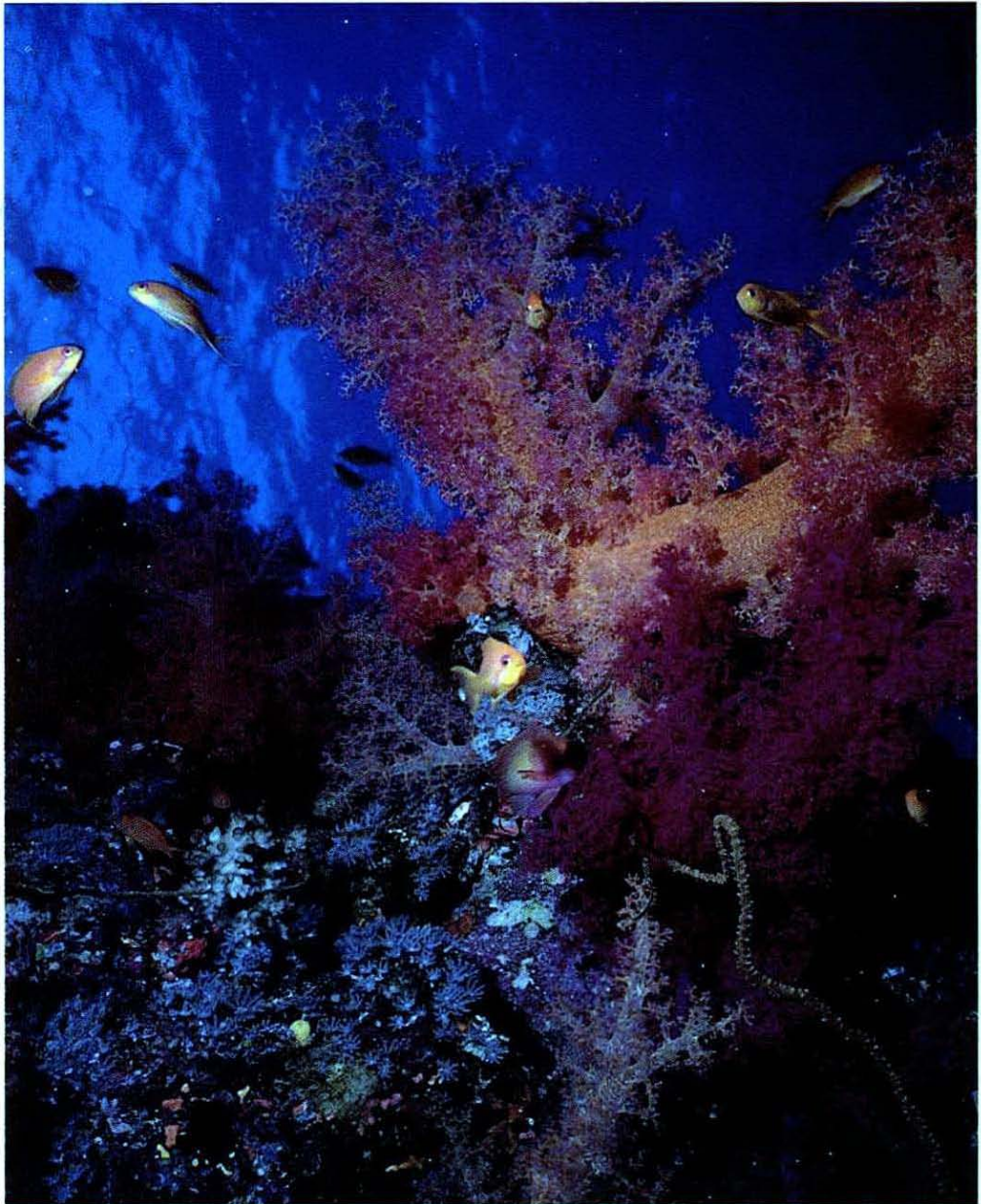


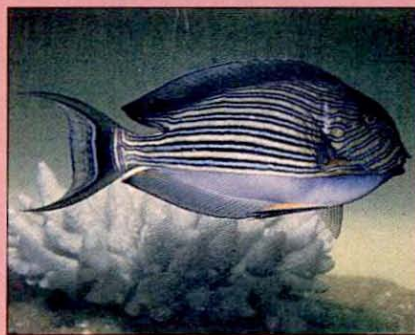
# HORNBILL

Vol. 1995. No. 3



BOMBAY NATURAL HISTORY SOCIETY





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The Society was founded in 1883 for the purpose of exchanging notes and observations on zoology and exhibiting interesting specimens of animal life. Its funds are devoted to the study of natural history in the Oriental region, and for nature conservation. Individual membership can be either in personal or official capacity. Membership is also open to scientific and educational associations and institutions as well as companies.

Ordinary members get *Hornbill* free, and can subscribe to the Journal of the BNHS (now in its 92nd volume) at concessional rates.

Entrance fee Rs. 50

Membership fees and annual subscriptions

Ordinary, individual Rs. 150. Life Rs. 3,000 (Rs. 5,000 with Journal). Institutional Rs. 1,000. Student Membership Rs. 75.

For more information on the Society and its activities, write to The Honorary Secretary, Bombay Natural History Society, Dr. Salim Ali Chowk, Shaheed Bhagat Singh Road, Bombay 400 023. Tel.: 2843869, 2843421 Fax: (91-22)2837615.



## HORNBILL

1995 (3)



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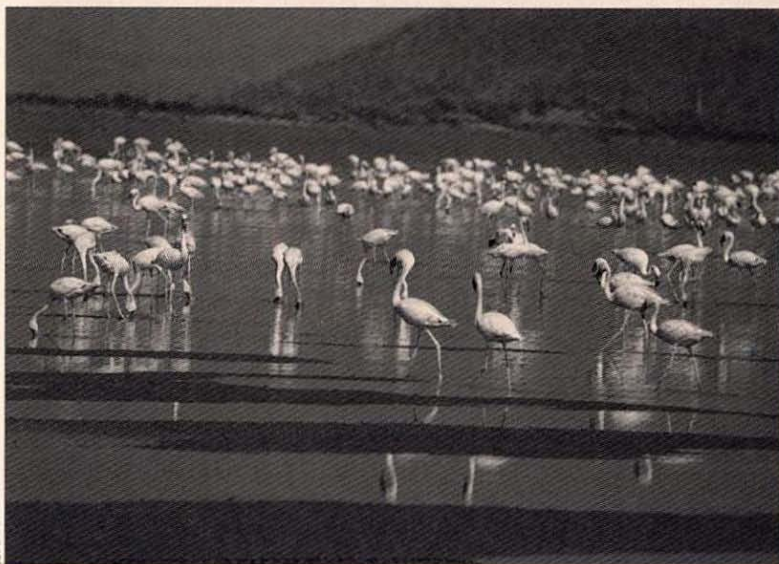
V. Gopi Naidu

*Cover*

*Coral reef*  
 Suresh Malkani

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## A GLIMMER OF HOPE



ISAAC KEHIMKAR

Last year when the flamingos left the Bombay shore, nobody expected them to return next winter, especially in the effluent-soaked mudflats. But what a surprise it was when the news of the arrival of the first flocks of flamingos flashed out. Birdwatchers were overjoyed. First there were a few hundreds, then thousands gathered. Yes, just like last year. We thought they would leave once the sea began to swell to greet the oncoming monsoon. But they remained till mid July. Now we wait with our fingers crossed. Will they return for the third time too?

Flamingos may or may not return, but the mudflats and the mangroves are in the limelight. The Bombay Port Trust has launched Project Emerald to protect these lesser known mudflats, which have attracted attention — thanks to the flamingos. It is indeed amazing to see the place teeming with waders like redshanks, curlew-sandpipers, plovers and several other winter migrants — all in their breeding plumage and who should have been on their way back by April. But they were all still there in the middle of May. That they were held back is a sure sign of hope. All is not lost.

The Project Emerald is the glimmer of hope to the otherwise doomed mangroves amidst the effluent spewing industries along the crescent shore. It's time these industries join in and take their share of responsibility seriously to make the emerald dream come true.

ISAAC KEHIMKAR



# SEASHORE LORE

20. Rainbows in the <sup>sea</sup> sky—

Beefsea



A cow among roses?

This cowfish *Lactoria cornuta* investigating amongst some hydroid polyps typifies the beauty and variety of the piscean life which is associated with coral reefs.





B. F. CHHAPGAR

The racoon butterfly fish *Chaetodon lunula* has a false eye spot near the tail to deceive its enemies

Anyone who has seen the grey, dull-eyed fishes in a fisherwoman’s basket has no idea how prettily coloured the fishes that dwell in coral reefs can be. They sport all the hues of the rainbow and are as beautiful as birds or butterflies. They may appear very conspicuous against a plain background in an aquarium, but the colouration matches the bright hues of corals and associated life in the sea and thus they blend with the background.

According to Hawaiian mythology, their god *Kumukonua* called all the fishes together and, to distinguish one from the other, painted them differently. He coloured some white, others yellow. He painted some with stripes, while to others he gave just a mottled appearance by sprinkling their body with ash.

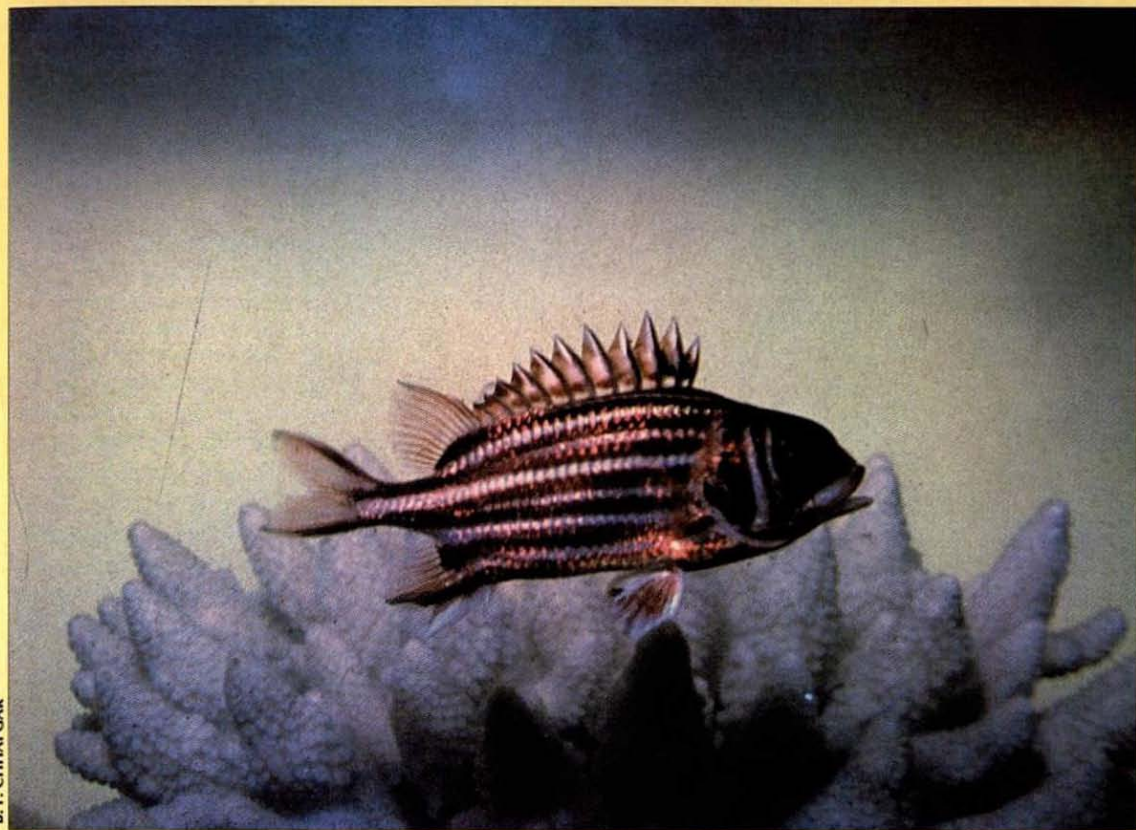
Apart from serving as camouflage, the conspicuous colouration, called flag- or poster-colouration, serves another purpose. In a kind of self-advertisement, it helps to space out competing individuals over the reef. Like the songs and postures

of birds, colour serves to advertise to rivals the dominance of the fish in that area. Scuffles occur between rivals of equal size and strength, but these are rarely in the form of serious aggression, being rather ritualised showing-off.

The young of such territorial fishes are very differently coloured from the adults, so that the latter allow the young to live in harmony with them.

Some of the most prettily coloured coral-reef denizens are the butterfly fish. Like butterflies flitting from flower to flower, these fish go from one coral head to another, feeding on the coral. All of them have a dark vertical stripe running over the eye. This helps to hide the eye — the most conspicuous and vulnerable part of a fish’s body, and therefore the first to be attacked — from a predator. Many butterfly fish have, in addition, a dark, oval spot near the tail; this is called a “false eye” and serves to fool the enemy into mistaking it for an eye and attacking it. A bite near the tail may leave a butterfly fish temporarily crippled, but it will not be fatal, as a lunge at the eye.





B. F. CHHAPGAR

The squirrel fish *Holocentrus rubrum* gets its name from the stripes and red colour of its body

Many butterfly fish also have a peculiar criss-cross pattern of parallel straight lines on the body. These, plus the false eye, help in communication. Butterfly fish are usually found in pairs. As one follows the other from coral to coral, the flat body can hardly be seen. If they become separated, one of them will swim up above the corals and tilt its body so as to flash the eye-spot and parallel lines.

Butterfly fish are highly fecund; a female can lay up to 20,000 transparent eggs, each less than a millimetre in diameter. The eggs float up, and the young hatch in 28 hours. These are silvery and are protected by transparent, thin bony plates on the body. They may spend many months drifting in the sea before settling down on a coral reef.

Trigger fishes are another colourful, interesting group. The name comes from the ability of the fish to "lock" the first spine of the fin on to its back by a shorter spine behind it. Like the safety catch on the trigger of a gun, the first spine can be lowered only if the second spine is folded down. The fish, when threatened, hides itself in a crevice and locks

itself so firmly that it cannot be nudged out. The head is very large, with a pig-like snout. The Hawaiian name for the trigger fish is *humuhumunukunuku-apua'a*, meaning "the fish that carries a needle, has a snout and grunts like a pig."

It searches for buried food — molluscs and crustaceans — by blowing jets of water on the sandy bottom to expose its buried victims. Sea urchins are its favourite food. They are blown upon by the water jets till they roll over, exposing the vulnerable underside which has shorter spines, and then cracked them open with the sharp, chisel-like teeth of the fish.

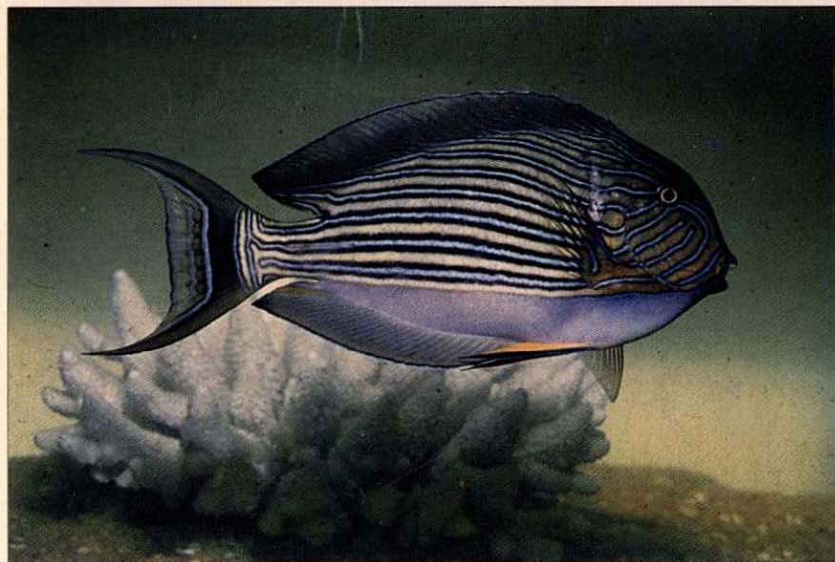
Trigger fish form a harem of one male and several females, each female occupying a small territory. They dig a nest in the sand and lay their eggs in it before dawn. The female looks after the eggs, and the young hatch in 12 to 24 hours.

Some trigger fish grow as large as 60 cm and are relished by the natives of Hawaii as food.

Surgeon fish are so called from the sharp-edged spine on each side at the root of the tail. Normally



B. F. CHHAPGAR



The striped surgeon fish *Acanthurus lineatus* has a spine on either side of the tail, resembling a surgeon's scalpel.

folded inside a horizontal groove, it can be swept out when the fish feels threatened, and used like a pen-knife or, rather, a surgeon's scalpel to give a nasty cut. The groove holding the spine has a conspicuous colour contrasting with the body colour.

Wrasses are gaudily coloured. As they grow, they change their sex, having two different types of males

B. F. CHHAPGAR



The brightly coloured checkerboard wrasse buries itself in a sandy bed at night

and many intermediate colour phases which add to the confusion in their identification. They have prominent front teeth like a rabbit's, which are used to pull away snails clinging to rocks and crack hard-shelled prey like crabs, sea urchins, brittle stars and worms. They are cousins of parrot fish, and some grow as big as 2.5 metres. Many bury themselves in sand at night before going to sleep.

Parrot fish scrape algae and break off pieces of live coral with their strong teeth, which are fused together to form a parrot-like beak. The coral is then ground into powder by two flat tooth-plates in the throat. This is done to extract the zooxanthellae — tiny algae growing within the tissues of the coral. These are digested and the calcareous coral skeleton is voided in the form of white coral sand. At night, they secrete a "blanket" of slime around themselves, leaving an opening in front for breathing. They go to sleep inside this cocoon, secure in the knowledge that this will block their body odour from going out into the water, and prevent detection by predators like moray eels which hunt by smell. The "blanket" is thrown away in the morning. Many parrot fish start life as females and later change sex to become males. Others start life as males but with female colour patterns; they are known as primary males.

A turkey fish may appear to be very pretty, with its long frilled fins



like turkey feathers. It is sometimes called lion fish, as these fins resemble a male lion's mane. But this flaunted beauty only serves to warn its enemies to keep away, as the fins on the back are like hollow needles which can inject venom into anyone foolish enough to venture too close.

Whenever I see these coral-reef fishes, I am reminded of a very unusual lunch in Sri Lanka. I was already a proficient *scuba*\* diver then, but I went there to learn the technique of catching these fishes alive, without hurting or harming them. My *guru* was Rodney Jonklaas, a renowned exporter of coral fishes. He had a great sense of humour.

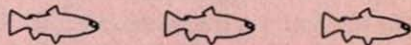
He gave his assistant divers a holiday for the day, and the two of us went in a small boat to the fishing grounds. Three hours of hectic fish-catching and we were ravenously hungry, so we scrambled onto the boat, where he offered me a small, sausage-shaped loaf of bread. I waited for him to offer me something to go with the bread. He teased me, "Aren't you hungry? Then go ahead and eat." All the while, he was eyeing me intently, so I resigned myself to eat just bread and nothing else, and reluctantly bit into the bread. At my first bite, he burst out laughing; there was a delicious fried, filleted sardine embedded inside the loaf! It was a kind of closed sandwich. It turned out that Rodney had a neighbour who was a baker, and whenever



B. F. CHHAPGAR

The puffer fish *Arothron reticulatus* has become inflated by swallowing water and now looks like a child's toy ball

Rodney caught fish he gave some to him. In return, the baker gave him those special fish-enclosed loaves of bread for picnics. □



\* *scuba* = self contained underwater breathing apparatus



B. F. CHHAPGAR

The trigger fish *Rhinecanthus rectangulus* with the fin-spine on its back locked like the safety catch on the trigger of a gun





On 11th July 1995, four boxes containing the skins and antlers of chital and sambar worth a lakh of rupees were seized from a bus in Karhal block in Sheopur tehsil of Morena district which is situated south of the Chambal river in north Madhya Pradesh. The culprits, however, managed to escape.

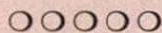
It seems that the poachers of Rajasthan and Madhya Pradesh have found a new route, as a new road bridge has begun functioning across the Chambal river, connecting Sawai Madhopur in Rajasthan and Sheopur in Madhya Pradesh. The seized lot is believed to have had its origin in Ranthambore National Park.

In an earlier incident in the month of October 1994, one tusk valued at Rs. 2.8 lakhs was seized from a person riding in a jeep near Nurabad along the Agra-Bombay National Highway, 12 km south of the district headquarters of Morena. The person was arrested and a case was registered against him. The tusk is considered to have come from north India.

Smuggling of a large number of skins of the common Indian monitor in this area has already been reported by the author [*Cobra*, 1993. 12:2-6.]. Concerted efforts of the police, wildlife personnel and researchers are needed to prevent wildlife trade in this region.

**Rajiv Saxena**

MIG-853, Darpan Colony,  
Thatipur,  
Gwalior-474 001 (M.P.)



I have received the 1994 (4) issue of *Hornbill*. It is indeed extremely attractive both in illustration and contents.

Regarding the article 'Vulture eating community of Andhra Pradesh' the editor's footnote said that it was a unique instance of a non-scavenging community taking carrion-eating birds for food.

I would like to say something in this context.

A few months ago (Sept-Oct) while I was watching birds on a pond fed by a reservoir, I

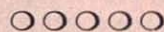
saw a person catching birds with the help of a net which was similar to the one shown in the photograph. The birds caught were the little stint and wagtails. I spoke to the person and he informed me that they catch birds by this method in their native village too; he was from U.P. and belonged to the *kevat* tribe of boatmen.

The net is spread about 1 ft. deep in water, bordered with a long steel wire (similar to that used for fencing), of about 100 metres. A helper drives the birds towards the net by clapping, shouting, singing or even cursing and abusing them! When a large number of birds are in the net area, the steel wire is pulled and the net closed from the top. At each catch they are able to net anything between 10-50 birds. Starting from around 7 a.m. they can catch about 100 birds or more (i.e., two or three catches a day) working upto 7 p.m. The whole process takes two to three hours. I asked him what birds they catch and what they do with them. He said that the catch includes the little stint, wagtails (yellow and white), black-winged stilt, ducks, and egrets, though egrets were not much preferred.

Out of curiosity I asked him if they also caught raptors. He told me that he did not, but that some tribes of M.P. and U.P. did. Perhaps this information may be of some help. As to which tribes, I could not find out anything.

I bought a stint from him to show the police guards nearby (the area is protected!) and to impress upon them to stop this killing as not very many birds, especially migratory ones, visit the place. This is mainly due to water pollution and lack of tree cover. At this, the police man looked at me as if I belonged to some other planet! That fellow simply could not understand what I was saying!

**Dr. B. Utpal**



Please convey my congratulations to the author and artist of the excellent series **Seashore Lore**

**Dr. Sushrut M. Patel**  
Ahmedabad.





As a life member of the Society and a retired soldier of our army, I wish to convey my appreciation and thanks to all those who contributed in shaping the *Hornbill* 1994 (3), which is devoted to the contribution of army officers towards conservation. I was particularly impressed by the excellent article "Warriors in a Green Kingdom" by Parvez Cama.

It would be interesting to know how many officers of the armed forces of India are now members of our Society. So I suggest that a list of their names be published in the next issue of the *Hornbill*.

I also suggest that the three Services Chiefs be requested by the Society to issue instructions to all unit commanders to become members of the BNHS.

Col. K. Guman Singh (Retd.)  
Ajmer.

Letters submitted for this page should, if possible, be typed, double-spaced, on one side of the paper only. For queries regarding circulation, please write to the Membership Officer, BNHS.

### Advice to contributors

*If you've got a thought that's happy,  
Boil it down.*

*Make it short and crisp and snappy,  
Boil it down.*

*When your brain its coin has minted,  
down the page your pen has sprinted,  
If you want your effort printed,  
Boil it down.*

*Take our every surplus letter,  
Boil it down.*

*Fewer syllables the better,  
Boil it down.*

*Make your meaning plain. Express it  
so we'll know, not merely guess it;  
Then my friend ere you address it,  
Boil it down.*

*Cut out all the extra trimmings,  
Boil it down.*

*Skim it well, then skim the skimmings,  
Boil it down.*

*When you're sure 'twould be a sin to  
Cut another sentence into,  
send it on, and we'll begin to,  
BOIL IT DOWN!*

Anon.

From Treasure Trove, p.115, London 1924

### ANTIES

BLAH BLAH



CONSTANT



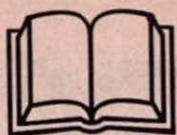
BANTU

RITA GANGOLI



TYRANT





## THE HIMALAYA — ASPECTS OF CHANGE — A SELECTION

Edited by J. S. Lall

Oxford University Press, Delhi, 1995

pp. xvi+225. Price Rs. 155/-

The book, first printed in 1985, is now presented in this paper-back edition containing thirteen authoritative studies by experts in their respective fields, and a brief introduction to the book and the authors by the editor. The introduction though brief reveals the great sensitivity of a person who has experienced the joys of living among the lofty mountains and feels that this glorious gift of nature is being ravaged by human greed, resulting in irreversible damage to the Himalayan ecosystem.

1. The article on bird life by the late Dr. Sálím Ali is brilliant in its preciseness of information and style. The rarity of the mountain quail is noted with recorded data and possible explanation. There are interesting notes such as those on honey guides consuming beeswax, *Aquila* relishing a diet of bone marrow extracted ingeniously and polygamy among birds. It contains interesting information on bird

migration.

2. The account of floristics of the Eastern Himalayan region by Prof. K.C. Sahni is quite informative and comprehensive. It describes five tree-producing climate zones. The note on *Sapriya himalayane*, a near ally of *Rafflesia arnoldii* of Malaya, a parasite is described as bearing buds as large as grape fruits and flowers 35 cm across, and reveals the joys experienced by botanical explorers.

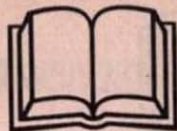
3. The account of the Himalayan Flora by M.K. Ranjit Singh is again a lucid, gripping account resembling the style of the Ornithology article which makes for a comprehensive and enjoyable piece of reading.

4. H.M. Chaudhury's contribution on earthquakes in the Himalayas traces the causes of the interaction of plate tectonics between Indian and Eurasian plates, which is a continuous process. It is pointed out that the region is liable to continue to experience these damaging earthquakes. Action similar to that taken by the people of Japan is advocated. People have to live with earthquakes and remember the Japanese saying that earthquakes occur when we forget about them.

5. Christoph von Fiirer-Haimendorf writing about the social change in the Himalayan region, makes a very illuminating study of the economic activity and influence of political change on social relations of prominent groups of inhabitants in the neighbouring Himalayan kingdoms of Tibet and Nepal.

6. J.S. Lall's article on Sikkim gives an authoritative account of a region under the influence of Nepal, Bhutan, Tibet and India. It deals with ethnic and economic onslaught and





adjustment to the various influences, mainly political and economic where the traditional way of life can still be observed in some of the regions, together with developmental activities. The area given at the end of the first para seems erroneous and needs correction (p. 98)

7. D.D. Bhatt's account on Nepal Himalayas gives a realistic picture of changes taking place and the adjustments being made by people at high altitudes, in the terai and remote parts of Nepal Himalayas. He makes a futile plea for retaining traditional values enshrined in cultural aspects against the onslaught of tourism and communication media.

8. Helena Norberg Hodge considers development in Ladakh to be Mahatma Gandhi's utopia of rural self-sufficiency, due to intrinsic social life, worthy of emulation elsewhere.

9. B.N. Goswami's *Lost vision-Art in the Himalayan region* is a brilliant account of the evolution of art and artists influenced by Buddhism and Vaishnavism in the Himalayan region. The institution of pilgrimages as a means of communication of arts and ideas is pointed out with great sensitivity. The author ends woefully on the decline of art and artists due to lack of patronage.

10. K.L. Khosla's account of the romance of surveying in the Himalayas is a fascinating study of the same since 1814, of the mountains, glaciers, river courses and natural resources, together with an appreciation and deep regard of devoted men who often underwent extreme privations, to enable us to grasp the majesty of the Himalayas. The full scope and history of the Survey of India, the oldest scientific institution in India, is briefly recorded.

11. H.C. Sarin and Gyan Singh have compiled an admirable account of mountaineering in the Himalayas. It is a brilliant tribute to the efforts of a hardy band of mountaineers, and makes gripping reading. A short account of the contribution of Himalayan institutions in India is also included. Deletion of the word 'at' appears

necessary in the last line of the first para (p. 174)

12. B.K. Roy Burman's study of the population and society in the Himalayas deals largely with statistics of the composition of social groups of inhabitants — urban and rural, industrial and farming groups, migratory activities of populations and ethnic diversity of the people of the Himalayas. It also includes a summary of the origin and arrival of man in the Himalayan region.

13. R.K. Barthakur's contribution on shifting cultivation and economic change in the Northeast Himalaya is a thought provoking and interesting article giving us a critical look into the *jhooming* activity with attendant advantages and disadvantages, versus settled farming by terracing in the hills.

The book makes very interesting reading to lovers of the Himalayan region and gives an overall idea of the various aspects of human activities in the regions. A few good illustrations or photographs would have added immense pleasure if appended to the wonderful accounts of birds, animals and plant life. Effective warning and consequent remedial measures to the trigger-happy armed forces, together with conservation action, is suggested by way of education. Regulatory legal provisions and establishment of reserved areas, nature parks and biosphere reservations are also suggested by the authorities concerned. This paperback edition is a useful publication.

..... P. R. BOLE

### BIRDS AND TREES OF TOLLY

By Kushal Mookherjee

Tollygunge Club Ltd., Calcutta. 1995  
pp. 126 Price Rs. 300/-.

The Tollygunge Club's 100-acre estate was the private residence of Prince Ghulam Mohammad, exiled son of Tipu Sultan. Later the building was abandoned and was purchased by Sir William





Cruickshank, who established in February 1895, the Tollygunge Club Ltd. On the occasion of the club's completion of a hundred years, Kushal Mookherjee has, after a deep study of trees, bird life, mammals and reptiles as well as amphibians, brought out this colourful little book containing useful information. The British, with their well known habit of planting a variety of trees wherever they went, made any estate or club into a mini-botanical garden. Trees from different parts of the world are planted here, which attract a rich variety of bird life. The Tollygunge Club, a green open space surrounded by the cement jungle of a busy metropolis, has jackals and the common palm civet as its inhabitants, among other small mammals.

Meticulously researched and well illustrated in colour, this book describes 50 species of trees, and an equal number of birds. In addition, studies of some mammals, reptiles and amphibians that are found in the club are included. The brief

descriptions of the trees include their medicinal properties and other useful information. The Child life tree (*Putranjiva roxburghii*) is so called because rosaries made from small fruits of the tree, according to common belief, when worn by children, ward off evil spirits and ill health. A decoction of leaves and seeds is used to cure cold, fever and rheumatism. The birds described include the blacknaped oriole, blue-throated barbet, stork-billed kingfisher, collared scops owl, spotted dove, white-breasted waterhen, green pigeon and the spotted dove.

A comprehensive field guide to the birds and trees of Tolly, the book will be of immense use to those interested in the natural history of Calcutta and the environs. It is a good attempt, with neat colourful illustrations on birds and trees of the area. The price should be brought down, with the help of government or private organisations, to an affordable amount.

..... ASHOK KOTHARI

## BNHS LIBRARY NEW ARRIVALS

1. Chaudhuri, A.B. Tree and the environment
2. LaBastille, Anne. Mama Poc — an ecologist's account of the extinction of a species
3. Mayr, E. & Ashlock, Peter D. Principles of systematic zoology
4. Laarman, Jan G. & Sedjo, Roga A. Global forests: issues for six billion people
5. Wallace, David Raius. Life in the balance.
6. Gaur, R.K. Indian Birds
7. Barron, P. Notes of wandering in the Himmala.
8. Bailey, N.T.J. Statistical methods in biology, 3rd edn.
9. Booth, M. Carpet Sahib: Life of Jim Corbett
10. Herriot, J. All creatures great and small
11. Herriot, J. All things bright and beautiful
12. IUCN: Membership directory
13. Begon, M & Ortimer, M. Population ecology: unified study of animals and plants
14. Krebs, J.R. & Davies, N.B. (eds.) Behavioural ecology: an evolutionary approach, 3rd ed.
15. Howe, H.W. & Westley, L.C. Ecological relationships of plants and animals
16. Excerpts from Forest Ecosystem Management, July 1993
17. Fielder, P.L. & Jain, S.K. Conservation biology: theory and practice of nature conservation, preservation and management
18. Krebs, C.J. Ecological methodology
19. Glasson, J. et al. Introduction to Environmental Impact Assessment
20. Gollar, N.J. et al. Birds to watch 2: World List of threatened birds
21. Erickson, J. Gardening for a greener planet: chemical-free approach.



## SHARAVATHY VALLEY TAIL RACE HYDROELECTRIC PROJECT

*Identified as one of the two richest biotas of the country, the Western Ghats have now been internationally recognised among the 18 biodiversity hot spots in the world that need to be preserved. At the current rate of vandalism and plunder of the biological treasure trove, we will soon be left with nothing but barren hillsides, whose capacity to retain water and recharge the aquifers will be lost forever. This is a reality in most of the hill villages where the vegetation cover has been wantonly destroyed. The time to act is now.*

This project which is located in the Western Ghats, in Karnataka's Uttarakannada district, was first envisaged in 1962. Incidentally, at the very outset it was considered to be economically unviable.

As emphasised in earlier reports, the dam's construction will lead to the submergence of about 700 hectares of prime evergreen forests, of which about 100 hectares lie within the Sharavathy Valley Wildlife Sanctuary. The actual damage, especially to the green cover in the locality, will be much more than officially admitted, considering the corruption such projects generally entail.

The transition period is taken advantage of by unscrupulous elements who plunder such areas, earmarked for development, of their natural wealth, in this case the lush green cover and the timber which is worth crores in the open market. The uncontrolled quarrying and scraping of top soil for "gardening" and other purposes further add to the damage.

Interestingly, an Ecologist's consultant report of the World Bank, for the Karnataka Hydroelectric Power Projects, admits the

impossibility of completely recreating the original forest and further adds that the compensatory plantations will not be as valuable as the forest being lost to the tail race hydroelectric project.

Moreover, the downstream damage has not been worked out. This will lead to the disruption of traditional fishing activities and also damage the ground water sources, as there is a likelihood of seepage of sea water into the fresh water aquifers in the absence of a natural drainage system. The resultant loss of livelihood for thousands of fishermen dependent on the water regime of the area, seems to have been ignored altogether.

The project is to be located near Gersoppa on the Honavar-Bangalore State Highway, two kms from Gersoppa town. The length of the dam will be c. 564 metres and its height c. 56 metres from the deepest river bed. The catchment area will be c. 151.20 sq. kms. It proposes to produce hydroelectricity, with an installed capacity of 240 MW, expected annual energy from the project will be about 619 million units (MU). The power house will work on continuous release of water from the



main Sharavathy dam located at Linganamakki, near the world famous Jog falls. The power generated here will be fed to the state grid.

The area is located in Sharavathy Valley and is flanked by hills of the Western Ghats approximately 600 metres high. Sharavathy river drains a catchment area of c.2774 sq. kms. It receives heavy rainfall ranging from 742 cm to 990 cm per annum. The average annual precipitation in the catchment area is c. 375 cm. The scheme contemplates harnessing a head of 51.4 metres available downstream of Sharavathy station.

The project will submerge prime forest land which currently feeds local fuelwood depots, catering to the fuel requirements of the local populace. The submergence will lead to a shortfall in the fuelwood supply to the local population, which is a basic need. These requirements cannot be met by extra felling as the remaining forested areas are located in sensitive catchment areas of the Western Ghats.

The several privileges and concessions which the forest dwelling community derives like grazing, collection of green manure, firewood, timber, etc., free of cost and at concessional rates, will be disrupted and cannot be replicated once the forest cover is lost. It is also essential that the siltation rate in the dam's catchment area be determined at the earliest, as most of the upstream area is devoid of vegetation. This aspect appears to have been overlooked.

The submergence will also lead to the disruption of the livelihood of the forest dependent communities, who derive their sustenance from works in forest coupes, in cane extraction, collection of minor forest produces, forest nurseries and plantation works. These communities have Nistar rights in the Sharavathy forests, and are adept at such

jobs. They will find it difficult to have a source of reasonably steady livelihood, once the forest area is submerged or clear felled. At the most, the locals may be provided with work during the dam construction, which is a temporary phase.

Moreover, the project site is reportedly an important crossover point for elephants in the area. This is bound to be disrupted once the construction activity picks up. The locality also supports a number of endangered species like the tiger, gaur, lion tailed macaque, giant squirrel, king cobra, besides other wildlife like the leopard, wild dog, sambhar, barking deer, common langur and python.

In the light of the above ecological and social implications, it is necessary that the project should be reviewed as per the guidelines provided in the exhaustive Mangalore University report, which was prepared after a two year field study of the project area.

Interestingly the report, commissioned at the request of Karnataka Power Corporation Ltd., was scuttled midway as it was found to be inconvenient! Instead, a Bangalore based organisation "Economics Agriculture & Ecology Consortium", was requested to give an environmental impact assessment of the proposed project. The scientists involved in this study stayed for about 30 days in the Sharavathy valley for reconnaissance, analysis and observation of flora, fauna and aquatic structures. On the basis of this exercise the project was given the final green signal!

Since the very first day of construction activity, a small band of dedicated conservationists, appalled at the ecological implications of the hydroelectric project, put up stiff resistance and managed to corner the concerned authorities with several uncomfortable questions. A litigation was filed by the Uttarakannada Parisara Kuta against the project. The case went up to the Karnataka



High Court, which appreciated the views put forth by the anti-dam protagonists and ordered a stay. It further noted that a cumulative impact study of all the projects in the entire Western Ghats region was essential before the Sharavathy Tail Race project was implemented, since the entire zone comprises a fragile ecosystem.

The authorities went on to appeal to the Supreme Court and managed to convince the MoE&F that due care would be taken of the ecological implications of the project. On the basis of this argument, they managed to withdraw the case from the apex court. The project work soon resumed with a vengeance and has already played havoc with the lush greenery of the area. The damage, if not checked now, will be irreversible. Moreover, the damage caused to the local forest cover by the migrant labour force will also hasten the destruction of the lush valley. The labour force in similar projects elsewhere in the state, e.g., the Kali basin valley not only encroached the forest lands but settled down permanently in the area.

The latest information as provided by Dr. Kusuma Sorab, a deceptively frail and determined woman leading the anti-dam protagonists, is that they are planning a writ petition in the Karnataka High Court to stay the construction of the dam. During a recent rapid survey of the area, organised under the aegis of the Salim Ali Nature Conservation Fund, it was noticed that the dam construction activity was in full swing. Dr. Kusuma Sorab gave a very informative talk on various aspects of the Sharavathy Valley Tail Race Project in January '95 at BNHS. The talk was well attended by members and representatives of the press.

Described as a biological treasure trove and lifeline of peninsular India, the 1400 km stretch of high hills collectively known as the

Western Ghats, with an average elevation of 900 metres feet and peaks over 2500 metres in the Nilgiris, require immediate protection from the onslaught of unplanned development activities. A recent survey indicates that the present forest cover of 38% in the Ghats is well below the National Forest Policy stipulation of 60% in such ecologically fragile areas.

Even with all this mutilation, the Western Ghats are the region's main watershed with rivers like the Kaveri, Tungabhadra, Krishna, Bhima and Godavari originating here. The 200 odd big and small dams in the Ghats produce 60% of the power supply, in five of the six states through which the range passes, besides irrigating large tracts of land. The Ghats produce two thirds of India's iron-ore exports and a substantial amount of bauxite and manganese, which together account for 8% of India's exports.

Identified as one of the two richest biotas of the country, the other being the Himalayas, the Western Ghats have now been internationally recognised as being among the 18 biodiversity hot spots in the world that need to be preserved. We will soon be left with nothing but barren hillsides, whose capacity to retain water and recharge the aquifers will be lost forever. This is a reality in most of the hill villages where the vegetation cover has been destroyed. The time to act is now.

Public opinion helps to force the authorities to plan in terms of alternative and non-conventional sources of energy. The growing need for more power should force the concerned authorities to develop environmentally safe nonconventional sources of energy as is being done in other parts of the country. □

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*Compiled by S. Asad Akhtar,  
Conservation Officer,  
BNHS.*







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# THE LEOPARDS OF THE SANJAY GANDHI NATIONAL PARK

J.C. DANIEL

"The leopard lying on the rock looked up casually as the Caravelle thundered overhead, giving one the curious feeling of being in a Wellsian Time Machine with the dial turned back two centuries. It was the locale that gave one the feeling of unreality. From the other side of the hill on which the leopard lay, a radio blared music advertising a particular brand of detergent. Behind us, as we sat quietly on our machan watching the leopard, the noise of trains and cars formed the background hum of a city of nearly six million people. One does not expect a wild and free leopard to live within the municipal limits of a city of such magnitude. Yet here it was, one of the pleasant surprises that makes Bombay such an exciting city — a leopard with a postal address — Bombay 400092!"

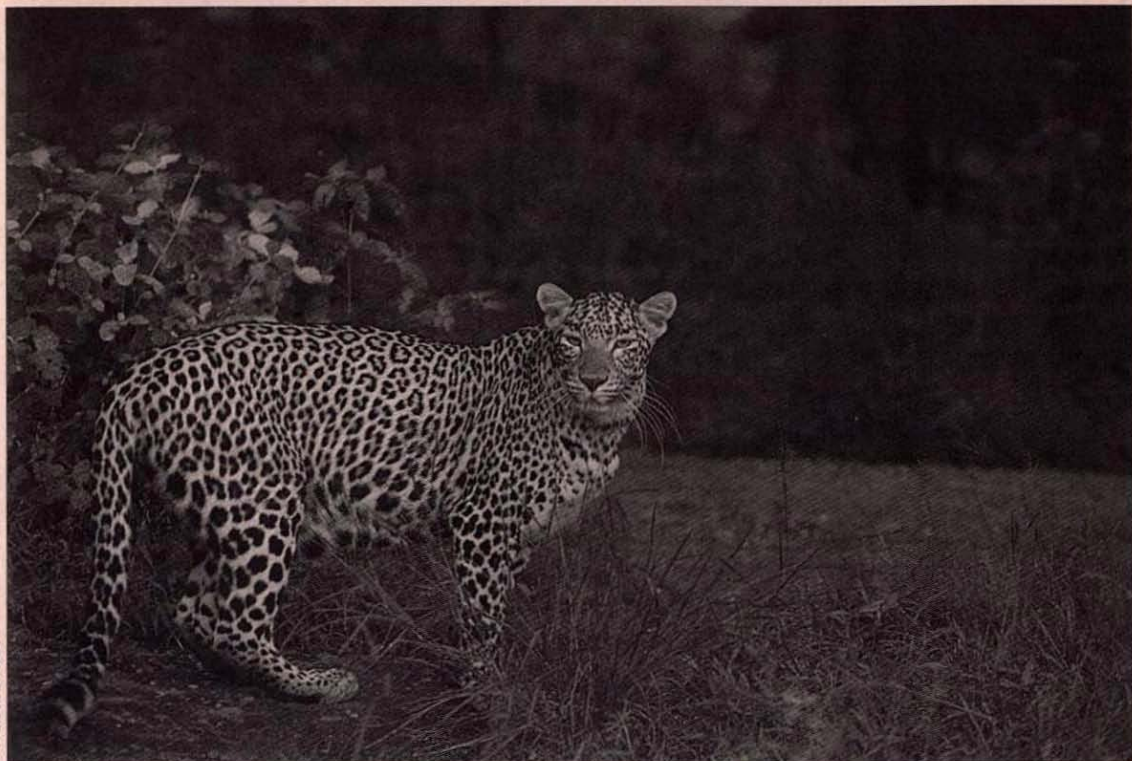
**“W**e had been on the track of the leopard for more than a year. There had been reports of sightings at Borivli for some time. These reports, based largely on fleeting glimpses, were not taken very seriously. No one thought that the leopards would outlast their natural prey, the deer and the antelope, which had become extinct in the National Park.

It was only when the re-introduction of deer was planned that the future position of the leopards came into focus. Their elimination was proposed to protect the introduced deer. Conservationists felt that the leopard, as the natural survivor in the park, should get precedence in protection and the deer (protected from poachers) should be allowed without interference to find their own level in relation to the leopards.

The leopards had remained so elusive that no one knew how many there were, what they lived on or where they operated. A small group comprising members of the Bombay Natural History Society decided to obtain this information. A study of this type has little glamour and is largely a prosaic and time-consuming gathering of data. Time, unfortunately, was our problem. Our occupations covered a wide spectrum from company directors to college students and weekends were the only spare time we had. We concentrated first on the collection of indirect evidence.”

*The preceding paragraphs are from an article I wrote for The Times of India on the leopards of Borivli two decades ago. The methods used for collecting data are still applicable today.*





Survival depends on avoidance of conflict with man.

Leopards are rather partial to dogs as food and we spent quite a few weekends making enquiries at most of the villages within and on the periphery of the National Park for information on dogs and other domesticated animals that had mysteriously disappeared or were actually seen being taken by a leopard. The information we obtained, plotted on a map, gave us a fair indication of the range of the leopards in the park. We then spent several weekends hiking through 'leopard country' in search of their hideouts. We did not find any but we did obtain leopard droppings which could, on analysis, give us an idea of the food ingested, as the droppings of carnivores invariably contain the indigestible portions such as hair or teeth.

When the analysis of the droppings was complete, we knew how and why the leopards had survived even when their wild prey animals had become extinct. The leopards had merely shifted to living more or less exclusively on dogs.

Over 95 percent of the droppings had only dogs' hair and occasionally there was additional evidence in the form of an odd claw or tooth. Leopards had been seen on the park roads at night by people driving through. We spent several days driving along the roads of the park at dusk and in the early hours of the night and also sat near likely trails in the hope of seeing a leopard but without success.

There was a pair of leopards living on the Society's forested land adjoining the National Park. Their conduct till recently had been impeccable. We have watched from our machan a leopard moving off the trail into the forest as women carrying firewood came along, waiting quietly till after they had passed, totally oblivious of the leopard lying nearby. Among the large cats the leopard is the great survivor, largely because of its smaller size and its ability to live near enough to man without its human neighbours being aware of its presence.





Clouds gather over the deciduous forest at Borivli National Park

The recent human killings around the park are, therefore, rather inexplicable. The fact to be kept in mind is the radical change of the environment in the park which needs serious consideration.

The Forest Department authorities believe that there has been an explosive increase in the population of leopards and that there are about 47 leopards in the Park. This seems very unlikely. The park area, excluding the Nagla Block on the mainland, is 103 sq. km. which would give a density of roughly two leopards per sq. km. of the park. This is a very improbable conclusion, considering the fact that leopards live solitarily, are wide ranging, and have a strong sense of territory which they defend against others of their kind. Censusing leopards is a very difficult process. In fact, as the sighting of leopards is so uncommon and difficult, most of the censusing is based on pugmarks, and in a wide-ranging

animal like the leopard, the same animal is likely to be counted repeatedly. Even the best trackers can be misled. I have worked with some of the best tribal trackers in the country and even they have not been able to positively identify particular leopards by their pugmarks.

Whatever the numbers, the alarming factor is the change in behaviour and this cannot be understood unless a long-term study is set up. For instance, consider the forest department's hypothesis of an increase in population. Even if the number has not increased to the extent of the departmental census figures, if it exceeds the number that can live within the confines of the sanctuary there will be dispersal. There is evidence that presently more leopards are operating in the periphery of the sanctuary, mainly the sick, the old and the very young, who lose out in the competition with prime animals for living space. The young leopards which were caught at



Andheri outside the park and the leopard which was trapped near a village on the outskirts of the park (allegedly the man killer), are possibly in this particular category.

We are not aware of the present situation of the prey animals — deer, fourhorned antelope, wild boar, langur, bonnet and rhesus macaques, hare and other smaller animals within the park. The park has been very unwisely closed to visitors and one of the strong deterrents to poaching, namely wildlife oriented visitors, are no longer permitted to wander within the park. It is rumoured that the park has become a paradise for poachers, woodcutters and bootleggers. The peace and quiet of the green lungs of the city are no longer available to its law abiding citizens, denied them by this whimsical decision of a former Central Minister. The remedy that has been suggested is a wall, to be built at a cost of Rs. 18 crores to keep the animals in and the encroaching human population out. It will do neither. The Keoladeo Ghana National Park at Bharatpur is surrounded by a wall. It has been breached at several places and cattle and people still move freely within the park. As long as people use the resources of the park no fence can keep them out. The leopards are the most difficult animal to fence in, that is why one does not see them in Safari Parks. A fence is useless unless rigorously maintained and that would require a service road. Of course, the service road would also be of service to wood poachers. Maintenance has never been the strong point of Government departments. The Government often spends enormous amounts of money on construction but is so parsimonious in paying out recurring costs that the initial expenditure usually becomes just

**It is rumoured that the park has become a paradise for poachers, woodcutters and bootleggers. The peace and quiet of the green lungs of the city are no longer available to its law abiding citizens, denied them by the whimsical decision of a former Central Minister**

money down the drain. The rubble wall that was built around the Gir National Park in Gujarat, to keep the cattle out and the lions in, is an instructive example. In an area where land is as valuable as gold, the politician will see to it that no fence keeps him from satisfying his vote bank. The people in the villages and *bustees* living along the boundary of the park will be best served if some simple precautions are taken. The main deterrent would be lighting. A well-lit village or *bustee* with brightly lit toilets in an open area, without any cover nearby or along the path leading to it, will ensure that natural protection is available to those who are compelled to go out at night. Dogs, poultry and domestic pigs attract leopards in search of an easy meal. Children especially need protection at dusk. If the department can consider spending crores on a fence, lights and protection at a fraction of the cost can assure the safety of the people who live on the park boundaries.

The leopards of the Sanjay Gandhi National Park really need serious study if they are to survive without coming into conflict with man. Such a study using radio-telemetry to trace their movements, assessment of available prey species, assessment of the ecological environment of the park animals and the human pressures on park resources is now urgent. Trained scientists with the BNHS would be well-equipped to study this problem which needs immediate attention. □

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*J.C. Daniel, former Director, BNHS is currently a member of the Executive Committee, BNHS and chairman of the Salim Ali Wild Wings Trust.*





## A few tobacco leaves could be enough!

**W**ant to get vaccinated against malaria? Try tobacco leaves instead.

Researcher Thomas H. Turpen of the California-based Biosource Technologies Inc. and his colleagues at the Naval Medical Research Institute in Bethesda, USA, have worked out a way to produce an experimental vaccine against malaria by genetically engineering a virus that attacks tobacco, and then using it to infect the plant.

The researchers are hopeful that the vaccine will be effective against malaria, but they are primarily interested in showing that plants can be used — literally — to grow vaccines. This, they contend, would be a cheaper way to produce vaccines. Moreover, these vaccines would also be

easier to produce than those made conventionally from broths of micro-organisms by fermentation. The virus infects the plant and multiplies in it. Turpen and his colleagues estimate that as much as a milligram of the vaccine is produced per gram of plant tissue. They estimate that a hectare of tobacco plants could produce as much as 250 kg. of vaccine a month.

A team from Bethesda, led by L. Hoffman, identified proteins on the surface of the malarial parasite, which trigger a strong immune response in humans. They identified the genes that produce these proteins. A synthetic version of these genes was incorporated into the DNA of the Tobacco Mosaic Virus (TMV). This

altered virus was then used to infect tobacco plants.

The infected tobacco plants produced large quantities of the malarial parasite protein in the leaves. This protein was extracted by grinding the leaves and processing the material. The researchers say that the protein, when extracted, can be used as a vaccine; in fact, the entire TMV can be used, especially since it is harmless to human beings. The protein will soon be tested on mice by Hoffman's team.

Meanwhile, the researchers are excited about the prospects this research opens up. Other researchers are also trying to produce vaccine in plants, including one against hepatitis B virus.

Adapted from *Down to Earth*

## A Hundred Years in Captivity

**A** bird of the parrot family, the citron crested cockatoo, survived for more than one hundred years in the Sakkarbaug Zoo, Junagadh. The chief attraction to visitors at the zoo, it was called "Kaka kauva". The bird was gifted by the then Nawab of Junagadh in 1924. According to the record, the bird was 30 years old in that year. The bird, which lived through times of great turmoil in Junagadh state and through the freedom struggle, died on 8th July, 1995, due to old age, at the ripe old age of 101.

Very few species of birds are known to survive more than 30 years, and this is an all time record in the history of Indian birdlife.

The citron crested cockatoo is distinguished from other parrots by skull characteristics. The most distinguishing feature of the bird is the erect crest on the head, which it raises when alarmed.

H. S. Singh,  
Conservator of Forests,  
Wildlife Circle, Junagadh.



## Breeding Extinction

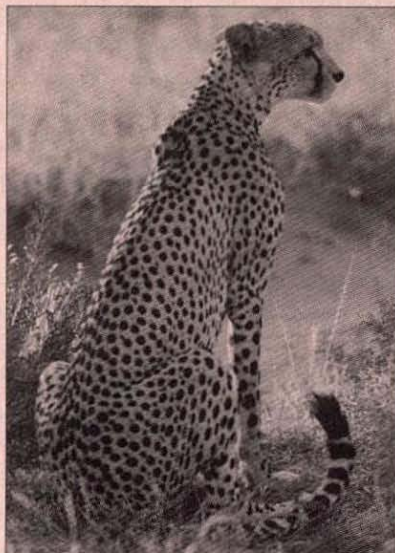
### What is the fate of the African Cheetah ?

In *Hornbill*, vol. 1995, no. (1) we featured a photograph of the African cheetah. Here we give a note excerpted from *Down to Earth* on possible clues to its future extinction.

Inbreeding has been a suspect social-sexual practice. A research team led by S. J. O'Brien, centering their working on minimum viable population sizes, said in 1983 that the cheetahs could become extinct due to inbreeding, since they had very little genetic variability.

They had concluded from their study that some 10,000 years ago, the cheetah population had passed through a genetic bottleneck, and a second bottleneck is responsible for the loss of genetic variability in the southern African cheetahs.

But M. Merola and G. J. Caughley in separate research work contest O'Brien's



theory. Cheetahs are not specially impoverished in their genes, they say, and even if they were, it would make little difference. Merola opines that genetic variability of the cheetah is not very different from that of other carnivores, which, compared to other mammals, have less variation anyway.

O'Brien argues that inbreeding depression leads to sperm abnormalities, resulting in smaller litter size which is more susceptible to diseases. He supports his

theory by referring to the problems faced in the captive breeding programmes.

Is O'Brien right or wrong? Robert M. May of the Department of Zoology, University of Oxford, says diplomatically that genetic diversity is not essential, but may be a clue to the conservation of cheetahs (*Nature*, vol. 335, no. 7909).

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## The Plight of Swallows

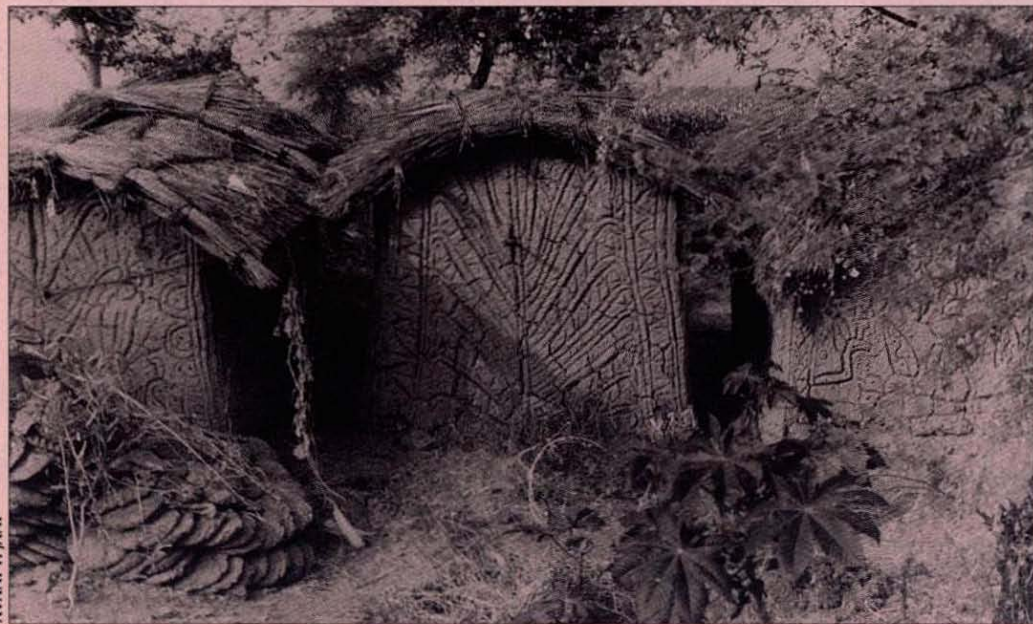
Has anyone noticed that since the last few years annual migration and breeding of swallows, *gaunthali* in Nepali, in and around Gangtok, has been reduced to a trickle? Just ten years ago, large numbers used to breed between March and July in bazaar shops in Gangtok, Mangan and other places. Dr. Sálím Ali writes of the conditions in the sixties: "In Gangtok town and bazaar it is a familiar sight to see numbers of swallows shooting up and down at high speed close over the road surface in pursuit of midges and flies, twisting and dodging their way amongst mules, loiterers and other obstacles with the utmost dexterity and confidence of safety. Breeding preliminaries commence in March when birds take possession of traditional sites within bazaar shops and dwellings, perching on brackets, wall clocks and the like, and twittering spiritedly an arm's length above the heads of noisily haggling customers..."

...In April, 1955, there was an occupied nest in the Dewan's Office in Gangtok. The pair of owners flew in and out freely all day long, regardless of the noise of the telephone and typewriters and the bustle of chattering clerks and visitors in the low ceilinged little room. The building was shut up every evening after office hours and not opened again next morning till well after sun-up, so that the birds had to co-ordinate their daily chores closely with the working hours of the Government Secretariat!"

This year less than a dozen nests were noticed in and around Gangtok town and the only noticeable breeding bustle was in a small colony of house swifts in Paljor Namgyal Girls' Senior Secondary School, under an overhanging roof.

*Excerpted from Panda*

## CONSERVATION BEGINS AT HOME



AVANI Y. JANI

Sent in by Avani Y. Jani this photograph reflects the involvement of the Rajasthani village dweller with nature — tree and animal motifs traced by hand on the mud plaster of these huts. The cowdung cakes in the foreground are the villager's "ecofriendly fuel", for which these huts are storehouses.



## To William Blake and Species

Human, human, brute upright,  
'Burning bright' is pale with fright.  
But since it is our Week, I may  
Dare plead a thoughtful seven-day.

To such distant deeps and skies  
Range the roovings of thine eyes!  
Can't you leave us... to retire..  
Our little patch of thorn and briar?

If you so clean out my beat,  
What the dickens do I eat?  
What can water-pistols do  
Against the AK-42?

Skin, claw, bristle I donate?  
You, your houses, make ornate?  
Shredding, grinding, glutting us,  
Struts the Casanova Plus?

Sov'ment Projects, NGOs  
Friends who mop my bloody nose,  
If you cross-mop with such glee,  
Do I need the enemy?

Human, human, brute upright,  
'Burning bright' is fraught with fright.  
Will I?... Will YOU?... live to see  
And hail the coming century?



Issued on the occasion of Wild Life Week 1st Oct. 1995 to 7th Oct. 1995 by  
Field Director Project Tiger Melghat AMRAVATI 444 602 INDIA.





The tiger link meet drew attention to this large cat's plight

## The Salim Ali Nature Conservation Fund

The Salim Ali Nature Conservation Fund (SANCF) is an important component of conservation activities at the BNHS. The Fund is pivotal to all conservation related activities at the BNHS and takes the initiative to tackle such issues in the country. The issues which come to the notice of members and other concerned citizens are immediately brought to the attention of the Conservation Officer, for an appropriate response and mobilisation of resources and public opinion. Besides, the contacts maintained by the Conservation Officer at various levels of the government and the public help BNHS to keep abreast of developments in this field. The Fund has helped to focus attention on certain critical conservation issues in the country, like the denotification of protected areas in Orissa (Bhitarkanika, Balukhand-Konark), Gujarat (Narayan Sarovar) and Maharashtra (Melghat Tiger reserve). Certain highly fragile habitats, like the Mangroves along the country's coastline, have also been identified as areas of prime conservation importance. The Society's wealth of scientific information on the Asian Elephant,

gathered mainly during a decade long research project focussing on the main elephant habitats of the country, is being channelled towards evolving better management plans.

Similarly, under the aegis of the SANCF, the Tiger crisis cell at the BNHS has been helping to build up public opinion and mobilise resources towards strengthening conservation measures for the critically endangered tiger. Public meetings have been organised at the BNHS, which is an important component of the western node of the "Tiger Link" initiative across the country. This Link is an informal network of NGOs and concerned citizens.

### TIGER LINK MEET AT BNHS A Western node initiative

The second public meeting to take stock of the current status of the tiger in the country was held on 6th October, 1995, at Hornbill House. The meeting was well attended by BNHS members, concerned citizens, NGOs and the press. BNHS is a vital component of this link.

Mr. Valmik Thapar of Ranthambore Foundation, briefed participants about the current trends in tiger



conservation. The grim scenario that he presented, highlighted the various lacunae in enforcing even basic protection measures. One of the glaring deficiencies is in the patrolling of vast stretches of wilderness in which the average area that has to be covered works out to 15 to 25 sq. km per forest guard, which he is expected to monitor with the most minimal facilities.

A single tiger and its various parts can fetch US \$ 5000. Between January, 1994 and August, 1995 about 120 tiger skins and derivatives were seized from poachers around the country. The actual figures might be still higher as the seizures appear to be the tip of the proverbial iceberg.

It was emphasised that patrolling facilities could be strengthened by providing well equipped vehicles to the forest department, as has already been done

by certain local and international NGOs for the Tiger reserves in Karnataka, Madhya Pradesh and Uttar Pradesh. If the public could mobilise funds for these purposes, this would ease the pressure on the enforcing authorities.

The role of citizen intelligence cells was also highlighted during the meeting and it was noted that such a cell was already in action at the BNHS. The information received to date is being pursued at various levels and a field survey of the tiger areas has been initiated as a follow up. A suggestion to set up a tiger cell in Maharashtra under the supervision of the inspector-general of police, as has been done in Madhya Pradesh, was made during the meeting.

For further information please contact:  
S. Asad Akhtar Conservation Officer, BNHS.

## World Environment Week

World Environment Week was celebrated at BNHS, starting from 5th June, 1995. To mark the occasion, an exhibition of nature photographs by Sudhir Agashe was organized from 5th to 8th June. The exhibition focussed on Indian fauna, but it also included a series of photographs on the wildlife of east Africa.

Notable among the exhibits were outstanding photographs of the jewel beetle and of the common garden snail, the helix of which, photographed against the parallel venation of a leaf, made a graphic artist's delight. Several birds, including demoiselle cranes and an iora at its nest, were eye-catchers, while a landscape of Bharatpur's Keoladeo National Park was significant.

SUDHEER AGASHE



A hanuman langur — one of the species exhibited



# WHAT'S IN A COLOUR?

Text and photographs by  
M. R. ALMEIDA

About 25 years ago, when I was just getting acquainted with field research in Botany, a student of Rev. Fr. H. Santapau approached him with a twig of *Hygrophila schulli* bearing pinkish-mauve flowers, as opposed to the normal bluish-purple colour. I happened to enter the Blatter Herbarium and my attention was

systematic Botany under Fr. Santapau. He had asked Fr. Santapau whether flower colour can be taken as a reliable character for taxonomic separation or not. When he asked me whether I had observed this difference, I told him that I had, in fact, located a few plants with pure white flowers near Kalyan, which I had collected and



Orange-yellow turns to red as the flowers of *Lantana camara* var. *aculeata* reach maturity.

was cultivating in the St. Xavier's terrace garden. Then I took them to the terrace and showed them the same plant with white flowers. When we returned to the herbarium, Rev. Fr. Santapau explained that the recent trend among taxonomists was not to consider colour differentiation for identification. He explained that there were two main objections to the colour of flowers being used as a taxonomic indicator. Firstly, when a herbarium specimen becomes dry, the flowers fade. Even when the collector does record the original colour of the flower while collecting the specimen, the description is often ambiguous and misleading. The second reason, he explained, was that colour differentiation in flowers occurs due to translocation of a single gene in a chromosome which is not considered genetically very significant. However, he elaborated, in horticulture these colour differences play an

caught by the plant in Rev. Fr. Santapau's hand. I asked, "Isn't it *Asteracantha longifolia*?" Father replied, "Yes, but have you noticed the colour of the flower? Generally the colour of the flower in this species is bluish-purple, but Mr. Mitra has found some plants with pinkish-mauve flowers. If you want to study the taxonomy of flowering plants you have to be observant like him while working in the field." It turned out that Mr. R.L. Mitra was working for the Botanical Survey of India and had come to register as a student of

used as a taxonomic indicator. Firstly, when a herbarium specimen becomes dry, the flowers fade. Even when the collector does record the original colour of the flower while collecting the specimen, the description is often ambiguous and misleading. The second reason, he explained, was that colour differentiation in flowers occurs due to translocation of a single gene in a chromosome which is not considered genetically very significant. However, he elaborated, in horticulture these colour differences play an



important role, and therefore plants bearing differently coloured flowers become identified as horticultural or cultivated varieties and are frequently called by fancy varietal names. Such names, generally found in roses and hybrid orchids, include Rosa Abraham Lincoln, Rosa Rajamani, Madam Butterfly, Dendrobium Madam Pompadour and Bougainvillea Sundari!

In the case of roses, when two different rose plants are crossed artificially or in nature, the resulting new generation always produces a new variety totally different from the parents, particularly in the colour of the flowers.

The main difference in horticultural and natural variation is that horticultural varieties are a result of induced mutations, whereas natural varieties arise from the creative force of natural selection.

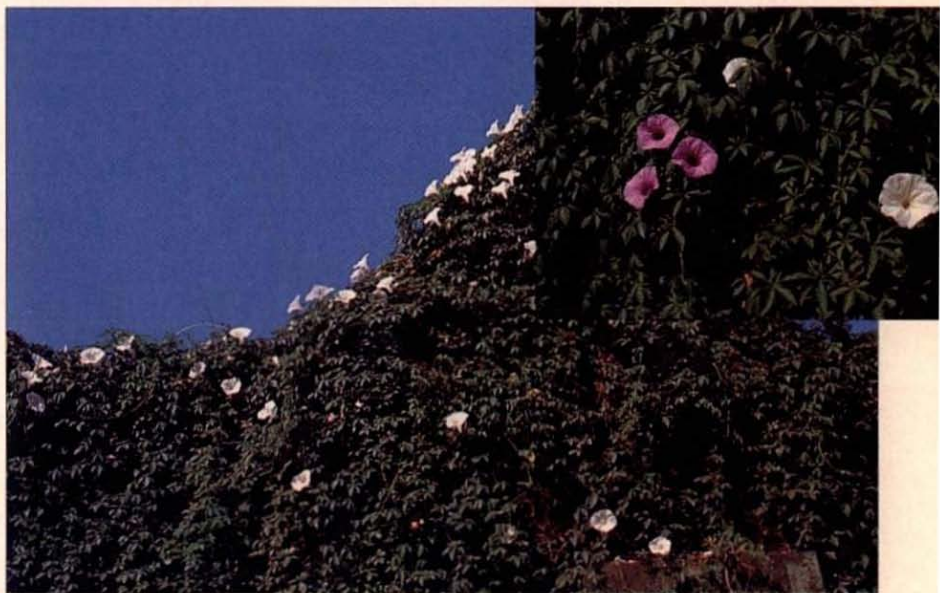
In nature, we come across some examples of colour differentiation and some of them are indeed used as taxonomic features, as for example, in *Butea monosperma* var. *lutea*, *Impatiens balsamina* var. *rosea*, *Loranthus longiflorus* var. *coccinea*, *Erythrina indica* var. *alba*, *Smithea sensitiva*



The coral tree's typical jewel red blooms contrast with the white of the variety *alba* (inset)

var. *flava*, and *Tephrosia tinctoria* var. *coccinea*

I have cited these examples especially because Fr. Santapau had described several new varieties of plants based on of floral colours, though he was against using colour differentiation for separating species or varieties of plants. Some of these are *Cyathocline purpurea* var. *bicolor*,



The railway creeper *Ipomoea cairica* has two colour variants — the pure white and the common purple (inset)





The bluish-purple flowered *Hygrophila schullii* also varies to white

*Cyathocline purpurea* var. *alba*, *Aeginetia indica* var. *alba*, and *Striga asiatica* var. *albiflora*.

In recent years I have also observed that these minor variations in colour can be used for differentiating the varieties of a species. The varieties which were segregated by J.D. Hooker and his contemporaries in *Flora of British India*, based on distinct visible characters, are now being elevated to sub-species or sometimes even species level.

Subsequent to my first observation on *Hygrophila schullii* bearing white flowers, I have seen it again in many places bearing pure white flowers. In fact, I am not the only person to have observed the white-flowered variety. Francis Buchanan-Hamilton had observed the white flowers as far back as 1828. My second

observation of the same kind was during a visit to Kerala. I saw a few variant plants of *Ipomoea pes-caprae* in the hilly parts of Alleppey district. There were creepers with the usual pink flowers, but a few others bore only white flowers. From my childhood I had observed this creeper growing on the sandy sea-shore, always bearing pink flowers. Since then I have seen it at many places in coastal sands, although I remember Rev. Fr. J. Palithanam mentioning in one of his lectures that he had come across *Ipomoea pes-caprae* at higher altitudes in the Shevaroy hills in Kerala. But, not having come across any report of white flowers in the species so far, I was really delighted to see this plant at a higher altitude and fascinated by its white flowers. I wondered whether the change of colour in these flowers arose from a change in altitude or whether the white colour was a characteristic of the higher elevations? I am not sure even today.

Perhaps there are more flowering plants that bear white flowers than those bearing any other particular colour. Remarkably, all night-blooming plants which are mostly pollinated by moths and other nocturnal fauna are white in colour. Since the colour spectrum is the result of dispersal of different colours of light into variable wavelengths, it is obvious that in darkness colours are not seen. Thus, I wonder whether the ultimate colour to evolve in flowers is white? However, geneticists and biologists agree that the future colour of flowers will depend upon the pollinators which help the plants to reproduce. My latest observation of this phenomenon is in the railway creeper *Ipomoea cairica*, where I have seen white flowers in place of mauve-purple ones. This decorative climber is extensively grown on trellises.

My friend, Dr. Parvish Pandya, once told me that when there was a colour change in an individual flower due to aging, the change in pattern was always related to the colour spectrum, i.e., from violet to red. Although I am not sure if



this is a general rule in nature, I have observed certain changes of colour in the following cases:

1. Flowers of *Thespesia populnea* Soland, commonly known as Paras Pipal, Portia Tree or Bhendi, are yellow in the younger stages but turn purplish red at maturity.

2. *Eranthemum roseum* Br. bears blue flowers, but when drying they turn red.

3. Young flowers of the ashoka and the common garden shrub *Ixora singaporensis* are yellow, but turn brick-red at maturity.

#### Which chemicals cause these changes?

To appreciate this phenomenon it is necessary to know some basic facts about flower colours. These are largely due to the presence of different pigments in chromoplasts or cell vacuoles of floral tissues.

The colours in flowers generally belong to the three main classes, namely Flavonoids, Carotenoids, Quinones.

Besides these three groups, some alkaloids are also believed to impart colours to certain flowers. The most important group of flower pigments are the flavonoids. They contribute cyanic colours (orange, red and blue) and yellow and white. The carotenoids provide mostly yellow and some orange and red. Some less important flower pigmentation is due to chlorophylls (green), quinones (red and yellow) and betalain alkaloids (yellow, red and purple).

In the animal kingdom, especially in fishes, colours are often produced by the reflection and refraction of light from cell surfaces. This phenomenon is not known in plants.

Several factors play an important role in controlling cyanic colour in flowers, such as 1. Hydroxylation pattern of anthocyanidins (i.e. based on pelargonidin, cyanidin or delphinidin). 2. Pigment concentration, 3. Presence of flavone or flavonol as co-pigment (many of which have a bluing effect), 4. Presence of chelating metals

#### Colour preferences of different pollinators (After Harborne, 1977)

Pollinators	Flower colour preferences	
Bats	White or drab colours (e.g. greens) and pale purples.	Mostly colour blind.
Bees	Yellow and blue intense colours and also white.	Can see in UV, but not sensitive to red.
Beetles	Dull, cream or greenish.	Poor colour sense.
Birds	Vivid scarlets, also bicolours (red-yellow)	Sensitive to red (Orange-red Yellow, Yellow-red. e.g. Erythrina, Bombax, Butea.
Butterflies	Vivid colours including reds and purples	Pollinate at day-time
Moths	Reds and purples, white or pale pinks.	Mostly pollinate at night.
Flies	Dull-brown, purple or green	Chequered pattern may be present.
Wasps	Brown	Pollinate at daytime

(importing bluing effects), 5. Methylation of anthocyanidins (giving small reddening effect), 6. Blending with other types of pigments. (Carotenoids have browning effect).

Anthocyanidins in plants occur as glycosides (anthocyanins) with sugars attached to hydroxyl groups in 3- or 3- and 5- positions. Attachment of sugars has little or no effects on the colours of the flowers, however, it is believed that it gives stability to the pigments. Due to the presence of sugars and methyl groups in different positions, there is a large range of different modified shades found in flowering plants.

The deviation of colour from dark bluish-purple to mauve-pink flowers in *Hygrophila schullii* has now been explained. It has been demonstrated that for the full expression of the colour of all three common anthocyanidins — pelargonidin, cyanidin and delphinidin — flavones or flavonols



are needed to stabilise the pigment chromophores at the pH of the flower cell sap (around 4.5). This is the reason why all cyanic flowers (not just those which have blue colours) contain both anthocyanidin and flavonol. Therefore, the bluing effect of flavones in the blue flowers is simply due to an increase in the concentration of flavone; i.e. the anthocyanin: flavone ratio is decreased from that in mauve blooms. This has been confirmed, to be so, by directly comparing the spectra of pigments and co-pigments mixed in test-tubes with the spectra given by the pigments in the living flowers.

J.B. Horborne gives the reasons of colour change in the blue-bell. According to him, in days of scarcity of nectar in flowers, bees are compelled to visit flowers bearing white blossoms which they would otherwise ignore. In the process, they pollinate blue-bells with unusual pollen, giving rise to white mutant forms in natural populations. Such mutants are unable to propagate because of the lack of viability and poor seed setting.

Evolutionary changes in flower colours are observed at the species level also. Plants may have to switch their flower colours in different generations in order to adapt to change in pollinators. It is known that considerable differences in dominant flower colour exist between two adjacent habitats depending upon the pollinators operating in the area. Herbaceous species growing in open grasslands are pollinated by bees and have yellow flowers, while close by in dark woody forests the plants pollinated by moths have white or pale pink flowers.

Another chemical feature, which may be important in providing blue colour for flowers is the presence of chelating metals. Aluminium, molybdenum, iron and other metal complexes of anthocyanidins have been isolated from plants including the blue cornflower and the blue lupin. However, some scientists believe that the metallic ion only provides stability to the colour, since

the bluing in these plants is achieved even by the flavone alone present in the species.

Most of the yellow colour in flowers is due to the presence of carotenoids, especially the xanthophylls, such as zeaxanthin and its derivatives — auroxanthin and flavoxanthin, along with three groups of flavonoid pigments — flavonols, chalcones and aurones.

Yellow flavonols such as gossypetin, quercetagenin and their derivatives are present in cotton flower, primrose and composites like chrysanthemum. Yellow flavonols with an extra hydroxyl (or methoxyl) group in the 6- or 8-position in "A" ring provides this colour. The related flavonols without these groups (OH or MeO) are more or less colourless, e.g., quercetin.

Yellow chalcones and aurones are found in members of the Asteraceae, e.g., coreopsis, dahlia, and nine other families. A simple test for identification of these compounds is known as the 'Cigarette test'. When the yellow petals of any such plant are smoked with a cigar or exposed to ammonia they turn red. Chalcones and aurones often occur together in flower petals and are collectively known as anthochlor pigments. Some alkaloids like berberine are also responsible for yellow colours in flowers.

Deep orange flowers may have large amounts of betacarotene, as in the orange fringes of narcissus, or lycopene, as in calendula.

Any species migrating across the border from one habitat to another would have to switch flower colour rapidly in order to adapt to the new environment. This could be an answer to change in colour observed by me in *Ipomoea pes-caprae* from coastal sandy shores to hilly regions. □



## THE SEA URCHIN



ALPANA BHAGWAT

Sea urchins are close relatives of starfishes, brittlestars, sea lilies and sea cucumbers. They are grouped as Echinoderms or 'spiny skins'. Their internal organs are enclosed in a more or less rounded, rigid box made up of chalky plates that fit neatly together. The box is called 'test' and its shape may be spherical, flattened or heartshaped. Many a time, these are found washed ashore, with or without spines, and often end up as decorative paper weights or ashtrays. In most sea urchins, the spines may be short and sharp, long and slender or thick. Among the spines, there are small jointed rods with two or three jaws at the tip, which act like tiny pincers to collect food and pass it on to the mouth.

Sea urchins are attractively coloured varying from green to yellow, red, orange and purple. The smallest sea urchin known is a little over 1 cm across and the largest is about 45 cm across. 800 species of sea urchins are known to occur throughout the world. Most dwell on the shallow shores as much as 180 metres deep, but some do live at a depth of more than 450 metres.

For sea urchins, moving appears a cumbersome task. This is accomplished by using their tube feet to pull themselves along. When walking the tube feet are pushed out, their suckers take hold and then the tube feet shorten to pull the body along. This way the urchin 'inches' its way. Sea urchins are mainly vegetarians and chew on seaweeds. ●

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The Selection Committee reserves the right to request copies of publications or other evidence demonstrating the candidate's contributions to nature conservation. Such materials will be retained by BNHS unless requested otherwise. Nominees will be considered for a period of four years. A fresh letter of nomination and an update of achievements will be required thereafter.

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