ROLE OF ENTOMOLOGY OUTREACH EDUCATION IN DEVELOPING INSECT INTEREST GROUPS IN INDIA: A BNHS INITIATIVE IN POPULARIZING ENTOMOLOGY

V. Shubhalaxmi and Isaac Kehimkar

Bombay Natural History Society, Hornbill House, Shaheed Bhagat Sigh Marg, Fort, Mumbai –400 001,

email : vshubhalaxmi@gmial.com

ABSTRACT

The Bombay Natural History Society (BNHS) has been conducting several entomological outreach educational programmes since 2000. These have increased awareness about insects. The programmes were largely conducted at BNHS Nature Reserve, in Mumbai; however, the connectivity with the target audience was countrywide. The range of approaches used by the authors was suitable for all age groups. These included walks, camps, special events, online course, hands-on activities, social media network groups, citizen science models and research projects. To support these activities, a range of educational materials were also developed. These included AV shows, field guides, exhibits, models, souvenirs and booklets. This paper documents the success indicators of the BNHS initiatives in popularizing entomology over the past 12 years. The outcomes of these initiatives have benefitted the audiences, authors and collaborators. The effectiveness of these efforts has generated interest among audiences who intend to pursue entomological studies or are pursuing them and contributed to insect conservation through education, tourism and community involvement.

INTRODUCTION

The BNHS has been largely known for its ornithological studies and publications, and now it largely focuses on vertebrates. Invertebrates were largely unexplored till 2000, when the authors designed the first Correspondence Course in Entomology. This gave rise to a series of outreach programmes that promoted insect awareness and developed a cadre of insect lovers. Overall, wildlife literacy in India is poor, and literacy about insects is poorer. So the authors strived hard to popularize entomology.

Today, the Conservation Education Centre (CEC) of the BNHS, in Mumbai, offers entomological outreach programmes about insects for the general public. The primary goal of these programmes is to promote entomology education. These programmes highlight the biology, ecology, diversity and novelty of insects to cultivate awareness about and appreciation of insects in the environment. These programmes extend beyond the traditional classroom to reach diverse audiences. Throughout the year, the Education Department faculty, staff and volunteers conduct insect-related programmes to children and adults at the BNHS Nature Reserve campus. These programmes provide school children and the general public with a great introduction to insect biology and ecology. The department also conducts 'live insect shows' at a variety of educational fairs and exhibitions. This paper documents the impact of BNHS initiatives in popularizing entomology through its outreach programmes.

STUDY AREA

On the event of its centenary celebration in 1983, the Government of Maharashtra had leased 33 acres of forested land to the BNHS, which is now known as BNHS Nature Reserve (BNR). The land is sandwiched between Sanjay Gandhi National Park and Film City. The forest is of a semi-moist deciduous type with rich floral and faunal elements. The CEC came into existence

on this land in 1997. The terrain is undulating and thickly forested. There are five designated nature trails, which are used by 15,000 visitors annually. Most of the entomology outreach programmes were held at BNR. Insect activity is seen throughout the year, with different insect groups being active in different seasons.

OUTREACH EDUCATIONAL ACTIVITIES

The entomology outreach methods included a various interactive approaches and formats. Most of these programme modules were devised for the first time (for a summary, see Table 1.). The details of these methods are presented in the following paragraph:

BASIC COURSE IN ENTOMOLOGY (2000-2012)

This year course was developed in 2000 order to provide in-depth knowledge about the insect world to nature enthusiasts. In 2010, the correspondence course was converted into an online course by using Google Apps and Lore as course management software. A comparison of the course formats is given in Table 2. The course now offers online (asynchronous) learning in the form of monthly assignments and face-to-face (synchronous) activities such as online chat with experts, study of BNHS insect collection and field trips, which are interwoven through the course work. The participants are graded on the basis of their performance in assignments, project work and field trips and issued a certificate on successful completion, with appropriate grades. A total of 250 participants from 12 states have enrolled to date. The course is non-accredited; yet, the certificate has been accepted by foreign universities as an add-on year for the Indian graduates.The success of the course was presented as a poster in Communication and Education for Public Awareness (CEPA) Fair at the Conference of Parties (COP 11) held in October 2012 in Hyderabad.

INSECT PROGRAMMES

A range of programme modules were developed that were interactive and fun learning. The details are given in the following Paragraph:

BUG WALKS @ BNR (2011-2012)

During the year, seasonal insect walks were arranged at BNR. The aim of these walks was to infuse interest among the insects and banish insect phobias. These walks were usually held during weekends and lasted a few hours. Each month one seasonal insect was chosen. The walks were named after them, such as Cicada Walk and Red Cotton Bug Walk.

SPECIAL EVENTS

These include a unique half-day programme format that includes indoor and outdoor activities revolving around one theme. These are annual events designed according to the seasons at BNR. There were four such special events that were designed to glamourize the insect world. The details are given below:

BREAKFAST WITH BUTTERFLIES (2004-2012)

This unique annual event was inspired by the event held in Bronx Zoo, New York City, in 2003. It was first held in Mumbai in 2004. Since then it has been held every October. Till now 587 adults and 278 children have attended this unique event. The entire event revolves around butterflies and has a combination of indoor and outdoor activities. The sessions include the following: butterfly watching trail, illustrated talk on butterflies, butterfly photography, caterpillar rearing, gardening for butterflies, baiting for butterflies and butterfly quiz. Fun activities such as butterfly games, butterfly craft, face painting and treasure hunt are arranged for children. This is the most popular event at CEC and has received wide coverage on national TV channels. Film personalities such as Sonali Kulkarni, Shubhangi Ghokhale and Raghvendra Vasudevan attended this event on various occasions.

MEAL WITH MOTHS (2009)

This unique overnight event created a buzz in moth studies in India and made mothing popular. The event was attended by nine adults and seven children. The activities included an illustrated talk on moths, a nature trail and a mothing session with a light trap. The participants photographed the moths that visited the white sheet and grasped the moth family names with ease.

BASH WITH BUGS (2007)

This unique event is conducted every monsoon. Till now 106 adults and 41 children have attended this event. The sessions include an insect watching trail, illustrated talk, Kidagiri (locate insects in a terrarium), Ento-quest (quiz), Kidon ke Funde (ento-facts), Timtimate Jugnu (firefly light production mechanism), tips on keeping kitchens cockroach free and insect camouflage. Activities such as Insect Detectives, crosswords, treasure hunts and face painting are conducted for children.

INSECT CAMPS

The BNHS Programmes Department conducts regular butterfly/moth and insect camps for its members. The authors have been leading these camps. These include the following:

- Short-duration camps to Malshej Ghat, Bheemashankar Wildlife Sanctuary and Goa.
- Long-duration camps to destinations such as Namdhapha Wildlife Sanctuary, Nameri Tiger Reserve, Ultapani (in Assam), Sikkim and Bhutan.

CITIZEN SCIENCE MODULE

Under this category the first author has been training volunteers for insect studies. The details of these initiatives are given below:

BE A SCIENTIST FOR A DAY MODULE – INSECT AND MOTH SURVEY (2011-2012)

In January 2011, the CEC started a year-long biodiversity assessment of BNR with the title 'Be A Scientist for A Day'. The programme aimed at providing knowledge about field techniques to members of civil society. Insects were one of the biodiversity survey components. These monthly surveys include nocturnal surveys for moths and day surveys for diurnal insects. During the survey the participants helped with data collection. Moths and other nocturnal insects were studied using the light sheet method, in which a mercury lamp and white cloth are used. Analysis of the data from 2011 revealed that there had been 200 species of insect belonging to 15 orders, with the order Hymenoptera being the dominant order, while the Lepidoptera showed a greater species diversity. The programme was attended by 30 participants. The module became popular among schools and colleges. It was widely covered by many newspapers. Recently it has been covered by NDTV Greenathon, and Milind Soman participated in the insect survey.

VOLUNTEERS FOR MOTH STUDIES (2004-2006)

The first author selected three female entomology course participants and trained them to assist her in moth surveys. The team surveyed Sahyradri ranges for two years and developed a comprehensive paper on the moths of the northern Western Ghats. The listing presented an inventory of 419 moth species from 28 moth families belonging to 15 superfamilies. The paper is published in the Journal of the BNHS. Two other students were trained to collect life history data of moths from BNR Data are being collected over the past 3 years. Once the data are comprehensive, a joint paper will be published.

RESEARCH PROJECTS

Small research projects were designed to generate interest in insects.

PROJECTS FOR UNDERGRADUATES (2009-2012)

CEC recruits interns every summer. Those interns who show interest in field research are assigned small research projects at BNR. They included the following: study of ground-dwelling insects using the pit-fall trap method, study of food plants of cicadas, study of life-history of Red Cotton Bug and phenology of butterflies. While some of these studies yield interesting observations, not every project is completed due to various reasons. Nevertheless the interns get to learn about insect research through such small projects.

PROJECTS FOR STUDENTS OF HORNBILL NATURE CLUBS (2010-2011)

The BNHS's CEC has been establishing Hornbill Nature Clubs to support the environment education curriculum in schools. One of the club activities is a year-long project on local biodiversity. Insects are one of the easiest subjects to be seen in any urban area. The projects include a fortnightly or monthly insect survey in the immediate vicinities of schools and homes. The

students carry out these surveys, collect data and enter them in data sheets provided by us. The BNHS team would then help the students in identification of insects. At the end the project, students analyse and present the data. The projects help students develop a better understanding about the role of insects role and get rid of their phobias.

PROJECTS FOR STUDENTS OF VACATION TRAINING PROGRAMME IN BIORESOURCES (2005-2006)

Under this 1 month long training programme, supported by the Department of Biotechnology, Government of India, research projects of students of standards X and XII students were planned. They included the following.

- Study of Swallowtail Butterflies of BNR
- Study of Pierid Butterflies
- Study of Nymphalid Butterflies
- Study of Milkweed Butterflies
- Study of Insect Homes Made Out of Soil
- Study of Insect Homes on Plants
- Study of Insect Homes Made Out of Body Secretions
- Study of Bugs
- Study of Ground-Dwelling Insects

EDUCATIONAL ACTIVITIES RELATED TO INSECTS

During the insect programmes mentioned earlier, a range of insect activities were devised and used:

- Be an Insect Detective. A game in which participants look for tell-tale signs of the existence of insects. They collect a variety of things that demonstrate the presence of any insect. A study kit is now being developed for schools.
- Pondipping for Aquatic Insects. The participants study aquatic insects by scooping a pond floor and identify insects with the help of an identification key. A study kit is now being developed for schools.
- Insect Quiz. There are several quizzes about insects that are used for a wide range of target groups. These quizzes are designed using the Kaun Banega Crorepati format, which brings in fun and interactivity.
- Insect Terrariums. Live insects and their relatives are kept in glass tanks. These tanks are used inside the classroom, where participants can view the animals and learn about them.
- Insect Skit. Several thematic skit plays were designed by the participants during course camps.
- How to have Cockroach-Free Kitchen. A poster demonstration on tips for eliminating cockroaches from kitchens.

ONLINE SOCIAL MEDIA GROUPS

With the advent of the Internet, many natural history e-groups have been established. The first author established two e-groups for interactions related to insects.

INSECTLOVERS YAHOO GROUP

http://pets.groups.yahoo.com/group/insectlovers/ (2000-2012)

The group was established along with the launch of the first entomology correspondence course. The purpose of the group was to provide a communication channel to all the course participants. It was used by the faculty as well as students to share and learn. Every year, a new batch of students was enrolled to the group. This practice was discontinued after the course became online. Currently, there are 258 members, and 4050 messages have been exchanged. This has been a closed group. There is not much communication now happening as most of the insect identification tasks are handled by another yahoogroup – InsectIndia – which was started by an Entomology Course alumna, Vijay Barve, who also established groups such as ButterflyIndia and DragonflyIndia.

INDIANMOTHS YAHOO GROUP

http://in.groups.yahoo.com/group/indianmoths/ (2005-2012)

The aim of the group was to popularize moths among the growing audience of butterfly lovers. It currently has 362 members, and 4029 messages have been exchanged. The first author enrolled international experts such as Dr. Roger Kendrick from Hong Kong and Dr. Ian Kitching from the U.K. These experts with their identification skills developed interests among amateurs who were keen to get their photographs identified. Understanding the demand, the first author established the group, but the moderation rights were given to Vijay Barve, who was keen to take this group under his e-groups banner, Diversity India.

EDUCATION MATERIALS (Table 2)

A range of educational resources were developed at the CEC by the first author to support insect outreach programmes for every age group. These included the following materials.

AUDIO-VISUAL SHOWS

A range of audio-visual (AV) shows was developed:

- Ek Kahani Titli Ki (A Story of a Butterfly): A 50-slide AV show on Indian butterflies was developed. The commentary was a jingle composed by the first author. The 7-minute jingle in Hindi was appropriate for smaller children. This became popular among children.
- Insect Mania: A 60-slide AV show on insects was developed in an interesting manner to orient any person with no knowledge about insects. It included trivia about insects and compared insects and human beings.
- Insect Classification: A 50-slide on insect classification was developed for the entomology course participants.
- World of Insect: An interactive multimedia presentation on insects was developed. This presentation provided basic and advanced information about insects. These levels ensure that the multimedia presentation could be used for a wide range of target groups.
- Moth Mania: A 45-slide AV show on moths was developed to orient people toward moths. This highlighted the basic differences between a butterfly and a moth and inroduced common moth familes.
- Insect Architecture: A 45-slide AV show on insect homes was developed. It was divided into three categories – subterranean, ground and tree insect homes.
- Plant-Insect Associations: A 50-slide AV show was developed. It was divided into two categories: (1) insects that use plants for food, shelter and defence and (2) plants that use insects for pollination, defense and food.

EXHIBITS

The CEC develops a range of exhibition materials for its own exhibition room as well as for other interpretation centres that it develops. The exhibit size varies from 3 × 4 square feet to 4 × 8 square feet.

EXHIBITS AT CEC'S EXHIBITION ROOM

1. Insect Architecture
2. World of Insects
3. Butterflies of BNHS Nature Reserve
4. Moths of BNHS Nature Reserve
5. Insects of BNHS Nature Reserve

EXHIBITS AT OTHER NATURE INTERPRETATION CENTRES

1. Insects of Malshej Ghat
2. Moths of Malshej Ghat
3. Insects of Mahableshwar

SOUVENIRS

Two souvenirs were developed, including a butterfly sticker sheet of 26 species and an insect badge for entomology course participants.

PUBLICATIONS

Every insect event was accompanied by a thematic booklet. The following major publications were also developed.

- Entomology Course Content: Altogether 28 chapters on entomology were developed. These were contributed by individual authors. Each chapter was 25-40 pages long. The content has been continually updated and provided to the course students.
- Field Guide Brochures: Three field guide brochures were developed for BNHS Nature Reserve. These were on butterflies, moths and other insects. Each field guide covered 60 commonly seen species. The insect and moth field guides were the first of their kind.
- Insect Educational Trunk: A mobile educational trunk on insects for secondary schools was developed. This trunk included an activity book, fact sheets, quiz cards, a flash card story, game cards, puzzles, puppets, a poster set on insect adaptations, the butterfly life cycle, camouflage and insect houses, a pond dipping kit, a caterpillar rearing kit, field guides and lesson plans. The trunk was used in classrooms, and a variety of activities were conducted.

INSECT MODELS

Two models were developed by CEC volunteers and course participants. The details are given below:

- Fire-fly Model: An electronic model to explain the light production in fireflies.
- Camouflage Model: An interactive model on Blue Oakleaf butterfly.
- Butterfly Chair: A butterfly chair has been developed for children.

PROGRAMME EVALUATION

As an evaluation of the BNHS initiatives in promoting entomology, an online survey was carried out among the participants who have been associated with BNHS for more than 10 years. The survey was taken up by 46 participants and here are the results.

PARTICIPATION IN PROGRAMMES (Figure 1)

The survey shows that a majority of participants participated on the insect walks (n=22%) and camps (n=22%) followed by special events (n=20%)such as Breakfast with Butterflies. This makes aggregate total of 44%. The participation in course work and other insect related activities accounted for 25% responses. A small percentage(n=11%) took up research related works such as project work and Insect Surveys during Be a Scientist for a Day event.

INSECT E-GROUPS (Figure 2 & 3)

A large number of participants were members of Butterfly India (n=72%) followed by Insectlovers (n=45%) and InsectIndia (n=45%). When the reasons for enrolling for these e-groups were analyzed, it was found 88% of participants mentioned learning about insects as prime reason for being part of these groups, followed 61% of participants mentioned meeting experts as a reason and equal percentage mentioned for socializing with like-minded people. A small percentage of participants (n=12%) wanted to develop a personal niche in entomology therefore they joined these groups.

FEEDBACK ON PROGRAMMES (Figure 4)

When the effectiveness of BNHS initiatives in popularizing entomology was analyzed against 8 parameters, it showed that 45% participants rated BNHS initiatives to be effective and 39% rated them to be very effective which makes an aggregate total of 89% effectiveness of the initiatives and remaining 11% rated them to be ineffective. On question, whether these initiatives will help in insect conservation, 99% respondents favourably.

BENEFITS TO PARTICIPANTS (Figure 5)

When the participants benefits were analyzed against the 11 parameters in three categories, it was found participants gained 63% personally, 20% academically and 17% professionally.

PARTICIPANT'S INITIATIVES (Figure 6)

When the participants' responses were analyzed for their contribution after being aware about insects, 58% participants showed willingness to contribute towards insect conservation, 30% participants were not sure and 12% were not keen. Among those who showed willingness it was found 42% participants wanted to work for insect education and 38% wanted carry out entomological research. Of which 34% exclusively wanted to work in education creating awareness, 33% wanted to work for insect conservation through education, 25% wanted to develop insect publications, and remaining 8% wanted to work in promoting butterfly tourism.

INDICATORS OF SUCCESS

The success of BNHS initiatives could be gauged from the success of participants as well as the authors who excelled in their respective fields. Some examples are mentioned below:

Success of Entomology Course Participants

- Nelson Rodrigues, a copywriter who started his first brush with insects 8 years ago when he enrolled for the entomology course. He got fascinated by butterflies and second author became his role model. This inspired him to write his first book- Butterflies of Mumbai.
- Rishiddh Zaveri was a class XI student when he joined the entomology course, his interest in entomology grew in his grooming years as he was mentored by the first author. He completed his post graduation in environmental sciences and now works as an environmental consultant with specialization in insects.
- Alka Vaidya, a housewife who completed her entomology course in 2001 and then in 2004 volunteered on the moth project of the first author and readily pursued her moth studies beyond the project period wherein she surveyed moths of Eaglenest Wildlife Sanctuary for Kaati Trust. She continuous to survey moths of North-eastern states of India.
- Alaka Bhagawat, a housewife who completed her entomology course in 2003, joined as volunteer for the moths' project of first author in 2004, thereafter she pursued her Ph.D in butterfly gardening.
- Sheila Tanna, an Ophthalmologist who completed her entomology course in 2003, got new record of Common Jay Butterfly for Mumbai
- Vijay Barve, an IT professional when he joined entomology course in 2002, now pursuing doctoral studies in Geography at University of Kansas. He established highest number of e-groups (12 yahoogroups and Facebook groups) on natural history subjects. His first group being Butterfly India established in October 2001 which is the most popular among all the groups

Success of Participants of Insect Programmes

- Rajendra Ovalekar,a school teacher who established the first open-air butterfly park in Thane after attending Breakfast with Butterflies event at CEC in 2004. The garden is visited by 4000-5000 visitors annually.

Success of Authors

- The entomology course module was accepted as first non-degree entomology course in the world. The paper was presented in 22rd International Congress of Entomology in Brisbane, Australia
- Volunteers for moth studies were developed and first joint paper alongwith volunteers is being published
- Breakfast with Butterflies event has become a branding event for BNHS, however many other organization have now started conducting these events in other parts of the country. The event received thorough media coverage on NDTV and IBN Lokmat channels
- Developed professional contacts with moth experts from the world; Dr. Jermy Holloway and Mr. H.S.Barlow from Malayan Natural History Society, Dr. Ian Kitching from Natural History Museum, London, Dr. Roger Kendrick from Kadoorie Botanical Gardens, Hong Kong and Dr. Shen-Horn Yen, University of Taiwan. These experts played an important role in providing help with moth identification and promoting mothing interest among Indians through the e-groups. The first author has collaborated with Dr. Kendrick for two joint papers on moths. Dr. Ian Kitching has agreed to become BNHS referee for moth papers. The collaboration got strengthened when Dr. Kendrick held the third Asian Lepidoptera Conservation Symposium at Coimbatore in 2010, which was first of its kind for India.
- Along with Vijay Barve and Dr. Kendrick the first author has initiated National Moth Monitoring Programme through Facebook group on Indianmoths. Through the programme, amateurs around the country are encouraged to set up mothing sheets every new moon night to attract and photograph moths. The moth pictures are then uploaded on a

Flickr group site which are then identified by the experts. The aim is to develop a pool of moth photographs which will help to prepare a quick checklist of Indian moths. This programme is under progress.(visit http://www.flickr.com/groups/indianmothsmonitoringnetwork/)

- Through the Butterfly India e-group, the first author came acrosss a new Zygaenid moth which was mistakenly posted as a butterfly by Mr. Punyo Chadha, a school teacher in Arunachal Pradesh. The first author was able to conduct a rapid survey for the moth with help of Mr. Chadha. The search of new moth is still in process.

Success of Collaborators

- Dr. Ian Kitching, a Hawkmoth specialist at Natural History Museum at London mentions that his association with indianmoths yahoogroup from 2005 till to date has added 112 new records for moth species from India. This data is now part of his project; Creating a Taxonomic e-Science (CATE).

DISCUSSION

The paper successfully documents more than decade efforts of BNHS's entomology outreach programmes in promoting entomology. These initiatives that are divided into eight categories have used a variety of approaches that is suitable for all target audiences. All programmes and events mentioned herein attracted a small number of audiences as not many people are keen to learn about insects, however on regular basis a small population of audience got rid of their insect phobias specially children. It has been observed that brain teasers on insects were effective in attracting people's attention. Also nick names given to the authors such as bug lady, moth lady and butterfly man added charm to the programmes and interesting titles such as Breakfast with Butterflies, Bash with Bugs, Cicada Walk and others helped publicity of these programmes. The role of media in popularizing entomology has been crucial, especially when one newspaper covers a photo feature on insects, other news papers follow the league. This combined effect benefits the insect popularity. It was important that insect information was given in a lucid and interactive manner. Analogies played an important role in explaining the complexities among the insect world. The usage of educational aids also made an impact (Fig.6.).

Bird watching has become synonymous with BNHS, however with advent of butterfly watching which was primarily made popular by the second author, a new batch of butterfly lovers emerged who now compete with the birdwatchers in numbers and enthusiasm. When butterfly watching reached to its prime, it was time for mothing to make presence felt. After the advent of Indian moths yahoo group, awareness about moths grew and today butterflies and moths share equal importance among the target groups who realized the dual benefits of photographing butterflies during day and moths by night. When it came to photography insects proved to be best subjects due their easy availability and diversity in shapes, sizes and colours. It was seen that people were keen to get their photographs identified and there was a constant quest for common names as most of the insects do not have one.

It has been observed that absence of field guides on insects is the main reason why many do not take interest in observing insects. After the launch of second author's butterfly book, a cadre of new butterfly enthusiasts was born who joined the already growing bandwagon of butterfly lovers across the country. Due to internet access, information from remotest areas was easily available and people were able to connect with the experts more easily. A similar guide is required for different insect groups and the first to follow will be moths. As of now, the field guide brochures on insects and moths are filling in the gap.

There is an urgent need of young workers in the field of entomology as there exists a generation gap between the stalwarts' of entomologists and new generation of insectlovers. There is a need of role models, mentors and research guides. More importantly equal weightage need to be given to entomology in colleges and universities so that entomological research are not confined to agricultural pests and insects of economic importance, ecological researches are undertaken. With the international experts on the board, enthusiastic young members supported by dedicated mentors at BNHS, the indianmoths/Butterflyindia group will soon revolutionize the way lepidoptera studies are conducted in our country. The entomology outreach programmes has been successful to fast track the insect documentation of India through various interest groups that are scattered all over the country.

ACKNOWLEDGEMENTS

We wish to primarily acknowledge late Shri. Naresh Chaturvedi, Curator at BNHS and guide to first author. His support in designing the entomology course was very crucial. We wish to thank all our course/programme participants who helped us with the survey and provided us with their important inputs. These include Chinmayi S K, Vandana Thakur, Jaykant Saini, Akshat Mullerpatan,Sanjay Marathe,Poorvi Raghavendra, Purnima Palekar, Nelson Rodrigues, Judhajit Dasgupta, Mehul Vasanjibhai Dedhia, Sanjeev Asher, Dr. Sanjyog Rai, Neelima Kalgi, Sanjay Sondhi, Viren Vaz, Dr. Suresh Jagtap, Subodh Juwatkar, Alaka R. Bhagwat and Sunila Navalkar. A special thanks for our international collaborators; Dr. Ian Kitching and Dr. Roger Kendrick for being mentors to many of our participants virtually. Lastly we thank the education team at CEC and volunteers of CEC who have played a key role in during the execution of the entomology outreach activities.

Table 1. Summary of Entomology Outreach Activities

Category	Name of the Activity
Course	Basic Course in Entomology (online)
Walk	Bug Walks @ BNR
Camp	Short-duration camp Long-duration camp
Special event	Breakfast with Butterflies Bash with Bugs Meal with Moths
Citizen cience	Be A Scientist for A Day module – Insect and moth survey Volunteering for moth studies
Research project	Projects for undergraduates Projects forstudents of Hornbill Nature Clubs Projects for students of Vacation Training Programme in Bioresources
Interactive activity	Be an Insect Detective Pondipping for Aquatic Insects Insect Quiz Insect Terrariums Insect Skit How to Cockroach-Free Kitchen?
Online social media group	Insectlovers yahoogroup Indianmoths yahoogroup

Table 2. Comparison of Entomology Course Formats

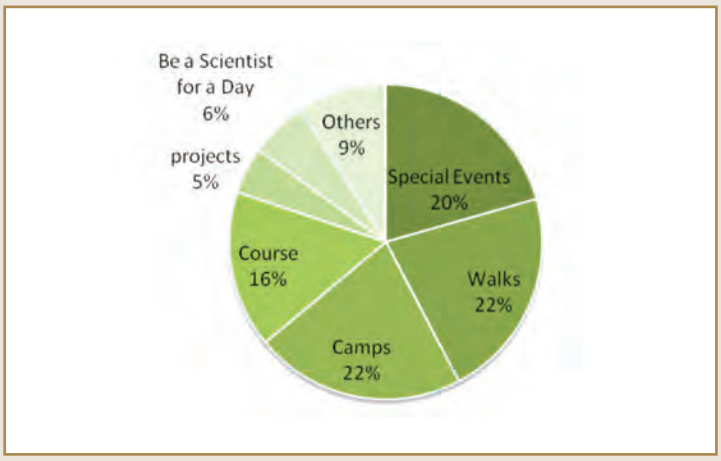
Course Components	Correspondence Course	Online Course
Number of chapters	28	12
Delivery of chapters	Post	E-mail
Presentation of chapters	B/W	Colour
Powerpoint presentations	Yes	Yes
Number of field camps	4	3
Number of field outings	6	5
Local insect project work	Yes	Yes
Open book examination	Yes	No
Visit to insect collections	Yes	No
Experts chats	No	Yes
Entomology news	No	Yes
Research paper review	No	Yes
Photo-sharing	Yes	Yes
Camp report submissions	No	Yes
Course inaugural camp	Yes	Yes

Valedictory function	Yes	Yes
Graded course	No	Yes
Certificate of completion	Yes	Yes
First started in	2000	2010

Table 3. List of Insect Educational Resources

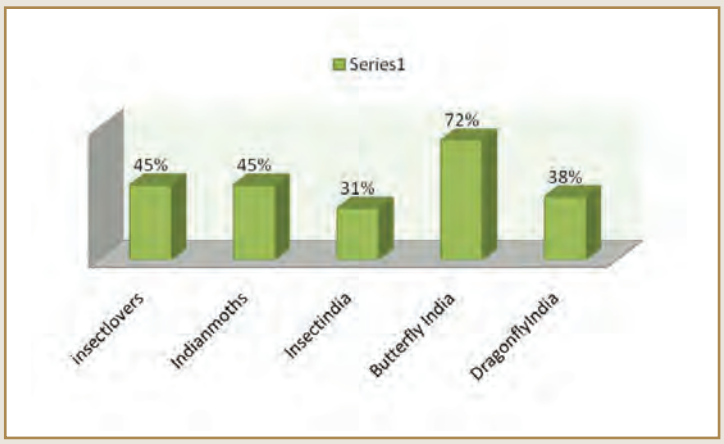
Category	Name of Educational Resource	Numbers
Audio-Visual Shows	Ek Kahani Titli Ki (A Story of a Butterfly)	8
	Insect Mania	
	Insect Classification	
	World of Insect	
	Moth Mania	
	Insect Architecture	
	Social Insects	
	Plant-Insect Associations	
Exhibits	Insect Architecture	8
	World of Insects	
	Butterflies of BNHS Nature Reserve	
	Moths of BNHS Nature Reserve	
	Insects of BNHS Nature Reserve	
	Insects of Malshej Ghat	
	Moths of Malshej Ghat	
	Insects of Mahableshwar	
Souvenirs	Butterfly sticker sheet	2
	Insect badge	
Publications	Entomology course content	5
	Field guide brochure on insects of BNR	
	Field guide brochure on butterflies of BNR	
	Field guide brochure on moths of BNR	
	Insect educational trunk	
Insect models	Firefly model	2
	Camouflage model	

Figure 1.



Participants and programmes

Figure 2.

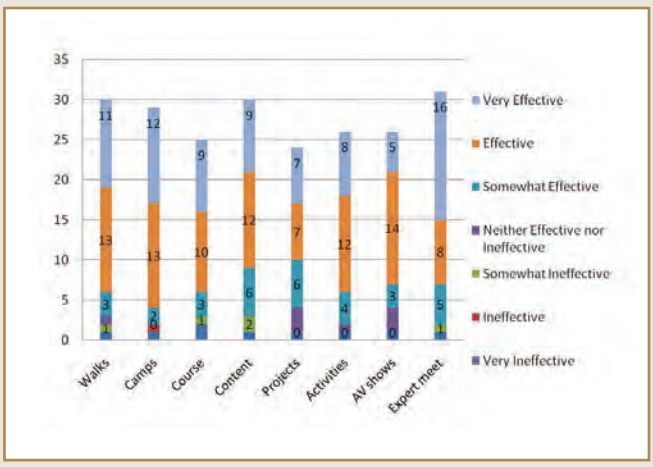


Members of e-groups

Figure 3.

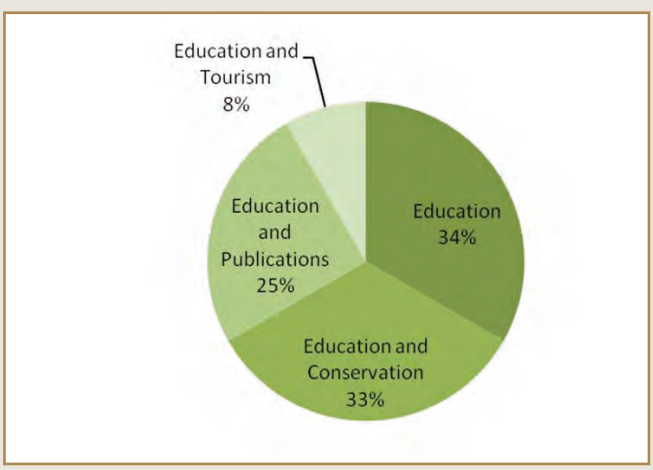
Expectations of participants of the E-groups

Figure 4.



Feedback on Programmes

Figure 5.



Participants' Initiatives

Figure 6.

Participants viewing insects in a special two-way magnifying lens jar