B. R. Subba Rao (1925–2020)

Many summers ago, tennis legend Martina Navratilova playing on the famed Centre Court at Wimbledon, London, UK, was finding it difficult to concentrate on her game, and the chair umpire asked the linesman at the net cord to investigate. The gentleman walked up to Navratilova, asked her to stand still, and caught an insect buzzing around her face with a quick sleight of hand. He took one look at the insect, a male bee, and remarked to Navratilova, '...it is only a male, it can't hurt you!', only afterwards realizing what he had said. The gentleman officiating as the linesman would have known the insect, because he was an accomplished entomologist and a passionate tennis player himself. Dr B. R. Subba Rao, Principal Taxonomist, Commonwealth Institute of Entomology, London, would often recall this cryptic quip as one of the most memorable moments he had at Wimbledon as a linesman.

Bokinakere Ramakrishnaiya Subba Rao hailed from a family of sportspersons from Mysore. His parents Ramakrishnaiya and Parvathamma were sports enthusiasts, and encouraged their children to excel in studies and sports. Majoring in zoology, Subba Rao obtained B.Sc. (Hons.) degree in 1948 from Central College, Bangalore, then under the University of Mysore. In 1950, he obtained the 'IARI Associate' in Entomology and joined the Indian Agricultural Research Institute (IARI), New Delhi, as a Research Assistant in 1953. Subba Rao got his Ph.D. degree from the University of Mysore in 1954, following which he was appointed as an Assistant Entomologist at IARI in 1955. He began his career at IARI under the tutelage of E. S. Narayanan. In 1958, he was appointed as an Assistant Professor in the Division of Entomology, IARI, and in the same year, he was elected a Fellow of the Indian Academy of Sciences, Bengaluru. Subba Rao was selected under a Rockefeller grant to visit several countries which helped him hone his entomological skills, including the use of artificial insemination equipment for honeybee breeding. To his dismay when the equipment did arrive, he was refused access and the same was rendered broken and useless by the scientist given charge. Following some differences with his Division Head and realizing the need to put his expertise to better use, Subba Rao decided to move on, and in 1968 worked for a brief period at the Commonwealth Institute of Biological Control, Bengaluru. However, as luck would have it, in the same year he was offered the position of a Principal Taxonomist by the Commonwealth Institute of Entomology, London, and he emigrated to the UK, where he spent the rest of his research career. He retired from this position in 1995 after a distinguished service of close to 27 years.

It will not be an exaggeration to mention that Subba Rao along with Mohammad Hayat and T. C. Narendran constituted the trinity of Indian hymenopterists who laid the foundation for taxonomic studies on Indian Chalcidoidea after the era of M. S. Mani. Though Subba Rao was not as prolific as the other two, his oeuvre of 106 publications in Chalcidoidea[1] is formidable by any standards and includes papers on many families, including Pteromalidae, Eurytomidae, Trichogrammatidae, Aphelinidae, Encyrtidae and Mymaridae. The catalogue of Chalcidoidea (Insecta: Hymenoptera) of India and the adjacent countries, edited and published in two volumes by Subba Rao and Hayat[2,3] is perhaps his most important contribution because it laid the foundation for the present generation of Indian hymenopterists and remained the most sought-after literature resource on Indian Chalcidoidea for beginners and specialists alike until the advent of the 'Universal Chalcidoidea Database' hosted by Noyes[1]. Subba Rao and Hayat's[4] key to the identification of Indian genera of Mymaridae was indispensable for future workers on the topic. He even established a mymarid genus 'Narayana', in honour of his mentor, Narayanan, which he later renamed as *Narayanella* because there was another older genus described by W. L. Distant with the same name in the family Issidae (Hemiptera).

Subba Rao will be remembered forever as the taxonomist who described *Neodusmetia sangwani*, a curious-looking, flightless encyrtid parasitoid (Figure 1), which is among the most successful biological control agents exported from India to other countries such as USA, Israel and Brazil. The classical biological control of the Rhodesgrass mealybug (*Antonina graminis* (Maskell), Pseudococcidae), a major pest of lawn and turfgrass, using *N. sangwani* in Texas, USA, in the 1960s, is hailed as one of the most successful examples of classical biological control in the annals of entomology[5,6]. In 1957, Subba Rao[7] described this parasitoid under the name *Dusmetia sangwani* from specimens reared on *A. graminis* collected in Hessaraghatta, Bengaluru, by H. S. Sangwan. In the USA, *A. graminis* infestation affected a whopping area of 155,400 km^2 and *N. sangwani* was one of the many parasitoids used for its control. It was introduced in USA in 1959 and released in southern Texas during 1959–60. Grass sprigs with the parasitoids in cardboard boxes were air-dropped at the rate of about 1 per 0.25 square mile for speedy dissemination and spread. The parasitoid was estimated to have saved 17 million USD annually in turf management and boosted cattle production by an estimated US$ 177 million per year. Total funding for this project by the Texas Agricultural Experiment Station at Weslaco did not exceed US$ 200,000 (ref. 5). This parasitoid was later introduced into Israel, Bermuda and northern Brazil, where it proved to be a success[8–10]. Now it is found in several countries spread across the world[4].

In addition to his excellence in taxonomy, Subba Rao is also recognized for improving our understanding of the ecology and life-histories of several families of parasitic Hymenoptera. He established protocols for mass multiplication of several parasitoids on laboratory hosts to facilitate field studies on laboratory-reared parasitoids for biological control.

After his retirement in 1995, Subba Rao compiled a *History of Indian*

Figure 1. The curious looking flightless encyrtid parasitoid, *Neodusmetia sangwani*.

Entomology. It received mixed reviews, but remains an important resource for anyone interested in the study of Indian insects because it provides a concise summary of the growth of entomology in India in the British era and after independence. Undoubtedly, the book will remain a benchmark for all future studies on the history of entomology in India.

During his annual visits to India and Bengaluru, he used to make it a point to visit the campus of the erstwhile Commonwealth Institute of Biological Control (now ICAR-National Bureau of Agricultural Insect Resources) and interact with the scientists on the latest developments in the taxonomy of parasitic Hymenoptera and the ongoing work at the Bureau. He was a staunch votary for redoubling the dwindling support for the development of insect taxonomy in India. In an article titled 'Systematic entomology in India – Past, present and future', Subba Rao[11] emphasized the need for Indian taxonomists 'to carry out work of high international standards and offer their expertise wherever required.' He proposed the establishment of an identification service in India to cater to the needs of Indian entomologists engaged in research in insect biology and economic entomology. Unfortunately, the situation is not much better even 37 years after his publication, and the best tribute we can pay to his memory is to ensure funding and other opportunities for developing Indian insect taxonomy.

Subba Rao was a multifaceted personality who excelled in many sports, including tennis, cricket and athletics (he had represented the University of Mysore in all the these sports, but remained a tennis partisan). He officiated as an umpire in the Davis Cup tennis tournament and later had a long stint (1969–1995) as a chair umpire/linesman at Wimbledon, the most prestigious of the four Grand Slam tennis tournaments. He was a recipient of the prestigious Alistair Wotherspoon Salver by the British Tennis Umpires Association in 1989 for being 'a back-bone of the Association, who will always turn out on time and will also stand in at short notice'. He was enrolled as a member of the Wimbledon Club after a trial match which he won 6-1. He soon began officiating in various capacities at the Wimbledon tennis matches and served as a chair umpire for more than ten years, all in the hallowed Centre Court. Subba Rao had many anecdotes to share about the matches and players at Wimbledon, his favourite being the mercurial John McEnroe about whom he said in an interview that 'when he started quarrelling, he was always right. It was the media you see, they write to provoke' (http://www.thewimbledonclub.co.uk/Media/Default/Tennis/Subba%20Interview.docx.pdf). Subba Rao's ready wit on the court had endeared him to many players, with several of whom he had more than a nodding acquaintance. His training as a taxonomist and field entomologist studying minute insects in detail perhaps helped him in his avocation of tennis umpiring.

Fit as ever, Subba Rao last visited Bengaluru in December 2018 and interacted with the students of the Department of Entomology, University of Agricultural Sciences, GKVK, Bengaluru, and showed a keen interest in the collections of the Department (Figure 2). He was 93 and as sprightly as any athlete, and when the students asked him about the secret of his health, pat came the reply, 'a game or two of tennis every day'. It may also be noted here that his brother B. R. Kapanipathy was a well-known tennis player (ranked fourth in the all-India ranking in the 1960s), umpire and administrator of the sport in Karnataka.

Subba Rao who had lost his wife a few years ago, is survived by two sons, both settled in the UK.

Figure 2. B. R. Subba Rao (second from left) looking at the insect collections in the Department of Entomology, University of Agricultural Sciences, GKVK, Bengaluru.

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