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SYMPOSIUM ARTICLE

## Symposium Report: International Symposium on Ciliate Biology, India Habitat Centre, New Delhi, India, 04–06 April 2018

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Biodiversity; bio-indicators; ecotoxicology; IRCN-BC; ISOP; symbiosis.

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RESEARCH on ciliated protists has ramified in the Indian subcontinent in last few years. The first International Symposium on Ciliate Biology held at Sri Guru Tegh Bahadur Khalsa College, University of Delhi, on 06–07 February 2007 was a successful event (Lynn 2007). The second International Symposium on Ciliate Biology (ISCB) 2018 was held on 04–06 April 2018 at the India Habitat Centre, New Delhi, India. The symposium resulted from a synergy with the International Research Coordination Network for Biodiversity of Ciliates (IRCN-BC), an affiliate society of International Society of Protistologists (ISOP). The major

### ABSTRACT

Ciliated protists have attracted wide interest among researchers from the Indian subcontinent in the last few years. An International Symposium on Ciliate Biology (ISCB) 2018 was held on 04–06 April 2018 at the India Habitat Centre, New Delhi, India. The symposium represented a synergy with International Research Coordination Network for Biodiversity of Ciliates (IRCN-BC), an affiliate society of International Society of Protistologists (ISOP). The symposium provided a platform for Indian and International delegates to exchange knowledge, present their latest research findings, and establish collaborations as well as creating a networking opportunity for undergraduate and postgraduate students. Nine foreign delegates from 5 countries and 300 Indian delegates actively participated in the event which included 22 oral and 57 poster presentations.

aim of the symposium was to provide a platform for ciliate biologists to exchange knowledge, present latest research findings, and establish collaborations as well as a networking opportunity for undergraduate and postgraduate students. Over 300 Indian and 9 International delegates from 5 countries participated in the event. The symposium comprised 22 oral and 57 poster presentations delivered by participants. Symposium proceedings are in the process of publication by Zoological Survey of India.

The symposium, convened by Dr Komal Kamra, co-convened by Dr Renu Gupta, Dr Seema Makhija, and Dr

Ravi Toteja, was organized at the India Habitat Centre in New Delhi, India, on 04–06 April 2018. The scientific advisory committee included Professor GR Sapra and Professor Rup Lal (University of Delhi), Dr Manjari Tripathi (Professor, AIIMS, New Delhi), Dr Madhu Bala (Director, DIBER, DRDO, Govt. of India), Late Professor John Clamp (USA), Professor Weibo Song (China), Professor John R Dolan (France), Late Professor Denis Lynn (Canada), Professor Virginia P Edgcomb (USA), Professor Cristina Miceli (Italy), Dr Sabine Agatha (Austria), and Dr Alan Warren (UK).

Dr Mahesh Sharma, Minister of State, Union Ministry of Tourism and Ministry of Environment, Forest and Climate Change inaugurated the symposium by giving a captivating address to the delegates highlighting the importance of ciliate research especially in view of their ecological role (Fig. 1). The keynote address by Alan Warren, “What have ciliates ever done for us?” set the tone for the symposium. Students of the three organizing colleges enthralled the delegates with their cultural programme depicting the flavours of India through song and dance.

The themes covered during the symposium included taxonomy and systematics, evolution and phylogeny, ciliates as bio-indicators, symbiosis in ciliates, genomics, epigenetics, molecular biology, the ecology of aquatic and soil ciliates, ciliates as model organisms in UG teaching and in research, and other individual specializations.

## THEMES

### Ciliates as bio-indicators

Use of ciliates as bio-indicators in freshwater, marine water, and soil ecosystems were discussed in three oral presentations. Komal Kamra shed light on ciliates from different locations of the River Yamuna, Delhi, India, as bio-indicators of water quality. She presented changes in the ciliate community with respect to change in the water quality along the River Yamuna. The presentation by Alan Warren summarized results of investigations on the relationships between ciliate communities and physicochemical analyses of water samples collected from Jiaozhou Bay, on the Yellow Sea Coast of NE China. Antonietta La Terza delved into using ciliates in prognostic and diagnostic assays to detect overall ecosystem impairment and ecosystem health.

### Ciliates as model systems in ecotoxicological studies

Rup Lal gave an overview on the effect of pesticides on growth and DNA and protein synthesis using *Stylonychia notophora* as the model system. This pioneer work on ciliates helped him in using bacterial systems for evaluating various environmental stress conditions



**Figure 1** ISCB 2018 Inaugural.

entering the fields of genomics and metagenomics. Nageswara Rao Amanchi addressed the cytotoxic effects of cypermethrin on both morphological and physiological changes in two freshwater ciliates *Paramecium caudatum* and *Blepharisma intermedium* and concluded that these two ciliates can be used as models for ecotoxicological studies. A deliberation by Ravi Toteja examined the effects of heavy metal toxicity on freshwater ciliates. Increase in the activities of antioxidant enzymes and in the transcriptional expression of stress genes (like *hsp70* and *metallothionein*) were discussed concluding that these enzymes and stress genes can be used to evaluate heavy metal toxicity.

### Biodiversity of ciliates

Rosaura Mayén-Estrada gave an overview of the family Vorticellidae which included detailed information on more than 250 ciliate species, both free living and ecto-symbiotic on crustaceans, suggesting a needed revision of the family. A highlight of the symposium was a presentation by Anastasia Shatilovich on ciliate diversity in the permafrost sediments and in the profiles of tundra soils. She discovered that many ciliates present therein, mostly colpodids, were in resting cyst stage and she was able to revive them! The capacity of reviving and forming communities from long-term resting cysts shows prolonged cryobiosis of colpodid ciliates. Alexey Potekhin gave an overview of the hidden diversity within the genus *Paramecium*, reporting revision of two subgenera and description of two new *Paramecium* morphospecies. Shashi presented description of four hypotrichous ciliates (3 urostylids and one stichotrichid) isolated from Maharashtra, India. Santosh Kumar gave morphological and molecular description of two species, one each of *Sterkiella* and *Fragmospina*, collected from soils of the Silent Valley National Park, India. Harpreet Kaur described a novel freshwater oxytrichid ciliate, *Gastrostyla* sp., and compared it with other reported species belonging to the genus *Gastrostyla* using molecular phylogeny. Jasbir Singh talked about ciliate biodiversity across Sikkim, mainly focusing on hypotrichous ciliates belonging to the family Oxytrichidae that are predominant in the region.

### Ecology of ciliates

Sai Elangovan S. reported the interaction between the environment and diversity of tintinnids (loricate ciliates) inhabiting mangrove proximal zone waters of South Andaman and characterized the correlation with certain physicochemical parameters using statistical analyses. The presentation by V. Ratna Bharathi correlated physicochemical parameters with diversity of protozooplanktons at Konam reservoir, Andhra Pradesh, India. Anjusha presented the diversity of aloricate and loricate ciliates in estuaries, coastal waters and open ocean waters at Kochi, India.

### Ciliates as parasites

Probir Kumar Bandyopadhyay gave an overview of controlling the growth of trichodinid ciliates parasitizing fish using fresh garlic-bulb. Use of garlic reduced the trichodinid burden of goldfish significantly. Amlan Kumar Mitra talked about the diversity and distribution of ectoparasitic ciliates belonging to the family Trichodinidae that are responsible for trichodiniasis in fishes.

### Genomics

Cristina Miceli delivered a talk on genomics of the Antarctic ciliate, *Euplotes focardii*, explaining the pervasive phenomenon of frameshifting. She focused the attention on the *hsp70* gene that has lost the response to thermal stress in a constant cold environment such as Antarctica but has remain inducible by oxidative stress known to be present in very cold water. This concluded that ciliates can act as model systems to study environmental adaptation.

### Symbiosis in ciliates

Elena Sabaneyeva described two new eukaryotic and two new prokaryotic endosymbionts detected in the ciliate *Paramecium* sp.: a microsporidium in *Paramecium primaurelia*, yeast in *Paramecium bursaria*, and two endosymbiotic bacteria in *Paramecium nephridiatum*. This was a first-ever report of eukaryotic invaders in paramecia.

### Overview of ciliate research in university of Delhi

Seema Makhija gave an overview of progression of ciliate biology research at the University of Delhi where different kinds of research on ciliates have been done and are currently being done.

### AWARDS

Fifty-seven delegates (including undergraduates, postgraduates, research scholars, and faculty members) actively participated in poster presentations, grouped into three themes. The three best posters in each theme were chosen for top awards. Jeeva Susan Abraham et al., Maksim Melekhin et al., and Sheeba et al. received the best poster awards in the "Ciliate Experimental" theme. Abraham et al. inferred phylogenetic positioning of three spirotrich ciliates by using modern molecular techniques. Melekhin et al. explained the species divergence in the genus *Paramecium* by studying micronucleus morphology, 18S rDNA and COI gene. Sheeba et al. presented a phylogenetic study of *Blepharisma* sp. using molecular markers like 18S rDNA and ITS gene. Additional prizes in the theme, "Ciliate Experimental" were given to Charan Kumar, Sai Elongvan S, and Sukanya Chanda.

Under the theme "Ciliate Review," posters by Harsh Thakur and Priyank Rawat, Arveen Kaur et al., and Tanvi Gupta et al. received the top honours. Thakur and Rawat



made a presentation on various molecular marker genes to study the phylogeny of any species. Kaur et al. gave presentation on symbiotic relationship of *Chlorella* sp. with the ciliate *Paramecium bursaria*. Gupta et al. reviewed the telomeric G-quadruplex DNA structure in various ciliate species.

Under the theme "Biological Sciences," Jasmine Purushothaman et al., Akhila A et al., and Mahima et al. received the best poster presentation awards. Purushothaman et al. presented a paper on diversity and distribution of testate amoeba from different ecosystems in urbanized areas of Kolkata, West Bengal, India. Akhila A et al. gave a presentation on *Moina*, which can be used as a new model system for studying neurodegenerative disorders. Mahima et al. quantified vitamin P in different types of tea.

### JOINT WORKSHOP BY INTERNATIONAL SYMPOSIUM ON CILIATE BIOLOGY AND ZOOLOGICAL SURVEY OF INDIA

A workshop entitled "Tools and Techniques used in ciliate studies" was conducted for undergraduate and postgraduate students. Sixty-nine students actively participated in the workshop. The workshop began with information on sample collection and sample processing using a classical approach by Renu Gupta and Santosh Kumar. Tools for diagrammatic representation of ciliates were explained by Jasbir Singh. Nageswara Rao Amanchi explained the use of ciliates as model systems in ecotoxicological assays using bio-statistical tools. Seema Makhija and Ravi Toteja explained the participants about the PCR technique used in molecular phylogeny, and they also touched upon the various criteria used for designing oligomer primers

manually as well as using various free OPEN source software applications. Various bioinformatics tools to analyse the ciliate biodiversity using a molecular approach were explained by S Sripoorna and Jeeva S Abraham. Jasmine Purushothaman gave an informative talk on submission of specimens in Zoological survey of India.

### VALEDICTION

Dr Chandrima Shaha, Vice President (Foreign Affairs), Indian National Academy of Sciences (INSA), was the Chief Guest during the valedictory (Fig. 2). Dr Alan Warren presented a comprehensive report of the three-day symposium, including an obituary for John Clamp whose demise months before the symposium was a great loss to the world of ciliate science. Dr Jaswinder Singh, Principal, SGTB Khalsa College, complimented the organizing team for the smooth conduct of the symposium, thanked the Indian and International delegates for their presentations, and gave special thanks to the funding agencies, both Indian and International. He commended the whole-hearted involvement of the students in the venture. The symposium ended with a symposium dinner.

### ACKNOWLEDGMENTS

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**Figure 2** ISCB 2018 Valedictory.

symposium is greatly appreciated. We thank the staff of SGTB Khalsa College for complete support for financial management. We also put on record the services extended by Neumech Technologies for logistic support and India Habitat Centre for excellent venue and services support. The symposium was supported by grants from the International agencies: International Society of Protistologists and International Union of Biological Sciences, and Indian agencies: Indian National Science Academy, Science and Engineering Research Board (DST), Department of Biotechnology, Council of Scientific and Industrial Research, Defence Research and Development

Organization, Indian Council of Medical Research. Additional financial help was provided by the Institute of Microbial Technology. Zoological Survey of India was the print partner apart from co-organizing the workshop and agreeing to publish the "Symposium Proceedings" (in process).

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