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# Taxonomy of Plant Parasitic Nematodes in Global Context vis-à-vis India

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## Editorial

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Nematodes are most abundant multicellular animals on earth, almost similar in number to that of insects. The phylum Nematoda comprises of over 26650 described species [1] and many of them are parasitizing plants or animals. Nearly 4100 phytoparasitic nematode species belonging to 197 genera have been described all over the world; they represent about 10% of total number of nematodes known so far. Plant parasitic nematodes deserve adequate attention for damaging crops and are often considered as a limiting factor in crop cultivation. At least 10 nematode species have been recognized for their economic significance in agriculture [2]. Identification of plant parasitic nematode species is relatively difficult for its small size and limited number of differentiating characters which requires trained specialist for dealing with the population. Nematode parasitizing on animals are known since ancient times but knowledge on plant feeding nematode are rather recent. Prior to 1950, a few nematode species were known attacking plants and posing threat to crop cultivation. The taxonomic contributions of N.A. Cobb, H.C. Bastian, H. Micoletzky, I.N. Filipjev, J.B. Goodey, T. Goodey, A.A. Paramonov, M.W. Allen, G. Thorne, B.G. Chitwood, A.L. Taylor, A. Coomans, E. Geraert etc. are remembered in history of Nematology. In India, some economically important nematodes of crops were reported from time to time; root knot nematode on tea from south India by Barber [3], Ditylenchus angustus inducing ufra disease on rice by Butler [4], wheat seed gall nematode (Anguina tritici) on wheat by Hutchinson [5], Aphelenchoides besseyi inducing white tip disease of rice in the Central Province (now Madhya Pradesh) by Dastur [6], *M. incognita* on jute by Chattopadhyay and Sengupta [7] and M. javanica on vegetables by Sen [8], Tylenchulus semipenetrans on citrus from Uttar Pradesh by Siddiqi [9] and Radopholus similis on banana from Kerala by Nair et al. [10]. A strong foundation to Nematology in the country was built with the devotion of nematologists worked at Aligarh Muslim University, Aligarh, and Indian Agricultural Research Institute, New Delhi and some other universities like Osmania University, CCS-Haryana Agricultural University, Tamil Nadu Agricultural University, Orissa University of Agriculture and Technology, Assam Agricultural University to name a few. About 631 phytoparasitic species belonging to 56 genera under Tylenchida have been reported from India; it is nearly one-third of the total known plant parasitic nematodes (1900 species of 116 genera) around the world. During 1960s and 1970s, more than 500 species was described from India; this was within a span of less than 13 years [11]. Later the taxonomists shifted their attention for developing sound classification and studying intra-specific variations in major nematode species. A quick overview of the published works in the three major journals viz., Nematologica (now Nematology), Indian Journal of Nematology (IJN), Journal of Nematology (JON) was scanned for taxonomic contributions from India and by the Indian taxonomists. It was evident from the IJN (1971-2014) that number of taxonomic publications varied with the years and the maximum taxonomic papers appeared (14-32 per volume) during 1980s and a marked decline was noted since 1990 onwards. Taxonomic contributions of Indian nematologists in the Nematologica during 1956 to 1998 were notably high; 38 during 1956-1966, 59 during 1967-1977, 41 during 1978-1988, and 20 during 1989-1998. The contributions of Indian nematologists in the JON were very meager, and in Nematology it was only 8 during 1998-2014. The approaches of taxonomy have shifted from conventional description of species primarily based on morphological characters to biochemical and molecular parameters. Most of the reputed journals accept taxonomic papers provided with traditional descriptions of species

supplemented with biological, biochemical and molecular information. Indian nematode taxonomists by and large are not yet equipped with modern identification tools (DNA barcoding, 4D microscopy, video vouchering) for description and discrimination of species as evidenced by a conspicuous lack of such publications. Majority of the newly described species provide adequate illustration, diagnostic relationship with closely related species and supplementary information. This led to sizeable number of new species described that find place in the list of synonymy of species. This has become a major impediment for Indian nematode taxonomists to meet the current criteria for accessing high impact factor journals for publishing their works. Modern approaches of taxonomy attract molecular biologists to take the stage of traditional taxonomists. In fact, the taxonomy field is waning and remains unattractive for the younger generation of nematologists. Currently, nematode taxonomy is handicapped through a shortfall of nematode taxonomists with the superannuation of senior taxonomists from most reputed institutions. However, taxonomy is not only necessary but also imperative for conserving known and exploring unknown biological diversity on earth. There is an urgent need to take initiative for global and regional capacity building on taxonomy and systematics, and utilize Information and Communication Technology (IC&T) for taxonomic research [12]. Therefore, Global Taxonomic Initiative (GTI) was launched in 2002 Smith and Klopper [13] to reduce taxonomy impediment but its progress is not encouraging. Much of molecular works have been focused on plant nematodes of quarantine significance. Further attention is required for developing genomics resources and tools for multiple plant parasitic nematode species, and designing molecular tools for identification and surveillance. However, there is pressing need for a synergy between traditional and molecular maker based identification in nematode taxonomy to pinpoint the species identity at both levels.

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