, respectively. The population of both in the following month was maintained more or less at the same level. Increase in population of both started in March becoming 4.21 and 7.38 per leaf in case of *B. californicus* and *P. orientalis*, respectively when the mean temperature and RH were 26.31° C and 65.29%, respectively. Almost same level of population was found during April also. However, with the further increase of temperature in May, the population of *B. californicus* increased considerably to become 9.51 per leaf when temperature and RH were 30.12° C and 72.12%, respectively. The peak population of *B. californicus* was attained in June when it was 9.70 per leaf and that of *P. orientalis* dropped down further to become 2.17 per leaf (Table 1). The mean temperature and RH during that month were 31.15° C and 75.62%.

**Table 1. Population fluctuation of *Brevipalpus californicus* and *Paraphytoseius orientalis* on *Ocimum basilicum* at Narendrapur campus of R.K. Mission, during January - July, 2016.**

Month/Year	Mean population <i>Brevipalpus californicus</i> per leaf	Mean population <i>Paraphytoseius orientalis</i> per leaf	Abiotic factors	
			Mean Temperature(°C)	Mean RH(%)
January 2016	3.50	6.91	18.32	67.50
February 2016	3.69	7.01	22.52	65.20
March 2016	4.21	7.38	26.31	65.29
April 2016	4.42	4.13	27.81	70.10
May 2016	9.51	3.20	30.12	71.12
June 2016	9.70	2.17	31.15	75.62
July 2016	2.91	4.12	30.15	70.64

Table 2. Correlation coefficient (r value) of phytophagous and predatory mites with abiotic factors.

Variables	Phytophagous mite ( <i>B. californicus</i> )	Predatory mite ( <i>P. orientalis</i> )	Mean Temperature	Mean RH
Phytophagous mite ( <i>B. californicus</i> )	-	0.048	0.018	(-)0.229
Predatory mite ( <i>P. orientalis</i> )	0.032	-	0.681	(-)0.630

respectively. However, in July, the population of *B. californicus* dropped down considerably to become minimum of 2.91 per leaf but the predatory mite population increased to 4.12 per leaf. The mean temperature and RH during that month were 30.15°C and 70.62%, respectively (Table 1).

From overall analysis of data to find out the correlation coefficient (r value) (Table 2), it appeared that population of *B. californicus* was positively correlated with predatory mite and temperature and negatively with RH while the popula-

tion of *P. orientalis* was positively correlated with temperature and negatively with RH. Since earlier studies are not available, the present result could not be compared with those of others.

**Acknowledgements:** The authors offer sincere thanks to the National Medicinal Plants Board, Govt. of India, for funding the project; and to Swami Sarvolokananda Maharaj, Secretary and Swami Vasavananda Maharaj, Assistant Secretary, R.K. Mission, Narendrapur, for providing laboratory facilities and encouragement.

## Climate Change

### Increase in Temperature in Upper Himalayas Affecting 40 Species

SHIVANI AZAD

A study by scientists of the Dehradun-based Wildlife Institute of India (WII) in the Bhagirathi basin near Gaumukh has revealed that in the last two years, there has been a rise of at least 0.5 degree temperature accompanied by an almost 10% variation in humidity levels in upper Himalayas in Uttarakhand at an altitude between 3500-4500 meters. This alteration in temperature, will have direct impact on 40 species of animals and birds having their habitats in the region like Snow leopard, Musk deer, Himalayan snowcock and Snow partridge which are "under stress due to the escalated temperature." "Even a 0.5 degree rise in temperature in the past two years in the upper Himalayas affects the equilibrium of the sensitive species living in these regions. If this persists, we fear that the sensitive ones will phase out and only the tough ones would be able to survive the changed environment", said Dr S Satyakumar, Scientist (G), WII, that is being monitored by the National Action Plan on Climate Change.

The variation in temperature in these altitudes—the maximum temperature at 4500 metres touches 5 degree celsius while the minimum plunges to -14 whereas at 3500 metres, the maximum temperature is 10 degrees celsius while the minimum is around -2.5 degrees — is affecting not just animals but also the vegetation. "Flowering patterns are now happening in May instead of June."

Rains are happening in late September which is unusual since this is the autumn season. These variations are

going to have consequences," he added.

Elaborating, he said, "In response to the changed temperatures in alpine meadows which are the grazing and hunting sites for the species inhabiting the region, premature budding and flowering happens in plants. This leads to a change in the activities of insects. In response, birds will have to change their patterns.

Scientists have now begun monitoring the effects of the climate change on animals like Snow leopard, Musk deer, Kashmir stag, Himalayan mouse hare (among mammals) and Himalayan snowcock and Snow partridge among birds. In addition, aquatic species like Golden mahseer, Snow trout and Gangetic mystus are also being monitored. Further, flora like Himalayan birch, White lily, Tibetan sea buckthorn, Spotted heart orchid, Himalayan fir and Sikkim Rhubarb are under the scanner of WII too. In some species, notable changes have already begun to be observed.

"Our researchers have identified that Himalayan mouse hare, a kind of rodent unique to the alpine area is unable to adapt to the new environment. During snowbound months, it goes inside its burrows under partial hibernation.

A study by the dean of WII, GS Rawat sometime ago had found that the Golden mahseer which was earlier breeding at altitudes of 600 to 700 meters was now being found in heights of 1200 to 1300 meters, indicating its need for a cooler environment.

**Extension of the known distribution of the Dingy Lineblue butterfly,  
*Petrelaea dana* (de Niceville, [1884]) to Bastar, Chhattisgarh  
(Lepidoptera: Lycaenidae)**

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Raipur - 492007 (Chhattisgarh).

### Introduction

*Petrelaea dana* (de Niceville, [1884]) is a Lycaenid butterfly which is known from Uttarakhand to North East India; Maharashtra to Kerala; Jharkhand and Andaman Islands in India (Varshney & Smetacek (eds.), 2015). Kehimkar (2016) reports it as a forest species of low elevations which flies between March to November. Members of this group are not known to be migratory.

### Material and Methods

Opportunistic surveys were undertaken on 24 and 25 July, 2018 in Kurandi Range of Kanger Valley National Park, Bastar, Chhattisgarh. The paths followed on foot were randomly chosen and the main criterion for choosing suitable paths was the likelihood of encountering butterflies along the way.

Kurandi range is a dense forest which has sal and bamboo as major vegetation along with thick undergrowth. During the survey, in between regular thunderstorms a group of mud puddling Lycaenids comprising of Hedge Blues, Lineblues and Plain Cupid was photographed on a forest track at 2.20 pm.

While examining the photographs it appeared that one of the members of the mud puddling congregation was a Dingy Lineblue. This was confirmed by Peter Smetacek.

### Discussion

Chandra et al. (2014) reported *Petrelaea dana* from GGNP, Koriya district on 17th August 2011 and in Lalpur Range of Kawardha Forest Division on 23rd September 2012. But the only evidence they provided is a misidentified photograph of *Prosotas dubiosa* (Semper, [1879]). It therefore seemed that the species might not occur in Chhattisgarh or along the Eastern Ghats.

A single subspecies of the butterfly occurs in India. The known distribution of this species is disjunct with no known connecting links between the Peninsular Indian and Himalayan populations. The discovery of the Chhattisgarh population suggests that the peninsular Indian and Himalayan population of the species might be linked via the East-

ern Ghats.

**Acknowledgements** : Author is grateful to Mr. Peter Smetacek, Butterfly Research Centre, Bhimtal, Uttarakhand, for his help in writing this note and identification of the species. Thanks to Mr. Ravi Naidu from Jagdalpur for being the local resource on field.

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(Contd. from page 110)

connect to our neocortex by the year 2029".

He remarks, "It will just be a chip in our brain like a smartphone in our hands." With the supercomputing power of AI and chips embedded in our brains, he predicts we are only about eleven years away from acquiring superhuman qualities by integrating the best of what man and machine together can accomplish.

And if that happens, we become the superheroes of the Avengers team — who would have not only saved the world from extinction but taken the human race to the next evolutionary plane.

It's worth remembering that if the primitive caveman who lived millions of years ago in the Paleolithic era—without electricity, cars, railroads, airplanes and medical advances—were to see the progress we have made until now, even without AI, we are already demi-gods in his eyes! The man-machine debate in AI, then, just becomes a matter of perspective.

## Moth Fauna of the Kheoni Wildlife Sanctuary, District Dewas, Madhya Pradesh

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Kheoni Wild Life Sanctuary (KWLS) is situated in Kannod tehsil of Dewas district. It was first notified in the year 1955 vide Madhya Bharat, Gwalior notification No. 5898-10-F-55 dated 05.12.1955. This area was previously the hunting reserve of rulers of Holkar state. The area was rich in forest and wildlife. Earlier, the forests of Dewas Forest Division were included in the wildlife sanctuary. Subsequently, in the year 1982, some areas of Sehore Forest Division were also included and a fresh notification was issued by Government of Madhya Pradesh No. 15-4-X-(2)-82 dated 04.12.1982, with a total area of 132.77 km<sup>2</sup>. It includes 28.12 km<sup>2</sup> Reserved Forest, 104.66 km<sup>2</sup> Protected Forest. Keoni Wildlife Sanctuary lies between N latitude of 22°12' and 22°23' and E longitudes of 75°3' and 75°38'. This WLS is 115 Km from Bhopal, 35 Km from Ashta and 65 Km from Dewas. This sanctuary is connected to the Ratapani Wildlife Sanctuary.

There is an acute shortage of water in the sanctuary, particularly during the summer. The water sources which exist in the WLS are seasonal and dry up after February. There are 4 tanks and 17 jhirias, but many of these dry up in the summer. Some hand pumps have been dug up to augment the water supply.

### Flora

The forests of the sanctuary belong to Dry Deciduous type with teak (*Tectona grandis*) as a predominant species. Other species associating with teak are saj (*Terminalia alata*), dhaora (*Anogeissus latifolia*), salai (*Boswellia serrata*), moyan (*Garuga pinnata*), anola (*Emblia officinalis*), dhaman (*Grewia tilifolia*), haldu (*Adina cordifolia*), Kalam (*Myrtagyna parvifolia*) khair (*Acacia catechu*), kullu (*Sterculia urens*), mahua (*Madhuca latifolia*), bija (*Pterocarpus marsupium*) and palas (*Butea monosperma*). On hill tops, salai (*Boswellia serrata*) and gurjan (*Lannea coromandelica*), form almost pure crop. Khair (*Acacia catechu*) tends to become pure on shallow and rocky soils. Bamboo (*Dendrocalamus strictus*) also occurs in better areas particularly in valleys.

### Fauna

Kheoni WLS has a sizeable species of wild animals.

Among the fauna of this sanctuary carnivores like tiger and panther are most important wild animals of this sanctuary. Other carnivore species found in the sanctuary include hyena, wild dog, jackals and wolf. Among herbivores, important species include spotted deer, sambar, nilgai, chausingha and barking deer. Rhesus macaque and common langur are common primates. Smaller mammals include field mouse, squirrel, porcupine, etc. Fauna like sambar, wild boar, barking deer, four-horned antelope, and palm civet are also observed but rarely sighted.

Avifauna of the WLS has not been studied properly. Common birds of this sanctuary include common crow, night jar, sand grouse, myna, peafowl, Indian roller, babbler, vultures, bulbul, lapwing, peacock, cuckoo, tailor bird, wood pecker, kingfisher, tree pie, wagtail, parakeet, crow pheasant, dove, etc. Among reptilia, garden lizard, chameleon, skink, Bengal monitor, snakes, etc. are generally seen. Among snakes, cobra, common krait, Russel's viper and python are commonly found in this sanctuary. Besides, no study has been reported on the moth fauna of Kheoni WLS.

Hence, attempt has been made to record the moth fauna of this sanctuary, during Geometridae survey of Madhya Pradesh, under the in-house research programme of Zoological Survey of India, Central Zone Regional Centre, Jabalpur, during the year 2012-14. The study yielded to record 39 species of moths belonging to 39 genera in six superfamilies. The superfamily Noctuoidea outnumbers the other superfamilies. All moth species recorded for the first time from this sanctuary. There would be more moth species available from this sanctuary. Hence, further intensive survey could add more number of species which would be highly significant for the better management of insect biodiversity of the sanctuary, especially moths.

**Acknowledgements:** The author is grateful to Dr. Kailash Chandra, Director, Zoological Survey of India, Kolkata for providing facilities and encouragement. Sincere thanks are also due to the Principal Chief Conservator of Forests (WL), Bhopal, Madhya Pradesh, Divisional Forest Officer, Narsingharh Wildlife Sanctuary, and Forest Guard, for extending support in the field during the period of field survey.

Table 1. Moth Fauna of Kheoni Wildlife Sanctuary, District Dewas, Madhya Pradesh.

Species	Family	Subfamily
Superfamily: Zygaenoidea Latreille, 1809		
1 <i>Altha subnotata</i> Walker, 1865	Limacodidae	-
2 <i>Miresa albipuncta</i> Herr.-Schaffer, 1854	Limacodidae	Limacodinae
3 <i>Parasa hilaris</i> (Westwood, 1848)	Limacodidae	-
4 <i>Phacoderma velutina</i> Kollar, 1844	Limacodidae	-
Superfamily: Thyridoidea Herrich-Schaffer, 1867		
5 <i>Dixoa albatalis</i> Swinhoe, 1889	Thyrididae	-
6 <i>Rhodoneura</i> sp.	Thyrididae	Siculodinae
Superfamily: Pyraloidea Latreille, 1809		
7 <i>Omiodes diemenalis</i> Guenée, 1854	Crambidae	Spilomelinae
8 <i>Parotis marginata</i> Hampson, 1893	Crambidae	Spilomelinae
9 <i>Pygospila tyres</i> Cramer, 1780	Crambidae	Spilomelinae
10 <i>Tyspanodes linealis</i> Moore, 1867	Crambidae	Spilomelinae
Superfamily: Bombycoidea Latreille, 1802		
11 <i>Eupterote</i> sp.	Eupterotidae	Eupterotinae
12 <i>Actias selene</i> Hubner, 1806	Saturniidae	Saturniinae
13 <i>Agnosia orneus</i> Westwood, 1847	Sphingidae	Smerinthinae
14 <i>Marumba indicus</i> Walker, 1856	Sphingidae	Smerinthinae
15 <i>Agrius convolvuli</i> Linnaeus, 1758	Sphingidae	Smerinthinae
16 <i>Psilogramma menephron</i> Cramer, 1780	Sphingidae	Sphinginae
Superfamily: Geometroidea Leach, 1815		
17 <i>Amraica recursaria</i> Walker, 1860	Geometridae	Ennominae
18 <i>Biston suppressaria</i> Guenée, 1857	Geometridae	Geometrinae
19 <i>Chiasmia fidoniata</i> Guenee, (1858)	Geometridae	Ennominae
20 <i>Traminda mundissima</i> Walker, 1861	Geometridae	Sterrhinae
Superfamily: Noctuoidea Latreille, 1809		
21 <i>Allata argentifera</i> Walker, 1862	Notodontidae	Pygaerinae
22 <i>Antheua servula</i> Drury, 1773	Notodontidae	Phalerinae
23 <i>Neocerura liturata</i> Walker, 1855	Notodontidae	Cerurinae
24 <i>Phalera grotei</i> Moore, 1859	Notodontidae	Phalerinae
25 <i>Euproctis lunata</i> Walker, 1855	Erebidae	Lymantriinae
26 <i>Olepa ricini</i> Fabricius, 1775	Erebidae	Arctiinae
27 <i>Tatargina (Hindergina) sipahi</i> (Moore, 1872)	Erebidae	Arctiinae
28 <i>Asota ficus</i> Fabricius, 1775	Erebidae	Aganainae
29 <i>Achaea janata</i> (Linnaeus, 1758)	Erebidae	Erebinae
30 <i>Artena dotata</i> Fabricius, 1794	Erebidae	Erebinae
31 <i>Bastilla torrida</i> Guenee, 1852	Erebidae	Erebinae
32 <i>Grammodes stolidia</i> Fabricius, 1775	Erebidae	Erebinae
33 <i>Ophiusa tirhaca</i> Cramer, 1777	Erebidae	Erebinae
34 <i>Aegocera bimacula</i> Walker, 1854	Noctuidae	Agaristinae
35 <i>Chrysodeixis eriosoma</i> Doubleday 1843	Noctuidae	Plusiinae
36 <i>Xanthodes intersepta</i> Guenee, 1852	Noctuidae	Bagisarinae
37 <i>Acantholipes trajectus</i> (Walker, 1865)	Noctuidae	-
38 <i>Callyna costiplaga</i> Moore, 1872	Noctuidae	Noctuinae
39 <i>Callyna jugaria</i> Walker, 1858	Noctuidae	Noctuinae

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### '14 of world's 15 worst polluted cities in India' Kanpur Tops the List in terms of PM 2.5

Delhi is not the most polluted city in the world. But that is hardly any reason to cheer. The WHO global air pollution database released in Geneva reveals that India has 14 out of 15 most polluted cities in the world, in terms of PM 2.5 concentration, with the worst being Kanpur.

Despite public outcry over severe air pollution, and both Centre and Delhi governments taking up the issue, WHO's database of more than 4,000 cities in 100 countries shows that Delhi's pollution levels improved only marginally between 2010 and 2014, but started deteriorating again in 2015.

In 2016, the latest WHO's database, Delhi recorded the highest pollution levels in six years. The city's PM 2.5 annual average was 143 micrograms per cubic metre, more than three times the national safe standards, while the PM 10 average was 292 micrograms per cubic metre, more than 4.5 times the national standard.

The Central Pollution Control Board (CPCB) had recently claimed that air pollution levels improved in 2017 as compared to 2016. The board, however, hasn't released the annual average PM 2.5 concentration for 2017 yet.

A number of policies came into effect towards the end of 2016—the graded response action plan (GRAP) in October, doubling of the environment compensation charge (ECC) on trucks in December 2015 and better coordination among NCR states on pollution control.

The WHO report however doesn't reflect this because it considers annual PM 10 and PM 2.5 averages between 2010 and 2016 for this database. Data sources for Delhi is mainly from CPCB (about 10 stations), although for the years 2015 and 2016, WHO has also considered data from Ministry of Earth Sciences (MoES) and US Environment Protection Agency's (EPA) Air Now. This may have also influenced the air pollution concentrations for 2015 and 2016, experts said.

Kanpur tops the list with a PM 2.5 concentration of 173 micrograms per cubic metre, followed by Faridabad, Varanasi and Gaya. "With improved air quality monitoring, we are beginning to understand the depth and spread of the air pollution problem in India. While Delhi is at the crossroads and is expected to bend the curve post 2016, other pollution hot spots are proliferating across the country" said Anumita Roy Chowdhury, executive director, Centre for Science and Environment (CSE).

Some of the well known reasons for the pollution in Indian cities are—vehicular exhaust emissions from the diesel and petrol vehicles; dust and debris dispersal due to construction activities; road traffic particularly lorries; and burning of farming residues (called *parali*).

The population explosion and subsequent migrations from rural to urban areas escalate the pollution levels, in air, water, soil and noise. Plastic pollution is another scourge of cities.

## Research Notes

### RANGE EXTENSION OF THE BENGAL SPOTTED FLAT BUTTERFLY, *CELAENORRHINUS PUTRA* IN MUMBAI, MAHARASHTRA

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The author hereby reports the occurrence and range extension of the Bengal Spotted Flat *Celaenorrhinus putra* (Moore, [1866]) in Mumbai, Maharashtra. The butterfly was seen many times in the butterfly garden of the BNHS Nature Reserve. Here is a list of dates on which the species was photographed nectaring in the butterfly garden in the BNHS Nature Reserve in Goregaon, Mumbai:

08 November 2016 (2 individuals, 09.30 am), 21 September 2017 (2 individuals, 10.18 am, 06.45 pm), 8 October 2017 (one individual, 9.35 am), 9 October 2017 (two individuals, 11.10 am), 13 October 2017 (one individual, 12.45 pm), 16 October 2017 (one individual, 9.45 am) and 10 October 2018 (3 individuals, 4 pm till 06.30 pm).

Some of the best pictures of the species have been uploaded on Wikipedia commons website (<https://en.wikipedia.org>) and available for review. The species can be identified from the two big semi-transparent spots on the upperside of forewings which are loosely connected, but the top most spot does not touch the leading edge of the fore wing. Whereas in Common Spotted Flat *Celaenorrhinus leucocera* (Kollar, [1844]) the semi-transparent white spots on the upperside of forewings are joined together and the top most spot touches the leading edge of the fore wing.

Bengal Spotted Flat was observed nectaring in the mornings or evenings. On all occasions it was nectaring on the Indian Snakeweed *Stachytarpheta indica*. Only once it was seen patrolling a small area of less than 10 square metres in the evening. The flight was swift and hovered in circles around a forest path. All the observations were taken during the three months of September, October and November. There is another similar looking species of skipper, namely, the Common Spotted Flat *Celaenorrhinus leucocera* (Kollar, [1844]). The photographs were segregated using the field guides mentioned in the references.

BNHS Nature Reserve is a 33 acres dense forest land where the Conservation Education Centre of BNHS is situated. It lies nestled between the Sanjay Gandhi National Park and the Dadasaheb Phalke Film City in Mumbai.

Bengal Spotted Flat was reported from only Sikkim to North-east India (Kehimkar, 2008 and 2016); Varshney & Smetacek (eds.) (2015). It is also found beyond Nepal, Bhutan and Myanmar.

It was not reported in South India in these older publications. Publications related to butterflies of Mumbai area also did not mention any sightings of the species (Gaonkar, 1996; Sharma & Chaturvedi, 2006; Patwardhan, 2010; Kasambe, 2012; Rodrigues, 2012; Patwardhan, 2014).

However the website (Bhakare et al. 2018) has many photographic records of the species from South India, most taken after 2008. There are photographic records from Amboli, (district Sindhudurg, Maharashtra), Dandeli in Uttara Kannada District of northern Karnataka southward to central Kerala in the Western Ghats, ca 1,500 to 2,000 km away from the previously known range of the species (Bhakare et al. 2018). Now there are many records of the species from Goa, Karnataka and Kerala. The website also has three photographs by Vikrant Jathar taken on 17 October 2014 and by Abhijit Jagtap taken on 18 October 2014, in Yeoor range of Sanjay Gandhi National Park, district Thane.

The *BNHS Field Guide—Butterflies of India* by Kehimkar (2016) also mentions the updated distribution of the species in south India as “Western Ghats (Maharashtra southwards)”. These observations by the author clearly indicate range extension of the species upto Mumbai where as it was reported in Western Ghats.

**Acknowledgements:** Thanks to Omkar Joshi, Priyadarshini Supekar and Bhagyashree Grampurohit for their help during observations.

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## RECORD OF CHOCOLATE ALBATROSS BUTTERFLY, *APPIAS LYNCIDA* IN THANE CREEK FLAMINGO SANCTUARY, MUMBAI (MAHARASHTRA)

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On 27th October 2012, the author visited Bhandup Pumping Station area for survey of birds and butterflies. The area has been declared as Thane Creek Flamingo Sanctuary in 2015. During the survey the author found a butterfly which was photographed by his friend Mr. Nandish Songire. It had the underside of hind wing bright yellow with outer border chocolate in colour. It was later identified as Chocolate Albatross *Appias lyncida* (Boisduval, 1836) from the photograph.

There are only few records of the species from Mumbai area. Patwardhan (2010) recorded a specimen on 29th October 2006 and a second on 02nd November 2009 in Sanjay Gandhi National Park (SGNP).

The website [www.ifoundbutterflies.org](http://www.ifoundbutterflies.org) (Saji et al. 2018) has two photographic records from SGNP, one by Sarvesh Abhyankar of an individual on 01st May 2015 and another by Yuwaraj Gurjar on 02nd November 2008. There are two records by Swapnil Lokhande 10th December 2011 and 13th

January 2014 from IIT Powai campus, Mumbai. There is one record from Pelhar dam, Vasai in Palghar district, which is northwards.

Another nearest record is from Kihim in Raigad district. The species was photographed by Salman Abdulali here. There are more records from farther south, i.e. Ratnagiri and Sindhudurg districts in Maharashtra and down south in [www.ifoundbutterflies.org](http://www.ifoundbutterflies.org) (Saji et al. 2018).

Wynter-Blyth (1957) mentions the distribution of the species as "along the foot of the Western Ghats and in the Nilgiris". Kehimkar (2016) gives the updated distribution as "South India up to Mumbai, Uttarakhand, Arunachal Pradesh, Northeast, Odisha & Nicobar Islands".

Chocolate Albatross is a rare butterfly in Mumbai area and only above few records of sightings are available. This one is from Thane Creek Flamingo Sanctuary where the habitat is mostly mangroves, littoral forest, mudflats and salt pans, thus very different from SGNP and the Western Ghats. Sighting of the rare species in such an open habitat is an important record. The record quoted in the note might reveal the northernmost limit of distribution of the species in South India.

*Acknowledgement:* Thanks to Sri Nandish Songire for accompanying during the field visit.

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[Other references are as given in the above research note

—Ed.]

## NEW ADDITIONS TO THE MITE FAUNA ASSOCIATED WITH MEDICINAL PLANTS IN SOUTH BENGAL

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This paper reports the occurrence of 9 species of mites under 5 genera, 3 families, 2 orders not hitherto known to occur on medicinal plants in South Bengal.

Gupta & Bose (2017) reported 120 species of mites under 44 genera, 15 families, 3 orders collected from 158 species of medicinal plants from 11 districts of South Bengal. Thereafter, by making further collection from some more areas of South Bengal and subsequent identification of those, revealed the occurrence of another 9 species, not hitherto reported on medicinal plants and all those are included in this paper.

The mites were collected from different medicinal plants from different districts of South Bengal during 2017-18. Those were preserved in 70% ethyl alcohol and were identified under stereo research microscope.

A total of 9 species of mites under 5 genera, 3 families and 2 orders could be identified (Table 1). None of those were reported earlier on medicinal plants while some were new reports from India. The Table 1 provides data regarding their host/habitat records, districts wherefrom collected and importance and hence it is self-explanatory.

**Acknowledgements :** The authors offer sincere thanks to the National Medicinal Plants Board, Govt. of India, for funding the project under which the present work was done. Thanks are also due to Swami Sarvolokananda Maharaj, Secretary and Swami Vasavananda Maharaj, Assistant Secretary, R.K. Mission, Narendrapur, for providing laboratory facilities and encouragement.

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Gupta, S.K. & Bose, S. 2017. Mites (Acari) on medicinal plants in South Bengal, India. *Rec. Zool. Surv. India*, 117 (2) : 1-29.

**Table 1. Additional list of mites collected from medicinal plants in South Bengal.**

Family/ Species	Host/ Habitat	District	Remarks
1 Family Tetranychidae <i>Oligonychus iselemae</i>	<i>Avicennia alba</i>	South & North 24 Parganas	A reasonably high infestation observed during May-September on upper leaf surface and feeding caused brownish patches towards leaf tips and leaf margins, occasionally found on lower surface as well.
2 <i>Oligonychus pratensis</i> (Banks)	<i>Cyperus rotundus</i>	South & North 24 Parganas	Infestation noticed on under surface of leaf producing whitish stippings, new report from India.
3 <i>Tetranychus turkestani</i> (Ugarov & Nikolski)	<i>Nyctanthes arbor-tristis</i>	Birbhum	Mild infestation, no damage done.
4 Family Tenuipalpidae <i>Tenuipalpus hastaligni</i> DeLeon	<i>Lagerstroemia speciosa</i>	South & North 24 Parganas	Infestation acute during summer months, disappear during rainy season, reappear in October and remain till March. The infestation appears mostly on upper surface of leaves along mid rib causing production of chocolaty-brown patches and such leaves dry up and defoliate.
5 <i>Brevipalpus dipholisi</i> DeLeon	<i>Phyllanthus debilis</i>	Burdwan	Casual occurrence, no damage. New report from India.
6 <i>Brevipalpus trinidadensis</i> Baker	<i>Butea monosperma</i>	Purulia	Casual occurrence, no damage. New report from India.
7 <i>Dolichotetranychus floridanus</i> (Banks)	<i>Cassia fistula</i>	South 24 Parganas	Casual occurrence, no damage.
8 Family Phytoseiidae <i>Amblyseius</i> sp. near <i>schusteri</i> (Chant)	<i>Calotropis gigantea</i>	South 24 Parganas	Interesting species, may be new.
9 <i>Amblyseius</i> sp. near <i>invictus</i> Schuster	<i>Curcuma longa</i>	South 24 Parganas	Interesting species, maybe new.

## Obituary

### V. K. GUPTA

(14.3. 1932—24.12.2017)

Virendra Kumar Gupta, an acclaimed taxonomist, who contributed immensely to the Hymenoptera and the insect diversity of the Oriental insects left for heavenly abode on 24th December, 2017, when attaining the age of 85. He was born on 14th March, 1932 at Delhi, and was at the University of Delhi until he left for USA and settled at Gainesville, Florida. Virendra was a resident of Indiana at the time of passing.

Virendra obtained his Ph.D in Entomology from the University of Michigan, Ann Arbor. He had contributed to the Ichneumonidae of Hymenoptera with innumerable species descriptions while he was teaching and guiding students for research at the Department of Zoology, University of Delhi for more than two decades. His contributions to the Hymenoptera, in particular and Oriental Insects, in general, are unparalleled and extraordinary. The collections that he enriched on the Ichneumonidae and finally housed at the Division of Plant Industry are a notable achievement for the Hymenoptera research.

While he was Professor of Zoology at the University of Delhi for more than 20 years, he was devoted towards insect taxonomy with publication of the journal *Oriental Insects* through the Association for the study of Oriental Insects. He had the unique opportunity of working with stalwarts like M.S Mani at the St John's College, Agra, M.L. Roonwal at the Zoological Survey of India, S.M. Alam at the Aligarh Muslim University, T.N Ananthkrishnan, Loyola College, Chennai, G.P. Sharma and G.L. Arora, Punjab University, Chandigarh, M.G. Ramdas Menon, IARI, New Delhi, and many such taxonomists during his stint at the University of Delhi and nurtured many students in taxonomy of Oriental insects and mites.

Virendra spent an equally more 20 years of period at the University of Florida, Gainesville. Virendra's wife Santhosh Gupta associated and collaborated in his work on the faunistics survey of ichneumonids of Florida during 1986 to prepare a monograph. During this period, Virendra worked on the revision of catalog on the Indo-Australian Ichneumonidae, Volume 1 of the Fauna of India, and revision of the world species of *Microcharops*. When Henry and Marjorie Townes moved themselves from Ann Arbor, Michigan to 3005, 56th Avenue, Gainesville, Florida in two buildings of the American Entomological Institute with storage space for 1.5 million specimens, Gupta's Ichneumonidae col-

lections got housed in there. His Ichneumonidae collection was the second largest of all such collections. Ever since Virendra joined University of Florida, his collection of Hymenoptera of over 35000 specimens, including types of Braconidae and Hymenoptera were donated by the Delhi University to the Zoological Survey of India, Kolkata, at that time under the care of Dr J.K. Jonathan, In Charge Hymenoptera. Virendra retired in November, 2003 from the University of Florida, moved out of his labs and office, and had the temporary use of a room for his office.

During this period, Virendra continued as Founder Editor, with the *Oriental Insects* under the Associated Publishers, and also taking care of the publications of the American Entomological Institute, with publication of Memoirs, and with many monographs. Thus he contributed to the dissemination of taxonomic work on the Oriental insect fauna exemplarily. The 46 years of publishing the *Oriental Insects*, with meager resources during more than half of these will ever remain immortal speaking volumes of his devotion to insect taxonomy. It is only with the volume 43 of the *Oriental Insects* published in 2009, and up to volume 46 of 2012 with the cooperation of Prof. V V Ramamurthy, at IARI, as the Chief Editor, he availed a break with the publication of the *Oriental Insects*. He continued to guide the journal as Founder Editor, when it was subsequently taken over by the Taylor and Francis, UK.

Virendra always urged that the tropics abound with insects diversity, yet we hardly know about a tenth of them. He was of the view that destruction of natural habitats due to deforestation, monoculture and urbanization results in their extermination or change of habits, and often leads to devastating results. He was of the view that if the insects are to be properly managed for the benefit of mankind, an inventory of them should be taken before they are destroyed and their habits and habitats studied. He always felt that a team of well trained taxonomists is required, and he had encouraged many such taxonomists during his entire life. His support to the taxonomists from the entire Oriental region including India, China, and other South Asian countries was overwhelming and will be remembered forever, as well his devotion to the study of Oriental insects and mites.

He is survived by his wife, Santosh, his two sons, Mayank and Varun, and four grandchildren now at Sunnyvale, California. Many of his contemporaries like me will miss him badly and it is a huge loss.

—Dr. Swaraj Ghai

(Ex Head/Professor, Division of Entomology, ICAR-IARI, New Delhi-110012)

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