

One of the main points that Balachandra Rao (as also Bhanu Murthy) wants to emphasize is that it is not true, as is generally believed, that Indian mathematics entered a dark age after Bhaskara II (*ca* 1120 AD). There were substantial contributions even after him, specially by the Kerala school. In fact, to quote Dani '... The sustained development of mathematics in India in the post-Greek period was indirectly instrumental in the revival in Europe after its "dark ages" '.

Though the achievements of mathematicians in ancient India may look impressive, there were serious deficiencies also. They have noticed that π cannot be calculated exactly but nothing seems to have been done to investigate this aspect further in contrast to the amount of time and effort that have gone into *squaring the circle* in the Greek civilization. Indian mathematicians have handled surds with ease but the notion of irrational numbers escaped them. The deductive reasoning which characterized the Greek mathematics and which really gave the impetus for the phenomenal development of mathematics outside India is conspicuous by its absence in Indian mathematics. Another significant factor which impeded the progress was that mathematics mostly served as the hand-maid of astronomy whose needs it soon outgrew. One also has to consider the fact that physics had not developed much, since it was in trying to answer the needs of physics that calculus was discovered and several other areas of mathematics developed. As Balachandra Rao rightly observes, the perfection to which Indian logic (*tarka*) was developed seems to have had no influence on the thinking of ancient Indian mathematicians. To quote him further: 'The over-emphasis on utilitarianism of mathematics seems to have had unfortunate results in the development of the subject in this country... The nonchalance with which the splendid achievements of the Greek geometry were ignored while the pseudoscience of Greek and Babylonian astrology was received with open arms is indeed the worst of these.'

For further serious study of history of mathematics in India it is very much necessary to bring out authoritative translations of the original works. For most of them the translations available are more than 60 years old and so do not have the benefit of research done on the

subject in recent times, which is quite substantial. Also, some positive attempts should be made to educate the public about the facts concerning *Vedic Mathematics*. It has acquired a large following and there are even correspondence courses on the subject! There is a danger, a very real one at that, of this having undesirable consequences on mathematics education in our country. Already the Uttar Pradesh government has introduced 'vedic mathematics' in school textbooks based on the Swamiji's book. While it is important to create an awareness of our past achievements (based on authentic sources) it is also necessary to confront and expose baseless constructs such as these.

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Leks. Jacob Høglund and Rauno V. Alatalo. Princeton University Press, 41 Williams Street, Princeton, New Jersey 08540, USA. 1995. 248 pp. Price: Not known.

Blazes of swarming fireflies in the woods, synchronized arm-waving of fiddler crabs on estuarine mudflats, incessant nocturnal choruses of crickets, katydids and frogs/toads in our neighbourhoods and dancing peacocks are familiar yearly events in India. These male aggregations are meant to attract females for the purpose of mating. However, not all these events are treated in the strict sense as 'lekking'.

Lekking has been defined as 'males aggregating for the purpose of mating'. In lekking animals the male's contribution to parental care is none, females have the option of mating with males of their choice and female gathering on the leks is not a response to some resource such as food or ideal breeding site that the male actively defends. Thus by the above definition, many mating aggregations of animals such as that of fiddler crabs, some fishes and frogs cannot be treated as typical lekking, as males of these animals are known to defend egg

deposition sites simultaneously as they display.

Almost 200 years ago, naturalists observed and reported mating aggregations on natural 'arenas' in vertebrate animals. Somewhere in the late 1800s, the term 'lek' was first coined to describe the arena and 'lekking' for the rather deviant mating system. Lekking is now reported in many groups of lower organisms including insects and spiders. Nevertheless, the most typical and well-studied forms of lekking are those that the birds and a few ungulate mammals demonstrate. And probably the most intensively studied of animals is the temperate sage grouse, a galliform bird that mates on leks throughout its range.

Field study of animal behaviour has not gained the same momentum in India as it has in the western world. In India there have been some attempts to study the breeding ecology and behaviour of animals in the field starting with Salim Ali's work on the weaverbirds in the nineteen thirties. Although there have been a few casual reports of lekking in peacocks and blackbucks in the past, the only real attempt to study the ecology of lekking in Indian animals *in situ* is a recent Master of Science dissertation from the Wildlife Institute of India, Dehra Dun. This rather illuminating piece of work on lekking blackbucks in north-western India is however unpublished.

The book under review is easily the most complete treatise on this special subject relating to animal mating systems in recent times. It is written in a very simple and readable style. The authors have been considerate in keeping the more complex mathematical modelling as a latter chapter without depriving the uninitiated reader the pleasure of going through the book.

The organisms listed as observed lekking in chapter 2 are surprisingly many and spread across taxonomic groups. Taking a variety of general and detailed case studies from this spectrum of animals, the authors discuss the broad causal factors of lekking. Although detailed discussions of sexual selection, female mating strategies and a number of models that attempt to explain the advantages and disadvantages of lekking, including predation risk, sharing information, etc., are invoked, what ultimately perplexes the reader is the fact that there has not been one gen-

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eral governing principle that has hitherto been identified without ambiguity.

Lekking has best evolved in birds. Interestingly, of the nearly 100 species of birds (as listed in the book) in which this behaviour has been documented/studied in detail, 78% are forest birds, especially tropical, as that in families Paradisidae (New Guinea/Australasia), Cotingidae and Pipridae (both Neotropical). Similarly, it is noteworthy that 62% and 20% of all lekking birds belong to the New World and Australasia respectively. These patterns are suggestive enough to start speculating the role of biogeography and habitat on the origins of this particular mating system, at least in birds.

Tropical rainforests in New Guinea and America are very dense and dark within. Male birds of paradise, cotingas and manakins with their elaborate and strikingly iridescent plumage will certainly attract females better by aggregating and displaying than being solitary. Although related ideas, viz. 'visual

stimulus' and 'passive attraction' to females offered by aggregating males have been addressed and dismissed as causal factors in the book, these ideas have not been put to good test in the tropics.

Whether this behaviour is 'relict' in animals has not been addressed in the book. Considering the biogeographical and habitat-related pattern of distribution of lekking behaviour in birds, it is also tempting to invoke the argument of patchy habitat availability in the tropics during the Pleistocene glaciations. Works in the early 1970s and 1980s have discussed the possible influences that reduced availability of forest habitats had on the diversity and speciation of neotropical birds. If reduced habitat availability had forced breeding birds to aggregate and display during the long periods of climatic fluctuations, such traits could not have been eliminated during the last 10,000 more or less steadily warm years. When ecology fails to explain an observed pattern in nature,

scientists have resorted to history. The book under review fails to do this.

More examples of birds, especially the migratory waders such as snipes and ruff/reeve in which lekking is reported, are compelling enough to invoke historical explanations to the origin and persistence of lekking. Migration in birds is itself considered a climate change-induced relict behaviour. Future studies should probably look at the lower animals, especially the invertebrates in the light of the existing theories on lekking, not ignoring the importance of history. Any further knowledge on animal mating systems will not only be of academic interest but of great value in the conservation of biodiversity.

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MEETINGS/SYMPOSIA/SEMINARS

X National Carbohydrate Conference

Date: 8-9 November 1995

Place: Vallabh Vidyanagar

Topics include: Plant and microbial polysaccharides; Isolation, characterization and their biological activity; Carbohydrate synthesis; Industrial polysaccharides: Production and utilization; Carbohydrate fermentation/biotransformation.

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National Workshop on Biodiversity Conservation in Managed Forests and Protected Areas

Date: 29 November to 1 December 1995

Place: Bhopal

Topics include: Biodiversity conservation in managed forests; Biodiversity in protected areas; Ethical and ecological considerations; Socio-economic issues; Institutional, policy and planning issues.

Contact: Prof. P. C. Kotwal
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Second National Symposium on Magnetic Resonance

Date: 8-9 February 1996

Place: Pune

The symposium will cover all topics on magnetic resonance and its applications in physics, chemistry, biology and medicine.

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