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# Bionotes

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**Vol. 18, No. 2** **April — June, 2016**

## Lunar Tides Beaching Dead Whales, Dolphins

### Strandings occur during New Moon and Full Moon Phases on the Maharashtra Coastline

While climate change is real and rising levels of manmade pollution continues to pose serious threats to marine life, the beaching of dead dolphins and whales every fortnight on the Mumbai's seacoast might have the moon and its pull on the tides to blame for disorientating marine mammals and driving them to their deaths.

A year long study by Myvets Charitable Trust & Research Centre, to assess pathological, seasonal and anthropogenic causes, reveal that most of the strandings occurred during the new moon and the full moon phase and during receding tides in the region.

The finding of a hump-back dolphin along the Worli seaface on 25 March 2016 morning, too, was an occurrence three days ahead of a full moon.

A total of 13 deaths have been reported in the past one year. There have been up to 70 unreported deaths of marine mammals washed out on Maharashtra shores and deep mangroves.

What seems like a spate of whale and dolphin strandings on Maharashtra's coastline in a year is in fact not a new phenomenon, "It's been happening for decades. People are now alert to these sightings, thanks to phone cameras and social networks and young scientists are taking reasonable interest in it," explained Chennai-based Kumaran Sathasivam, author of *The Marine Mammals of India* and who runs a database of marine mammal strandings. "Forensic investigations indicated that the animals were healthy when stranded," said Madhurita Gupta, wildlife conservationist and President of Myvets. "After opening the carcass of most dolphins, no plastic or foreign body was found inside the stomach; nor were there any parasitic infestations inside the intestines. Teeth showed no signs of aging. Only the two whales washed ashore at the Gorai and Juhu beaches had suffered injuries on the tail fin".

The findings pointed to an error in navigation within the social group of the mammals. A correlation between marine mortality and the lunar cycle fluctuations in the ocean bed, unusual currents and increased tidal bulges—preventing whales and dolphins from geo-navigating effectively. Quakes around those dates causing seismic shifts on the seabed seem to have addled their navigation further, the reasearchers said.

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# BIONOTES

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# State of GM Crops in India and the World

**For & Against Debate**

• Making hybrid seeds is a laborius technical process and costly, while varities a result of generations of selective breeding.

• Regular seeds can be reused, have lower yields, cheaper and widely available.

• GM crop seeds have higher yields, can't be reused, costlier.

• When crops failed in the past, farmers could save seeds, replant.

• GM seeds contain so-called 'terminator technology', meaning they have been genetically modified, so resulting crops do not produce viable seeds of their own.

• Farmers have to buy new seeds each year.

**Cultivation and Field Trials in**

1. Punjab (Mustard, Maize)
2. Haryana (Maize, Cotton)
3. Rajasthan (Cotton)
4. Delhi (Mustard)
5. Gujarat (Maize, Cotton)
6. Maharashtra (Brinjal, Rice, Maize, Cotton)
7. Karnataka (Cotton)
8. Andhra Pradesh (Chickpea, Cotton).

**State of BT Crops in India**

**BT Cotton**

• BT cotton grown in India for over a decade—output up fourfold since commercial cultivation allowed in 2002.

• 95% of 11-12m ha under the crop is GM cotton.

• Punjab and Haryana produce 4m bales (1 bale = 170kg) of India's total output of 38m bales.

**Controversy**

• BT cotton, supposed to be immune to pests, crumbled under whitefly attack in Punjab in 2015. [see page 43].

• Over 95% damaged crop was BT cotton. Rs 4.5k cr estimated loss.

• Blamed for over a dozen farmer suicides.

**Forecast**

• US says India will surpass China as world's largest cotton producer in 2015-16.

• India's cotton forecast for 2015-16 : 29.5m bales (Share in world production 26.5%).

**BT Brinjal**

• Had it not been banned, BT brinjal would have been India's first GM food crop.

• Approved for cultivation by India's Genetic Engineering Approval Committe in Oct 2009.

• But stiff opposition led to indefinite moratorium on its cultivation in Feb 2010.

**Controversy**

• Activists raised food safety to human beings.

• Famers dependent on MNCs for seeds from the single firm that makes them.

**BT Mustard**

• India's edible oils import bill exceeds $10bn.

• On Feb 5, 2016, the biotechnology regulator deferred a decision to allow commercial cultivation of Mustard DMH-11, a transgenic crop.

• DMH-11 (Dhara Mustard Hybrid-11) is said to deliver 25-30% higher mustard-seed yields compared to the best 'check' varieties.

**Controversy**

• Those opposing DMH-11 mustrad are against genetic modification technology over food safety issues.

**Silently Policy Change**

1. India has gone slow on GM trials since 2010 after opposition from farmers, activists.

2. In 2010, UPA government barred commercial planting of BT brinjal.

3. It gave States the power to veto transgenic-crop field trials, leading to a virtual moratorium on such trials.

4. Present Central Govt. quitely changed course on GM field testing.

5. In the past year, seven BJP-ruled States approved field trials of GM crops.

There's a viewpoint that the global buzz over 'Going Organic' may mean India does not necessarily have to chase the GM route. In Oct 2015, more than half of the EU, including Germany, France, Italy and Austria, voted to ban growing of the GM crops. The risks BT toxin poses to human beings and livestock are not yet detectable by current scientific risk assessment techniques.

**In the World**

Total area under the GM Crops : Year 2014 : 181.5 million hectares, Year 2015 : 175.2 million hectares.

**1.** USA (Maize, soya bean, cotton, canola, suagrbeet, alfalfa, papaya, squash) - 73.1 mh; **2.** Canada (Canola, maize, soya bean, sugarbeet) - 11.6 mh; **3.** Brazil (Soya bean, maize, cotton) - 42.2 mh; **4.** Paraguay (Maize, soya bean, cotton) - 3.9 mh; **5.** Uruguay (Soya bean, maize) - 1.6 mh; **6.** Argentina (Maize, soya bean, cotton) - 24.3 mh; **7.** South Africa (Maize, soya bean, cotton) - 2.7 mh; **8.** Pakistan (Cotton) - 2.6 mh; **9.** China (Cotton, papaya, poplar, tomato, sweet pepper) - 3.9 mh; **10.** India (Cotton) - 11.6 mh.

(Source : Nature India, GEAC, TNN and Agencies. Also the Economic Survey, 2016).

# Fruity Summers

## In this Extreme Hot Weather, One needs to Cool it up with Seasonal Fruits

SONAL JAIN

As we tend to wither in hot summers, one needs to keep hydrated and fresh. Though, human body comprises of 79% water, yet, even 2% water loss dehydrates the person. Summer fruits and some easy to make drinks are indeed the best source to keep fresh, cool and healthy. Sharing, Prof. Neetu Chopra, Head, Food and Nutrition Department, puts forward nutritional aspects of fruits available in the hot summer season.

### APRICOT

Rich in Vitamin A, Vitamin C, Minerals, Calcium and Iron, the fruit has no fat and little amount of carbohydrates. It helps in earache as well as in overall digestion of food. It prevents cancer. Its juice should be repeatedly consumed due to high amount of nutrients.

### WATERMELON

It keeps body hydrated and re-energized as more than 90% of its concentration is water and 6% is sugar. Rich in Vitamin C and Minerals, the fruit is good for energy production. It also helps in fighting heart diseases and reduces the risk of cancer. It contains Lycopene and Beta-Carotene and acts as good filler for those aiming for weight loss. Presence of Vitamin B6 in the fruit, promotes chemicals in brain that help to cope with anxiety and panic. It prevents dehydration and has a high amount of trace elements like Potassium, Sodium, and Magnesium.

### STRAWBERRY

This nutrient rich fruit prevents oxidation process in body and handles the heat. It tightens the skin and prevents leukemia. It effects the growth and curbs the happening of tumors. It is a fibrous fruit and has Vitamin A, E, C and B, Manganese and Flavanoids that protects you from cell mutations and cancers. Presence of powerful anti-oxidants, give natural sun protection and prevention from cold, flu and other infections.

### RASPBERRY

Low in calories, this fibrous nutrient dense fruit is an excellent source of cancer-fighting compound. 41% RDV (Recommended Daily Value) per cup has high level of Anthocyanin which defends against neurological disorders as well as tumor growth. Vitamin B and C, Iron, Manganese and Copper are also present.

### PLUM

Rich in dietary fiber, the fruit proves helpful in improving digestive system. It has Vitamin C which is good for body's immune system. It prevents flu, cold and diseases like colon cancer, rheumatoid, arthritis, asthma, and osteoarthritis.

### PEACH

With little acidity, the fruit is rich in Vitamin A and Potassium which makes the skin healthy and adds colour to complexion. If taken on regular basis, it makes bowel movements regular and prevents straining. It also removes worms from intestinal tracts.

### PAPAYA

It has anti-oxidant nutrients like Vitamin A and C, Carotene and Flavnoids which prevent atherosclerosis, diabetic heart diseases, allergies, chronic diarrhea, indigestion, hay fever and sports injuries. This anti-bacterial, anti-cancerous and anti-stress fruit has the enzyme Papain which treats indigestion and other gastrointestinal diseases.

### MANGO

This nutritionally rich fruit has Vitamin C and E which controls heart rate, blood pressure and asthma. It has Iron content which helps to reduce anemia. Over 60 varieties of the fruit are available and it masters in Carotene which is best for eyes. It has B-complex vitamins and trace elements. If consumed in liquid form with mint leaves, salt, sugar, chili and cumin, it acts as a natural source of electrolyte solution.

### LYCHEE

The fruit is low in calories with no saturated fats or cholesterol. Rich in dietary fiber, the fruit helps for excess bodyweight. The fruit slows down evolution and initial development of breast cancer cells. It has Vitamin C, Magnesium, Sodium, Copper and Potassium and gives a cooling effect when consumed.

### GRAPES

Rich in Vitamin A, more than 80% of the fruit concentration is water. Black grapes have powerful anti-oxidants and Resveratol which helps prevent narrowing and hardening of arteries. Hence, it is good for cardiac patients. Due to high level of sugar, the fruit should not be consumed by diabetic or people on a weight loss diet.

### FIGS

It lowers and controls blood pressure as it contains Potassium, a mineral used to control hypertention. It is good for diabetic and breast-cancer patients and great for menopausal women. It is good for liver and for people suffering from jaundice. It is a good source of Carotene.

CHERRY

The fruit tastes best when consumed humid. It has powerful pain relief benefits especially for athletes as it impacts on relieving muscle and joint discomfort more quickly. Though, less available and expensive, the fruit has high medicinal values and contains Beta Carotene, Vitamin B1, B2, B3, and C. Sodium, Magnesium and Potassium are also present.

KIWI

Low in calories, this fibrous fruit has tremendous variety of vitamins and minerals. One average sized kiwi has less than 60 calories and 11% RDV of Fiber and 2-7% of Vitamin A, E, and B, like Thiamine, Riboflavin and Niacin. It is rich in Vitamin C and Potassium which helps in fast healing of cuts and wounds.

PHALSA

It is good for summers and is very economical. It has trace elements like Magnesium, Sodium and Potassium which helps in maintaining electrolyte balance, thereby, preventing diarrhoea. It should be consumed as a whole with salt or should be grinded in mixer with sugar and water and sieved to make juice out of it, as Carotene present in it is good for eyes.

All yellow and red fruits are excellent sources of Carotene. Musk Melon is an excellent source of Carotene, Thiamine, Riboflavin, Sodium, and Potassium and saves one from dehydration. Same is applicable with Pineapple, which is rich in Carotene, B-complex Vitamins, Trace Elements and Choline Vitamins.

It's important to keep your body hydrated and to stay healthy this session. Besides drinking coconut water, buttermilk and loads of water, it is important to have fruits. Nutritionists suggest which fruits to have this season to cope with the heat and stay cool.

ICE APPLE

This fruit has a fantastic cooling effect on the body. During the summer, we tend to get heat rashes and stomach burns. Regular intake of ice apples will help overcome common health-related issues that arise in the summer. With the ongoing summer vacations, children will spend a lot of time outdoors. Give them this fruit as it will help them cope with the scorching heat. Ice apples are also high on vital minerals and Vitamin B12.

PEAR

This juicy fruit will quench your thirst and even has several digestion benefits as it is rich in fibre. It helps prevent constipation. Pears are also rich in vitamins and minerals. Make sure you include the fruit in your diet plan, as it is available at a reasonable rate in the market.

MELONS

You shouldn't miss out on water melons this season. Pack your refrigerator with this fruit, which is 90% water. If have a heat stroke, watermelon will have a soothing effect on your stomach. You can also try muskmelon, which also has plenty of Vitamin C and will boost your immunity.

## Khushwant's Book on Delhi Flora, Fauna Relaunched

It was called *Nature Watch*. Novelist and journalist Khushwant Singh's 1990 book about the flora and fauna of Delhi recorded the shifts in seasons, the change in landscape, the appearance of flowers on plants, fruits on trees, and birds in the sky among other things. With illustrations by Suddhasattwa Basu, the slim volume has been relaunched in ornate hardback. Now, it has been renamed, *Delhi Through The Seasons*, with a chapter dedicated to each month of the year.

## Whitefly wipes out Punjab Cotton

Whitefly, a common insect pest, on the cotton crop in Punjab's Malwa region this year has created havoc. It has affected about two thirds of standing cotton crop in the state, causing an estimated loss of about Rs 4,200 crore.

Punjab has nearly 12 lakh acres under cotton last season and almost all of it was Bt cotton, which is resistant to some major pests such as bollworm. But over the years, whiteflies have regularly attacked cotton plants.

Several cotton farmers in Bathinda and Faridkot districts of Punjab and adjoining Sirsa district of Haryana said that the whitefly appeared earlier than usual and that deficient rains seem to have helped it survive longer.

# Seaweed Cultivation in the Gulf of Mannar

## Women of Ramanathapuram dive deep to make a living

AROCKIARAJ JOHNBOSCO

• WOMEN'S ENTRY : Tamil Nadu coast is divided into four sub divisions—Coromandel, Palk Bay, Gulf of Mannar and the Western coast. Although each hamlet has its own unique character, all of them treat it the sea as a male preserve and discourage their women from entering it. But a few thousand women divers have defied social convention to take up seaweed cultivation.

• TYPES OF SEAWEED : More than 140 seaweed species are found in Gulf of Mannar. Indigenous *Gelidelia, Sargassum, Turbinaria* harvested in Gulf of Mannar, a protected area. Red algae seaweed from Philippines, Indonesia are also cultivated.

• SEAWEED CULTIVATION : Cultivated in Palk Bay area from Rameswaram to Pudukottai, employs about 25,000 people.

• Green, Blue and Brown algae are harvested by women divers.

• Women divers number 5,000; are spread in 25 fishing hamlets of Ramanathapuram.

• THE ECONOMICS : Diving for 8 hours, a group may harvest nearly 400 kg of fresh weed, which will shrink to 150-200 kg after drying.

• Green algae sold at Rs. 8 per kg, brown algae at Rs. 15 per kg when dried.

• Seaweed processing majors buy it at Rs 4 per fresh weed and Rs. 25 for dry weed.

• USES : Fresh seaweed is used to make organic liquid manure for plants.

• Carrageenan extracted from dry weed, used in foods, cosmetics like toothpaste, soft drinks, and chocolates.

• Research is also on to use this seaweed for bio-diesel extraction.

• LOCAL CUISINE : Green algae boiled to extract gel like substance. Milk, sugar added to make a sweet.

• Dried seaweed powder or gel obtained from boiling green algae used to make seaweed tender coconut halva.

As heavy winds lash the Ramanathapuram coast, A. Mariammal and her niece M. Rasakka sit outside their shanty and stare listlessly at the turbulent sea—the same blue space that swallowed their tiny fishing hamlet and their friends who ventured in to eke out a living that fateful morning on December 26, 2004. But the two can't wait for the gale to calm to take on the waves. Every day lost comes at a price.

"The tide at this time is dangerous as the winds are strong and unpredictable. Four women who went diving recently drowned", says Mariammal, "But if this continues, we have no choice. We will have to say our prayers and enter the ocean," she says. Mariammal and Rasakka, who live in Sadaimunivalasai, 30km from Ramanathapuram, are among 5,000-odd women divers who have turned breadwinners for their families after they lost their men to the tsunami.

But dividing for seaweed in the shallow waters of the Gulf of Mannar is not merely a source of income for women in hamlets along the Ramanathapuram coast, starting from Valinokkam to Pamban. For many, it's also the road to gender empowerment in a deeply patriarchal society—fisherfolk treat the sea as a male preserve, with the women usually confined to the task of selling the produce or processing it.

As dawn breaks, these women head into the water with a pair of goggles and makeshift flippers. Till noon they harvest seaweed, which is then carted off to the market for supply to a growing food processing industry. Carrageenan extracted from dry weed is used in foods and cosmetics including toothpaste, soft drinks, and chocolates. "Life hasn't been easy though," says Rasakka.

"Not only hast the harvest dropped drastically, we are also frequently harassed by forest officials who say this is a protected area", Mariammal and Rasakka are first generation divers, who found themselves at the cross-roads after the giant waves swept away most members of their family. Rasakka, 35, had never ventured into the sea, until the tsunami. In most fishing villages, it is considered taboo for women to enter the sea. Tamil Nadu's coast is divided into four sub-divisons—Coromandel, Palk Bay, Gulf-of-Mannar and the western stretch. While the church plays a big role in the Gulf of Mannar and the western coast, village councils dictate terms in Coromandel and Palk Bay areas. Although each hamlet has its own character, all of them discourage women from setting out into the sea, "Women take up as much work as men, but we stick to the shore. We wait for the men to return with the catch", says Fatima Babu of Veeranganai Movement in Tuticorin.

"There is a popular belief in many parts that women venturing into the sea will defile it," she says, But in several pockets, economic circumstances and social changes have prompted them to defy convention and take recourse to the same sea that swept away their families. The women seaweed divers of Ramanathapuram are among them. Not everyone has entered the profession because they have a missing male member in the family. Some have come into it due to the scourge of alcoholism. "Our men spend all their earnings on booze, what should we do to support our children?" asks Rasakka.

It is these issues that shape the growth and spread of aquaculture and allied industries, providing opportunities to fisherfolk. A few kilometers from Sadaimunivalasai, between Mandapam and Pudukottai, men and women have organised themselves into self-help groups. Around 1,500 of them, supported by seaweed processing companies and concessional loans from the government, cultivate '*Kappaphycus alvarezil*' an exogenous weed brought from Indonesia and Philippines.

"It is very good business as one can earn upto 20,000 a month, and 5,000 to 8,000 during off-season. Besides seaweed processing companies support us with compensation during off-season period," says Seeni Salabudeen, a cultivator from Munaikadu near Mandapam.

They use two methods, monoline and raft of cultivation. "While monoline needs minimum investment, at least 1,200 is required for each raft made of bamboo," says Ajmal Khan, a cultivator. "Moreover, it has given us an alternate income and we don't have to venture into Palk Bay and fall into the hands of the Sri Lankan Navy," says Khan. However, here, women don't enter the sea. They limit themselves to working on drying and cleaning the harvested seaweed.

# Some Like It Raw

## The Chinese really like to Eat their Food Uncooked

NEHA DARA

The Chinese eat early and they eat long. Dinner normally starts at 6 pm and last until past 8. When they eat out, which is often, they order one dish of every kind—plant, animal, fish and the odd crustacean.

All the food is placed on a rotating glass top at the centre of the table and everybody gets a set of chopsticks. As the glass top is rotated slowly, you can reach in and pluck out of a bowl whatever you want.

For all the excess, food habits of the Chinese are rather healthy. Apart from the obvious benefits of an early dinner, there was the fact that almost all their preparations were sautés with minimal oil and subtle spices or were grilled and roasted. I don't think I had a single fried dish during the trip.

I'm a great believer in local food. I think it is one of the best ways to experience a place and in keeping with that, I avoided the KFCs and the Pizza Huts like plague. The range of street food available was mind-boggling. For one there were the many types of dim sums, from the famous rice cakes of Xian (thick doughy creations) to the towers of the dim sum steamed in the bamboo containers that I found outside Yu Yuan garden in Shanghai.

At places like Beijing's Wangfujing Street, there were the candy sticks of meat, like kebab skewers, some a little too bizarre for even me to experiment with.

If I thought I was done with the hotpot though, I was wrong. The culmination of my Chinese food trail was my second encounter with that stove of boiling water. Tickled silly by my dad's recounting of my experience at the hotpot joint, a friend of his decided I should get a guided tour. So he took us to his favourite joint in Jiangyin, about two hours outside of Shanghai, and sat us down to a table of raw food. I made the mistake of mentioning my fondness for seafood, so a lot of the raw food was still alive.

Brown shrimps jumped in their jug, making water splash out on my arm. On a bed of ice, there was a clam-like thing, shell on one side and sinuously-moving mass of flesh on the other. My voice was several octaves higher as I asked our host, "I'm, ulpp...., supposed to eat this?"

As he replied in the affirmative, I chose from a tray the garnishings that would go into my stove of boiling water—some garlic flakes, coriander, and chilli, a few dried prawns and a pinch of salt. I decided to take things slow, so first to go into my pot were leafly greens that turned out tasting incredible. Emboldned by this early success, the shrimps went in next, jumping and dancing their way into the stove, where they were covered and allowed to cook. They turned a bright orange and actually tasted quite delightful.

The big hurdle was still to come though. The unnamed clam thing went into the pot next. In less than a minute , it wound up in my plate, and I heard myself asking plaintively, "Are you sure it's cooked?"

My fears were dismissed and it was cut and served. With that the ice was broken, and I could begin to enjoy the meal. There was sliced fish, oyster and chicken, and I have to admit that food was very delicious and super healthy (no fears of too much oil, or overcooking and losing all the minerals eh?).

If reading this has convinced you that local food is the way to go, then my work's done. But before we part, as a cautionary tale, here's the recipe for a dish that was really popular in China a few years back and I didn't try: Drunken Prawns.

Put a dozen live prawns in a pitcher of vodka. Leave covered for a couple of hours. Use tongs to pick out a prawn, place deep inside mouth and then, with a backward jerk of your head, swallow.

# Saffron : The King of Spice World

## It has a Heavenly Aroma

VIKRAM DOCTOR

Saffron's status as the world's most expensive spice is a mixed blessing. It bestows superluxury status which ensures the extra demand that keeps its price high. It entices top chefs to use it in premium priced dishes such as Ferran Adria's tagliatelle of jellied saffron consomme cut in fine strips and Jordi Roca's frozen orange mousse with saffron, and makes it a must for the most expensive Diwali mithai.

But it does mean most of us rarely experience how good real saffron can be, and oddly accessible too. Many spices require cooking in oil—frying in a tadka, for example, or grinding with oil for a cooking paste— because their essential flavour chemicals are fat soluble.

**Constituents**

Saffron contains crocin, which is not a brand name analgesic, but a chemical that food scientist Harold McGee describes as "a molecular sandwich of one pigment molecule with a sugar molecule attached at each end".

The sugar molecules ensure that crocin dissolves in water, which is why steeping saffron strands in cold water overnight will result in a fine clear gold liquid with faint bitter taste that fades into lingering notes of near-sweetness and fine fresh clean aroma. Saffron's aroma is often described as hay-like and if you close your eyes when sipping an infusion you can imagine you are in an open field in summer where the heat is drying out a rising fragnance, redolent of both warm earth and sweet herbs and grasses.

It is subtle, unlike the harsh attack of spices like cloves and cardamom, but it does need a mediating liquid—saffron eaten on its own is mostly just bitter. McGee notes that a liquid with alcohol or fat in it will also dissolve out the other flavour moleclues in saffron, which is why milk heated with it has a richer taste and deeper colour.

**Kesar Kasturi**

Saffron also features in gins like Boudier's Saffron Gin from France and Old Raj from the UK, both of which claim to be based on colonial Indian recipes. It is also the main ingredient in Kesar Kasturi, the famous heritage liquor from Rajasthan. Yet in the end plain water in which saffron has been steeped, has a simple elegance that is hard to beat as a sign of real luxury.

Saffron's accessibility also comes from its surprising strength: it may be expensive, yet you need just a few strands to feel it. McGee writes that just one part per million units of crocin in water can make a visible tinge. Saffron will never be cheap and, like all luxury goods, it is very often adulterated. But if you are willing to pay a fair amount, and can find a trusted source—and the best way is just to risk one, and then go back if it's real—you can get good saffron without needing to mortgage your house.

This is partly due to another paradoxical saffron fact—it is, or can be, one of the most widely cultivable of spices. Many spices come from plants that grow in the tropical zone, where most of India falls, and it is why these are sometimes called The Spice Lands. But the saffron crocus, from which the stigmata are harvested as the spice, grows best in subtropical zones that surround the tropics and can even, given a sheltered location and mild weather conditions, be grown in fairly cool climates.

As a result, saffron's growing range is very wide. Iran accounts for the most production by far, followed by Spain, but pockets of saffron cultivation are found in unexpected places. The Swiss village of Mund harvests a few kilos a year and the town of Saffron Walden not far from London commemorates in its name a historical tradition of growing saffron, though this no longer takes place. German migrants are said to have taken saffron to the US where the community knwon as the Pennsylvania Dutch (from Deutsch) were known for growing and using it.

**Hard to Harvest**

The saffron crocus is tricky to grow, but the real constraint with saffron is the harvesting. The crocus blossoms for just a day and must be picked at once for the saffron to be at its best. The flowers are so delicate that it must be done by hand, and it is backbreaking labour. The cost of this is so high that many places which could grow it have given up. Yet the prices are tempting and saffron's history is full of examples of places that started growing it, but gave them up when extra supply brought prices down.

This subtropical origin of saffron is why Kashmir is the only place in India to grow it. It also points to another curious fact. Despite its niche cultivation in India it is associated with Hinduism (and other religions) across the country, and this in turn has led to its association with strongly nationalistic politics of a certain kind. Yet this saffron label—which is probaly used by opponents—comes from a plant whose Indian history is relatively recent.

**Origin**

Saffron's exact point of origin is not clear, but it was proably in the Eastern Mediterranean, with Crete and other neighbouring islands being one plausible location. The Minoan civilisation that flourished there depicted saffron's growth and use in frescoes on its palace walls. Since the volcanic eruptions and tsunamis that destroyed these palaces can be dated, saffron's use can be put as far back as 1500-1600 BCE. A painting on Santorini showing a goddess using saffron to heal a foot injury may be the earliest known depiction of a particular plant being used for medicinal purposes.

In the millennium that followed, saffron seems to have made its way East across Asia, may be reaching Kashmir between 700-500 BCE, though some sources suggest its cultivation started centuries later. It is quite possible, it was imported before it was grown—Andrew Dalby points out in '*Dangerous Tastes*', his history of the spice trade, that India was as much a consumer of expensive imported commodities like spices as much as it exported them.

**In Ashokan Period**

Trade always flows both ways and India's position, between the Spice Islands of Southeast Asia and the spice hungry West, had made it rich and ready to consume expensive commodities. There was also an interest in growing new, potentially useful plants. Dalby quotes from an edict of Emperor Ashok, in the third century BCE, recording how "medicinal herbs, suitable for plants and animals, have been imported and planted wherever they were not previously available". Ashoka was a Buddhist and one tradition from Kashmir ascribes the introduction of saffron to the Buddhist monk Madhyantika.

Another aspect of India's tradition of importing plants is how we seem pragmatically ready to substitute a traditional product with a more efficient new one. Chillies were probably substituted for long pepper, a similar-looking but more perishable spice, and potatoes for tubers such as various yams which didn't grow as easily or needed more processing. And this suggests one possibility for how foreign saffron was so quickly absorbed into the Indian tradition, by substituting with turmeric.

Turmeric's history in India is truly ancient, used in medicine, cooking, religious rituals and even dyeing cloth (though other yellow pigments were also used for this, like the urine of cows fed with mango leaves). It has never ceased to be esteemed, but it is not subtle in its taste, as saffron is, and it is also very cheaply and easily available. Perhaps expensive, imported and subtle saffron was preferred by kings, priests and merchants as a refined alternative to humble, harsh and simple turmeric. Luxury comes from both intrinsic and perceived factors and saffron has always been able to master them all.

(From the *Economic Times*, Nov. 2014).

## Climate Change

### May cause 5 lac additional deaths by 2050

If the global emissions continue unabated, it may lead to half a million extra deaths by 2050, reveals a recent study by "*The Lancet*". Among the worst-hit countries will be China and India, where scores of people will die due to food scarcity and malnutrition triggered by climate change.

While India will witness 1.36 lac additional deaths by 2050, China will register over 2.48 lac deaths.

The study, which is being pegged as first of its kind, focuses on the impact of the climate change on public health. It states that a change in climate will also eventually lead to a change in people's diet, resulting in rise in fatal diseases.

Dr. Marco Springmann, lead author of the study and a researcher at the Oxford Martin Programme on the Future of Food at the University of Oxford in England, mentions in the research, "The model projects that by 2050, climate change will lead to per person reductions of 3-2% in global food availability, 4-0% in fruit and vegetable consumption, and 0-7% in red meat consumption. These changes will be associated with 5,29,000 climate-related deaths worldwide, representing a 28% reduction in the number of deaths that would be avoided because of changes in dietary and weight-related risk factors between 2010 and 2050. Twice as many climate-related deaths were associated with reductions, in fruit and vegetable consumption, than with climate-related increases in the prevalence opf underweight, and most climate-related deaths were projected to occur in South and East Asia."

Experts are of the view that health effects of climate change from changes in dietary and weight-realted risk factors could be substantial and exceed other climate-related health impacts.

On death data, the study indicates that adoption of climate-stabilisation path-ways can reduce the number of climate-related deaths by 29-71%, depending on the adopted strategy.

Giving out various ways to mitigate the impact of climate change on public health across the world, the study further states, "Strengthening of public health programmes aimed at preventing and treating diet and weight related risk factors could be a suitable climate change adaptation strategy".

# Butterflies of Gulbarga District, Deccan Plateau, Hyderabad Karnatak

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Gulbarga District lies in northernmost Karnataka State, in southern India, immediately south of Bidar District. Recently its southern half or so has been designated a separate Yadgir District for administrative reasons, but it is treated here as the old, more inclusive political unit. It lies bang in the centre of the Deccan Plateau, a singular endemic region of the Indian sub-continent. Having once constituted a segment of the ancient prehistoric continent of Gondwanaland, this land is the oldest and most stable in India. The plateau is mainly between 1,000 and 2,500 ft (300 to 750 m) above sea level, and its general slope descends toward the east. A number of hill ranges of the Deccan were eroded and rejuvenated several times, and only their current remaining summits testify to their geological history. The main peninsular block is composed of gneiss, granite-gneiss, schists, and granites, as well as of more geologically recent basaltic lava flows. Telengana State covers the east-central region of this Plateau, and Karnataka the west central and most of the southern areas of the Deccan Plateau, with its extreme southeastern portion lying in Tamil Nadu.

The only paper I found on butterflies of this district was by Ankalgi & Jadesh (2014), documenting the Rhopalocera faunistics of the small Ankalga village which is "located . . . near Kurikotta Bridge (longitude 76.921163 and latitude 17.491258) of Gulbarga district" which is about 25 km NE. of Gulbarga. This village receives the backwaters of Bennathora reservoir. The temperatures there range from 16°C to 45°C and average annual rainfall is about 750mm. I have noted which species they listed and have made corrections and updates as necessary in the list below. Ankalgi & Jadesh (2014) stated that their specimens were identified by Dr C.A. Viraktamath and his team at the Agricultural College, University of Agricultural Sciences, Bangalore. I was also shown a set of large specimen boxes with butterflies sampled by Dr Shankara Murthy and his team, Department of Entomology, Agricultural College, Bheemarayanagudi, Yadgir District, which data has also been incorporated. I was also shown butterflies collected by students of KVK, Agricultural College and Research Station, on Aland Road, Gulbarga, through Dr Suhas Yelshetty, which data is also incorporated in the list below.

In this paper, 'old species' names are placed in roman italics (in parentheses), for recognition (see Tiple & Ghorpadé, 2012, for more details). The list is in alphabetical order of genera and species for convenience of reference, but families are included in currently understood phylogenetic order, from basal to derived.

Acronyms used are for species citations in the following reference books or papers : IK = Kehimkar (2008), WB = Wynter-Blyth (1957), HE = Evans (1932), besides TL = Larsen (1987-1988) and HG = Gaonkar (1996), by page or serial numbers.

## Family HESPERIIDAE

One species, undetermined, viz., Ankalgi & Jadesh (2014 : 1168).

## Family PAPILIONIDAE

1. ***Graphium (doson) eleius*** Frühstorfer : Dravidian Jay—IK 120, 147, WB 402, HE 55, FBI 66b, TL 16, HG 6.

2. ***Graphium (agamemnon) menides*** Frühstorfer : Tailed Jay—IK 120, 148, WB 404, HE 56, TL 17, HG 7.

3. ***Pachliopta aristolochiae*** Fabricius : Whitespotted Rose — IK 141, 157, WB 375, HE 44, TL 3, HG 3. Ankalgi & Jadesh (2014), as "*Atrophaneura aristolochiae*".

4. ***Pachliopta hector*** Linnaeus : Crimson Rose — IK 142, 157, WB 375, HE 44, TL 4, HG 4. Ankalgi & Jadesh (2014), as "*Atrophaneura hector*".

5. ***Papilio demoleus*** Linnaeus : Lime Swallowtail — IK 133, 154, WB 395, HE 52, TL 6, HG 11. Ankalgi & Jadesh (2014).

6. ***Papilio (polytes) romulus*** Cramer : Black Mormon — IK 127, 150, WB 392, HE 52, TL 10, HG 15. Ankalgi & Jadesh (2014), as "*Papilio polytes*".

## Family PIERIDAE

1. ***Appias libythea*** Fabricius : Striped Albatross — IK 174, 193, WB 427, HE 73, TL 28, HG 37.

2. ***Belenois aurota*** Fabricius : Pioneer — IK 188, 198, WB 425, HE 71, TL 26, HG 35. Ankalgi & Jadesh (2014).

3. ***Catopsilia pomona*** Fabricius : Lemon Emigrant — IK 164, 190, WB 446, HE 75, TL 42, HG 20. Ankalgi &

Jadesh (2014).

4. ***Catopsilia pyranthe*** Linnaeus : Mottled Emigrant — IK 164, 190, WB 447, HE 75, TL 43, HG 21. Ankalgi & Jadesh (2014).

5. ***Cepora (nerissa) phryne*** Fabricius : Field Gull — K 182, 195,WB 421, HE 72, TL 24, HG 33. Ankalgi & Jadesh (2014), as "*Cepora nerissa*".

6. ***Colotis danae*** Fabricius : Southern Crimson Tip — IK 169, 191, WB 441, HE 83, TL 35, HG 44. Ankalgi & Jadesh (2014).

7. ***Colotis etrida*** Boisduval : Small Orange Tip — IK 169, 191, WB 440, HE 83, TL 33, HG 42.

8. ***Colotis eucharis*** Fabricius : Plain Orange Tip — IK 170, 191, WB 441, HE 83, TL 34, HG 43.

9. ***Colotis (fausta) fulvia*** Wallace : Large Salmon Arab — IK 170, 191, WB 440, HE 83, TL 36, HG 45.

10. ***Delias eucharis*** Drury : Indian Jezebel — IK 187, 198, WB 420, HE 69, TL 20, HG 29. Ankalgi & Jadesh (2014).

11. ***Eurema (andersoni) ormistoni*** Watkins : One-Spot Grass Yellow — Ankalgi & Jadesh (2014), as "*Eurema andersoni*"; IK (160), WB 454, HE 78, TL 48, HG 27. Taxonomy unresolved.

12. ***Eurema (brigitta) rubella*** Wallace : Red-Line Grass Yellow — IK 161, 189, WB 450, HE 77, TL 44, HG 22. Ankalgi & Jadesh (2014), as "*Eurema brigitta*".

13. ***Eurema hecabe*** Linnaeus : Two-Spot Grass Yellow — IK 161, 189, WB 453, HE 78, TL 46, HG 24.

14. ***Eurema (blanda) silhetana*** Wallace : Three-Spot Grass Yellow — IK 160, 189, WB 453, HE 78, TL 47, HG 25.

15. ***Ixias marianne*** Cramer : White Orange Tip — IK 171, 192, WB 436, HE 81, TL 37, HG 48. Ankalgi & Jadesh (2014), as "*Ixias marianne*".

16. ***Ixias (pyrene) sesia*** Fabricius : Yellow Orange Tip — IK 172, 192, WB 437, HE 81, TL 38, HG 49.

17. ***Pareronia hippia*** Fabricius : Indian Wanderer — IK 174, 192, WB 444, HE 84, TL 40, HG 50.

18. ***Pieris (canidia) canis*** Evans : Indian Cabbage White — IK 179, 194, WB 433, HE 67, TL 23, HG 32.

## Family LYCAENIDAE

1. ***Caleta decidia*** Hewitson : Angled Pierrot — Ankalgi & Jadesh (2014); IK 250, 291, WB 259, HE 214, TL 52, HG 153 [ Ankalgi & Jadesh (2014: 1168) placed this, probably indavertently, as a Nymphalidae (!) and as "*C. caleta* Hewitson" which is extralimital ].

2. ***Castalius rosimon*** Fabricius : Woodland Pierrot — Ankalgi & Jadesh (2014); IK 251, 291, WB 259, HE 214, TL 51, HG 152.

3. ***Catochrysops strabo*** Fabricius : Blue Forget-Me-Not — Ankalgi & Jadesh (2014); IK 259,WB 289, HE 236, TL 77,HG 182.

4. ***Euchrysops cnejus*** Fabricius : Gram Blue — IK 268, WB 287, HE 234, TL 76, HG 181.

5. ***Freyeria putli*** Kollar : Tiny Grass Jewel — D 23, C 131, T 102; IK 262, WB 284, HE 233, TL 75, HG 180.

6. ***Lampides boeticus*** Linnaeus : Pea Blue — IK 260, WB 289, HE 236, TL 78, HG 184.

7. ***Leptotes plinius*** Fabricius : Zebra Blue — Ankalgi & Jadesh (2014); IK 252, 292, WB 266, HE 217, TL 57, HG 160.

8. ***Prosotas (dubiosa) indica*** Evans : Tail-Less Lineblue — Ankalgi & Jadesh (2014), as "*Prosotas dubiosa*"; IK 256, 293, WB 298, HE 243, TL 90, HG 196.

9. ***Tarucus indica*** Evans : Pointed Pierrot — IK 261, 294, WB 264, HE 216, HG 159.

10. ***Tarucus nara*** Kollar : Striped Pierrot — IK 260, 293, WB 264, HE 216, TL 55, HG 156.

11. ***Zizina (otis) indica*** Murray : Lesser Grass Blue — Ankalgi & Jadesh (2014), as "*Zizina otis*"; IK 263,WB 285, HE 234, TL 70, HG 175.

## Family NYMPHALIDAE

1. ***Acraea violae*** Fabricius : Tawny Coster — IK 355, WB 235, HE 192, TL 227, HG 88. Ankalgi & Jadesh (2014).

2. ***Ariadne (ariadne) indica*** Linnaeus : Angled Plains Castor — IK 393, WB 231, HE 191, TL 178, HG 120.

3. ***Byblia ilithyia*** Drury : Joker — IK 394, WB 231, HE 190, TL 177, HG 119. Ankalgi & Jadesh (2014).

4. ***Charaxes solon*** Fabricius : Black Rajah — IK 314, WB 146, HE 142, TL 226, HG (87).

5. ***Danaus chrysippus*** Linnaeus : Plain Tiger — IK 302, 413, WB 69, HE 88, TL 149, HG 143. Ankalgi & Jadesh (2014).

6. ***Danaus genutia*** Cramer : Striped Tiger IK 301, 413, WB 69, HE 88, TL 142, HG 144.

7. ***Euploea core*** Cramer : Indian Black Crow — IK 308, WB 72, HE 90, TL 148, HG 145. Ankalgi & Jadesh (2014).

8. ***Hypolimnas bolina*** Linnaeus : Great Eggfly — IK 409, WB 201, HE 174, TL 196, HG 134. Ankalgi & Jadesh (2014).

9. ***Hypolimnas misippus*** Linnaeus : Danaid Eggfly — IK 410, WB 202, HE 173, TL 195, HG 135. Ankalgi & Jadesh (2014).

10. ***Junonia almana*** Linnaeus : Peacock Pansy — IK 408, 444, WB 207, HE 176, TL 189, HG 128.

11. ***Junonia hierta*** Fabricius : Yellow Pansy — IK

407, 444, WB 206, HE 176, TL 186, HG 125.

12. ***Junonia lemonias*** Linnaeus : Lemon Pansy — IK 409, WB 207, HE 176, TL 188, HG 127. Ankalgi & Jadesh (2014).

13. ***Junonia (orithya) swinhoei*** Butler : Blue Pansy — IK 407, WB 206, HE 176, TL 187, HG 126. Ankalgi & Jadesh (2014), as "*Junonia orithya.*"

14. ***Melanitis leda*** Linnaeus : Familiar Evening Brown — IK 322, 421, WB 122, HE 125, FBI 405, TL 151, HG 55. Ankalgi & Jadesh (2014).

15. ***Phalanta phalantha*** Drury : Large Leopard — IK 364, 433, WB 224, HE 187, TL 181, HG 92.

16. ***Tirumala (limniace) leopardus*** Butler : Pale Blue Tiger — IK 300, WB 67, HE 87, TL 143, HG 141.

17. ***Ypthima (asterope) mahratta*** Moore : Regular Three-Ring — IK 351, 430, WB 115, HE 120, TL 170, HG 75.

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## Life Began on Land, Not Sea
## Darwin was Right

Charles Darwin had suggested that life on Earth originated on land in a 'warm little pond' and not in the oceans. Now, a new study has claimed the theory proposed by the legendary naturalist more than 150 years ago could actually be right.

The study by researchers at the Osnabruck University in Germany found that the first primitive cells could have germinated in pools of condensed vapour caused by underground hot water or steam bubbling on the surface of the planet. The findings, published in the journal *Proceedings of the National Academy of Sciences*, challenging the wide spread view that life originated in the sea, the *Daily Mail* reported.

For their study, the researchers analysed evidence of key rock chemicals in ancient inland and marine habitats and then compared them with a genetic reconstruction of Earth's first cells. They found that the oceans did not contain the best balance of the ingredients to foster life.

Instead the simplest cells assembled in inland hatcheries where—like the hot springs—volcanic processes actively vented vapour from the planet's interior, the scientists said. The chemical composition of these emisssions most closely matches the inorganic chemistry of the cells.

These "cradles of life" share all of the advantages of the deep sea hydrothermal vents that have been previously proposed in the same capacity including the presence of organic matter, they said.

# Occurrence of Soil Nematodes and their Co-relation with Ecological Factors at Himayat Baugh, Aurangabad (Maharashtra)

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Soil is home to many vertebrate and invertebrate forms of life. Soil micro fauna such as protozoa and nematoda are important for soil food web (Chanu, 2011). The soil regulates the size and function of fungal and bacterial population in the soil (Mwanigi et al., 2014 ). The assemblage of plant and soil nematode species occurring in nature constitute nematode community and occupy central position in soil web (Reenco & Kova, 2012). Nematode composition and nematode community structure is closely related to their habitats and exhibit rapid response to change in environmental condition (Zhang et al., 2007).

The awareness of the diversity and ecological significance of nematodes have been used as indicator in the area of biodiversity and sustainability. Present work deals in this direction in the area of Himayat Baugh "Phal Phool Sanshodhan Kendra", near Salim Ali lake, Aurangabad (Maharashtra).

Present study compares the population dynamics of nematodes with ecological factors like pH, temperature, moisture and rainfall.

## Material and Methods

Soil sampling : Soil samples from selected site were taken. 50 samples were collected from Feb 2014 to Jan 2015. Samples were tagged, stored in sealed plastic bag and brought to the laboratory for further processing. Processing of soil samples was done by sieving and decantation by modified Baermen funnel technique (Singh, 2011). Population count of nematode was made using syracuse counting dish (Chanu, 2011). 2 ml of nematode suspension in the dish for counting final population was obtained by multiplying final quantity of nematode suspension ( 50 ml ) with mean number of nematodes counted and dividing by quantity of suspension used for counting (2ml).

Co-relation by Pearson formula using M.S. Excel soil moisture was done using following formula :

$$\text{Soil moisture } \% = \frac{\text{Loss of Wt on drying} \times 100}{\text{Dry Wt of Soil}}$$

Soil temperature was recorded by soil thermometer, soil pH by pH meter (Kadam et al., 2012).

## Results and Discussion

The analysis of linear correlation were significantly positive except soil moisture : significance at 0.01 (95 %) level of significance and above correlation of soil temperature with plant parasitic nematodes is (r x 2y = 0.69128), free-living (r x = 0.81344), and predatory (r x 2y = 10491). Whereas correlation of soil pH with plant parasitic nematodes is 0.39420, for free-living 0.32850 and predatory is 0.10491. The present study revealed that soil moisture is

**Table 1. Occurrence of Soil Nematodes during Feb. 2014 to Jan. 2015.**

| Month | Plant Parasitic | Free-living | Predatory | Total |
|---|---|---|---|---|
| January | 700 | 650 | 200 | 1500 |
| February | 800 | 600 | 500 | 2000 |
| March | 650 | 700 | 550 | 1800 |
| April | 500 | 600 | 710 | 900 |
| May | 420 | 390 | 100 | 800 |
| June | 560 | 280 | 530 | 1700 |
| July | 470 | 700 | 430 | 1600 |
| August | 700 | 600 | 200 | 1500 |
| September | 800 | 700 | 500 | 2000 |
| October | 800 | 900 | 700 | 2700 |
| November | 720 | 320 | 220 | 1300 |
| December | 700 | 300 | 200 | 1100 |

**Table 2. Ecological factors during the study period.**

| Month | Soil temp °C | Soil pH | Soil moisture% | Rainfall mm |
|---|---|---|---|---|
| January | 23.00 | 4.6 | 23.00 | - |
| February | 22.40 | 4.3 | 33.00 | - |
| March | 22.50 | 4.6 | 18.00 | 80 |
| April | 23.40 | 4.5 | 16.00 | - |
| May | 25.50 | 4.5 | 13.00 | - |
| June | 21.00 | 4.4 | 14.50 | 131.14 |
| July | 20.00 | 4.3 | 22.00 | 168.12 |
| August | 20.00 | 4.4 | 26.00 | 166.12 |
| September | 22.50 | 4.3 | 24.50 | 125.72 |
| October | 22.8 | 4.4 | 26.00 | 80.00 |
| November | 22.4 | 4.5 | 38.50 | 20.00 |
| December | 22.00 | 4.6 | 47.00 | - |

**Table 3. Correlation between Nematodes and Ecological factors.**

| Parameter | Plant Parasitic | Free-living | Predatory |
|---|---|---|---|
| Soil Temperature | 0.69128 | 0.81344 | 0.10491 |
| Soil pH | 0.39470 | 0.32850 | 0.20190 |
| Soil Moisture | -0.57680 | -0.48450 | 0.24376 |
| Rainfall | 0.351 | 0.357 | 0.327 |

negatively correlated with plant parasitic ( - 0.57680) and free-living ( -0.4845), whereas positively correlated with predatory forms ( 0.312 ).

The findings were correlated with the study of the other authors. According to Mwanigi et al. (2014), the plant parasitic Nematodes dominate over other groups. Singh (2011) reported slight decline in number of nematode genera from sowing to harvesting . According to him tropic diversity of crop field showed abundance of predatory 3% plant parasitic 31% and free living 66%. Zhang et al. (2007) reported that nematode population and diversity act as indicators of overall soil condition. According to Sanei (2011) nematodes are sensitive to chemical and physical disturbance in ecosystem.

In this study free living nematodes was the most abundant group and confirm to the work of (Sultan, 1991). The correlation of moisture with plant parasitic nematodes is negative which confirms with the observations by Zhang et al. (2007) and Sultan (1991). Authors observed the abundance of plant parasitic nematodes 41% , free-living 42% and predatory 17%.

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# An Account of the Rove Beetles (Coleoptera : Staphylinidae) from the Sunderban Biosphere Reserve, West Bengal

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About 30, 000 species are known from the world and more than 2000 species have been recorded from India. Motschulsky (1858), Kraatz (1859), Fauvel (1895) and Bernhauer (1915) are the pioneer workers of the family Staphylinidae. After Cameron's work in the *Fauna of British India* series (1930, 1931, 1932), Rougemont (1986) and Biswas & Biswas (1995) are noteworthy.

Recently Sar et al. (2015) have reported five species of three genera under three subfamilies of family Staphylinidae from the Sagar Island, West Bengal. This island comes under the Sunderban Biosphere Reserve (SBR). Present communication reports further eight species of six genera under two subfamilies of Staphylinidae, from different localities of SBR, of which *Stanus carinatus* Cameron was reported earlier also from the Sagar Island.

Hence, altogether 12 species of seven genera under four subfamilies of the family Staphylinidae are reported from SBR. All the collections reported here were made by Bulganin Mitra & Party.

List of total species so far reported from SBR :

**Subfamily Paederinae**

1. *Paederus fuscipes* Curtis
2. *Astenus leptocerus* Eppelsheim
3. *Cryptobium elephas* Fauvel
4. *Lathrobium cafrum* Boh.

**Subfamily Staninae**

5. *Stanus carinatus* Cameron

**Subfamily Staphylininae**

6. *Philonthus castaneus* Gemm. et Har.
7. *Philonthus rotundicollis* Menet.
8. *Philonthus fimetarius* Gr.
9. *Philonthus quediiformis* Cameron
10. *Philonthus quisquilirius* (Gyll.)
11. *Philonthus quisquilirius* var. *inquinatus* Stephens

**Subfamily Oxytelinae**

12. *Bledius (s. str.) hoplites* Fauvel

Eight species of rove beetles reported from the SBR here are recorded as follows :

**Order : Coleoptera**

**Family : Staphylinidae**

**Subfamily : Paederinae**

1. ***Paederus fuscipes*** Curtis

1823-40. *Paederus fuscipes* Curtis, *Ent. Brit.*, 3: 108.

1931. *Paederus fuscipes*: Cameron, *Fauna of British India, incl. Ceylon & Burma (Col.: Staphylinidae)*, 2: 40-41.

Material examined: 1 ex. Gosaba island: Jatirampur, dt.16.xii.2014., 1 ex. Pakhirala, dt.16. xii.2014, 1 ex. Satjelia Island: 4 no. Satjelia, dt.30.x.2015.

2. ***Astenus leptocerus*** Eppelsheim

1895. *Sunius leptocerus* Epp., *W.E.Z.*, 14: 64.

1931. *Astenus leptocerus*: Cameron, *Fauna of British India, incl. Ceylon & Burma (Col.: Staphylinidae)*, 2: 75-76.

Material examined: 1 ex. Bali island: 9. no. Gheri, dt. 29.viii.2014., 1 ex. Pakhirala, dt.16. xii.2014, 1 ex. Satjelia Island: 4 no. Satjelia, dt.30.x.2015.

3. ***Cryptobium elephas*** Fauvel

1904. *Cryptobium elephas* Fauv. *Rev.d'Ent.* 23 : 54.

1931. *Cryptobium elephas*: Cameron, *Fauna of British India, incl. Ceylon & Burma (Col.: Staphylinidae)*, 2: 230.

Material examined: 1 ex. Gosaba island: Jatirampur, dt. 16.xii.2014., 1 ex. Pakhirala, dt. 16. xii.2014.

4. ***Lathrobium cafrum*** Boh.

1848. *Lathrobium cafrum* Boh. *Ins. Cafir.*, i : 285.

1931. *Lathrobium cafrum*: Cameron, *Fauna of British India, incl. Ceylon & Burma (Col.: Staphylinidae)*, 2: 40-41.

Material examined: 42 ex., Gosaba island: Jatirampur, dt. 16.xii.2014., 1 ex. Pakhirala, dt. 16.xii.2014.

**Subfamily : Staninae**

5. ***Stanus carinatus*** Cameron

1914. *Stenus (Nestus) carinatus* Cam., *Trans. Ent. Soc. Lond.*, p. 532.

1930. *Stanus carinatus* Cameron, *Fauna of British India, incl. Ceylon & Burma (Col.: Staphylinidae)*, 1: 345-346.

Material examined: 1 ex.,Gosaba island: Jatirampur, dt.16.xii.2014., 3 exs., Pakhirala, dt.16. xii.2014,

**Subfamily : Staphylininae**

6. ***Philonthus castaneus*** Gemm. et Har.

1868. *Philonthus castaneus* Gemm. et Har., *Cat. Col. ii.* : 586.

1932. *Philonthus casteneus*: Cameron, *Fauna of British India, incl. Ceylon & Burma (Col.: Staphylinidae)*, 3: 99-100.

Material examined: 1 ex., Gosaba island: Jatirampur, dt. 16.xii.2014.

7. ***Philonthus rotundicollis*** Menet.

1832. *Philonthus rotundicollis* Menet, *Cat.rais.* ;145.

1932. *Philonthus rotundicollis* Cameron, *Fauna of British India, incl. Ceylon & Burma (Col.: Staphylinidae)*, 3: 84.

Material examined: 1 ex., Gosaba island: Jatirampur, dt. 16.xii.2014.

8. ***Philonthus fimetarius*** Gr.

1802. *Staphylinus fimetarius* Gr., *Col. Mier. Brunsv.* : 210.

1932. *Philonthus fimetarius*: Cameron, *Fauna of British India, incl. Ceylon & Burma (Col. : Staphylinidae)*, 3: 92-93.

Material examined: 43 ex., Gosaba island: Jatirampur, dt. 16.xii.2014., 1 ex.Pakhirala, dt. 16.xii.2014,

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Kraatz, G. 1859. Staphylinen—Fauna von Ostindien, insbesondere der insel Ceylon. *Archiv. fur Naturgesch.*, 25 : 1-193.

Motschulsky, V. 1858. Enumeration des nouvelles especes de Coleopteres rapports de ses voyages. *Bull. de la Societe Imperiale des Naturalistes de Moscou*, 31 (2): 634-670.

Rougemont, G. de 1986. Revision of the genus *Stiliderus* Motschulsky, 1858. Part II: The species with bilobed IVth tarsomeres (Coleoptera: Staphylinidae: Paederinae). *Ent. Abh. Mus. Tierk. Dresden*, 50 (2): 33-58.

Sar, A., Chakraborti, U., Roy S., Biswas, O. & Mitra, B. 2015. New records of some staphylinid beetles from Sagar Island, West Bengal. *Bionotes*, 17(2): 46.

## Bhang, the Secret to Ellora's Decay Shield

### No Insect Damage on the Walls

A mix of hemp with clay and lime plaster has protected the Ellora Caves from decaying over the last 1,500 years, a new study has found. "The use of hemp helped the caves and most of the paintings remain intact at the 6th century Unesco World Heritage site," says the study. Rajdeo Singh, a former Superintending Archaeological Chemist of Achaeological Survey of India's science branch (western region), and M. M. Sardesai, who teaches botany at Dr. Babasaheb Ambedkar Marathwada University, have carried out the study, which has been published in the '*Current Science*'.

"*Cannabis sativa*, popularly known as ganja or bhang, was found mixed in the clay and lime plaster at Ellora. This was confirmed by technologies such as scanning of the electron microscope, Fourier transform, infra-red spectroscopy and stereo-microscopic studies," Singh said.

"Hemp samples were collected from areas in Jalna district near Aurangabad and also from the outskirts of Delhi. These specimens were matched with the samples found in cave number 12 of Ellora," he added.

He says there was no difference. "In the sample collected from the Ellora's cave, we found a 10% share of *Cannabis sativa*. This is the reason why no insect activity is found at Ellora," Singh said.

The study indicates that many valuable properties of hemp were known to Indians in the 6th century. "Hemp was extensively used in Ellora as well as by the Yadavas, who build the Deogiri (Daulatabad) Fort in the 12th century," Singh told. "It was not used in the Ajanta Caves, which are about 30 rock-cut Buddhist structures dating back to the 2nd century BC. Rampant insect activity has damaged at least 25% of the paintings at Ajanta."

# Effect of pH on the Growth of Fungi associated with Lac

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Lac is a natural resinous substance of profound economic importance in India. It is one of the most valuable gifts of nature to man. It is the only resin of animal origin, being actually the secretion of a tiny scale insect, *Kerria lacca* (Kerr) (Homoptera : Tachardiidae). It basically yields three useful materials: resin, dye and wax. It makes a small but significant contribution to the foreign exchange earnings of the country, but the most important role that the lac plays in the economy of the country is that roughly 3-4 million tribal people, who constitute the socio-economically weakest link of Indian population, earn a subsidiary income from its cultivation.

India is the major producer of lac, accounting for more than 50% of the total world production. It virtually held a monopoly in the lac trade during the period of the world war-I, producing nearly 90% of the world's total output. Now a day's lac cultivation has become very popular all over the country due to its uses, a source of high income, suitable for tribal people of Jharkhand etc. Scientific methods of lac cultivation provide high income and reduce risk. At present total annual average production of stick lac in India is approxmately 20-22 thousand tons, which forms the raw material for lac industries. Chhattisgarh ranks Ist among the States followed by Jharkhand, Madhya Pradesh, Maharashtra and West Bengal. These five states contribute around 95% of the national lac production.

It has been shown that pH is an important criterion for understanding the ecology of spoilage fungi, especially mycotoxigenic species (Ahmed & Naresh, 2009). Reports have shown that growth of fungi could be affected by 'Hydrogen ion concentration' (pH) in a medium in which it grows, either directly by its action on the cell surface or indirectly by its effect on the availability of nutrients. Fungi differ considerably in their tolerance to different pH values. The growth of fungi may be completely inhibited in media, which are either too acidic or too alkaline. Most of the fungi, however, tend to grow better on the acidic side. Therefore, present study was carried out to determine the effect of pH on the growth of fungi associated with lac.

**Material & Methods**

Isolation and Identification of Fungi associated with lac : Fungal species were isolated from soil samples by using Potato Dextrose Agar (PDA) medium. Samples were inoculated over plates by multiple tube dilution technique (MTDT) and the plates were incubated at 26°C for 6 days. Fungi were identified with the help of compound microscope.

Effect of lac on growth of fungi : Petri plates containing PDA, medium with different concentration of lac was used as agar medium (1.0g 2.0g, 3.0g,4.0g and 5.0g). The plates were inoculated with 5 mm diameter disc from ten day old cultures of different fungi. The inoculated plates were kept at 30°C. Three replications were maintained for each media. Colony diameter was measured ten days after inoculation. Three replications were maintained for each medium.

**Table 1: Isolation of Fungi from Lac collected from different host plants.**

| | Name of Fungi | Fungi isolated from Lac of different host plants | | | |
|---|---|---|---|---|---|
| | | Umber | Palas | Raintree | Ber |
| 1 | *Aspergillus niger* | + | + | + | + |
| 2 | *A. flavus* | + | + | + | - |
| 3 | *A. fumigatus* | - | + | - | + |
| 4 | *Fusarium moniliforme* | + | + | + | + |
| 5 | *Penicillium citrinum* | + | + | - | .- |
| 6 | *Rhizoctonia solani* | - | + | - | + |
| 7 | *Curvularia lunata* | - | + | + | - |
| 8 | *Cladosporium* sp. | + | - | + | + |

**Table 2. Effect of pH on growth of Lac fungi.**

| | Name of Fungi | Days | Colony diameter at pH (mm) pH | | |
|---|---|---|---|---|---|
| | | | 3.5 | 6.5 | 8.5 |
| 1 | *Aspergillus niger* | 2 | 38 | 62 | 06 |
| | | 4 | 46 | 74 | 10 |
| | | 6 | 58 | 88 | 12 |
| 2 | *Fusarium moniliforme* | 2 | 15 | 14 | 05 |
| | | 4 | 20 | 25 | 05 |
| | | 6 | 25 | 30 | 05 |
| 3 | *Penicillium citrinum* | 2 | 08 | 60 | 06 |
| | | 4 | 12 | 70 | 08 |
| | | 6 | 15 | 84 | 09 |
| 4 | *Rhizoctonia solani* | 2 | 14 | 35 | 05 |
| | | 4 | 16 | 45 | 05 |
| | | 6 | 18 | 56 | 05 |
| 5 | *A. flavus* | 2 | 15 | 60 | 05 |
| | | 4 | 18 | 70 | 05 |
| | | 6 | 23 | 80 | 05 |
| 6 | *A. fumigatus* | 2 | 14 | 55 | 06 |
| | | 4 | 17 | 66 | 08 |
| | | 6 | 20 | 72 | 10 |
| 7 | *Curvularia lunata* | 2 | 12 | 56 | 05 |
| | | 4 | 14 | 73 | 05 |
| | | 6 | 16 | 68 | 05 |
| 8 | *Cladosporium* sp. | 2 | 11 | 35 | 05 |
| | | 4 | 13 | 42 | 05 |
| | | 6 | 15 | 52 | 05 |

Effect of Hydrogen Ion Concentration (pH): The effect of pH on the growth of the fungi was studied following the method described by Kiryu (1939) using PDA medium. Three replications were maintained for each treatment.

**Results and Discussion**

Results presented in tables 1 and 2 show that total 8 fungal species were isolated from lac. Maximum fungi were recovered from lac on *Butea monosperma* (Palas), followed by *Ficus racemosa* (Umber). *Aspergillus niger* and *Fusarium moniliforme* were dominant fungi as compared to other fungi. *Rhizoctonia solani* was isolated from Palas and Ber. However, acid/alkaline requirement for growth of fungi is quite broad, ranging from pH 3.0 to more than pH 8.0, with optimum around pH 5.0 if nutrient requirements are satisfied (Pardo et al., 2006). Studies on pH reveal that fungi grow at pH 3.0 - 8.0, with maximum production of dry mycelial weight and sporulation at pH 5.5 and pH 6.5 respectively, in liquid media (Saha et al., 2008; Deshmukh et al., 2012)). In general, a neutral to weak acidic environment was suitable for mycelial growth, with optimum pH 5.0-7.0 and pH 5.0-8.0 for conidial production (Zhao et al., 2010). For this reason, *in-vitro* studies of Fungi generally utilize substrates in the form of solution only if the reaction of solution conducive to fungal growth and metabolism (Kiryu, 1939). This brings importance of hydrogen ion concentration for better fungal growth. Of all the eleven pH levels, pH 6.5 was found to be ideal and produced the maximum mean mycelial growth of 87.50 mm, followed by pH 3.5 (84.60 mm) . The mean mycelial growth was lowest at pH 8.5 which recorded 28.00 mm. The pH below six and above seven was noticed to be inhibitory to the growth. The results of experiment indicated that *A. alternata* prefers pH 6.5. The inhibitory action of pH above 6.5 and below 6 was attributed to the unconducive reaction of the media. Filamentous fungi are generally known to be tolerant to acidic pH and most of them have an optimum pH between 5.0 and 6.0 for cellular growth and several metabolic activities (Rosfarizan et al., 2000). However, the range of pH for growth in *A. parasiticus* with regards to dry mycelial weight and sporulation seem to be wide; spanning from pH 4.0 to pH 9.0 and pH 4.0 to pH 8.0 respectively. Cochrane (1958) states that many fungi, with few exceptions, grow best on media with an initial pH of 5.0 to 6.5.

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## Three Indian Beaches among Asia's Top 10

### Goa and Andamans have these

India has three of the top 10 beaches in Asia favoured by travellers, a survey by travel website 'Trip Advisor' said. The beaches are Agonda, Palolem (both in Goa) and Radhanagar on the Havelock Island in the Andamans, according to Trip Advisor's top 10 Asia's Travellers' choice Award-winning Beaches.

"India, with its extensive shoreline, is dotted with beautiful stretches of sand and it's great to see these gems gaining recognition globally," Trip Advisor India's Country Manager Nikhil Ganju said.

Traveller's Choice Award winning beaches were determined on the quantity and quality of traveller reviews and ratings on the Trip Advisor website gathered over a 12-month period.

This year's award honour 343 beaches, including the top 10 in the world and lists for Asia, Africa, Australia, the Caribbean, Central America, Europe, South America, the South Pacific, the UK and the US.

Three of India beaches have featured in the list of the top 10 beaches in Asia.

Agonda beach (Goa) has been ranked at number four position in the Asia's top 10 list, mostly for being wide, quiet, picturesque and a great spot for sunbathing and relaxing with relatively few tourists around, the survey said.

Goa's Palolem beach has been ranked 8th in the list for its beach hut accomodations. Stretching between two magnificent head lands, Palolem beach is lined with towering coconut palms and is largely unspoiled. It is inhabited by local fishermen and foreign tourists alike.

Radhanagar Beach on the Havelock Island in the Andamans has been placed at number 10 in the list for its stretch of white sand with picture perfect waters lined with palm trees, it said.

Ngapali beach in Myanmar has topped the list, followed by Nacpan beach in Philippines and Kata Noi beach in Thailand, it said.

Yapak beach in Philippines stood at number five, followed by Nai Harn beach in Thailand at number six and Sunrise beach in Thailand at seventh spot, while Otres beach in Cambodia was ranked at number nine, it said.

However, none of the beaches from India features in the category of the world's best beaches.

Grace Bay beach in the Caribbean has topped as the world's number one Traveller's Choice beach, followed by Baia do Sancho beach in Brazil and Playa Paraiso beach in Cuba, the survey said.

# Notes from D'Abrera's *Butterflies of the Oriental Region*, Relevant to South Asian Taxa

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

**(Contd. from Vol. 17, No. 4, page 100)**

(11) ***Discophora*** Boisduval, 1836

1. *D. sondaica* Boisduval, 1836

i. *D. s. tulliana* Stichel (= *muscina* Stichel) - India to China.

[ii. "f. *spilopora* de Niceville has bluish white spots missing on both wings"—D' Abrera].

2. *D. deo* de Niceville, 1898

i. *D. d. deo* de Niceville - ?Assam, Myanmar (Shan States), N Thailand.

3. *D. lepida* Moore, 1857

i. *D. l. lepida* Moore - S India.

ii. *D. l. ceylonica* Fruhstorfer - Sri Lanka.

["Very rare and local." "In Ceylon, the only species there *D. lepidus* is a great rarity." "Larval host plant: Bamboo." —D' Abrera].

4. *D. timora* Westwood, 1850

i. *D. t. timora* Westwood (=*continentalis* Staudinger) - Sikkim, Assam, Myanmar, Thailand.

ii. *D. t. andamensis* Staudinger - Andamans.

["♀ had as yet not been described", figured for first time" in D' Abrera, 1985.]

(12) ***Enispe*** Doubleday, 1848

1. *E. euthymius* Doubleday - Sikkim, Assam, Manipur, N Myanmar.

2. *E. intermedia* Rothschild, 1916

i. *E. i. intermedia* Rothschild - ?Assam, Manipur, Myanmar, Thailand.

["Easily confused with *euthymius* 'f. *tesselata* Moore' in Assam/Burma"—D' Abrera].

3. *E. cycnus* Westwood, ?1851

i. *E. c. cycnus* Westwood - Sikkim, Asssam, N Myanmar.

ii. *E. c. verbanus* Fruhstorfer - Bhutan.

## Part III : pp. 535-672.

## LYCAENIDAE*

(1) ***Cyaniriodes*** de Niceville, 1880

1. *C. libna* Hewitson

i. *C. l. andersonii* Moore - S Myanmar, Thailand, peninsular Malaya and Langkawi Is.

(2) ***Poritia*** Moore, 1866

1. *P. karenina* Evans, 1921 - Myanmar (Karen Hills), ?Thailand, ?peninsular Malaya.

2. *P. sumatrae* Felder, 1865

i. *P. s. sumatrae* Felder - S Myamnar, Thailand, peninsular Malaya, Singapore, Sumatra.

3. *P. philota* Hewitson, 1874

i. *P. p. philota* Hewitson - S Myanmar, Thailand, peninsular Malaya, Singapore, Sumatra, and Borneo.

4. *P. erycinoides* Felder, 1865

i. *P. e. trishna* Fruhstorfer - Assam, ?Nepal, ?Sikkim. [D' Abrera questions "Is this a separate species?"]

ii. *P. e. elsiei* Evans - Myanmar, N Thailand.

[" May be a junior syn. of *trishna*"].

5. *P. manilia* Fruhstorfer, 1912

i. *P. m. dawna* Evans - Myanmar (Dawnas Range).

ii. *P. m. evansi* Corbet - S Myanmar, ?Thailand.

6. *P. hewitsoni* Moore, 1866

i. *P. h. hewitsoni* Moore - Sikkim to N Myanmar, N Thailand.

ii. *P. h. tavayana* Doherty - Manipur, S Maynmar, Thailand to peninsular Malaya.

7. *P. phama* Druce, 1896

i. *P. p. geta* Fawcett - Assam to Central Myanmar, ?Thailand.

(3) ***Simiskina*** Distant, 1886

1. *S. phalena* Hewitson, 1874

i. *S. p. harterti* Doherty - Assam, Myanmar, ?Indo-China, Thailand.

2. *S. parira* Moulton, 1911 - S Myanmar, Thailand, peninsular Malaya, Langkawi, Borneo.

3. *S. proxima* de Niceville, 1895

i. *S. p. dohertyi* Evans - S Myanmar to Thailand to peninsular Malaya, Langkawi Is.

4. *S. phalia* Hewitson, 1874

i. *S. p. potina* Hewitson (= *binghami* Fruhstorfer) - S Myanmar, Thailand to peninsular Malaya, Singapore.

5. *S. pediada* Hewitson, 1877 - S Myanmar to Indo-China, peninsular Malaya, ?Singapore.

*Although published in 1986, Eliot & Kawazoe, 1983, '*Blue Butterflies of the Lycaenopsis Group*' is not covered in this part.

(4) ***Deramas*** Distant, 1886

1. *D. jasoda* de Niceville, 1889

i. *D. j. jasoda* de Niceville - S Myanmar and Thailand, Mergui Is., Langkawi Is.

2. *D. nolens* Eliot, 1964

i. *D. n. nolens* Eliot - S Myanmar, ?peninsular Malaya, ?Philippines.

3. *D. livens* Distant, 1886

i. *D. l. evansi* Eliot - S Myanmar (Tenasserim, Mergui).

(5) ***Liphyra*** Westwood, 1864

1. *L. brassolis* Westwood, 1864

i. *L. b. brassolis* Westwood - Sikkim to Myanmar, Thailand.

["Subfam. Miletinae of some authors, containing *Logania* Distant, *Allotinus* Felder & *Miletus* Hübner is not treated comprehensively in this work. The larvae are carnivorous, feeding on aphids and ant larvae."-D' Abrera]

(6) ***Allotinus*** Felder

1. *A. drumila* Moore - Assam.

(7) ***Miletus*** Hübner

1. *M. ancon* Doherty

i. *M. a. ancon* Doherty - "Alaran" Valley [?Ataran], S Myanmar.

(8) ***Taraka*** Doherty, 1889

1. *T. hamada* Druce, 1875

i. *T. h. mendesia* Fruhstorfer - Sikkim to peninsular Malaya, Sumatra and Borneo.

[ 2. *T. mahanetra* Doherty, 1890 included in de Niceville, 1890, *Butterflies of India, Burmah & Cylon*, 3: 59 is not Indian, but distributed in Peninsular Malaya, Sumatra and Thailand.]

(9) ***Spalgis*** Moore, 1879

1. *S. epius* Westwood, 1851 - Entire Oriental region.

i. *S. e.* race *epius* Westwood - India, Sri Lanka, Nicobars, peninsular Malaya, Mergui Is.

ii. *S. e.* race *nubilus* Moore - Andamans, Pulao Tioman.

(10) ***Curetis*** Hübner, 1819

1. *C. thetis* Drury, 1773

i. *C. t. thetis* Drury - India, Sri Lanka.

ii. *C. t. saronis* Moore - Andamans.

iii. *C. t. obscura* Evans - Car Nicobar.

iv. *C. t. nicobarica* Swinhoe - Central Nicobars.

v. *C. t. kondula* Evans - Great & Little Nicobars.

vi. *C. t. glorisa* Moore - Assam.

2. *C. regula* Evans, 1954 - S Myanmar, Thailand, Sumatra, peninsular Malaya, Java, Borneo.

3. *C. sperthis* Felder

i. *C. s. sperthis* Felder - S Myanmar, Thailand, peninsular Malaya, Langkawi, Singapore, Pulau Tioman, Sumatra, Java, Borneo.

4. *C. siva* Evans, 1954 - S India.

5. *C. bulis* Westwood, 1851

i. *C. b. bulis* Westwood - NW India to China, SW China, peninsular Malaya, Langkawi Is and Myanmar (Ataran Valley).

6. *C. tonkina* Evans, 1954 - Myanmar, Indo-China. ? Thailand.

7. *C. santana* Moore, 1858

i. *C. s. malayika* Felder - N Myanmar, Indo China to peninsular Malaya, Thailand, Sumatra, Bangka and Borneo.

8. *C. dentata* Moore, 1879

i. *C. d. dentata* Moore - India to S Myanmar, Thailand.

9. *C. acuta* Moore, 1877

i. *C. a. naga* Evans - Assam, ?N Myanmar, ? Indo China.

(11) ***Chaetoprocta*** de Niceville, 1890

1. *C. odata* Hewitson - NW India to Sikkim.

["Eggs are laid on walnut leaves" - Seitz, 1926: 969].

(12) ***Euaspa*** Moore, 1884

1. *E. milionia* Hewtison, 1869

i. *E. m. milionia* Hewitson - NW India to Nepal.

2. *E. pavo* de Niceville, 1887 - Bhutan, Assam, Nagaland.

(13) ***Teratozephyrus*** Sibatani, 1946

i. *T. tsangkie* Oberthür, 1886 (= *doni* Tytler) - Tibet, Manipur.

(14) ***Neozephyrus*** Sibatani & Ito, 1942

1. *N. sikkimensis* Howarth, 1957 - Sikkim to Thailand.

2. *N. kabrua* Tytler, 1915 - Sikkim, Assam, Manipur.

3. *N. watsoni* Evans, 1927 - Myanmar (S Shan States).

4. *N. vittatus* Tytler, 1915 - Assam, Manipur, W China.

5. *N. letha* Watson, 1897 - Myanmar (Chin Hills).

6. *N. tytleri* Howarth, 1957 - Manipur (Mt. Kabru).

7. *N. intermedia* Tytler, 1915 - Assam, Nagaland, Manipur (Mt. Kabru).

8. *N. zoa* de Niceville, 1889 - Sikkim, Manipur.

9. *N. sandersi* Howarth, 1957 - Sikkim.

10. *N. desgodinsi* Oberthür, 1886 - Sikkim, Manipur.

11. *N. duma* Hewitson, 1869 - Bhutan, Sikkim, Manipur, SW China.

12. *N. disparatus* Howarth, 1957

i. *N. d. pseudoletha* Howarth - Assam.

ii. *N. d. interpositus* Howarth - Sikkim.

13. *N. jakamensis* Tytler, 1915 - Manipur.

14. *N. assamicus* Tytler, 1915 - Bhutan, Sikkim, Assam, Manipur.

15. *N. bhutanensis* Howarth, 1957 - Bhutan, Nepal, Sikkim.

16. *N. kirbariensis* Tytler, 1915 - Assam, Nagland,

Manipur.

17. *N. paona* Tytler, 1915 - Manipur, ? Assam, Nagaland.

18. *N. khasia* de Niceville, 1890 - Assam, Manipur, [Meghalaya].

19. *N. ataxus* Doubleday & Hewitson, 1852

i. *N. a. ataxus* Doubleday & Hewitson - NW India to Upper Myanmar.

["Taken in Pumps Stn. nullah by O., who netted 200 *Z. ataxus* there in 1915!" - On label by H. D. Peile].

ii. *N. a. zulla* Tytler - Assam, Nagaland, W China.

20. *N. suroia* Tytler, 1915 - E Manipur (Mt. Suroifui, 8-9000').

(15) ***Apporasa*** Moore, 1884

1. *A. atkinsoni* Doherty - Myanmar, Thailand.

(16) ***Mahathala*** Moore, 1878

1. *M. ameria* Hewitson, 1862

i. *M. a. ameria* Hewitson (?= *burmana* Talbot)- ? NE India to S Myanmar.

(17) ***Thaduka*** Moore, 1878

1. *T. multicaudata* Moore, 1878

i. *T. m. multicaudata* Moore - Myanmar, N Thailand.

ii. *T. m. kanara* Evans - S India (Kanara).

(18) ***Arhopala*** Boisduval, 1832

["It seems that natural hybrids must occur more frequently in *Arhopala* than in any other Oriental genus"—Corbet & Pendlebury, 1978. *Butterfl. Malay Peninsula*, 3rd ed, p. 278. "Taxa listed must be regarded as tentaive....♂ genitalia is of little or no diagnostic value" - D' Abrera].

1. *A. anthelus* Westwood, 1851

i. *A. a. anthelus* Westwood - Myanmar (Ataran Valley).

ii. *A. a.* race* *anthea* Evans - Mergui, S Myanmar, Thailand, Vietnam.

2. *A. ijauensis* Bethune - Baker, 1897 - Myanmar, Thailand, peninsular Malaya, Mergui and Langkawi Is.

3. *A. brooksiana* Corbet, 1941 - Peninsular Malaya, W Sumatra, Batu Is. and Mergui.

[Eliot in Corbet & Pendlebury, 1978. *Butterfl. Malay Penin.*, 3rd ed., p.447 treats it as a race of *achelous* Hewitson, 1862].

4. *A. anarte* Hewitson, 1862

i. *A. a. anarte* Hewitson - Assam to peninsular Malaya, Sumatra, Borneo, ?Palawan.

5. *A. camdeo* Moore, 1857 (=? *sebonga* Tytler) - ? Nepal, Bhutan, Sikkim, Assam, Manipur, Myanmar, Thailand, Vietnam.

6. *A. varro* Fruhstorfer, 1913 - Myanmar (Ataran Valley, Karen Hills).

7. *A. aedias* Hewitson, 1862

i. *A. a. yendava* Grose-Smith - Myanmar (Karen Hills, Yendaw Valley, Ataran).

ii. *A. a.* race* *meritatas* Corbet - Mergui, S Myanmar, Langkawi Is.

8. *A. opalina* Moore, 1884

i. *A. o. opalina* Moore (? =*fruhstorferi* Röber) - ?Assam, Myanmar to Thailand.

9. *A. dispar* Riley & Godfrey, 1921

i. *A. d. dispar* Riley & Godfrey (? = *diluta* Evans, *fràcta* Evans, *chota* Evans) - Assam area, Myanmar, Thailand.

10. *A. atosia* Hewitson, 1863

i. *A. a. atosia* race* *aria* Evans - Myanmar.

ii. *A. a. a.* race* *jahara* Corbet - Mergui, Langkawi Is.

11. *A. allata* Staudinger, 1889

i. *A. a. allata* race* *atarana* Tytler - Myanmar (Shan States, Ataran).

ii. *A. a. a.* race* *suffusa* Tytler - Manipur.

12. *A. epimuta* Moore, 1857

i. *A. e. epimuta* Moore - Myanmar to Borneo.

ii. *A. e. e.* race* *elsiei* Evans - Myanmar, Thailand.

13. *A. muta* Hewitson, 1862

i. *A. m. muta* race* *merguiana* Corbet - Thailand, Myanmar, Mergui.

["Very variable species, producing local forms..." —D' Abrera].

14. *A. moolaiana* Moore, 1879

i. *A. m. moolaiana* Moore - Myanmar (Tavoy, Tenasserim, Ataran, Karen Hills).

ii. *A. m. m.* race* *maya* Evans - Mergui, Thailand.

15. *A. agesilaus* Staudinger, 1889

i. *A. a. gesa* Corbet - Thailand, peninsular Malaya, Langkawi Is., Mergui, Bangka.

16. *A. catori* Bethune - Baker, 1903 - Mergui, Thailand, peninsular Malaya, Langkawi Is, Sumatra, Nias, Borneo and Palawan.

17. *A. amphimuta* Felder, 1860

i. *A. a.* race* *milleriana* Corbet - Thailand, Mergui, S Myanmar, Langkawi, Penang Is.

18. *A. belphoebe* Doherty, 1889 - Assam to peninsular Malaya.

19. *A. abseus* Hewitson, 1862

i. *A. a. mackwoodi* Riley - Sri Lanka.

ii. *A. a.* race* *ophiala* Corbet - S Myanmar, S Thailand.

iii. *A. a.* race* *indicus* Riley - India to N and Central Myanmar, N Thailand, Indo China.

20. *A. nicevillei* Bethune-Baker, 1903-Bhutan, Assam, N Myanmar, N Indo China.

21. *A. silhetensis* Hewitson - Sikkim, Assam, Manipur,

* D' Abrera has called these "races", but cited as "subspecies" in the figures.

Myanmar, Mergui, Thailand, ? Indo China. [?? Bangladesh].

22. *A. athada* Staudinger, 1889

i. *A. a.* race* *apha* de Niceville - Assam, Myanmar, Mergui.

23. *A. zambra* Swinhoe, 1910

i. *A. z. zambra* Swinhoe - Myanmar, Thailand, peninsular Malaya, Sumatra, Nias, Borneo, Bawean, Bangka, Java.

24. *A. ace* de Niceville, 1892

i. *A. a.* race* *arata* Tytler - Manipur, Myanmar.

25. *A. agrata* de Niceville, 1890

i. *A. a. a.* race* *binghani* Corbet - Assam, Myanmar, Mergui, Thailand.

26. *A. aurelia* Evans, 1925 - Assam to Langkawi Is.

27. *A. selta* Hewitson, 1869

i. *A. s. selta* Hewitson - Myanmar, Mergui, peninsular Malaya, Thailand, ? Sumatra.

ii. *A. s.* race* *constanceae* de Niceville - Andamans.

28. *A. sublustris* Bethune - Baker, 1904

i. *A. s. ridleyi* Corbet race* *ralanda* Corbet - S Myanmar, Thailand.

29. *A. aroa* Hewitson, 1863

i. *A. a. esava* Corbet - S Myanmar, Mergui, Thailand.

30. *A. alea* Hewitson, 1862 - S India.

31. *A. atrax* Hewitson, 1862 - India, Assam, Myanmar.

32. *A. oenea* Hewitson, 1869 (? = *khanti* Doherty) - Sikkim, Assam, Myanmar, ?Indo China, Hainan.

33. *A. alax* Evans, 1932 - Manipur, Myanmar, W Thailand.

34. *A. democritus* Fabr., 1793

i. *A. d. democritus* Fabr. - Myanmar, Thailand, Mergui, Indo China, Langkawi Is., N peninsular Malaya.

35. *A. alitaeus* Hewitson, 1862

i. *A. a. a.* race* *mirabella* Doherty - Myanmar, Mergui, Thailand, Langkawi Is.

36. *A. pseudomuta* Staudinger, 1889

i. *A. p. ariavana* Corbet - Myanmar, Mergui, Thailand, Langkawi Is.

37. *A. aida* de Niceville, 1889

i. *A. a. aida* de Niceville - Myanmar, Mergui, Thailand, Langkawi Is., Pulau Tenggol, Indo China, Hainan.

38. *A. ariana* Evans, 1925

i. *A. a. ariana* Evans - Mergui, Langkawi Is.

39. *A. elopura* Druce, 1894

i. *A. e. e.* race* *dama* Swinhoe - Myanmar, Mergui, Langkawi Is., Thailand, Indo China.

40. *A. bazalus* Hewitson, 1862

i. *A. b. teesta* de Niceville - Sikkim to China, Myanmar, Mergui, Thailand.

41. *A. singla* de Niceville, 1885 - NW India, Sikkim, Bhutan, Nepal, Assam, Myanmar to SW China.

42. *A. amantes* Hewitson, 1862

i. *A. a. amantes* Hewitson - Sri Lanka, S India.

ii. *A. a.* race* *apella* Swinhoe - N and Central India to Sikkim, ? Assam.

iii. *A. a.* race* *amatrix* de Niceville - Myanmar, Thailand, ? Indo China.

43. *A. hellenore* Doherty, 1889

i. *A. h. hellenore* Doherty - Assam, Manipur, Myanmar, Mergui, Thailand, Indo China, Hainan.

44. *A. eumolphus* Cramer, 1780

i. *A. e. eumolphus* Cramer - Sikkim, Assam, N Myanmar, N Thailand, Hainan.

ii. *A. e.* race* *maxwelli* Distant - Mergui, Myanmar, S Thailand, peninsular Malaya, Sumatra, Borneo.

45. *A. horsfieldi* Pagenstecher, 1890

i. *A. h. eurysthenes* Fruhstorfer - S Myanmar, Mergui, S Thailand, Langkawi.

46. *A. corinda* Hewitson, 1869

i. *A. c. corestes* Corbet - S Myanmar, Mergui, Langkawi.

47. *A. vihara* Felder, 1860

i. *A. v. hirava* Corbet - S Myanmar, Mergui, Langkawi.

48. *A. ormistoni* Riley, 1920 - Sri Lanka.

49. *A. bazaloides* Hewitson, 1878

i. *A. b. bazaloides* Hewitson - India, Assam, Thailand, Langkawi.

ii. *A. b.* race* *lanka* Evans - Sri Lanka.

50. *A. agaba* Hewitson, 1862 - S and central Myanmar, Mergui, Thailand, Langkawi Is., Indo China, peninsular Malaya, Sumatra.

51. *A. paralea* Evans, 1925 - Assam, Manipur, Central and S Myanmar.

52. *A. buddha* Bethune - Baker, 1903

i. *A. b. cooperi* Evans - S Myanmar, Mergui, peninsular Malaya, S Thailand, Sumatra, Bangka, Borneo, Philippines.

53. *A. barami* Bethune - Baker, 1903

i. *A. b. woodi* Ollenbach - S Myanmar, Mergui, S Thailand.

54. *A. alesia* Felder, 1865

i. *A. a.* race* *wimberleyi* de Niceville - Andamans.

ii. *A. a.* race* *sacharja* Fruhstorfer - Manipur, Central Myanmar, Thailand, Indo China.

55. *A. pseudocentaurus* Doubleday, 1847

i. *A. p. pirama* Moore - Sri Lanka, S India.

ii. *A. p.* race* *pirithous* Moore - N India, Assam, Sikkim.

iii. *A. p.* race* *coruscanas* Wood-Mason & de Niceville - Andamans.

iv. *A. p.* race* *pseudocentaurus* Doubleday - Myanmar, Thailand, Indo China, Hainan, part Sundaland.
56. *A. arvina* Hewitson, 1863
i. *A. a. ardea* Evans - Assam and Hainan.
ii. *A. a.* race* *aboe* de Niceville - S Myanmar, Mergui, S Thailand.
57. *A. epimete* Staudinger, 1889
i. *A. e. duessa* Doherty - S Myanmar, Mergui, Langkawi.
58. *A. alaconia* Hewitson, 1869
i. *A. e. aloana* Corbet - Central Myanmar.
ii. *A. a.* race* *media* Evans - Mergui, S Thailand, peninsular Malaya.
59. *A. agelastus* Hewitson, 1862
i. *A. a. perissa* Doherty - S and Central Myanmar, Mergui, S Thailand.
60. *A. labuana* Bethune - Baker, 1896 - Myanmar to peninsular Malaya, Sumatra, N Pagi Is., Borneo.
61. *A. asopia* Hewitson, 1869 - Assam to Central Myanmar.
62. *A. asinarus* Felder, 1865
i. *A. a. tonguva* Grose - Smith - Mynamar (Karen Hills, Bassein, Yangoon).
ii. *A. a.* race* *asinarus* Felder - SE Myanmar, Thailand, Indo China.
63. *A. zeta* Moore, 1878 - Andamans.
64. *A. aeeta* de Niceville, 1893 - Manipur, Central Myanmar, Indo China (S Annam).
65. *A. antimuta* Felder, 1865
i. *A. a. antimuta* Felder - Central and S Myanmar, Mergui, S Thailand, Langkawi, peninsular Malaya, Singapore, Sumatra, Natuna Is.
66. *A. perimuta* Moore, 1857
i. *A. p. perimuta* Moore - Sikkim, Assam, N and Central Myanmar, N Thailand.
ii. *A. p.* race* *regina* Corbet - S Myanmar, Mergui, S Thailand, peninsular Malaya.
67. *A. fulla* Hewitson, 1862
i. *A. f. ignara* Riley & Godfrey - Myanmar, Mergui, N Thailand.
ii. *A. f.* race* *andamanica* Wood - Mason - Andaman Is.
68. *A. curiosa* Evans - Bhutan (Dokyang La, 10,000').
["Looks more like a sp. of *Mahathala* than *Arhopala*". D' Abrera is misleading here, in description he states, "♂ (holotype) as illustrated", but below the fig. writes, "*A. curiosa* ? ♀ v".]
69. *A. comica* de Niceville, 1900 - Manipur, N and Central Myanmar, Thailand (Tukdah).
70. *A. paramuta* de Niceville, 1883
i. *A. p. paramuta* de Niceville - Assam, Sikkim, Myanmar, N Thailand, S China.
71. *A. rama* Kollar, 1842 (? = *ramosa* Evans) - Nepal, Sikkim, Assam, N Myanmar to China.
72. *A. dodonaea* Moore, 1857 - NW India, Sikkim.
73. *A. ganesa* Moore, 1857
i. *A. g. ganesa* Moore - NW India, Sikkim.
ii. *A. g.* race* *watsoni* Evans - Assam, Central Myanmar.
74. *A. birmana* Moore, 1884
i. *A. b. birmana* Moore - Manipur to Central Myanmar, Hong Kong.
75. *A. aberrans* de Niceville, 1888 - Sikkim, Assam to Central Myanmar, W China.
76. *A. paraganesa* de Niceville, 1882
i. *A. p. paraganesa* de Niceville - N India, Nepal, Sikkim.
ii. *A. p.* race* *zephyretta* Doherty - Assam, N and Central Myanmar, W Thailand.
77. *A. ammonides* Doherty, 1891
i. *A. a. elira* Corbet - Assam.
ii. *A. a.* race* *ammonides* Doherty - Myanmar, Mergui.
78. *A. ariel* Doherty, 1891 (= *antis* Corbet) - Assam, peninsular Malaya, Borneo.

(19) ***Semanga*** Distant, 1884
1. *S. superba* Druce, 1873
i. *S. s. deliciosa* Fruhstorfer (?= *siamensis* Talbot) - Sumatra, peninsular Malaya, Singapore, Langkawi, ?S Myanmar, ? Mergui, ?S Thailand, Pulau Tioman.

(20) ***Mota*** de Niceville, 1890
1. *M. massyla* Hewitson, 1862 - Sikkim, Bhutan, Assam, Manipur, ?N and Central Myanmar, N Thailand

(21) ***Surendra*** Moore, 1879
1. *S. vivarna* Horsfield, 1829
i. *S. v. discalis* Moore - Sri Lanka.
ii. *S. v. latimargo* Moore - Andamans.
iii. *S. v. biplagiata* Moore - S India.
2. *S. quercetorum* Moore - Assam, Thailand.
["Probably a 'good' species" - D' Abrera].
3. *S. florimel* Doherty, 1889 - Java, Sumatra, peninsular Malaya, Thailand, ? Myanmar.

(22) ***Zinaspa*** de Niceville, 1890
1. *Z. todara* Moore, 1884
i. *Z. t. todara* Moore - S India.
ii. *Z. t. karennina* Evans - Myanmar to peninsular Malaya, Thailand.

(23) ***Zesius*** Hübner, 1819
1. *Z. chrysomallus* Hübner, 1819 - Sri lanka, S India.

(24) ***Flos*** Doherty, 1889
1. *F. diardi* Hewiston, 1862
i. *F. d. diardi* Hewitson - Sikkim, Assam, Myanmar, Mergui, Thailand.
2. *F. fulgida* Hewitson, 1863

i. *F. f. fulgida* Hewitson - Sikkim, Assam to Myanmar, Thailand.

3. *F. anniella* Hewitson, 1862

i. *F. a. artegal* Doherty - Central Myanmar to N Thailand, Mergui.

4. *F. apidanus* Cramer, 1777

i. *F. a. ahamus* Doherty - Assam, Central and S Myanmar, Mergui, Thailand, Langkawi.

5. *F. adriana* de Niceville, 1883 - Sikkim, Assam, Myanmar, Thailand.

6. *F. asoka* de Niceville, 1883 - Sikkim, Assam, Myanmar, Thailand to SW China and Hong Kong.

7. *F. areste* Hewitson, 1862 - Nepal, Bhutan, Sikkim, Assam, Myanmar, China (Chekiang, Kawang Tung).

8. *F. chinensis* Felder, 1865 - Sikkim, Bhutan, Assam, SW China to Shanghai.

(25) ***Amblypodia**** Horsfield, 1829

1. *A. anita* Hewitson, 1862

i. *A. a. anita* Hewitson - India, Myanmar, Thailand, peninsular Malaya, Langkawi.

ii. *A. a. naradoides* Moore - Sri Lanka.

iii. *A. a. andamanica* Riley - Andamans.

iv. *A. a. gigantea* Tytler - Manipur.

v. *A. a. dina* Fruhstorfer - Sikkim.

2. *A. narada* Horsfield, 1828

i. *A. n. andersonii* Moore - Mergui.

ii *A. n. taooana* Moore - S Myanmar (Upper Tenasserim), Thailand to peninsular Malaya, Langkawi.

(26) ***Iraota**** Moore, 1881

1. *I. timoleon* Stoll, 1790

i. *I. t. timoleon* Stoll (? = *maecenas* Fabr., 1793) - NW India, Assam to S China.

ii. *I. t. nicevillei* Butler - Sri Lanka. ["Butter" lapsus in D' Abrera].

iii. *I. t. arsaces* Fruhstorfer - S India.

(27) ***Catapaecilma***** Butler, 1879

1. *C. major* Druce, 1895 (? = *anais* Fruhstorfer)

i. *C. m. major* Druce (? = *albicans* Corbet) - N India to Myanmar, N Thailand.

ii. *C. m. callone* Fruhstorfer - S India.

iii. *C. m. mysotina* Fruhstorfer - Sri Lanka.

2. *C. subochrea* Elwes, 1893 - Myanmar (Karen Hills) and Thailand.

(28) ***Acupicta*** Eliot, 1973

1. *A. delicatum* de Niceville, 1888 - Sikkim.

(29) ***Yasoda*** Doherty, 1889

1. *Y. tripunctata* Hewtson, 1869 (? = *atrinotata* Fruhstorfer) - Sikkim, to C Myanmar, Thailand, Indo China.

2. *Y. pita* Horsfield, 1829

i. *Y. p. dohertyi* Fruhstorfer - Central and S Myanmar, Mergui, W Thailand, Langkawi Is., peninsular Malaya, ?Sumatra.

(30) ***Loxura*** Horsfield, 1829

1. *L. atymnus* Stoll, 1780

i. *L. a. atymnus* Stoll (= *anglerius* Fruhstorfer) - S India.

ii. *L. a. arcuata* Moore - Sri Lanka.

iii. *L. a. continentalis* Fruhstorfer - Assam to W Thailand, Indo China, S China, Hainan.

iv. *L. a. praeha* Moore - S Andamans.

v. *L. a. nicobarica* Moore - Nicobars.

(31) ***Thamala*** Moore, 1879

1. *T. marciana* Hewitson, 1863

i. *T. m. sparanisa* Fruhstorfer - Central Myanmar.

ii. *T. m. miniata* Moore - Mergui, S Myanmar to Indo China.

(32) ***Neomyrina*** Distant, 1884

1. *N. nivea* Godman & Salvin, 1878

i. *N. n. hiemalis* Godman & Salvin - S Myanmar, Mergui, S Thailand, Langkawi.

(33) ***Drina*** de Niceville, 1890

1. *D. donina* Hewitson, 1865

i. *D. d. donina* Hewitson - Myanmar (Dawnas), Thailand, Indo China.

(34) ***Rathinda*** Moore, 1881

1. *R. amor* Fabr., 1775 - Assam, India, Sri Lanka. ['Not common', but 'easy to capture beacuse of its very laboured flight' —D' Abrera].

(35) ***Horaga*** Moore, 1881

1. *H. onyx* Moore, 1857

i. *H. o. onyx* Moore - N India, Sikkim, Assam, Maynmar, Thailand.

ii. *H. o. cingalensis* Moore - Sri Lanka, S India.

iii. *H. o. rana* de Niceville - Andamans, Nicobars.

2. *H. syrinx* Felder, 1860

i. *H. s. sikkima* Moore - Sikkim, Bhutan, Assam.

ii. *H. s. moulmeina* Moore - Mergui, S Myanmar, S Thailand.

*(To be continued).*

*Genus *Amblopala* Leech, 1893 is strictly speaking from Palaearctic China —D' Abrera.

** "*Iraota abnormis* Moulton mistakenly assigned to *Drupadia*. Corbet & Pendlebury (1978) corrected it." —D' Abrera.

*** D' Abrera has not given distribution of *Catapaecilma harmani* Cassidy, 1982; and cited (lapsus calami) *Hypothecla indrasari* Snellen, ?1878 (in figs.) as '*indrasiri*' (in the text). Both species are not found in the Indian region.

Research Notes

# NEW RECORDS OF ROVE BEETLES FROM HIMACHAL PRADESH (COLEOPTERA: STAPHYLINIDAE)

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The family Staphylinidae is one of the largest families of the superfamily Staphylinoidea and are commonly known as rove beetles, distributed throughout the world.

Cameron (1931) has dealt with this family in the Indian region extensively. Author has recently reported the rove beetles of Himachal Pradesh (*Bionotes*, Vol. 17 (3) : 76, 17(4) : 104, and 18 (1) : 25).

The present study is based on the collections brought from different districts of Himachal Pradesh by various recent survey parties from the Zoological Survey of India, Kolkata. The study reports 17 species under 11 genera and one subfamily. All the species are new records from Himachal Pradesh.

**Order : Coleoptera**
**Family : Staphylinidae**
Subfamily : Paederinae
Tribe : Pinophilini

Genus ***Palaminus*** Erichson

1. ***Palaminus andrewesi*** Cameron

Distribution: India : Himachal Pradesh, Sikkim, Tamil Nadu.

Genus ***Paederus*** Fabricius

2. ***Paederus nigripennis*** Cameron

Distr.: India: Himachal Pradesh, Uttarakhand, West Bengal, Uttar Pradesh.

3. ***Paederus atrocyanus*** Champion

Distr.: India: Himachal Pradesh, West Bengal.

4. ***Paederus birmanus*** Fauvel

Distr.: India: Himachal Pradesh, West Bengal, Nagaland. Elsewhere: Myanmar.

5. ***Paederus basalis*** Bernh.

Distr.: India: Himachal Pradesh, Uttarakhand:

Genus ***Acanthoglossa*** Kraatz

6. ***Acanthoglossa testaceipennis*** Kraatz

Distr.: India: Himachal Pradesh, Uttarakhand, Tamil Nadu, West Bengal, Tripura, Meghalaya, Sikkim.

Genus ***Stilicus*** Latr.

7. ***Stilicus velutinus*** Fauvel

Distr.: India: Himachal Pradesh, Uttarakhand, West Bengal, Tripura.

Genus ***Charichirus*** Sharp

8. ***Charichirus chinensis*** Boh.

Distr.: India: Himachal Pradesh, West Bengal. Elsewhere: Sri Lanka and Japan.

Genus ***Scopaeus*** Erichson

9. ***Scopaeus beesoni*** Cameron

Distr.: India: Himachal Pradesh, Tripura, Uttar Pradesh, and West Bengal.

Genus ***Lathrobium*** Gravenhorst

10. ***Lathrobium tristi*** Cameron

Distr.: India: Himachal Pradesh, Uttar Pradesh, West Bengal.

11. ***Lathrobium pustulatum*** Cameron

Distr.: Himachal Pradesh, Assam.

Genus ***Lobochilus*** Bernhauer

12. ***Lobochilus fortepunctatus*** Cameron

Distr.: India: Himachal Pradesh, Uttarakhand, Assam, West Bengal.

Genus ***Medon*** Steph.

13. ***Medon birmanus*** Fauv.

Distr.: India: Himachal Pradesh (Sirmour, Renuka W.R.S), Sikkim, Uttarakhand. Elsewhere: Myanmar.

14. ***Medon immsi*** Bernhauer

Distr.: India: Himachal Pradesh (Mandi, Ropa, Sundernagar), Uttarakhand. Elsewhere: Singapore.

Genus ***Pseudbium*** Muls. et Rey

15. ***Pseudobium laeviventre*** Champ.

Distr.: India: Himachal Pradesh, Uttarakhand.

Genus ***Cryptobium*** Mannerh

16. ***Cryptobium abdominal*** var. ***rufipenne*** Motsch.

Distr.: India: Himachal Pradesh (Chamba, Banikhet), widely distributed throughout India. Elsewhere: Sri Lanka.

17. ***Cryptobium bernhaueri*** Cameron

Dist.: India: Himachal Pradesh, Uttarakhand, Sikkim, Uttar Pradesh, Tripura, Siwalik.

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# GONADOSOMATIC INDEX OF THE FISH *CIRRHINUS FULUNGEE* FROM RIVER GODAVARI, MAHARASHTRA

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One of the methods of studying the spawning season is to follow the seasonal changes in gonad weight in relation to body weight expressed as the gonadosomatic index (Qasim, 1966; Bhatt, 1971; Ahirrao, 2002). Gonads undergo regular seasonal cyclical changes in weight, particularly in females. Such cyclical changes are indicative of the spawning season.

The gonadosomatic index (GSI) is one of the important parameter of the fish biology which gives the detail idea regarding the fish reproduction. GSI is one of the measures which can be used to assess the degree of ripeness of the ovary. GSI is an indicator of breeding period in fish (Gupta, 1974). The reproductive cycle in fishes involves large changes in the weight of gonads which are usually reported in terms of GSI expressed in terms of the gonadal weight as a percentage of the whole body weight. There have been numerous studies in which GSI has been used as an indicator of gonad development. The gonadosomatic index is an indicator of the status of gonads i.e. ovary and testis in terms of maturity and denotes the phase of reproductive cycle.

GSI is generally used for the study of maturation and spawning biology. It is also used to assess the degree of ripeness of the ovary. Gonadosomatic index is an indicator of breeding period in fish calculated at different intervals for adult female fish after taking the total weight of each fish into consideration (Gupta, 1974).

**Material and Methods**

For present investigation 10 female fishes of each fish species were randomly selected each month, from each station during 2 years tenure of study. They were weighed properly and their weight was noted. After dissecting the fish, ovary was removed carefully and preserved in 10% formalin for few days. After few days ovaries were dried by using blotting paper and then they were weighed carefully to note down their weight.

The GSI was calculated by following formula :

GSI = weight of gonad/weight of fish × 100.

**Observations and Results**

In present investigation, GSI of *Cirrhinus fulungee* ranged from 4.13 to 13.37 (Table 1). The maximum GSI was observed in the June month and minimum in October. Thus in present investigation the value of GSI indicate pre-spawning season i.e. January, February, March and April consisting of immature population. Gradual increase in the GSI values indicate prolonged spawning season in the months of May, June, July and August, indicating population of fully matured individuals, which is followed by sudden fall in the GSI values, which confirms the post spawning season in the months of September, October, November and December, showing the population of matured and spent individuals. Similar observations were also recorded by previous workers as Varghese (1971), Sharma et al., (1996) and Ahirrao (2002), which confirms the findings of the present investigation.

**Discussion:**

The percentage of gonad in the total weight of fish is known as GSI and these values are an index of maturation of fishes (Varghese, 1973). Nautiyal (1984) stated that the high value of GSI and relative condition of fishes are the indicator of peak activity of gonads. July-August which is also peak of the spawning season i.e. high values of GSI indicate high

**Table 1. Calculation of Gonadosomatic Index of Fish *Cirrhinus fulungee.***

| | Month | Average weight of fish (gm) | Average weight of ovary (gm) | GSI |
|---|---|---|---|---|
| 1 | July 2008 | 16 | 2.200 | 13.75 |
| 2 | August 08 | 40 | 4.695 | 11.73 |
| 3 | September 08 | 28 | 1.020 | 3.64 |
| 4 | October 08 | 29 | 1.200 | 4.13 |
| 5 | November 08 | 23 | 1.150 | 5.00 |
| 6 | December 08 | 30 | 1.580 | 5.26 |
| 7 | January 2009 | 30 | 1.600 | 5.33 |
| 8 | February 09 | 32 | 2.035 | 6.36 |
| 9 | March 09 | 34 | 2.500 | 7.35 |
| 10 | April 09 | 45 | 3.540 | 7.86 |
| 11 | May 09 | 32 | 3.600 | 11.25 |
| 12 | June 09 | 30 | 4.010 | 13.37 |
| 13 | July 09 | 32 | 4.250 | 13.28 |
| 14 | August 09 | 38 | 4.265 | 11.22 |
| 15 | September 09 | 33 | 1.550 | 4.69 |
| 16 | October 09 | 28 | 1.280 | 4.57 |
| 17 | November 09 | 30 | 1.650 | 5.50 |
| 18 | December 09 | 32 | 1.825 | 5.70 |
| 19 | January 2010 | 30 | 1.975 | 6.58 |
| 20 | February 10 | 31 | 2.300 | 7.41 |
| 21 | March 10 | 32 | 2.645 | 8.26 |
| 22 | April 10 | 38 | 3.125 | 8.22 |
| 23 | May 10 | 28 | 2.485 | 8.87 |
| 24 | June 10 | 20 | 2.225 | 11.12 |

value of relative condition (Nautiyal, 1985).

Pawar et al. (2007) observed that the GSI of *Macrones bleekeri* showed two peaks, one during March and other during June. The relatively smaller peak during March was mainly due to maturation of a small fraction of the population of this species during the period and higher water temperature and lower level of the Lake water. Slight fall of GSI in April and May indicated first attempt of spawning. The higher peak during June indicated greater number of fish maturing during this period. The decline following peak further suggested the onset of spawning. The monthly changes in the GSI show that the spawning season of *Mystus bleekeri* spreads over a long period of time; beginning in April and extending up to November, with a main peak season in June, July and August.

The measurement of GSI is an important tool in determining gonadal state (Neelakantan et al., 1989) and it has been used in a variety of fishes and crab species under normal and experimental conditions to show the state of gonads. Pathre & Patil (2011) reported the GSI in *Barytelphusa cunicularis* for female crab. It was high in the month of June, July and August. The highest ovarian index was found in the month of July, while the highest testicular index in the month of August.

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## Gecko's Foot to Clean Dust

### A Novel Method for Removal of Dust from Solid Surfaces using Polymeric Micropillars

The sticky pads of gecko feet are helpful for climbing walls—but they could also help clean up dust, too. Researchers from Yale University have found that microscopic structure could be used to gather ultrafine dust that's otherwise devilishly hard to capture.

Look at the surface of a gecko's foot under a microscope and you won't see a smooth surface, but thousands of tiny pillars. Those pillars help generate electrostatic charges that provide at least part of the creature's ability to clamber up vertical surfaces with relative ease.

But electrostatic charges could also be used to attract dust particles, the researchers figured—so they decided to build a new material that mimics the microstructure of the gecko foot. The result is a sheet of a polymer called polydimethylsiloxane (PDMS), with pillars over its surface that range in size from two to 50 microns in diameter.

Unlike a gecko foot, the electrostatic charge created by the pillars is too weak for a sheet of the material to stick to a surface—but it is strong enough to attract dust particles. The team tested it on a series of different surfaces, where it appears to work effectively and causes no damage to the objects it's being used to clean. Now we need to wait for their clever cleaning cloths to become a commercial reality.

# BEETLE FAUNA ASSOCIATED WITH THE TEA GARDENS OF NORTHERN WEST BENGAL

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Tea is an agro-ecosystem comprising tea plants, shade trees and other auxiliary crops along with various biotic and abiotic components (Roy et al., 2014). Tea plantations roughly resemble a single species forest (Cranham, 1966a, b) which is also a shelter, food and breeding ground of various insects.

Keeping in mind, several surveys were conducted during 2012-2016 under the project "Insect Pest and Pollinator diversity of some major Cash Crops of North Bengal" in different tea gardens of North Bengal by the scientists of Zoological Survey of India, Kolkata. As a result, total 13 species under 10 genera of 3 families of Coleoptera were recorded from the different tea gardens of Dooars and high altitude areas in North Bengal.

The Family Scarabaeidae was represented by 8 species which mostly include phytophagous species (*Brahmina* sp., *Holotrichia* sp., *Xylotrupes gideon, Anomala dimidiata, Anomala grandis)*. Of these, two species namely *Holotrichia* sp., and *Xylotrupes gideon* are reported as pests of tea (Roy et al., 2014). Apart from this, few coprophagous species (*Catharsius molossus, Catharsius sagax* and *Onitis subopacus*) were also recorded during this survey. These beetles are dung feeders which feed on the dungs and excreta of the animals. Thus helping in breaking down of plant and animal remains that contribute to the recycling of nutrients and the cleaning of the environment.

Wood boring is carried out by various groups of insects, either to obtain food or as means of protection of their eggs, larvae and pupae. Among the wood boring insects, the members of the family Cerambycidae are the most notorious pests of the freshly felled logs or dying standing trees. They mostly damage the shade trees of tea gardens and may also attack the tea plants. Only three species of Cerambycid beetles were recorded during this survey.

The members of the family Coccinellidae are mostly phytophagous but few species are also flower visitors. The only species recorded during present study is *Micraspis discolor* which is well known as flower visitor of several plant species.

The present communication is a first consolidated report on beetle fauna and their biological role in the tea gardens of North Bengal. All collection were made by B. Mitra and party.

Order COLEOPTERA

Family CERAMBYCIDAE

Subfamily Prioninae

Tribe Prinini

1. ***Dorysthenes (Lophosternus) indicus*** (Hope, 1831)
Material examined: 1 ex., Thurbo Tea garden, 12.vi.14 and 1 ex., Sourenee Tea garden, 15.vi.14; Mirik, Darjeeling district.

2. ***Dorysthenes (Paraphrus) granulosus*** (Thomson, 1861)
Material examined: 3 exs., Nagrakata Tea Research Association garden, Jalpaiguri district, 04.ix.12.

Subfamily Cerambycinae

Tribe Xystrocerini

3. ***Xystrocera globosa*** (Olivier, 1795)
Material examined: 1 ex. Hilla Tea Estate, Jalpaiguri district, 6.i.16.

Subfamily Lamiinae

Tribe Monochamini

4. ***Aristobia approximator*** (Thomson, 1865)
Material examined: 1 ex., Zurrantee Tea Estate, Jalpaiguri district, 14. xi. 14.

Family SCARABAEIDAE

Subfamily Dynastinae

5. ***Xylotrupes gideon*** (Fabricius,1775)
Material examined: 2 exs., Nagrakata tea garden, Jalpaiguri district, 8.ix.12.

Subfamily Scarabaeinae

6. ***Catharsius molossus*** (Linnaeus, 1758)
Material examined: 3 exs., Nagrakata tea garden, Jalpaiguri district, 8.ix.12.

7. ***Catharsius sagax*** (Quenstedt, 1806)
Material examined: 1 ex., Nagrakata tea garden, Jalpaiguri district, 9.ix.12.

8. ***Onitis subopacus*** Arrow, 1931
Material examined: 4 exs., Wasabari tea garden, Jalpaiguri district, 28.i.13.

Subfamily Melolonthinae

9. ***Holotrichia*** **sp.**
Material examined: 2 exs., Nagrakata tea garden, Jalpaiguri district, 11. ix.12.

10. ***Brahmina*** **sp.**
Material examined: 5 exs., Kartika tea garden, Aliporeduar district, 3. xi.14.

Subfamily Rutelinae

11. ***Anomala grandis*** (Hope,1840)
Material examined: 1 ex., Hilla tea garden, Jalpaiguri district, 27.vi.14.

12. ***Anomala dimidiata*** (Hope, 1831)
Material examined: 2 exs., Bagracote tea garden, Jalpaiguri district, 8.i.16.

Family COCCINELLIDAE
Subfamily Coccinellinae

13. ***Micraspis discolor*** (Fabricius)
Material examined: 10 exs., Red Bank tea garden, Jalpaiguri district, 5.ii.13.

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## News

## Fire in the NMNH, Delhi

A blazing inferno reduced the iconic National Museum of Natural History (NMNH) in central Delhi to ashes in the early hours of Tuesday, the 26 April, 2016, destroying precious natural treasures housed in the 38-year-old institution that had been frequented by generations of kids in the city.

The cause of the fire, which broke out in the sixth floor of the seven-storey building, is yet to be ascertained. It took 100 firemen, 37 fire tenders and eight lakh litres of water to control the blaze that had spread to all floors including the galleries, gutting the museum from inside.

No casualities were reported but six firemen who had first responded to the emergency calls had to be rescued from inside the building filled with thick plumes of smoke. They were briefly hospitalised. Police are also probing the possibility of a sabotage.

Fire officials said a notice has been sent to the museum authorities after it was found they did not have fire safety clearance that has to be taken every three years.

**Past Forward**

- Former PM Indira Gandhi announced the opening of a natural history museum in 1972 on the 25th Independence Day.
- The museum was eventually opened on June 5, 1978, coinciding with the World Environment Day.
- Regional branches of NMNH have come up in Mysore, Bhopal, Bhuvaneshwar, and Sawai Madhopur. Awaited at Gangtok.
- Visitors have very poor comments about the museum, the audit said.
- There were no guides, multimedia devices to enrich the experience of visitors. It's not disabled friendly and continues to function from a rented building even after 32 years.

**Important Specimens Lost**

- An ammonite fossil, a 160 million-year-old fossil bone of a sauropod, a large collection of bird eggs, including those of ostrich and the long-billed vulture.
- Several stuffed animal specimens, including various lions, tigers, clouded leopard, snow leopard and one horned rhino. Some of them were prepared by Mysore-based taxidermist Van Ingen & Van Ingen.
- A stuffed red panda and a duck billed platypus from Australia were among popular exhibits.
- A collection of butterflies and a melanistic tiger coat also lost.

**Neglected all the way**

In August 2015 the combined footfall in its five units across the country was a paltry 25,000. The exhibits seemed frozen in time, the descriptions accompanying them had faded, the video screens were too small and navigating from one section to another was quite tedious, owing to design and information flaws. In 2012, parliament's Public Accounts Committee had said the museum had an "amateurish" display and didn't focus on current issues like climate change, desertification and depletion of ozone layer.

The display depended heavily on stuffed animals with little interactive material to keep children engaged. Most of the display items were borrowed from the Zoological Survey of India (ZSI) in Kolkata. Among the important specimens were a sauropod femur bone and an ammonite fossil, an extinct marine mollusc. It was, perhaps, the only one in India. The biggest loss would be destruction of the taxidermy specimens.

Asif Naqvi, former scientist and curator of zoology, recollects that NMNH used to be hangout for some of the leading environmentalists and film makers of today. "Salim Ali, M. S. Swaminanthan, Ashish Kothari, Mike Pandey, and Vandana Shiva were among those who used to frequently visit NMNH. Many from National School of Drama would drop in to watch the film screenings. Everyone will vouch that it was the first museum to be so active and to focus so seriously on conservation," said Naqvi. An environmentalist said "It is the Ministry's neglect. Natural History Museums are incredible places for education..." In the 80s and 90s, there were projects at NMNH in collaboration with the American Museum of Natural History and the Carnegie Museum of Natural History of USA.

# EXPERIMENTATION ON FEEDING OF AN ALGA, *SPIRULINA* AND $ED_{50}$ DETERMINATION FOR A FISH, *HETEROPNEUSTES FOSSILIS*

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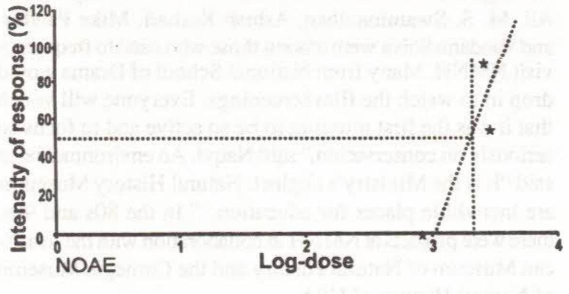
*Spirulina*, filamentous cyanobacterium (blue-green alga) has a long history of use as food. Its name derives from the spiral or helical nature of its filaments. Current production of *Spirulina* worldwide is estimated to be about 3,000 metric tons. Sold widely in health food stores and mass-market outlets throughout the world, Spirulina's safety as food has been established through centuries of human use and through numerous and rigorous toxicological studies. Early interest in *Spirulina* focused mainly on its rich content of protein, vitamins, essential amino acids, minerals, and essential fatty acids. *Spirulina* is 60-70% protein by weight and contains a rich source of vitamins, especially vitamin $B_{12}$ and provitamin A (β-carotene), and minerals (see Belay & coworkers, 1994, 1996, 1997).

The Asian stinging catfish or fossil cat, *Heteropneustes fossilis*, is a species of airsac catfish found in India, Bangladesh, Pakistan, Nepal, Sri Lanka, Thailand, and Myanmar. It is highly preferred in Assam and locally known as singhi. *H. fossilis* is found mainly in ponds, ditches, swamps, and marshes, but sometimes occurs in muddy rivers. It can tolerate slightly brackish water. It is omnivorous. This species breeds in confined waters during the monsoon months, but can breed in ponds, derelict ponds, and ditches when sufficient rain water accumulates. It is in great demand due to its medicinal value. The stinging catfish is able to deliver a painful sting to humans. Poison from a gland on its pectoral fin spine has been known to be extremely painful. This species grows to a length of 30 cm (12 in) TL and is an important




component of local commercial fisheries. It is also farmed and found in the aquarium trade.

Effective dose is the dose at which 50% animals show effect. For $ED_{50}$ determination of spirulina, the fishes were divided into four groups (I, II, III and IV). Each group consisting of 4 individuals. Different doses of spirulina were administered to fishes of each group. The standard solution of spirulina was prepared fresh daily and prepared by diluting it with distilled water. The effectiveness was noted after 96 hours in all the groups. The dose at which 50% effectiveness occurred was noted. The doses were converted mg to µg and then to log dose and then graph was plotted. The calculation of $ED_{50}$ was done by Thompson (1947) & Weil (1952) method, which is most efficient, accurate and shortest way to calculate effective dose. The doses are converted to logarithms and other values obtained from table (Weil, 1952) and then a graph was plotted in which concentration (first converted mg to µg and then to log dose) is on X-axis and on Y-axis % of response. $ED_{50}$ was calculated by the formula

$\log ED_{50} \sim \log D_a + d\,(f+1)$

$D_a$ = lowest dose

d = log of constant rates between dosage level = 0.30103

f = from table (which require r, n, k)

n = number of animals at particular level

k = number of doses 1 [(i.e. 4-1) = 3]

r = number of animals affected at particular level.

**Table 1. $ED_{50}$ of Spirulina against *Heteropneustes fossilis*.**

| Experimental material | (µg/L) | 'r' values | $ED_{50}$ (µg/L) |
|---|---|---|---|
| Spirulina | 15, 30, 45, 60 | 1, 3, 5 | 9.51 |

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## New Publications

### Recent Books

1. **Butterflies on the Roof of the World: A Memoir**, by Peter Smetacek, 2012. 224 pp. Price Rs 495/-. Published by Aleph Book Co., 7/16 Ansari Road, Daryaganj, New Delhi.

2. **Birds of Kangra**, by Jan William den Besten, 2011.176 pp. Price Rs 450/-, US $35. Published by Mosaic Books, New Delhi and Moonpeak Publishers, Dharamsala (H.P.).

3. **Conserving Biodiversity of Rajasthan (with emphasis on wild fauna and flora)**, by Ashok Verma (Ed.).2008, 549pp. Hard cover. Price Rs 1200/-. Published by Himanshu Publications, Udaipur & New Delhi.

4. **Golden Trees, Green spaces and Urban Forestry**, by S.G. Neginhal. 2006. 342 pp., 72 color pls., Price Rs 750/ -. Published by author.

5. **Vertebrate Pests in Agriculture - The Indian scenerio**, by Shakuntala Sridhara, 2006. 605 pp. Price not given. Published by Scientific Publishers, Jodhpur.

6. **Southeast Asian Biodiversity in Crisis**, by Navjot S. Sodhi and Barry W. Brook. 2006.190pp. Price Euro 65. Published by Cambridge University Press, U.K.

7. **Birds of Prey of the Indian subcontinent**, by Rishad Naoroji. Illustr. by N. John Schmitt. 2007. 692 pp. Price Rs 1800/-, £40. Published by Om Books International, New Delhi.

8. **The story of Asia's Lions**, by Divyabhanusinh, 2005. 259 pp. Price Rs 1850/-, US $40, UK £30. Published by Marg Publications, Mumbai.

9. **The complete fauna of Iran**, by Eskandar Firoz, 2005. 322 p. Price not given. Published by I.B. Taurus, London & New York.

10. **Atlas of the Birds of Delhi and Haryana**, by Bill Harvey, Nikhil Devasar & Bikram Grewal. 2006. 352 pp. Price Rs 795/-. Published by Rupa & Co., New Delhi.

11. **Mangroves and their Environment**, by H.S. Singh, 2006. 283pp. Price not given. Published by Forest Deptt., Gujarat State.

12. **Changing Faunal Ecology in the Thar Desert**, by B.K. Tyagi & Qaisar H. Baqri. 2005. 367pp., Price Rs1850/ -. Published by Scientific Publishers, Jodhpur.

13. **Raptors of the World: A Field guide**, by James Ferguson - Lees & David Christie. 2005. 320pp., Price £19.99. Published by Christoher Helms, London.

14. **Biodiversity of Mangrove Ecosystem**, by K. Kathiresan & S.Z. Qasim, 2005. 251pp. Price Rs 875/-. Published by Hindustan Publ. Corpn., New Delhi.

15. **Birds of South Asia: The Riplay Guide**, vol.1: Field Guide, vol.2: Attributes and status, by Pamela C. Rasmussen & John C. Anderton. 2005. vol.1: 1378 pp., vol.2: 683pp. Price Euro 55 for both vols. Published by Smithsonian Institution, Washington DC and Lynx Edicions, Barcelona.

16. **Host Plants of the Moth and Butterfly Caterpillars of the Oriental Region**, by Gaden S. Robinson, Phillip K. Ackery, Ian J. Kitching, George W. Beccaloni & Luis M. Hernandez. 2001. 744pp. Published by The Natural History Museum, London, and Southdene SDN BHD, Kuala Lumpur.

17. **Keralathile Sadharana Chithrasalabhangal (in Malayalam) [Pictorial book of Common Butterflies of Kerala]**, by C. Susanth. 2nd reprint. 2011. 128pp. Price Rs 100/-. Published by Kerala State Instt. of Children's Literature, Thiruvanathapuram.

18. **A photographic guide to Butterflies of Goa**, by Parag Rangnekar, 2007. 66pp. rice Rs 150/-. Published by Mineral Foundation of Goa, Panaji.

19. **Butterflies of Mumbai**, by Nelson Rodrigues. 199pp. Price not given. Published by Maharashtra Nature Park Society, Mumbai.

20. **Indyayile Chitrasalabhangal (in Malyalam) [Butterflies of India]**, by C. Susanth. 2007. 132pp. Hard Cover. Price Rs 145/-. Published by National Book Trust, India.

21. **Incredible Dibru-Saikhowa National Park**, by K.K. Dwivedi. 2009. 151pp., Price Rs 2000/-. Published by Dibru- Saikhowa Conservation Society, Tinsukia, Assam.

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