Response

Balasingh *et al.*[1] reported *Cynopterus brachyotis*, for the first time, from a Tiger Reserve area in Tamil Nadu. They stated it to be a little known and a very poorly studied species of the Indian subcontinent, reported from a few pockets only in Southern India. However, in my letter[2] I pointed out certain facts/observations: (1) *C. brachyotis* widely occurs in Southern India (Andhra Pradesh, Karnataka, Tamil Nadu and Kerala), besides Goa (see refs 4 and 5 in Varshney[2]). In addition, this species is well-represented in South and South-east Asia (as reported too by Balasingh *et al.*[1]). (2) Its South Indian and Sri Lankan population has a subspecies *ceylonensis*, which is distinct and well distinguished from the other Indian species *sphinx sphinx*. (3) The Indian bat population has been extensively studied. (4) None of the Indian species of bats is rare or endangered.

Balasingh[3], in his response to my letter agreed that they do not claim that their bat specimens from the Tiger Reserve were rare species. They also clarified that their specimens show characteristic features of *ceylonensis*.

Krishnan in the above letter has however raised some concerns about my observations on the distribution status of this Indian bat species[2]. Let me remind that *C. brachyotis* (Mueller) is a widely distributed species. Sinha (see ref. 1 in Krishnan's letter), and Chakraborty and Sen (see ref. 2 in Krishnan's letter) might have reported the occurrence of *C. b. sphinx* which is another subspecies of *brachyotis*, currently treated as a separate species. This *sphinx* is one of the most common bats of eastern India, occurring widely in Pakistan, mainland of India, Nepal, Bangladesh, Sri Lanka, etc[4].

Moreover, one need not be taken aback about the number of taxa in any group of animals or plants, which keeps changing on subsequent studies and according to the status given by different workers. Synonymy, homonymy, discovery of new species, and change of category from subspecies to species or vice versa, cause such changes in number. It is possible that in the book by Bates and Harrison (see ref. 3 in Krishnan's letter) some subspecies of Indian bats have been raised to species level, due to which the total number varies from 110 to 119.

As for example, I have already cited *sphinx*, which some authors treat as subspecies of *brachyotis* and some others as a separate species. Agrawal[5] has synonymized *C. s. gangeticus* with *C. s. sphinx*. Another species *C. angulatus* is treated as a subspecies of *C. brachyotis* by Ellerman and Morrison Scott[6].

Since the Zoological Survey of India has been exclusively studying the taxonomy and distribution of Indian fauna for the last 85 years, I thought it appropriate to rely more on its publications. Their findings are based on field work and examination of actual specimens, while the *Zoos' Print* list quoted by Krishnan (see ref. 4 in Krishnan's letter), is merely a compilation, probably out of a single seminar! Shall we devalue actual studies in favour of quick-done compilations? As far as 21 species suggested as threatened by the Zoo Outreach Organization, I can only assert that so far neither the CITES nor the Indian Board for Wild Life have declared any species of Indian bats as threatened.

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6. Ellerman, J. R. and Morrison-Scott, T. C. S., *Checklist of Palaearctic and Indian Mammals*, British Museum (Nat. Hist.), London, 1951, 2nd edn.

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NEWS

1999 TWAS awards in basic sciences

Each year, the Council of the Third World Academy of Sciences (TWAS) awards five prizes (US $ 10,000) to individual scientists from developing countries who have made outstanding contributions to the advancement of basic sciences (biology, chemistry, mathematics, physics, basic medical sciences).

The 1999 TWAS awards in basic sciences have been awarded to the following scientists who shall receive the prize money and a plaque commemorating the award on the occasion of the next General Meeting of the TWAS, to be held in Tehran, Iran, at the end of the year 2000.

Basic Medical Sciences: **Esper A. Cavalheiro**, Universidade Federal de São Paulo, Escola Paulista de Medicina, Depto. de Neurologia e Neurocirurgia, São Paulo, Brazil. For his fundamental contributions to the field of neuroscience, in particular for the development of an experimental model of epilepsy which has advanced the understanding of seizure mechanisms.

Biology: **Raghavendra Gadagkar**, Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India. For his fundamental theoretical and empirical studies on tropical social wasps that have contributed significantly to our understanding of the forces that mould the evolution of social life in animals.

Chemistry: **Darshan Ranganathan**, Indian Institute of Chemical Technology, Uppal Road, Hyderabad, India. For her outstanding contributions to bioorganic chemistry, particularly in the area of supramolecular assemblies, molecular design and chemical simulation of key biological processes, as well as for her work on the design of hybrid peptides which has led to a new class of cyclic receptors and membrane ion carriers.

Mathematics: **Servet Martinez**, Depto. de Ingeniería Matemática, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Santiago, Chile. For his pioneering work in probability theory, particularly conditionally invariant distributions in Markov processes and dynamical systems; and for his studies of deep connections between ultrametricity and potential and the description of cellular automata dynamics.

Physics: **Nai-ben Ming**, State Key Laboratory of Solid State Microstructures, Nanjing University, China. For the design and fabrication of periodic and quasiperiodic dielectric superlattices and the realization of second harmonic generation (SHG), multiple wavelength SHG, third harmonic generation, optical stability, polariton excitation and ultrasonic generation with high frequency up to GHZ in this kind of synthetic materials.

RESEARCH NEWS

Structure of materials

K. R. Rao

The structure of crystalline materials delineate the position of atoms in materials, an information that basic scientists seek to understand and interpret the nature of materials as well as their various physicochemical properties. Determination of the structure of materials is routinely carried out by well-established techniques of X-ray, electron and neutron diffraction and this is the subject matter of crystallography. The choice of radiation probe depends on the nature of information sought. For example, neutron diffraction is the preferred technique if one were interested in magnetic structures or in determining the position of hydrogens or other light atoms in the presence of heavy atoms.

Several interesting developments have been taking place in the field of crystallography and in this research note attention is drawn to some new results based on recent activities.

Single crystal specimens give rise to three-dimensional diffraction patterns where the overlap amongst different diffraction peaks is minimal; hence single crystal diffraction is a very useful technique for determination of the structure even of complex materials like proteins. However, it may not always be feasible to grow single crystals in sizes large enough to suit the diffraction technique used. One is compelled to use powders in such situations. A large number and variety of materials fall into this category.

When single crystals are not available but crystalline powders are available, one resorts to studying the diffraction patterns from powders themselves to delineate the crystal structure. A powder diffraction pattern is an average of a large number of (literally thousands of) single crystal patterns – arising from the small crystallites that compose the powder – superposed over one another randomly. The randomness and superposition is so much that every diffraction spot from a single crystal transforms to a spherical distribution for a powder. Consequently the diffraction pattern from a powder is a collection of a larger number of concentric (diffraction) spherical shells; this leads to a simplification also in the sense that one can sample the diffraction pattern of a powder by a one-dimensional traverse along any radius of the diffraction spheres. This is the situation for an 'ideal' powder diffraction pattern. As diffraction peaks from a powder are a result of overlap of individual single crystal diffraction peaks, peak-separation may not easily be possible in the large-angle region. In spite of this handicap, there have been a variety of methods adopted to make use of the powder diffraction patterns and still be able to derive crystal structures.

Analysis of the 'ideal' powder diffraction pattern has been carried out during the past two–three decades using the Rietveld analysis, known after Rietveld who in 1967 proposed the profile refinement technique[1] for refining nuclear and magnetic structures from neutron diffraction data[2]. The technique uses every point of data and not mainly the peak positions. No attempt is made to resolve overlapping reflections into separate Bragg reflections. Least square fitting procedures of the observed intensities to calculate the overall diffraction profile are adopted. The quantity[2],

$$M = \sum_i \omega_i \left[y_i(\text{obs}) - \left(\frac{1}{c}\right)\{y_i(\text{calc})\} \right]^2,$$

where y_i(obs) is measured intensity at scattering angle ϕ_i, ω_i its weight factor, c a scale factor and y_i(calc) is sum of contributions from intensities of all Bragg reflections which overlap at point i, is minimized in this procedure. (For further details see refs 1 and 2.) Rietveld showed that the profile refinement procedure leads to more accurate structures compared to conventional integrated intensity refinements. Rietveld's method has undergone considerable improvement over the past three decades and still remains an important tool to analyse powder diffraction data. Manohar[3] has reviewed application of Rietveld technique as applied to X-ray diffraction, ab initio determination of an unknown structure and energy dispersive synchrotron structure determination.

In spite of the interest in powder diffraction techniques using Rietveld analysis, several approaches have been tried to overcome the limitations of powder data based on single crystal methods[4] or by maximum entropy technique[5]. A plausible method of solving structures using full powder pattern