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Stephen Hawking

Passing away of the Generation's Leading Scientist

The 76-year-old Stephen Hawking, physicist and best-selling author who roamed the cosmos from a wheel chair—pondering the nature of gravity and origin of the universe— inspiring millions despite living with a debilitating disease, died on 14 March, 2018, at his home in Cambridge, England.

As a 21-year old graduate student at Cambridge, Hawking learnt that he had a neuromuscular degenerative disease. Doctors gave him just two years to live. The disease gradually left him wheelchair-bound and paralysed. He was able to move only a few fingers on one hand and was completely dependent on others or on technology for everything. A speech synthesiser allowed him to speak in a computerised voice. But an undeterred Hawking went on to become Lucasian Professor of Mathematics at Cambridge University, and published several bestseller books including *'A Brief History of Time'* and *'Universe in a Nutshell'*.

Hawking once said : "When you are faced with the possibility of an early death, it makes you realise that life is worth living and that there are a lot of things you want to do." British cosmologist Martin Rees said that millions around the world have been inspired by his unique example of achievement against all odds—truly a manifestation of amazing willpower and determination. He believed that people need not be limited by handicaps as long as they are not disabled in spirit. Hawking, according to physicist Roger Penrose, had an absolute determination not to let anything get in his way.

Considered on a par with the likes of Isaac Newton and Albert Einstein, Hawking is regarded as his generation's leader in exploring gravity and the properties of black holes. He discovered that black holes would eventually fizzle out, leaking radiation, which is now known as Hawking radiation.

At the time of Newton, there were believed to be four distinct and fundamental forces governing nature, which were later unified and reduced to three and then two. In 1974, Hawking published a thesis on black holes which is considered the first great landmark in the struggle to find a single theory of nature. With his work, Stephen Hawking helped in laying the foundation for unifying the remaining two forces of nature — gravity and quantum mechanics.

— Maulana Wahiduddin Khan

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In Memoriam

Remembering T. V. Ramakrishna Ayyar

The Doyen of Indian Entomologists

(1880—1952)

ANANTANARAYANAN RAMAN and ANAMIKA SHARMA

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'Although it is difficult to point out any field of entomology, which he had not touched, there is little doubt that his most substantial achievements were in the field of taxonomy. He was the first systematist – and one of the best – that India has ever produced. … and his systematic papers on Thysanoptera, Coccoidea, Psyllidae, Braconidae, Ichneumonidae, Chalcidoidea, Isoptera, Curculionidae, etc. are still standard works of reference.'

So say Mani & Rao[1], eminent entomologists of India by their own standing, in their eulogy on Tarakad Vythinatha Ramakrishna Ayyar (Ramakrishna, hereafter), offered on his passing away on 13 February 1952. The words of Mani & Rao[1] ring true even today, as Ramakrishna's papers are widely cited – 60 years after his death – by entomologists and economic biologists of India and abroad. Unquestionably the contributions of Harold Maxwell-Lefroy and Thomas Bainbrigge Fletcher to Indian entomology are of high relevance. Nonetheless, Ramakrishna impresses as a key force in the study of Indian insects of economic importance in the early decades of the 20th century. His crop-pest calendars and their designs impress as efforts that transcend time. Therefore, we, the authors of this note, feel justified in presenting this article. Mani & Rao[1], in their eulogy, speak of Ramakrishna's contributions to Indian entomology in general and economic entomology in particular. We have restricted ourselves to those aspects, which we consider are notable, but excluded in the Mani–Rao eulogy.

Ramakrishna, at 24, started as an Assistant to Harold Maxwell-Lefroy (Imperial Entomologist, Government of India) at the Surat Experimental Farm (SEF). With SEF moving to Pusa (now in Bihar) in 1905 and becoming the Imperial Agricultural Research Institute[2], Ramakrishna moved to Pusa. With the Madras Agricultural College (MAC) starting in Coimbatore in 1908, he moved there. Ramakrishna reported to Edward Ballard, the Madras-State Entomologist and lectured in agricultural entomology at MAC. When Ballard went overseas on war assignment in 1914–1919, Ramakrishna officiated as the Madras-State Entomologist. On Ballard's return to Madras in 1919, Ramakrishna returned to lecturing. Until his retirement from Government service in 1935, he remained at MAC. Between 1941 and 1944, he organized entomological research in Hyderabad State at the request of the Nizam of Hyderabad. In 1945, he settled in his home town Tarakad (Palghat). Ramakrishna died in 1952.

Why America

'In 1927, Ramakrishna Ayyar travelled …', say Mani & Rao[1], 'to Stanford University, California, where on the basis of his taxonomic studies of a large collection of Thrips from India, he was awarded the Ph.D. degree of the University.'

On reading this, we became curious why the US and not Britain, given that for higher academic degrees, the fashion in the early 1900s was to go to Britain. We secured some documents and on others we speculate (note 1).

Dudley Moulton (1879–1951), entomologist, California, USA (note 2), was making impressive strides in the study of thrips in the late 19th–early 20th centuries. Moulton studied thrips of North America and those of England, Australia, India, Japan and countries in South America. He could have been the key contact for Ramakrishna during the formative years of his career (note 3). Knowledge of thrips in India was still in infancy at this time. Professional rapport between Ramakrishna and Moulton may have encouraged the former to think of the doctoral programme in the US.

However, an alternative possibility also exists. Ramakrishna's earliest formal publications on thrips appear only in 1925. A majority of his papers published before 1925 refer to economically relevant Hemiptera (mostly Coccoidea, Scutelleridae, Psylloidea, Fulgoroidea), Coleoptera, parasitic Hymenoptera and those of the unique grasshoppers (Orthoptera: Chlorotypidae) (note 4). Because of his substantive work on Indian Coccoidea prior to 1925, Ramakrishna may have established contact with Gordon Floyd Ferris (1893–1958), who was prolific with the Coccoidea in California. Moreover, Ferris was an academic at Stanford.

These speculations lead to two prospects: (1) Ramakrishna may have decided that Thysanoptera would be his area of specialty – to be demonstrated by achieving a doctoral degree – and therefore was collecting thrips during field trips (1905–20?) and saving them for use in a consolidated manner by writing a doctoral thesis. (2) He may have been undecided about his future in an entomology-based career and was testing the waters by dealing with different insect groups responding to his work needs as an Assistant Entomologist; maybe by 1920, he was more definite about his future plans.

Ramakrishna mentions Ferris at least twice in his applications to Stanford University (see the following section), whereas nowhere Moulton is referred. At this stage, what influenced Ramakrishna to go to Stanford is hazy.

At Stanford

The Student Archives of Stanford University generously shared photocopies of the following documents pertaining to Ramakrishna:

1. Application to Stanford University (SU) for Ph D admission (23 October 1922).
2. Follow-up action taken at SU (5 March 1925).
3. Application for a scholarship (25 February 1926).
4. Personal application for admission with graduate standing (31 December 1926).
5. Appointment of the Committee of Examiners (22 July 1927).
6. Committee of Examiners' report (25 July 1927).
7. Stanford University – Graduate Record (7 October 1927).

Ramakrishna refers to his B A from Victoria College, Palghat obtained in March 1898 and his 'graduate study' as a Buckie Scholar at the Madras Christian College (MCC), Madras (1898–1900) (document 1 mentioned above). What is not clear is whether the two-year stint at MCC was an Honours programme or a research task completed towards an M A degree. He explains his purpose for the graduate study (Ph D) at SU as:

'My main idea as an Indian is to get myself acquainted with the Entomological work in the west – chiefly the methods of applied entomology with special reference to Horticulture and Pomology.'

A testimony from H. Reynolds (Acting Professor of Biology and Zoology, MCC) of 5 May 1889, attached in support of his application is relevant to the present note:

'Mr T. V. Ramakrishna Ayyar B.A., studied Biology with me at the Madras Christian College during the Second Session of 1897. He proved himself to be a very capable and painstaking student and in the University Examination did remarkably well standing second in the Presidency. He was subsequently appointed to the Buckie studentship in Zoology – the Studentship – having never previously been awarded – and has latterly been studying Zoology with me with the intention of going on to the M.A. Degree. His general conduct and my relations with him have always been of the most satisfactory character and I am confident that he will do well in whatever sphere of life he may be placed.'

Rennie Wilbur Doane (Head of the Department of Zoology, SU; 1905–36) supports Ramakrishna's application (document 2), based on which the Registrar of SU accepts the same.

A 'renewed' application dated 2 January 1924: a handwritten note possibly that of an official of SU indicates 'Renewed for June and 25 February 1926' (document 3). In this Ramakrishna seeks a scholarship of $750 (note 5), with a rationalization statement:

'I am a government servant under the Madras Agricultural Department and hope to be on long leave while I am in America. The leave allowance I may get will just be enough for my family at home here in India, during my absence.

I have already submitted my credentials etc. to Professors Doane and Ferris, and I believe reference may kindly be made to them with regards to my eligibility. As a foreigner and as one anxious to get some wider experience on my subject by a stay in California, I am anxious to do some work there. As a middle class man of very moderate means I may find it very hard to carry out my plans unless I get some substantial financial aid and hence I am applying for a fellowship. I hope my request may be favourably reviewed and granted.'

A 'fresh' application for enrolment is dated 31 December 1926 (document 4). This is based on the acceptance of his application for graduate standing (vide document 2). Possibly this application was made after he arrived at SU. He indicates his B A degree, in this document, as 'A.B.' following American convention. To the question 'When do you desire to enter Stanford?', he responds 'January 1927'.

An official note was issued by the Office of the Registrar, SU, on the appointment of the Committee of Examiners to examine Ramakrishna's thesis (document 5):

'The final examination of T.V. Ayyar [*not mentioned as T. V. R. Ayyar*] (Major, Zoology; Minor, Entomology) has been set for Saturday, July 23, 1927 at four o'clock in room 307 of the Library. At the request of the Chairman (acting) of

Graduate Study the following have been appointed to serve as a committee to conduct the examination:

Professor R.W. Doane (Chairman)
Professor E.C. Starks
Professor LeRoy Abrams
Professor F.M. McFarland
Professor Mary McCracken.'

Report of the Committee of Examiners after they examined Ramakrishna's thesis is as follows (document 6):

'The secondary examination of Mr. T. V. Ramakrishna Ayyar for the degree of Doctor of Philosophy was held in Room 307, Library, on Saturday, July 23d, at 4 p.m. The members of the examining committee present were: Professor E.C. Starks, Professor F.M. McFarland, Professor M. McCracken and the Chairman. At the conclusion of the examination it was voted unanimously that the candidate had satisfactorily passed the test, and should be reported with approval to the Committee on Graduate Study.

Signed: R. W. Doane
Chairman of the Committee'

Graduate Record, SU (document 7) mentions:

'Name: Ayyar, T. V. Ramakrishna
Place & Date of Birth: South India, July 1880
Date of Registration in Graduate Standing: Jan 1927
Major Department: Zoology
Degree Conferred: Ph D, Oct 7, 1927.'

Ramakrishna's stay in Stanford could not have exceeded one year, possibly from end-1926 to mid-1927. He mentions Gordon Ferris in his applications, but Ferris does not figure in any of the documents we received from the Stanford Archives. Dudley Moulton's name too does not figure in any of the SU archived documents.

Ramakrishna's efforts to travel to Stanford started in October 1922, which materialized only in late 1926. By March 1925, SU endorses his academic standing and offers him admission into Ph D programme. The Department of Zoology, SU, found merit in Ramakrishna's work and publications made in India and condoned the requirements of the 'primary' examination. In modern terminology, this could be the equivalent of offering either 'credit' or 'advanced standing'. The SU Department of Zoology consents that he be subjected to the secondary examination of submitting a thesis (note 6), meeting the academic rigours of SU. We infer that from January 1927 to June–July 1927, Ramakrishna worked at Stanford's Zoology Department putting his findings on Indian Thysanoptera together into a thesis.

The thesis submitted by Ramakrishna on Indian Thysanoptera was evaluated and accepted by the Doane Committee (Doane, Starks, McFarland and McCraken, *sans* Abrams), all of whom were SU academics. Doane was an economic entomologist and headed the Department of Zoology, Starks was a fishery biologist with a professorial title, McFarland was a marine-invertebrate histologist and held the title of Associate Professor of Histology, and McCracken was an entomologist, specializing in the genetics of beetles, and held the title of Assistant Professor of Zoology. Abrams was a botanist and held a professorial title. The Office of the Registrar (document 6) lists names of examiners, according to the academic hierarchy at SU.

Crop-pest calendars for South India

Ramakrishna[3] presents a colourful 'crop-pest calendar' at the Fourth Entomological Meeting at Pusa, 1920. This calendar refers to nine major insects and one minor insect on rice (*Oryza sativa*, Poaceae): the swarming caterpillar (*Spodoptera mauritia*, Lepidoptera: Noctuidae), paddy stem borer (*Scirpophaga incertulas* [*Schoenobius bipunctifer*], Lepidoptera: Crambidae), paddy leaf-mining beetle (*Dicladispa armigera* [*Hispa armigera*], Coleoptera: Chrysomelidae), smooth greenish-blue beetle (*Leptispa pygmaea*, Coleoptera: Chrysomelidae), paddy grain sucker (*Leptocorisa varicornis*, Hemiptera: Alydidae), paddy caseworm (*Nymphula depunctalis*, Lepidoptera: Pyralidae), paddy grasshopper (*Hieroglyphus banian*, Orthoptera: Acrididae), the rice gall midge (*Orseolia oryzae* [*Pachydiplosis oryzae*], Diptera: Cecidomyiidae), paddy mealy-bug (*Pseudococcus sacchari*, Hemiptera: Pseudococcidae) and paddy thrips (*Thrips oryzae* [*Bagnallia oryzae*], Thysanoptera: Thripidae). In this calendar, he relates population patterns of these insects to landscapes of rice-cultivating subregions of southern India and to climatic and edaphic factors. He also refers to two other similar calendars, one for insect pests of crops other than *O. sativa* in southern India, and the other referring to some minor pests of crops. Unfortunately, the latter two calendars as diagrams are not included in the published proceedings[3].

In p. 50, he[3] indicates:

'The attempt made in this paper at the preparation of a Calendar for South India is entirely based on past experience with however, no pretensions to any completeness or mathematical accuracy.'

When Ramakrishna presented this paper, he would have completed six years of employment as a lecturer in agricultural entomology. He mentions that the calendar is based on 14 years of records of crop pests. So it is highly likely that he extracted details from records prior to his employment and he must have supplemented his records to construct these calendars. In p. 49, he thanks Ballard for 'useful' discussions in developing these calendars.

In pages 49–50 of this paper, he describes the strengths and usefulness of this calendar. Even a quick reading offers a convincing and well-justified explanation. Given the advantages we enjoy today with advanced computer technology, with which we can easily construct 3D images, the effort made by Ramakrishna in the 1920s in constructing the rice-pest calendar, which could easily function as a ready-reckoner appears remarkable. As a 2D image, he has credibly incorporated details that would be imperatively necessary for a rice farmer as well as an agricultural extension worker. We are sure that this effort would have consumed considerable time to reach the thoroughness that characterizes this calendar.

The term 'calendar' occurs in two contexts in the history of economic entomology: (1) From the early 20th century, calendar-based application of aceto-arsenite of Cu (Paris green), arsenite of Ca (arsenite of lime, London purple) and arsenite of lime (gypsine) to manage pestiferous arthropod populations has been in vogue. For instance, a 'spraying calendar' to manage pestiferous arthropods and pathogenic fungi of diverse British fruit trees is available[4]. (2) After the development of the concept of integrated pest management (IPM), 'crop scouting' became a valuable tool in IPM efforts. IPM depends on field-specific information and improved decision-making to protect crop yield and quality, concurrently minimizing the risks associated with pesticide use. Through a systematic field-sampling programme, crop scouting provides field-specific information on pest pressure and crop injury. The systematic field-sampling programme is run after a specifically drawn calendar[5]. Except these, where the term calendar is available in entomological literature, Ramakrishna's use of this term in offering a useful tool to farmers and extension workers is not only novel, but also convincingly appropriate.

On an unusual grasshopper of southern India

Ramakrishna[6] provides cursory notes on the 'behaviour' of *Phyllochoreia ramakrishnai* (Orthoptera: Chlorotypidae), spelt as *Phyllocoreia ramakrishnai* (note 7), a unique orthopteran. He refers to them (p. 1034):

'... as extraordinary creatures ... found in damp localities ... found feeding on *Terminalia* leaves'.

He mentions of their characteristic hopping behaviour, winglessness, and ability to change colours suiting the environment in which they occur. Presently raised to Eumastacoidea[7], we know tha. a majority of them occur in the tropics, feeding on algae, ferns and gymnosperms; most of them being apterous and displaying camouflaging capability[8]. Before his note[6], William Kirby[9] had described three species of *Phyllochoreia* from Ceylon and Malabar. Ramakrishna sent specimens of Eumastacidae collected from different localities of southern India to Cándido Bolívar y Pieltain[10], Madrid (Spain) (note 8), who described *Phyllochoreia ramakrishnai* (referred as *Phyllocoreia Ramakrishnai*), *Bennia burri*, and *Mastacides nilgirisicus* in 1914. Five species of *Phyllochoreia* are known today in southern India, which are endemic to the Western Ghats (India) and Sri Lanka; a casual reference indicates *Mangifera indica* as its host.

Usefulness of the cochineal insect in the biological management of prickly pear

Dactylopius ceylonicus (Hemiptera: Dactylopiidae) the cochineal insect was introduced to India from Brazil in the late 18th century, thinking that it was *D. coccus* for the extraction of carmine dye[11]. In field conditions, *D. ceylonicus* spread to its natural host plant, *Opuntia vulgaris* (Cactaceae), a plant originally from South America, which in the absence of natural enemies spread widely in India. *D. ceylonicus* not only successfully established on *O. vulgaris*, but also suppressed it in northern and central India. Ramakrishna[12] has documented that when *D. ceylonicus* was introduced into southern India in 1863–1868, it brought about the 'first successful use' of an insect to manage a weed[13]. Ramakrishna's remark on the usefulness of *D. ceylonicus* in managing populations of *O. vulgaris* in India is pioneering; in high likelihood, he was influenced by the paper by Tryon[14] from Queensland (Australia). Ramakrishna challenged the contents of a letter to the editor of *Nature* by Wilfred Backhouse Alexander[15], who was the biologist with the Commonwealth Prickly-Pear Board of Australia in the 1920s on prickly pear incidence in India and its better management with manual removal. Ramakrishna disputed Alexander with a rejoinder in *Nature*[16], which has not been rebutted by the latter.

Handbook of Economic Entomology for South India

His *Handbook of Economic Entomology for South India* (1940) published by the Government of Madras, a jewel in Ramakrishna's crown, remains valid and relevant even today, nearly seven decades since its publication. *Nature*[17] notified Ramakrishna's book as follows:

'Knowledge of South Indian insects has greatly increased since the publication of T. B. Fletcher's book (note 9) on the subject in 1914. This work is now out of print and there is a growing demand for its replacement by a more modern book. As a desideratum it has been filled by the appearance of Ramakrishna Ayyar's volume that is now before us. This writer is very well qualified for the task, having many papers and bulletins on South Indian economic entomology to his credit. The book is divided into two parts, and Part I deals with general aspects of the subject such as anatomy, development and classification. Part II is in the main a conspectus of the chief injurious insects of South India and the best-known methods for combating them. The book is well printed and seems to be very free from errors, while its numerous illustrations add materially to its value. It should meet with a wide and speedy acceptance and fill a definite place in the literature of Indian economic entomology.'

A similar note is also available in the *Proceedings of the Royal Entomological Society of London, Series A, General Entomology* (1942, **17**, 80).

Conclusion

This note aims to remember T. V. Ramakrishna, whom we consider the doyen of Indian entomologists. He worked with an undiluted agenda of studying agriculturally relevant insects of India. Ramakrishna's excitement is evident right from his early career. The short notes (=posters in conferences of today) he presented at the annual entomological meetings of Pusa – in the early decades of the 20th century – vouch for his passion. What is worthy of note is that a contemporary entomologist was his sibling, T. V. Subramanyan, Mysore Agricultural Service. The brothers jointly published a paper on the biology and management of *Contheyla rotunda* (Lepidoptera: Limacodidae) in the *Madras Agricultural Department Yearbook* (1917). Ramakrishna's son T. R. Subramaniam worked as a professor of agricultural entomology for many years at MAC (now the Tamil Nadu Agricultural University). Do these foreshadow that the passion to study insects ran in Ramakrishna's family? His travel to America, at a time when the residents of British India preferred to qualify from the UK, is an academic adventure.

Ramakrishna's active professional life and the pioneering contributions he made to Indian entomology appear considerable, given the timeframe he worked in and the sorts of curtailments that may have prevailed then. He enlightened Indian intelligence about the arthropods in general and insects of agricultural relevance in particular; that ability is striking.

Notes

1. One of us (A.R.) has had opportunities to discuss Ramakrishna's life and work with T. N. Ananthakrishnan, entomologist–ecologist of India, who lives in America. Ananthakrishnan knew Ramakrishna personally. Both hail from Tarakad, Palghat.

2. Moulton received his A.B. and A.M. degrees from Stanford. He was the Agriculture Commissioner for the city and county of San Francisco in 1911.

3. Ananthakrishnan told A.R. that Moulton was a great correspondent. I (A.R.) interpret this remark as follows: 'Moulton should have had the habit of replying people quickly to, and possibly supportively of, upcoming scientists'.

4. A list of Ramakrishna's publications (supposedly complete) is available freely: *http://www.mediafire.com/download/a7- wob85w4mmolww/Dr.+Ayyar.pdf*.

5. At this time, Stanford University (SU) offered stipends to graduate students ranging from US$ 150 to 750. The highest award went to Ramakrishna.

6. The term 'thesis' is used in the SU documentation; although presently for the final reports submitted by Ph D candidates in North-American universities, 'dissertation' is used.

7. Whether this spelling error was committed by Ramakrishna or it is a printer's devil is uncertain.

8. Ignacio Bolívar y Urrutia (1850–1944) was an eminent naturalist–entomologist of Spain, whose son was Cándido Bolívar y Pieltain. Ignacio Bolívar published a three-part paper on the Orthoptera of southern India, entitled 'Les Orthoptères de St. Joseph's Collège, à Trichinopoly (Sud de l'Inde)' in the *Annales de la Société Entomologique de France* in the 1900s. Out of curiosity, I (A.R.) explored whether Ignacio Bolívar had travelled to southern India to collect the Orthoptera. I found that the Orthoptera from southern India were supplied to him by Reverend Augustine J Haas, S.J. (1869–1957), who was teaching chemistry at St. Joseph's College, Tiruchirapalli. Haas came to Madurai Jesuit Province from Alsace, now in France. His interest in plants and the insects of Madurai and neighbourhood is amazing given that he was a chemist. His name figures in the acknowledgements of papers by different European entomologists of that time (e.g. Jean-Jacques Kieffer, Alsace–Lorraine, France). Haas wrote a 214-page book, *Elementary Chemistry*, which was published by St Joesph's College, printed at their own press in 1908.

9. Thomas Bainbrigge Fletcher (1878–1950), *ex* English Navy, served as the Imperial Entomologist, succeeding Harold Maxwell-Lefroy. He studied insects and birds of India. He was keenly interested in Microlepidoptera. His book *Some South Indian Insects and Other Animals of Importance Considered Especially from an Economic Point of View* (1914, Superintendent, Government Press, Madras, 565 pages) remained current, until Ramakrishna's *Handbook of Economic Entomology for South India* (1940) replaced it.

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References

1. Mani, M. S. & Rao, Y. R., *Indian J. Entomol.*, 1952, **14**, 187–190.

2. Raman, A., *Curr. Sci.*, 2012, **103**, 573–575.

3. Ayyar, T. V. R., Report of the Proceedings of the Fourth Entomological Meeting, Pusa (1920), 1922, pp. 49–55.

4. Pickering, S. & Theobald, F. V., *Fruit Trees and their Enemies with a Spraying Calendar*. Simpkin, Hamilton, Kent & Co, London, 1908, p. 113.

5. Fishel, F., Bailey, W., Boyd, M., Johnson, B., O'Day, M., Sweets, L. & Wiebold, W., *Integrated Pest Management – Introduction to Crop Scouting*. College of Agriculture Food & Natural Resources, University of Missouri, Columbia, MO, 2001, p. 23.

6. Ayyar, T. V. R., Report of the Proceedings of the Third Entomological Meeting, Pusa, 1919, pp. 1033–1034.

7. Déscamps, M., *Acrida*, 1973, **12**, 161–298.

8. Rentz, D., *Grasshopper Country, the Abundant Orthopteroid Insects of Australia*, University of New South Wales Press, Sydney, 1996, p. 284.

9. Kirby, W. F., *The Fauna of British India, Including Ceylon and Burma*, Published by The Secretary of State for India in Council, London. Printed by Taylor & Francis, London, 1914, p. 278.

10. y Pieltain, C. B., *Trab. Mus. Nac. Cienc. Nat., Ser. Zool.*, 1914, **16**, 1–48.

11. Raman, A., *Curr. Sci.*, 2011, **100**, 1092–1096.

12. Ayyar, T. V. R., *Agric. Livestock India*, 1931, **1**, 154–159.

13. Viraktamath, C. A., *Micronesica Suppl.*, 2002, **6**, 67–83.

14. Tryon, H., *Queensl. Agric. J.*, 1910, **25**, 188–197.

15. Alexander, W. B., *Nature*, 1931, **128**, 226.

16. Ayyar, T. V. R., *Nature*, 1931, **128**, 837.

17. *Nature*, 1942, **149**, 9.

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Genes and the Prediction of Diseases

Genetic Data can predict height, intelligence, even the chances of getting arthritis

Angelina Jolie got both her breasts removed (double mastectomy) when she came to know she had a faulty gene that increased the chances of her getting breast cancer. Just five years later, our knowledge of the correlations between genes and disease has increased manifold. This is mainly due to the very large number of people whose genetic data is now available. And for the first time, scientists are using the data to guess a person's chances of getting common diseases like diabetes and arthritis.

The correlations now go beyond predicting disease. Sitting in their labs scientists can predict your height with a fair bit of accuracy—at present the margin of error is less than two inches. Since they predict on the basis of genetics, they can tell how tall your newborn child will grow up to be.

Only 10 years ago, researchers were confident they would be able to pin most common diseases to about a dozen genes, making it easy and economical to create new drugs, but this did not happen. They realised that one-to-one correlations between genes and diseases were hard to establish as most diseases had complex causes. "Instead of 12 genes, we now know, type 2 diabetes is influenced by at least 400 locations in our DNA, and probably many more—each with only a tiny hard-to-detect effect" says an article in *MIT Technology Review.*

Already scientists can assign you a 'polygenic score'— so called beacuse it is based on thousands of genes. These scores are like report cards of your possible future diseases. In California, doctors are testing an iPhone app to foretell your risk of coronary artery disease.

Not only diseases the data can predict your other measurable traits like personality and habits. For instance, whether you are likely to make a career in crime? One company even wants to test IVF embryos for intelligence and discard those it finds unfit. But who decides the threshold of fitness? Could not this technology be used to reject all but the most intelligent embryos?

The likelihood of "DNA Fortune telling" raises troubling questions. It is one thing to caution an 18 year old about the probability of their getting heart disease by the age of 50, but if parents choose their toddler's school on the basis of genetic intelligence scores, won't it amount to biological discrimination? It is not a far-fetched idea beacuse in just the past 12 months scientists have linked 206 genes to intelligence.

Eric Turkheimer, is a psychologist at the University of Virginia, says in the article the danger is that the scores will be overinterpreted to "recommend some truly dreadful social policies."

Yet, all that these 'genetic horoscopes' do is calculate probabilities. They tell what could happen to someone like you, not what will definitely happen to you. "The scores are not individual certainties, they are merely rough probabilities derived from large populations." Letting them shape lives could be as bad as leaving your future to the stars.

Initial Migrations of Human Beings

Genealogy reminds us that we all came from Africa and were once black

CHIDANAND RAJGHATTA

The story of human migration is very expansive and inexact. It has plenty of holes and lot of dots. It has cunning passages and contrived corridors. The world's greatest anthropologists, paleontologists, genealogists, archeologists and others involved in the science skip over the holes cautiously, connect the dots hesitantly, navigate the routes tentatively, and string together evidence, speculation, and theory to arrive at conclusions, some of which have stood the test of time.

You may believe the story of both human evolution and human migration, holes, warts, and all, is fairly logical, coherent, and broadly accepted. It is agreed on the basis of reasonable evidence that humankind took its first outbound steps from Africa to Asia. As they schlepped across Asia populating it, some sailed on towards Australia from Southeast Asia, while others doubled back north to Europe, populating that continent.

One or both of these groups populated northern and eastern Asia, including Russia, and some 15,000 years ago, stepped nimbly across the Bering Strait connecting Asia and America. Down they went along the west coast of America, the first place to be populated on the continent. It wasn't the conquistadors or the Pilgrim Fathers who came from the east across the Atlantic who discovered America. The land was discovered by itinerants who migrated from Africa to Asia to America, where they became Native Americans, and were later erroneously described by Columbus and co as Indians.

There are occassional challenges to this migration theory. Some experts have argued that America may also have been discovered and populated by seafaring Pacific islanders who came from the west, or ocean-faring Atlanticists predating the conquistadors by many centuries coming from the east. In either case, it would seem Native Americans are of Asian stock, and even before that, of African stock, because everything flowed out of Rift Valley. In that sense, we are all "black". Whether they came by boats or on foot through Bering Strait, the natives of America are of Asian or African origin, depending on how far back you want to go into the history of migration.

A recently analysed DNA sample from a 10,000-year-old skeleton discovered in Gough's Cave near Cheddar Gorge, England, offers a remarkable possibility : the first modern British people had "dark brown to black skin". This should not surprise anyone. Research presented at the American Association of Physical Anthropologists shows that the whiteness, or paleness, of Europeans is only 8,000 years old. It turns out that Christ was a middle-easterner with a swarthy complexion and black hair. An artist's impression from anthropologist Richard Neave showed him looking rather like Saddam Hussein.

In a "genetic portrait of America" that he drew in his 2012 book *DNA USA*, Bryan Sykes came to many startling conclusions on the basis of evidence from current US population ; Not only did European genes appear among Native Americans as early as 10,000 years ago, among white Americans too there is evidence of African DNA. America is genetic mosaic long predating the US boast of being a melting pot. The broader point is that America has been a melting pot melded from migration over centuries.

Of course, you can't expect white nationalists in the US and hypernationalists in India — which is also periodically in the throes of nativism — to absorb or process all this. They have little bandwidth for science, evolution, migration and other complex issues. For their leaders, it is easier to toss out red meat to nativist crowds and rile them up about immigrants and foreigners, rather than let them know that they too have DNA from the "shithole" continent.

Long before nativists in India settled on the country being Indic or Sanskritic or Brahminic or whatever term they prefer to "otherwise" rest of the population who choose to look beyond 5,000 years, it turns out that the subcontinent was open to two possible migration movements from Africa : One that set off some 60,000 years ago across the Horn of Africa and moving east across the Arabian Peninsula; another that crossed into Asia further north at Red Sea some 50,000 years ago and went across the Caucasus before looping south into India.

Along the way both groups possibly mingled with Neanderthals and other hominid derivatives / species who may have migrated earlier, before the two streams met in the heart of India over scores of generations.

So in the one sense, except for the original inhabitants' descendants of the Rift Valley who may remain there, everyone on this planet, unconstrained by narrow nationalism, is an immigrant descendant of one kind or the other. Our ancestors saw this, which is why, in recognition of our mongrel status, they embraced the concept of *vasudhaiva kutumbakam* — the world is one. This might hurt your feelings, but your holy cross or holy thread or holy book is not going to keep you pure, because you never were and you were never meant to be.

Eliminating Malaria
In India and Southeast Asia

POONAM KHETRAPAL SINGH
WHO Regional Director for Southeast Asia

The WHO Southeast Asia Region has made dramatic progress in malaria prevention and control. As the recently released World Malaria Report documents, since 2010 Southeast Asia has led the world in reducing the number of people falling ill and dying from malaria, slashing the caseload by 50% and associated mortality by 60%. Two countries in the region — Maldives and Sri Lanka—have been certified malaria free. In 2016 four countries recorded fewer than 10,000 cases, while Bhutan and Timor-Leste reported zero deaths since 2013 and 2015, respectively.

These are substantial achievements, particularly in a world where the battle against malaria remains as challenging as ever. That eight of the Region's nine malaria endemic countries are on course to reduce malaria cases by 40% by 2020 (with three countries — Bhutan, Nepal and Timor-Leste identified as having the potential to achieve elimination) is proof that with the right policies and robust political will, malaria's deadly burden can be lifted.

To make that happen Region-wide by 2030, high burden countries such as India, Indonesia and Myanmar must continue their forward trajectory. While each has made substantial gains in driving down malaria incidence and mortality, their further success will have a decisive impact on the Region's fortunes given that together they account for around 98% of its burden.

More importantly, they will have a decisive impact on vulneable populations now suffering the disease, raising up their health and wellbeing and promoting social and economic advancement. To achieve these outcomes, a number of tools outlined in WHO's Technical Strategy for Malaria 2016-30 are of critical function.

Key among them is deepening community engagement and action at the grassroots. Countries across the Region have benefitted immensely from working directly with affected communities. Whether by disseminating insecticidal nets or carrying out rapid diagnostic testing, grassroots volunteer networks have the ability to catalyse real change where effectively engaged. India's Accredited Social Health Activist programme is a good example of how this can be done, and how countries can reach the unreached and underserved while establishing greater community buy-in.

The embrace of innovation and new technologies is likewise crucial. That means strengthening and expanding support for basic, clinical and implementation research able to enhance understanding of both malarial parasites and the mosquitoes that spread them. It also means investing in new technologies and forms or service delivery that can hasten progress in specific contexts.

Stronger surveillance and information systems also hold great potential. By building on existing surveillance, national malaria programmes will be in a better position to allocate or redirect resources to affected areas, especially in the event of an outbreak. Stronger surveillance will also help gauge the efffectiveness of interventions, allowing authorities to modify their approach where appropriate.

Importantly, given that malaria's burden transcends national borders and can be reintroduced where it has already been eliminated, Region-wide cross-border collaboration is essential. To this end, WHO's data-sharing platform in the Greater Mekong Subregion is a great example of how countries can pool information to pursue common goals and empower national malaria programmes. A similar model should be considered for the entire Region, allowing authorities in each country to access robust and up-to-date data that can help guide their efforts. Political obstacles must be overcome in all countries and transparency pursued as a matter of principle.

Recent momentum in each of these areas is encouraging. In November, a ministerial roundtable was held in New Delhi where, among other things, member countries focussed on operationalising the Southeast Asia Region's 2017-30 malaria eliminating action plan. To follow that up, in early December the health ministers convened once again, this time in Myanmar's capital Naypyidaw, to share experiences and learn from one another in an effort to accelerate progress at local, national and regioanl levels.

For the Region's three high-burden member countries, as well as those that have eliminated or are on the cusp of eliminating the disease, the need to retain focus and deepen the implementation of key tools and strategies cannot be overemphasised. Across the Region, we can accelerate progress and help secure the health and well-being of vulnerable populations. We can—and must—eliminate malaria.

A Current List of the Moths (Lepidoptera) of West Bengal

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(Contd. from vol. 20, no. 1, pp. 29)

Family GEOMETRIDAE

Subfamily Ennominae (contd.)

487 *Hyposidra talaca* (Walker, 1860)
488 *Iridoplecta ferrifera* (Moore, 1888)
489 *Krananda semihyalina* (Moore, 1868)
490 *Leptodontopera basipuncta* (Moore, 1867)
491 *Leptomiza calcearia* (Walker, 1860)
492 *Leptomiza dentilineata* (Moore, 1887)
493 *Lomographa alba* Moore, (1888)
494 *Lomographa platyleucata* (Walker, 1866)
495 *Luxiaria obliquata* Moore, 1888
496 *Luxiaria tephrosaria* (Moore, 1868)
497 *Medasina albidaria* (Walker, 1866)
498 *Medasina basistrigaria* (Moore, 1867)
499 *Medasina combustaria* (Walker, 1866)
500 *Medasina contaminata* (Moore, 1887)
501 *Medasina creataria* (Guenée, 1858)
502 *Medasina dissimilis* Moore, 1887
503 *Medasina fratercula* Moore, 1887
504 *Medasina interruptaria* (Moore, 1867)
505 *Medasina mauraria* (Guenée, 1858)
506 *Medasina mucidaria* (Walker, 1866)
507 *Medasina objectaria* (Walker, 1866)
508 *Medasina similis* Moore, 1888
509 *Medasina strixaria* (Guenée, 1858)
510 *Medasina vagans* (Moore, 1887)
511 *Menophra decorata* (Mooe, 1867)
512 *Menophra subplagiata* (Walker, 1860)
513 *Micronidia simpliciata* (Moore, 1868)
514 *Mimochroa albifrons* (Moore, 1888)
515 *Mimochroa lugens* (Butler, 1880)
516 *Myrioblephara conifera* (Moore, 1888)
517 *Myrioblephara duplexa* (Moore, 1888)
518 *Myrioblephara idaeoides* (Moore, 1888)
519 *Myrteta planaria* (Walker, 1861)
520 *Nothomiza dentisignata* (Moore, 1867)
521 *Odontopera cervinaria* (Moore, 1867)
522 *Odontopera similaria* (Moore, 1888)
523 *Omiza pachiaria* Walker, 1860
524 *Ophthalmitis herbidaria* (Guenée, 1858)
525 *Opisthograptis sulphurea* (Butler, 1880)
526 *Opisthograptis tridentifera* (Moore, 1888)
527 *Opisthotia tumidilinea* (Moore, 1888)
528 *Ourapteryx ebuleata* (Guenée, 1858)
529 *Ourapteryx picticaudata* (Walker, 1860)
530 *Ourapteryx primularis* (Butler, 1886)
531 *Paradarisa comparataria* (Walker, 1866)
532 *Paralcis conspicuata* (Moore, 1888)
533 *Parapercnia giraffata* (Guenee, 1858)
534 *Parasynegia pluristriaria* (Walker, 1863)
535 *Peetula exanthemata* (Moore, 1888)
536 *Peratophyga hyalinata* (Kollar, 1844)
537 *Peratostega deletaria* (Moore, 1888)
538 *Percnia ductaria* (Walker, 1862)
539 *Percnia felinaria* (Guenée, 1858)
540 *Percnia foraria* (Guenée, 1858)
541 *Petelia medardaria* (Herrich-Schäffer, 1856)
542 *Petelia* sp.
543 *Plutodes subcaudata* (Butler, 1880)
544 *Pomasia obliterata* (Walker, 1866)
545 *Pristostegania trilineata* (Moore, 1868)
546 *Probithia exclusa* (Walker, 1860)
547 *Prorhinia pallidaria* (Moore, 1881)
548 *Pseudomiza castanearia* (Moore, 1868)
549 *Pseudopanthera himaleyica* (Kollar, 1844)
550 *Psilalcis albibasis* (Hampson, 1895)
551 *Psilalcis inceptaria* (Walker, 1866)
552 *Psyra angulifera* (Walker, 1866)
553 *Psyra cuneata* (Walker, 1860)
554 *Psyra spurcataria* (Walker, 1863)
555 *Racotis boarmiaria* (Guenée, 1858)
556 *Rhynchobapta cervinaria* (Moore, 1888)
557 *Sabaria incitata* (Walker, 1862)
558 *Sabaria rondelaria* (Fabricius, 1775)
559 *Scardamia metallaria* (Guenée, 1858)
560 *Semiothisa avitusaria* (Walker, 1860)
561 *Semiothisa effusata* (Guenée, 1858)
562 *Semiothisa eleonora* (Stoll, 1780)
563 *Semiothisa elvirata* (Guenée, 1858)
564 *Semiothisa emersaria* (Walker, 1861)

565 *Semiothisa fasciata* (Stoll, 1780)
566 *Semiothisa frugaliata* (Guenée, 1858)
567 *GSemiothisa nora* (Walker, 1861)
568 *Semiothisa ozararia* (Walker, 1860)
569 *Semiothisa pluviata* (Fabricius, 1795)
570 *Semiothisa vasudeva* (Walker, 1861)
571 *Sirinopteryx rufivinctata* (Walker, 1862)
572 *Synegia camptogrammaria* (Guenée, 1858)
573 *Synegia* sp.
574 *Sysstema semicirculata* (Moore, 1868)
575 *Tanaoctenia haliaria* (Walker, 1861)
576 *Thinopteryx crocoptera* (Kollar, 1844)
577 *Vindusara metachromata* (Walker, 1862)
578 *Xandrames albofasciata* (Moore, 1868)
579 *Xandrames dholaria* (Moore, 1868)
580 *Xerodes ypsaria* (Guenée, 1858)
581 *Zeheba lucidata* (Walker, 1863)

Subfamily Geometrinae

582 *Actenochroma muscicoloraria* (Walker, 1863)
583 *Agathia arcuata* Moore, 1868
584 *Agathia beata* Butler, 1880
585 *Agathia hilarata* Guenée, 1858
586 *Agathia laetata* (Fabricius, 1794)
587 *Agathia lycaenaria* (Kollar, 1844)
588 *Agathia visenda* Butler, 1880
589 *Anisozyga textilis* (Butler, 1880)
590 *Berta chrysolineata* Walker, 1863
591 *Chloeres quantula* (Swinhoe, 1885)
592 *Chlorissa distinctaria* (Walker, 1866)
593 *Chlorodontopera chalybeata* (Moore, 1872)
594 *Chlorodontopera discospilata* (Moore, 1868)
595 *Comibaena cassidara* (Guenee, 1858)
596 *Comostola laesaria* (Walker, 1861)
597 *Dindica polyphaenaria* (Guenée, 1858)
598 *Dooabia viridata* (Moore, 1868)
599 *Dysphania malayanus* recessa Walker, 1861
600 *Dysphania militaris* (Linnaeus, 1758)
601 *Epipristis minimaria* (Guenée, 1858)
602 *Gelasma acutissima* goniaria Felder, 1875
603 *Gelasma thetydaria* Guenée, 1857
604 *Hemithea costipunctata* (Moore, 1867)
605 *Idiochlora caudularia* (Guenée, 1858)
606 *Iotaphora iridicolor* (Butler, 1880)
607. *Jodis argutaria* (Walker, 1866)
608. *Maxates coelataria* (Walker, 1861)
609. *Microloxia herbaria* indecretata (Walker, 1863)
610. *Mixochloravittata* (Moore, 1867)
611. *Ornithospila avicularia* (Guenée, 1858)
612. *Osteosema pastor* (Butler, 1880)
613. *Osteosema sanguilineata* (Moore, 1867)
614. *Ourapteryx sciticaudaria* (Walker, 1863)
615. *Pamphlebia rubrolimbraria* (Guenée, 1858)
616. *Pelagodes* sp.
617. *Pingasa chlora* (Stoll, 1752)
618. *Pingasa ruginaria* (Guenée, 1858)
619. *Rhomborista devexata* (Walker, 1861)
620. *Tanaorhinus kina* (Swinhoe, 1893)
621. *Tanaorhinus rafflesii* (Moore, 1860)
622. *Terpna apicalis* (Moore, 1888)
623. *Terpna costistrigaria* (Moore, 1867)
624. *Terpna crocina* (Butler, 1880)
625. *Terpna leopardinata* (Moore, 1867)
626. *Terpna ornataria* (Moore, 1888)
627. *Terpna pictaria* (Moore, 1888)
628. *Terpna varicoloraria* (Moore, 1867)
629. *Thalassodes opalina* (Butler, 1880)
630. *Thalassodes quadraria* Guenée, 1857

Subfamily Larentiinae

631. *Acolutha pictaria* (Moore, 1888)
632. *Acolutha pulchella* (Hampson, 1895)
633. *Agnibesa recurvilineata* (Moore, 1888)
634. *Apithecia viridata* (Moore, 1868)
635. *Asthena albosignata* (Moore, 1888)
636. *Brabira artemidora* Oberthür, 1884
637. *Brabira atkinsonii* Moore, 1888
638. *Callabraxas amanda* Butler, 1880
639. *Carige cruciplaga* (Walker, 1861)
640. *Cataclysme conturbata* (Walker, 1863)
641. *Chloroclystis chlorophilata* (Walker, 1863)
642. *Cidaria* sp.
643. *Collix ghosha* (Walker, 1862)
644. *Collix hypospilata* (Guenée, 1858)
645. *Colostygia albigirata* (Kollar, 1844)
646. *Cosmorhoe argentilineata* (Moore, 1867)
647. *Cosmorhoe siderifera* (Moore, 1888)
648. *Docirava fulgurata* (Guenée, 1858)
649. *Docirava pudicata* (Guenée, 1858)
650. *Dysstroma subapicaria* (Moore, 1868)
651. *Ecliptopera delecta* (Butler, 1880)
652. *Ecliptopera muscicolor* (Moore, 1888)
653. *Ecliptopera oblongata* (Guenée, 1858)
654. *Ecliptopera triangulifera* (Moore, 1888)
655. *Eois plicata* (Moore, 1888)
656. *Euphyia cineraria* Butler, 1878
657. *Euphyia mediovittaria* (Moore, 1868)
658. *Euphyia ochreata* (Moore, 1888)
659. *Euphyia scortea* (Swinhoe, 1891)
660. *Eupithecia lineosa* (Moore, 1888)
661. *Eupithecia tricrossa* (Prout, 1926)
662. *Eupithecia ustata* (Moore, 1888)

663. *Eustroma aurantiaria* (Moore, 1867)
664. *Eustroma aurigena* (Butler, 1880)
665. *Eustroma lativittaria* (Moore, 1868)
666. *Gonanticlea anticleata* (Moore, 1888)
667. *Hastina gemmifera* Moore, 1867
668. *Heterophleps bicommata* (Warren, 1893)
669. *Horisme flavofasciata* (Moore, 1888)
670. *Hydrelia bicolorata* (Moore, 1868)
671. *Hydrelia subobliquaria* (Moore, 1868)
672. *Hypenorhynchus erectilineata* (Moore, 1888)
673. *Laciniodes plurilinearia* (Moore, 1868)
674. *Lobogonodes multistriata* (Butler, 1889)
675. *Loxofidonia obfuscata* (Warren, 1893)
676. *Melanthia catenaria* Moore, 1971
677. *Naxidia punctata* (Butler, 1880)
678. *Naxidia roseni* (Wehrli, 1931)
679. *Orthonama obstipatum* (Fabricius, 1794)
680. *Palaeomystis falcataria* (Moore, 1868)
681. *Pareustroma fissisignis* (Butler, 1880)
682. *Perizoma affinis* (Moore, 1888)
683. *Perizoma alchemillata* (Linnaeus, 1758)
684. *Perizoma decorata* (Moore, 1888)
685. *Perizoma maculata* (Moore, 1888)
686. *Perizoma plumbeata* (Moore, 1888)
687. *Perizoma schistacea* (Moore, 1888)
688. *Perizoma seriata* Moore, 1888
689. *Photoscotosia metachryseis* (Hampson, 1896)
690. *Photoscotosia miniosata* (Walker, 1862)
691. *Photoscotosia nubilata* (Moore, 1888)
692. *Sauris hirudinata* (Guenée, 1858)
693. *Sauris ignobilis* (Butler, 1880)
694. *Sauris lineosa* (Moore, 1888)
695. *Syzeuxis trinotaria* (Moore, 1868)
696. *Trichoplites cuprearia* (Moore, 1868)
697. *Trichoplites lateritiata* (Moore, 1888)
698. *Trichopterigia decorata* (Moore, 1888)
699. *Triphosa expansa* (Moore, 1888)
700. *Venusia obliquisigna* (Moore, 1888)
701. *Xanthorhoe curcumata* (Moore, 1939)
702. *Xanthorhoe sordidata* (Moore, 1888)

Subfamily Oenochrominae

703. *Sarcinodes aequilinearia* (Walker, 1860)
704. *Sarcinodes carnearia* (Guenée, 1858)
705. *Sarcinodes debitaria* (Walker, 1863)
706. *Sarcinodes restitutaria* (Walker, 1863)

Subfamily Sterrhinae

707. *Anisodes obrinaria* (Guenée, 1858)
708. *Antitrygodes divisaria* (Walker, 1861)
709. *Craspediopsis pallivittata* (Moore, 1868)
710. *Cyclophora punctaria* (Linnaeus, 1758)
711. *Idaea actiosaria* (Walker, 1861)
712. *Idaea acuminata* (Moore, 1888)
713. *Idaea macrospila* (Prout, 1926)
714. *Perixera absconditaria* (Walker, 1863)
715. *Problepsis deliaria* (Guenée, 1858)
716. *Problepsis delphiaria* (Guenée, 1858)
717. *Problepsis vulgaris* (Butler, 1889)
718. *Rhodometra sacraria* (Linnaeus, 1767)
719. *Rhodostrophia vinacearia* (Moore, 1868)
720. *Scopula actuaria* (Walker, 1861)
721. *Scopula albomaculata* (Moore, 1888)
722. *Scopula aspilataria* (Walker, 1861)
723. *Scopula cuneilinea* (Walker, 1863)
724. *Scopula emissaria* (Walker, 1861)
725. *Scopula ferrilineata* (Moore, 1888)
726. *Scopula fibulata* (Guenée, 1858)
727. *Scopula fluidaria* (Swinhoe, 1886)
728. *Scopula mecysma* (Swinhoe, 1894)
729. *Scopula minorata* (Boisduval, 1833)
730. *Scopula moorei* (Cotes & Swinhoe, 1888)
731. *Scopula opicata* (Fabricius, 1798)
732. *Scopula pulchellata* (Fabricius, 1794)
733. *Scopula pulverosa* (Prout, 1934)
734. *Scopula remotata* (Guenée, 1858)
735. *Scopula* sp.
736. *Scopula walkeri* (Butler, 1883)
737. *Somatina anthophilata* (Guenée, 1858)
738. *Synegiodes hyriaria* (Walker, 1866)
739. *Synegiodes sanguinaria* (Moore, 1868)
740. *Timandra aventiaria* Guenee, 1858
741. *Timandra convectaria* (Walker, 1861)
742. *Timandra correspondens* (Hampson, 1895)
743. *Timandra mundissima* (Walker, 1861)
744. *Traminda* sp.

Family GRACILLARIIDAE

Subfamily Gracillariinae

745. *Acrocercops diacentrota* Meyrick, 1935
746. *Synnympha perfrenis* Meyrick, 1920

Family HELIODINIDAE

747. *Stathmopoda chrysoxesta* Meyrick, 1923

Family LASIOCAMPIDAE

748. *Bharetta cinnamomea* Moore, 1865
749. *Crinocraspeda torrida* (Moore, 1879)
750. *Kosala flavosignata* (Moore, 1879)
751. *Odonestis bheroba* Moore, 1858/59
752. *Paradoxopla sinuata* (Moore, 1879)
753. *Paralebeda plagifera* (Walker, 1855)
754. *Suana concolor* (Walker, 1855)

755. *Syrastrena minor* (Moore, 1879)

Subfamily Lasiocampinae

756. *Arguda decurtata* Moore, 1879
757. *Arguda vinata* (Moore, 1865)
758. *Eteinopla signata* (Moore, 1879)
759. *Euthrix decisa* (Walker, 1855)
760. *Gastropacha lidderdali* Druce
761. *Gastropacha sikkima* Moore, 1879
762. *Kunugia divaricata* (Moore, 1884)
763. *Kunugia fulgens* (Moore, 1879)
764. *Kunugia latipennis* (Walker, 1855)
765. *Kunugia leucopicta* (Tams, 1928)
766. *Kunugia lineata* (Moore, 1879)
767. *Kunugia omeiensis* (Tsai & Liu, 1964)
768. *Lebeda nobilis* Walker, 1855
769. *Metanastria hyrtaca* (Cramer, 1782)
770. *Streblote dorsalis* (Walker, 1866)
771. *Streblote siva* (Lefèbvre, 1827)
772. *Trabala vishnou* (Lefèbvre, 1827)

Family LECITHOCERIDAE

773. *Frisilia crossophaea* (Meyrick, 1931)

Family LIMACODIDAE

774. *Altha nivea* Walker, 1862
775. *Macroplectra unicolor* (Moore,1858-1859)
776. *Phocoderma velutina* (Kollar, 1844)

Subfamily Limacodinae

777. *Parasa isabella* Moore, 1859
778. *Thosea cana* (Walker, 1865)
779. *Thosea tripartita* (Moore, 1884)

Family NOCTUIDAE

Subfamily Acontiinae

780. *Acontia notabilis* (Walker, 1857)
781. *Eublemma pudica* (Snellen, 1880)
782. *Hyposada ruptifascia* (Moore, 1888)
783. *Maliattha renalis* Moore, 1882
784. *Ozarba incondita* Butler, 1889

Subfamily Acronictinae

785. *Athetis cognata* Moore, 1882
786. *Aucha velans* Walker, 1857
787. *Chariclea marginalis* Walker, 1857

Subfamily Aganainae

788. *Asota caricae* Fabricius, 1775

Subfamily Agaristinae

789. *Aegocera bimacula* Walker, 1854
790. *Aegocera venulia* (Cramer, 1777)
791. *Episteme adulatrix* (Kollar, 1844)
792. *Mimeusemia basalis* (Walker, 1854)

Subfamily Bryophilinae

793. *Cryphia albistigma* (Moore, 1867)

Subfamily Calpinae

794. *Hypocala subsatura* (Guenée, 1852)

Subfamily Hadeninae

795. *Appana indica* (Moore, 1867)
796. *Borolia percussa* (Butler, 1880)
797. *Diphthera pulchripicta* Walker, 1865
798. *Leucania moorei* (Swinhoe, 1902)
799. *Mudaria cornifrons* Moore, 1893
800. *Paradrina clavipalpis* (Scopoli, 1763)
801. *Pseudaletia unipuncta* (Haworth, 1809)
802. *Xenotrachea auroviridis* (Moore, 1867)

Subfamily Hypeninae

803. *Dichromia trigonalis* Guenée, 1854
804. *Rivula ochracea* (Moore, 1882)

Subfamily Noctuinae

805. *Agrotis cuprea* Moore, 1867
806. *Euplexia albirena* Wileman, 1914
807. *Feliniopsis leucostigma* (Moore, 1867)
808. *Neurois atrovirens* Walker, 1865
809. *Spodoptera litura* (Fabricius, 1775)
810. *Spodoptera picta* (Guérin-Meneville, 1830)
811. *Spodoptera pectinicornis* (Hampson, 1895)

Subfamily Plusiinae

812. *Chrysodeixis eriosoma* (Doubleday, 1843)
813. *Trichoplusia lectula* (Walker, 1858)

Family NOLIDAE

Subfamily Chloephorinae

814. *Churia nigrisigna* Moore, 1881
815. *Earias vittella* (Fabricius, 1794)
816. *Gyrtothripa pusilla* (Moore, 1888)

Subfamily Eariadinae

817. *Earias cupreoviridis* (Walker, 1862)
818. *Earias vittella* (Fabricius, 1794)

Subfamily Westermanniinae

819. *Westermannia superba* Hübner, 1823

Family NOTODONTIDAE

820. *Teleclita strigata* Moore, 1879
821. *Turnaca acuta* Walker, 1865

Subfamily Dicranurinae

822. *Syntypistis perdix* perdix (Moore, 1879)

Subfamily Dudusinae

823. *Netria multispinae* Schintlmeister, 2006

Subfamily Notodontinae

824. *Cerura prasana* Moore, 1865

Subfamily Phalerinae

825. *Phalera raya* Moore, 1849

Subfamily Pygaerinae

826. *Clostera ferruginea* (Moore, 1865)
827. *Clostera restitura* (Walker, 1865)

Family OECOPHORIDAE

Subfamily Depressariinae

828. *Cryptolechia centroleuca* Meyrick, 1922

Subfamily Hypertrophinae

829. *Thudaca obliquella* Walker, 1864

Subfamily Oecophorinae

830. *Arctoscelis epinyctia* Meyrick, 1894
831. *Casmara epicompsa* Meyrick, 1922
832. *Promalactis calathiscias* Meyrick, 1937

Subfamily Stathmopodinae

833. *Oedematopoda clerodendronella* (Stainton,1859)

Family PLUTELLIDAE

834. *Ypsolophus astragalitis* (Meyrick, 1913)

Family PSYCHIDAE

835. *Kophene cuprea* Moore, 1879
836. *Kophene minor* Moore, 1879
837. *Metisa moorei* (Heylaerts, 1890)

Subfamily Oiketicinae

838. *Mahasena graminivora* Hampson, 1895
839. *Platyptilia exaltatus* (Zeller, 1867)

Family PYRALIDAE

Subfamily Epipaschiinae

840. *Canipsa pyraliata* (Moore, 1888)
841. *Coenodomus hockingi* (Walsingham, 1888)
842. *Lamida moncusalis* Walker, 1859
843. *Lista haraldusalis* (Walker, 1859)
844. *Orthaga euadrusalis* (Walker, 1859)

Subfamily Galleriinae

845. *Achroia grisella* (Fabricius, 1794)
846. *Aphomia cephalonica* (Stainton, 1866)
847. *Galleria mellonella* (Linnaeus, 1758)
848. *Lamoria planalis* Walker, 1863
849. *Stenachroia elongella* Hampson, 1898
850. *Trachylepidia fructicassiella* Ragonot, 1887

Subfamily Phycitinae

851. *Ancylosis mysorella* (Ragonot, 1888)
852. *Ancylosis resticula* (Hampson, 1896)
853. *Anonaepestis bengalella* Ragonot, 1894
854. *Cadra cautella* (Walker, 1863)
855. *Cathyalia fulvella* Ragonot, 1888
856. *Emmalocera paucigraphella* (Ragonot, 1888)
857. *Endotricha loricata* Moore, 1888
858. *Epicrocis oegnusalis* (Walker, 1859)
859. *Etiella behrii* (Zeller, 1848)
860. *Etiella zinckenella* (Treitschke, 1832)
861. *Euzophera perticella* (Ragonot, 1888)
862. *Faveria leucophaeella* (Zeller, 1867)
863. *Homoeosoma goliathella* Ragonot, 1888
864. *Hypsipyla robusta* (Moore, 1886)
865. *Hypsotropa grassa* Strand, 1918
866. *Hypsotropa sceletella* (Zeller, 1867)
867. *Metallosticha plumbeifasciella* (Hampson, 1896)
868. *Nephopterix eugraphella* Ragonot, 1888
869. *Phycita clientella* (Zeller, 1867)
870. *Phycita hemixanthella* Hampson, 1896
871. *Saluria opificella* (Zeller, 1867)
872. *Saluria paucigraphella* (Ragonot, 1888)
873. *Thylacoptila paurosema* (Meyrick, 1885)

Subfamily Pyralinae

874. *Endotricha loricata* Moore, 1888
875. *Hypsopygia ignifluālis* (Walker, 1859)
876. *Hypsopygia mauritialis* (Boisduval, 1833)
877. *Hypsopygia nigrivitta* (Walker, 1863)
878. *Hypsopygia suffusalis* (Walker, 1866)
879. *Pyralis elongalis* (Kollar & Redtenbacher, 1844)
880. *Pyralis funebralis* Warren, 1895
881. *Pyralis manihotalis* Guenée, 1854
882. *Pyralis phycidalis* Guenée, 1854
883. *Pyralis pictalis* (J. Curtis, 1834)
884. *Sacada discincta* (Moore, 1866)
885. *Zitha torridalis* (Lederer, 1863)

Family SATURNIIDAE

Subfamily Salassinae

886. *Salassa lola* (Westwood, 1847)
887. *Salassa royi* (Elwes, 1887)

Subfamily Saturniinae

888. *Actias selene* Hübner, 1806
889. *Antheraea frithi* Moore, 1858
890. *Antheraea helferi* Moore, 1858
891. *Antheraea paphia* (Linnaeus, 1758)
892. *Antheraea pernyi roylei* Moore, 1858
893. *Archaeoattacus edwardsii* White, 1859
894. *Argema maenas* (Doubleday, 1847)
895. *Attacus atlas* (Linnaeus, 1758)
896. *Caligula anna* (Moore, 1865)
897. *Caligula lindia* Moore, 1865
898. *Caligula thibeta* (Westwood, 1853)
899. *Cricula drepanoides* Moore, 1865
900. *Cricula trifenestrata* Helfer, 1837
901. *Loepa katinka* (Westwood, 1848)
902. *Neoris huttoni* Moore, 1862
903. *Neoris zuleika* (Hope, 1843)
904. *Rhodinia newara* (Moore, 1872)
905. *Samia cynthia* (Drury, 1773)

Family SESIIDAE

906. *Paranthrene croconeura* Meyrick, 1926
907. *Trichocerota erythranches* Meyrick, 1926

(To be continued)

Population Structure of some Molluscs and Their Dependency on Abiotic Factors, in a Desert Pond of Rajasthan

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Introduction

Phylum Mollusca comprise diverse group of bivalves, shells etc. having different shape, size, habit and habitat (Subba Rao, 1993). Around 8,765 species of fresh water molluscs are available all over the world, of which 284 species are reported from India and adjacent countries. Among them, 171 species of class Gastropoda are found in India (Punithavela & Raghunathan, 2006).

Fresh water gastropod species have economical and biological importance. Economy of desert state is partially based on dairy farming. Snails act as intermediate hosts for Platyhelminthes parasites, that cause infection to dairy animals and lead to morbidity and mortality in livestock.

Earlier malacological studies in Bikaner region were carried out by Khanam & Singh (2012) who studied the ecology, population density of prosobranch snails.

The aim of the present study was to know the impact of abiotic factors on gastropod population in a desert pond in district Bikaner of Rajasthan.

Material & Methods

Bikaner, a semiarid region of Rajasthan is at geographical location 28° N and 75° 17'E, MSL 228 m. Study was carried out from September 2010 to November 2011, in the Nal pond located at E 73° 12' and N 28° 4' and MSL 229m, covering an area of 2300 m^2. This pond is situated in low land, and receives rain water from surrounding areas. For physico-chemical analysis of water samples, APHA-AWWA-WPCF (1981) and Saxena (2001) methodology were followed. For qualitative analysis, a stereo microscope, and for identification the standard keys (Subba Rao, 1989) were followed.

Results and Discussion

During the study period three gastropod species belonging to two sub-classes viz., Pulmonata and Prosobranchia were recorded. Of which *Gabbia orcula* was observed to be highest contributing, followed by *Digoniostoma pulchella* (Table 1). The high population of these species can be attributed to their ability to adapt to the variations at water conditions.

The seasonal and monthly variation with respect to abiotic factors of pond and gastropod population show both negative and positive correlation (Table 2). Results indicate that, *Digonostoma pulchella* show negative correlation with water temperature, Dissolved Oxygen, Free CO_2, and organic matter. Similar observation was recorded by Gaikwad & Kamble (2014), reporting high temperature and CO_2 became unsuitable for molluscan fauna. Whereas, pH shows positive significant ($p<0.05$) correlation. Variations in pH directly affects the population density of species.

Electrical conductivity and total dissolved solids of pond soil directly influence ($p<0.05$)the density of *Gabbia orcula*. This species also showed significant high but negative correlation with water temperature ($p<0.01$). According to Bath et al. (1999) increase in water temperature, up to certain range, favor the molluscan abundance, and it the water temperature further rise, it inversely affects the population density. This study also revealed negative relation between abundance of species and turbidity, Free CO_2 and total alkalinity. Increase in turbidity lowered down the amount of DO, which may cause depletion in the population density. Sharma (2013) reported direct significant effect of water temperature on population density of this species.

Indoplanorbis exustus showed negative correlation with pH ($p<0.05$). Rathore (2003) reported positive significant correlation between *Indoplanorbis exustus* density and various abiotic factors (DO, water temperature, EC, TDS and hardness), but did not observe any significant correlation with the pH of water. Garg et al. (2009) reported negative correlation between pH and molluscan population. High pH indicates high concentration of electrolyte, which lowered down the molluscan abundance.

Total gastropods population show negative correlation

Table 1. Percentage share of gastropods species in the Nal Bari Pond.

Sub-Class	Species	Population Share (%)
Prosobranchia	*Digoniostoma pulchella*	37.58
	Gabbia orcula	43.61
Pulmonata	*Indoplanorbis exustus*	18.79

with Temperature, Dissolved Oxygen, Free CO_2, water and pH of soil. Hardness and pH must be most important abiotic factors, which directly and indirectly influence metabolic activity (Eleutheradis & Lazaridou-Dimitriadou, 1995). Present investigation indicate that positive ($p<0.001$) correlation with Electrical Conductivity (EC) and Total Dissolved Solid (TDS) of sediments and significant correlation ($p<0.05$) with EC and TDS of water. EC and TDS indicate large quantity of dissolved mineral salt (Trivedy & Goel, 1986). A strong relationship exists between the solute composition of water and occurrence of gastropods.

References

APHA-AWWA-WPCF, 1981. *Standard methods for the examination of water and waste water.* 15th ed. APHA, Washington DC.

Bath, K.S., Kaur, H. & Dhillon, S.S. 1999. Correlation of Molluscs with Physico-chemical factors at Harike Reservoir (Punjab). *Indian J. Environ. Sci.*, 3: 159-163.

Eleutheradis, N. & Lazaridou-Dimitriadou, M. 1995. Density and growth of freshwater snails *Bithynia graeca* and *Viviparus contectus* in relation to water chemistry in Serres, Northern Greece. *J. Mollusc. Studies*, 61: 347-352.

Gaikwad, Sanindhar Shreedhar & Kamble, Nitin Anandrao 2014. Population dynamics of malacofaunal assemblage. *Biolife*, 2(3) : 825-833.

Garg, R.K., Rao, R.J. & Saksena, D.N. 2009. Correlation of molluscan diversity with Physico-chemical characteristics of water of Ramsagar reservoir, India. *Int. J. Biodivers. & Conserv.*, 1(6) : 202-207.

Khanam, Yasmin & Singh, Yogender 2012. A study on biometry of some prosobranch snail in desert water at Bikaner, Rajasthan. *Bionotes*, 14(4):131.

Punithavela, V.R. & Raghunathan, M.B. 2006. Taxonomy and diversity of fresh water gastropods (Mollusca) from southern India. *Proc. Nat. Conf. on Wetland Biodiversity* : 26-27.

Rathore, N.S. 2003. *Bio-ecological studies on the banded pond snail Bellamya bengalensis Lamarck (Gastropoda: Viviparidae) in some desert waters.* Ph.D. Thesis, M.D.S. University, Ajmer: 100 pp.

Saxena, M.M. 2001. *Handbook of Water and Soil Analysis.* Nidhi Publ., Bikaner : 169 pp.

Sharma, Ankush 2013. *A study on macrobenthic fauna of some village pond ecosystem in Rajasthan desert, with special reference to Gastropods.* Ph. D. Thesis. M.G.S. University, Bikaner : 232 pp.

Subba Rao, N.V. 1989. *Handbook of Freshwater Molluscs of India.* Zoological Survey of India, Calcutta: 289 pp.

Subba Rao, N.V. 1993. Freshwater Molluscs of India. In: (Rao, K.S. Ed.). *Recent Advances in Freshwater Biology.* Anmol Publ., New Delhi. Vol. 2 : 187-202.

Trivedy, R.K. & Goyal, P.K. 1986. Chemical and biological methods for water pollution studies. *Enviro-Media, Karad*: 3 (34): 36-96.

Table 2. Correlation (r) of gastropods with abiotic factors of water and sediment.

Parameter	GASTROPOD			Total Population
	Digoniostoma pulchella	*Gabbia orcula*	*Indoplanorbis exustus*	
Water Temperature	-0.332	-0.659**	0.261	-0.426
Turbidity	0.170	-0.005	0.504	0.243
pH (Water)	0.598*	0.178	-0.602*	0.193
EC (Water)	0.361	0.534	0.534	0.609*
TDS (Water)	0.361	0.534	0.534	0.609*
Dissolved oxygen	-0.137	0.162	-0.218	-0.052
Free CO_2	-0.100	-0.119	0.189	-0.051
Hardness	0.173	0.504	0.568	0.533
Total Alkalinity	0.098	-0.240	0.334	-0.063
pH (soil)	0.098	-0.483	-0.529	-0.376
EC (soil)	0.546	0.601*	0.474	0.738***
TDS (soil)	0.546	0.601*	0.474	0.738***
Organic Matter	-0.365	0.203	-0.187	-0.132

***$P<0.001$; **$P<0.01$; *$P<0.05$

Extension of the known distribution of Moore's Five Ring Butterfly *Ypthima nikaea* to Pakistan, Nepal and Meghalaya, India (Lepidoptera: Nymphalidae: Satyrinae)

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Abstract

Casual surveys were carried out to determine the richness of butterflies in Godavari and Pokhara in Nepal and Meghalaya, India. Moore's Five Ring (*Ypthima nikaea* (Moore, [1875])) was recorded from all the sites in Nepal in the month of May and August, 2017 and from Meghalaya in October, 2016. The presence of *Y. nikaea* in Pakistan is discussed and its known distribution extended to Nepal and Meghalaya.

Introduction

Moore's Five Ring *Ypthima nikaea* (Moore, [1875]) was described from specimens from the North West Himalaya. Elwes & Edwards (1893) synonymised this taxon with *Y. sakra* Moore (1857), treating it as the west Himalayan subspecies. The nominotypical race of *Y. sakra* was reported by them from the North-West Himalaya to North-East India and Myanmar. Evans (1932) reported *Y. sakra nikaea* from Murree (Pakistan) to Kumaon (India); *Y. sakra sakra* from Sikkim (India) and *Y. sakra austeni* Moore (1893) from Assam (India) to the Karen Hills (Myanmar). Shima (1988) recognised that the two taxa *Y. nikaea* and *Y. sakra* were distinct and restored *Y. nikaea* to species rank.

Elwes & Edwards (1893) noted that *Y. sakra* occurred in present day Himachal Pradesh in India making the two taxa sympatric in the west Himalaya. Varshney & Smetacek (2015) reported *Y. nikaea* from Jammu and Kashmir to Uttarakhand and *Y. sakra* from Jammu and Kashmir to North east India.

Observations

In Nepal, during a casual butterfly survey in Godavari on 17 May, 2017 and from 7 to 29 August, 2017 in Pokhara, many specimens of *Y. nikaea* were observed. Some were photographed. *Y. nikaea* was recorded between 800m and 1600m.

In Godavari, this species was observed in company with *Y. sakra*, while in Pokhara it was observed in the company of *Y. baldus*. In Godavari, it was observed in mixed broadleaf forest. In Pokhara, it was common along roadsides, on grassy hillsides and in *Schima-Castanopsis* forest.

On 10 October, 2016, several specimens of *Y. nikaea* were recorded from Sohra, Meghalaya in a grassy compound of a resort by PS.

The species is fond of mud-puddling and attracted to low growing flowers such as thistles (*Cirsium* sp.). Rarely, individuals visit flowers of horse chestnut (*Aesculus indica*) in the western Himalaya.

Discussion

The confusion caused by synonymising the taxa *sakra* and *nikaea* by Elwes & Edwards (1893) resulted in the latter taxon being overlooked outside the western Himalaya by earlier workers. Tshikolovets & Pages (2016) ignored Shima (1988) and treated *Y. nikaea* under *Y. sakra sakra*, although true *Y. sakra* has so far not been reported from Pakistan. While Butler (1886, 1888) reported *Y. sakra* from Murree on the basis of specimens collected there by Major Yerbury, it appears that these were in fact *Y. nikaea*, since Butler (1886, 1888) does not mention *Y. nikaea* at all, while Elwes & Edwards (1893) note, "specimens from Murree (*nikaea*) are usually smaller and paler coloured than specimens from the east, but true *sakra* also occurs in the N. W. Himalaya." All four specimens of "*Y. sakra sakra*" illustrated by Tshikolovets & Pages (2016) are clearly *Y. nikaea* on the basis of the hindwing subapical ocelli on the *verso* surface being separated by a yellow ring, which is absent in *Y. sakra sakra*. While there are no reports of *Y. nikaea* from Arunachal Pradesh, its presence in Meghalaya and Nepal suggest that populations may exist in the intervening areas such as Sikkim and Bhutan.

In terms of altitude, *Y. nikaea* is more widely distributed than *Y. sakra*. It is at least bivoltine over its range with a large summer brood and smaller autumn brood in the western Himalaya. No seasonal variation has been observed between the broods.

Conclusion

The distribution of *Y. nikaea* is hereby extended from northern Pakistan through Nepal to Meghalaya. It was probably overlooked in the eastern part of its range by earlier workers due to the confusion arising out of its synonymy with *Y. sakra* before 1988. *Y. sakra sakra* is also formally removed from the list of butterflies of Pakistan, since there is no evidence that it occurs in that country.

References

Butler, A.G. 1886. On Lepidoptera Collected by Major Yerbury in Western India. *Proc. zool. Soc. Lond.*, (3): 355-396, pl. xxxv.

Butler, A.G. 1888. An Account of Three Series of Lepidoptera Collected in North-west India by Major Yerbury. *Ann. & Mag. nat. Hist.*, London, 1888 : 132-209.

Elwes, H. J. & Edwards, J. 1893. A revision of the genus *Ypthima*, with especial reference to the characters afforded by the male genitalia. *Trans. Ent. Soc. Lond.*, 1893 (1): 1-54, pl. 1-3.

Evans, W.H. 1932. *The Identification of Indian Butterflies*. 2nd ed. Bombay Natural History Society, Bombay: x+454 pp., 32 pl.

Moore, F. [1875]. Descriptions of new Asiatic Lepidoptera. *Proc. zool. Soc. Lond.*, 1874 (4): 565-579, pl. 66-67.

Shima, H. 1988. Phylogenetic relationships of the genus *Ypthima* Hübner (Lepidoptera, Satyridae) [in Japanese] *Spec. Bull. Lepid. Soc. Japan*, (6): 69-81.

Tshikolovets, V. & Pages, J., 2016. *The Butterflies of Pakistan.* Tshikolovets Publ., Pardubice : 318 pp, 67 pl.

Varshney, R.K. & Smetacek, P. (Ed.) 2015. *A Synoptic Catalogue of the Butterflies of India*. Butterfly Research Centre, Bhimtal & Indinov Publ., New Delhi : 261 pp., 8 pl.

7 Leaves to a Sprig

The saptaparni tree (*Alstonia scholaris*) outside my window has not yet bloomed. Normally, it blooms from October to December, sending gusts of sweet, spicy scent my way. Why is this tree late this year, I wonder, and look reproachfully at Delhi's polluted skies.

Saptaparni is sanskrit for 'seven-leaved' ; this tree's leaves grow seven or eight to a sprig. Saptaparni is also a name for girls. Said to be introduced to Delhi as recently as 1940, this tree has an ancient past elsewhere in the land, especially in the annals of Ayurveda.

Its bark-extract is said to boost immunity and help treat deep tummy disorders, malaria and epilepsy.

Out south, the saptparni is duly called 'Seven-leaved' in Kannada, Tulu, Malayalam and Tamil—the words are Paala, Paalai, and Ezh-ilai.

I have read a theory that Palakkad, celebrated as the 'Granary of Kerala' and the 'Gateway to Kerala' from the Western Ghats and famous for the Silent Valley National Park and scenic Malampuzha, may have got its name from being covered, once upon a time, by a kaad (forest) of Paala trees.

On the eastern seaboard, the saptaparni is the state tree of West Bengal. It is called Chhatim in Bengali. Graduating students of Vishwa Bharti University are ceremonially handed a sprig of saptaparni at convocation. I am told there is a story behind this graceful cultural tradition.

Vishwa Bharti University was originally founded as an alternative Indian school in 1921, by Rabindranath Tagore, at Shantiniketan in Birbhum district, West Bengal. But before that in the 19th century, Shantiniketan was apparently the name gievn to the only pukka building in a quite, scenic village called Bhubandanga, after Bhuban Mohan Sinha, the zamindar of Raipur.

One day in 1862, Debendranath Tagore, the poet's father, happen to pass by while on a journey to Raipur. Charmed by the beauty of the village and given to serious spiritual practice, he halted there for some days and spent time meditating in a grove of saptaparni trees.

He felt so light and happy there that he bought himself 20 bighas of land and built a spiritual retreat that he named Shantiniketan, where his son eventually set up his school. And that is why the sprig of saptaparni is still handed to each graduating student at Vishwa Bharti.

Another tree that is famously been called 'seven-leaved' is the banana plant. In the Aranya Kand, sarga 75, of the Ramayana, while in search of Sita, Ram and Lakshman halt at the lovely Pampa Lake.

The trees, plants, flowering bushes and creepers around it listed by Valmiki may still be found across India, and some of their names may be found even today as people's names : Tilaka, Bakula, Mallika, Ashoka, Malati, Kunda, Madhavi, Lata. In this list is the other 'Saptaparna'.

—Renuka Narayanan

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Bioeffectiveness of some Entomopathogenic Fungi (EPF) alongwith Spiromesifen against the Mite, *Oligonychus oryzae*, on Paddy

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Introduction

The mite, *Oligonychus oryzae* Hirst often becomes an important pest of paddy crop grown in the kharif season in many parts of India including West Bengal, Odisha and Southern India. The infestation when occurs becomes available on under surface in leaves and the colonies remain covered with thin webs where all stages may be seen. The feeding produces whitish stiplings which later turn into whitish patches. The infested clumps become droopy but no major crop loss has been noticed. Since occurrence of this mite on paddy (var. Masuri) was seen in Hooghly district of West Bengal during September, 2017 and as the efficacy of EPF on this mite has not been assessed earlier, it was thought desirable to conduct a field trial with 5 EPF taking one concentration each alongwith an organic pesticide namely Spiromesifen. The results thereof have been presented in this paper.

Material and Methods

The laboratory experiment was conducted for control of *Oligonychus oryzae* on paddy under field condition for evaluating efficacy of some EPF, i.e., *Beauveria bassiana, Metarhizium anisopilae, Paecilomyces fumosoroseus, Hirsutella thompsonii* and *Lecanicillium lecanii* at 10^8 spores/ml, alongwith a synthetic acaricide Spiromesifen (0.6 ml/l). Potted plants were maintained of common rice variety Masuri, each treatment having 3 replications. The rice variety Masuri was selected for this experiment and those were maintained in the field (1mt x 1mt area). Three clumps represented each replication. Since there were 7 treatments (including control), altogether 7 x 3 = 21 clumps were selected for this experiment. The EPF conc. which was used was 10^8 spores/ml of water. The EPF was applied with a hand sprayer. Population on each of the clumps before spraying and 3, 7, 10, 14 days after spraying was recorded. The % mortality over control was calculated by using the formula as % Mortality = (No. of dead mites/ total no. of mites) x 100. (McDonald et al.) In case of control only water was sprayed. The results obtained were statistically analyzed following SPSS software.

Results

The % mortality obtained in various treatments is presented in Table 1. The initial population of mites/ 6.25 sq. cm. area was found variable and in different treatments it was found to be 21.38 (*B. bassiana*), 25.03 (*M. anisopilae*), 20.73 (*P. fumosoroseus*), 24.66 (*H. thompsonii*), 30.40 (*L. lecanii*), and 14.18 (Spiromesifen).

3 days after spraying : At this interval, the minimum mite population was 19.29 in case of *B. bassiana* followed by 19.95 in *P. fumosoroseus*, 23.39 in *H. thompsonii*, 23.99 in *M. anisopilae*, 30.85 in *L. lecanii* and 41.94 in case of control. However, minimum mite population was seen in case of Spiromesifen which was 5.18/ 6.25 sq. cm. area.

7 days after spraying : At this interval, performance of both *B. bassiana* and *P. fumosoroseus*, maintained superiority over other treatment being both at par. This was followed by *H. thompsonii, M. anisopilae*, and *L. lecanii* registering mortality of 21.46%, 22.54% and 26.94% respectively. The mortality in case of control treatment was 43.22%. Spiromesifen registered the population of 6.23% which was far superior to all the treatment.

10 days after spraying : At this interval, *B. bassiana* registered the lowest mite population which was 18.71% which was close to 20.03% in case of *M. anisopilae*, 21.86% in case of *P. fumosoroseus*, 22.15% in *H. thompsonii*, and 23.87% in case of *L. lecanii*. In case of control, it was 41.15 mites and as usual Spiromesifen recorded the lowest mite population.

14 days after spraying : At this interval, *B. bassiana* recorded lowest mite population of 19.52 mites followed by 19.86 in case of *M. anisopilae*, 21.37 in *P. fumosoroseus*, 21.45 in *H. thompsonii*, and 25.17 in *L. lecanii*. Spiromesifen recorded population of 8.41 mites/ 6.25 sq. cm. area, as best while *B. bassiana* was the best among EPF.

% reduction over control : Among the EPF the highest % reduction was 53.97 in case of *B. bassiana* followed by 50.66 in *P. fumosoroseus*, 47.03 in *M. anisopilae*, 34.53 in case of *L. lecanii*. So, among the EPF, *B. bassiana* was found to be the best. However, the % reduction was highest (82.82) in case of Spiromesifen which was far superior to all the EPF treatments.

Pooled mean: As regards, the pooled mean of mite population the data can be arranged from increasing order as *B. bassiana (20.08)* < *P. fumosoroseus (20.43)* < *M. anisopilae (23.32)* < *H. thompsonii (23.39)* < *L. lecanii (28.56)* < control (42.89). In case of Spiromesifen, only 10.60 mite population was found/ 6.25 sq. cm. area.

Table 1. Bioeffectiveness of some EPF and Spiromesifen for *Oligonychus oryzae* on paddy under field condition.

Treatments	Mites/ 6.25 sq. cm. area	Days after spraying				Mean no mites/ 6.25 sq. cm. area	% reduction over control	Pooled mean	Cumulative % reduction over control
10^8 spores/ml		3 days	7 days	10 days	14 days				
Beauveria bassiana	21.38	19.29	17.35	18.71	19.52	18.78	53.97	20.08	53.18
Metarhizium anisopilae	25.03	23.99	22.54	20.03	19.86	21.61	47.03	23.32	45.63
Paecilomyces fumosoroseus	20.73	19.95	17.34	21.86	21.37	20.13	50.66	20.43	52.37
Hirsutella thompsonii	24.66	23.39	21.46	22.15	21.45	22.11	45.81	23.39	45.47
Lecanicillium lecanii	30.40	30.85	26.94	23.87	25.17	26.71	34.53	28.56	33.41
Spiromesifen (0.6 ml/l)	14.18	5.18	6.32	8.14	8.41	7.01	82.82	10.60	75.29
Control	44.98	41.94	43.22	41.15	36.89	40.8		42.89	
CD (0.05)		2.75	0.29	0.48	0.60	1.03			

Cumulative % reduction over control : Among the EPF, this data can be arranged in following descending order - *B. bassiana (53.18) > P. fumosoroseus (52.37) > M. anisopilae (45.63) > H. thompsonii (45.47) > L. lecanii (33.41).*

However, Spiromesifen registered the highest cumulative % reduction which was 75.29%.

Discussion

Poinar & Poinar, (1998) reported *H. thompsonii* being considerably good against many mite species. Kumar & Singh, (2007) while studying bioefficacy of *P. fumosoroseus* against *T. urticeae* reported that the fungi in WP formulation alongwith *Azadirachta* showed maximum mortality of 55.83% of adults at 0.187 + 5 ml. conc. followed by *P. fumosoroseus* WP with Neem oil (48.33%), *P. fumosoroseus* WP alone (47.50%) and *P. fumosoroseus* WP with NSKE (46.66%) at 0.187 + 2 ml., 0.375 and 0.187 + 5 ml. respectively. Rangrez & Rather (2007) also worked with *B. bassiana, L. lecanii, M. anisopilae* against *Tetranychus urticae* and reported mortality of 42.22%, 33.33% and 23.33% respectively after 144 hours at a spore conc. of 1.0 x 10^8 spores/ ml respectively. *P. fumosoroseus* was the least effective. *H. thompsonii* at 2.5 x 10^7 spores/ml gave a mortality of 23.33% after 144 hours.

Conclusion

All the EPF treatments and Spiromesifen proved to be good acaricide registering mortality ranging from 79.29% in case of Spiromesifen and among the EPF, it ranged between 53.18 in *B. bassiana* to 33.41 in case of *L. lecanii*. Therefore, it was found that Spiromesifen was best among all the treatments, though EPF like *B. bassiana* and *P. fumosoroseus* were also quite effective as they registered mortality of over 50% in all the cases.

In case the mite population in the field is at low level, any of the two EPF like *B. bassiana* and *P. fumosoroseus* can be applied in pest management programme, in lieu of synthetic chemical pesticide like Spiromesifen.

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References

Kumar, K. & Singh, R.N., 2007. Efficacy of entomopathogenic fungus *P. fumosoroseus* and Neem products against the spider mite, *T. urticae* Koch (Acari: Tetranychidae). *J. Acarol.*, 17 (1 & 2): 35-37.

Poinar, G.J.R. & Poinar, R., 1998. Parasites and Pathogens of mites. *Ann. Rev. Ent.*, 43: 449-469.

Rangrez, M.A. & Rather, A.Q., 2007. *In vitro* bioefficacy of various fungi against two spotted spider mite, *T. urticae* Koch on apple. *J. Acarol.*, 17 (1 & 2): 32-34.

List of Microlepidoptera (Moths) of Superfamilies Tineoidea, Gracillarioidea, Ypnometoidea, Gelechioidea, Tortricoidea and Pterophoroidea from Himachal Pradesh

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Animalia kingdom is represented by a total of 1,659,420 species which include 133,692 fossil species under 40 phyla on global basis. Out of which, phylum Arthropoda is represented by 1,302,809 species, which share of about 78.5% of the total biodiversity (Zhang, 2013). Order Lepidoptera is one of the third largest insect order which includes moths, butterflies and skippers. A total of 1,58,570 species of Lepidoptera reported on global basis, of which 1,38,656 species are moths and rest are butterflies (Zhang, 2011, 2013). In India, 15000 species belonged to 84 families are represented, of it 13,359 species belonged to 79 families of moths (88%) and rest are butterflies (12%) (Chandra, 2011). Microlepidoptera contain small primitive moths of small size, poor flight capacity and are difficult to study. 45735 species belonging to 4626 genera under 73 families and 19 superfamilies of the Microlepidoptera on world basis (Van Nieukerken et al., 2011). Microlepidoptera has great economic importance and are widely distributed throughout different regions of the world. In view of the necessity, the present study was undertaken on the micolepidoptera fauna collected from Himachal Pradesh.

Survey-cum-collection tours were undertaken from various localities of 12 districts viz., Shimla, Kangra, Mandi, Chamba, Hamirpur, Bilaspur, Solan, Sirmour, Una, Kullu, Kinnaur and Lahaul & Spiti of Himachal Pradesh for collection of micromoths from 400m ASL, to 3500m ASL from 1999 onwards. The collected material were killed, pinned, stretched and preserved in well fumigated air tight insect collection boxes. The identification were done by the literature (Hampson, 1892; Meyrick 1912-1936) and visits to National Collections. The classification given by Van Nieukerken et al., (2011) has been followed. In all, 75 species belonging to 58 genera under 10 families, i.e., Tineidae (11), Eriocottidae (1), Gracillaridae (3), Yponomeutidae (2), Oecophoridae (15), Gelechiidae (13), Lecithoceridae (10), Scythridae (1), Tortricidae (12) and Pterophoridae (7) were identified. List of identified species is given below:

Order : Lepidoptera

Superfamily : Tineoidea

Family : Tineidae

Genus: *Dasyses* Durrant
1. *Dasyses rugosella* (Stainton)
Genus: *Drimylastis* Meyrick
2. *Drimylastis telamonia* Meyrick
Genus: *Edosa* Walker
3. *Edosa opsigona* Meyrick
Genus: *Macraeola* Meyrick
4. *Macraeola inquisitrix* Meyrick
Genus: *Monopis* Hubner
5. *Monopis monachella* Hubne
Genus: *Opogona* Zeller
6. *Opogona isoclina* Meyrick
7. *Opogona lamprocrossa* Meyrick
8. *Opogona xanthocrita* Meyrick
Genus: *Thisizima* Walker
9. *Thisizima bubalopa* Meyrick
Genus: *Tinea* Walker
10. *Tinea pellionella* Linnaeus
11. *Tinea platyntis* Meyrick

Family: Eriocottidae

Genus: *Compsoctena* Zeller
12. *Compsoctena dehradunensis* Rose & Pathania

Superfamily: Gracillarioidea

Family: Gracillariidae

Genus: *Acrocercops* Wallengren
13. *Acrocercops resplendens* (Stainton)
Genus: *Gracillaria* Haworth
14. *Gracillaria teleodelta* Meyrick
Genus: *Parectopa* Clemens
15. *Parectopa bathracma* Meyrick

Superfamily: Yponomeutoidea

Family: Yponomeutidae

Genus: *Plutella* Schrank
16. *Plutella xylostella* Linnaeus
Genus: *Ypnomeuta* Latreille
17. *Yponomeuta bolidias* Meyrick

Superfamily Gelechioidea

Family : Oecophoridae

Genus: *Acria* Stephens
18. *Acria emarginella* Donovan
Genus: *Aeolanthes* Meyrick
19. *Aeolanthes sagulata* Meyrick
Genus: *Endrosis* Hubner
20. *Endrosis lacteella* (Denis & Schiffermuller)
Genus: *Ethmia* Hubner
21. *Ethmia acontias* Meyrick
22. *Ethmia assamensis* (Butler)
23. *Ethmia chamundai* Srivastava, Kumar & Sharma
24. *Ethmia pagiopa* Meyrick
25. *Ethmia praeclara* Meyrick
Genus: *Odites* Walsingham
26. *Odites atmopa* Meyrick
Genus: *Promalactis* Meyrick
27. *Promalactis sementris* Meyrick
Genus: *Psorosticha* Lower
28. *Psorosticha ziziphi* (Stainton)
Genus: *Stathmopoda* Herrich-Schaffer
29. *Stathmopoda adulatrix* Meyrick
30. *Stathmopoda orbiculata* Meyrick
Genus: *Tonica* Walker
31. *Tonica nigricostella* Snellen
32. *Tonica niviferana* Walker

Family: Lecithoceridae

Genus: *Homaloxestis* Meyrick
33. *Homaloxestis cholopis* Meyrick
34. *Homaloxestis xylotrypta* Meyrick
Genus : *Hygroplasta* Meyrick
35. *Hygroplasta spoliatella* (Walker)
Genus *Lecithocera* Herrich-Schaffer
36. *Lecithocera trigonopis* (Meyrick)

Family: Cosmopterigidae

Genus: *Cholotis* Meyrick
37. *Cholotis thoracista* Meyrick
Genus: *Cosmopterix* Hubner
38. *Cosmopterix ancalodes* Meyrick
39. *Cosmopterix mimetis* Meyrick
Genus: *Labdia* Walker
40. *Labdia echioglossa* Meyrick
41. *Labdia molybdaula* Meyrick
Genus: *Stagmatophora* Herrich-Schaffer
42. *Stagmatophora drosophanes* Meyrick

Family : Gelechiidae

Genus: *Anarsia* Zeller
43. *Anarsia ephippias* Meyrick
44. *Anarsia sagmatica* Meyrick
Genus: *Dichomeris* Hubner
45. *Dichomeris ianthes* Meyrick
Genus: *Gnorimoschema* Busck
46. *Gnorimeschema operculella* (Zeller)
Genus: *Helcystogramma* Zeller
47. *Helcystogramma arotraea* Meyrick
Genus: Onebala Walker
48. Onebala hibisci Stainton
49. Onebala hoplophora Meyrick
Genus: *Polyhymno* Chambers
50. *Polyhymno alcimecha* Meyrick
Genus: *Semnostoma* Meyrick
51. *Semnostoma barathrota* Meyrick
Genus: *Sitotroga* Heinemann
52. *Sitotroga cerealella* (Olivier)
Genus: *Stegasta* Meyrick
53. *Stegasta variana* Meyrick
Genus: *Symmoca* Hubner
54. *Symmoca anaphracta* Meyrick
55. *Symmoca dhauladharensis* Srivastava, Kumar & Sharma

Family: Scythrididae

Genus: *Eretmocera* Zeller
56. *Eretmocera impactella* Walker

Superfamily Tortricoidea

Family: Tortricidae

Genus: *Acroclita* Lederer
57. *Acroclita notophthalma* Meyrick
Genus: *Archips* Hubner
58. *Archips machlopis* Meyrick
Genus: *Argyroploce* Hubner
59. *Argyroploce erotias* Meyrick
Genus: *Bactra* Stephens
60. *Bactra truculenta* Meyrick
Genus: *Clepsis* Guenee
61. *Clepsis melissa* Meyrick
Genus: *Dicellitis* Meyrick
62. *Dicellitis nigritula* Meyrick
Genus: *Eucosma* Hubner
63. *Eucosma ceriodes* Meyrick
Genus: *Homona* Walker
64. *Homona coffearia* (Nietner)
Genus: *Meridemis* Diakonoff
65. *Meridemis bathymorpha* Diaknoff.
66. *Meridemis invalidana* (Walker)
Genus: *Polychrosis* Rogonot
67. *Polychrosis ephippias* Meyrick
68. *Polychrosis fallax* Meyrick

Superfamily: Pterophoroidea

Family: Pterophoridae

Genus: *Amblyptilia* Hübner
69. *Amblyptilia forcipeta* (Zeller)

Genus: *Exelastis* Meyrick
70. *Exelastis phlyctaenias* Meyrick
Genus: *Gypsochares* Meyrick
71. *Gypsochares catharotes* Meyrick
Genus: *Oxyptilus* Zeller
72. *Oxyptilus causodes* Meyrick
Genus: *Procapperia* Adamczewski
73. *Procapperia pelecyntes* (Meyrick)
Genus: *Sphenarches* Meyrick
74. *Sphenarches anisodactylus* Walker
Genus: *Stenodacma* Amsel
75. *Stenodacma pyrrhodes* (Meyrick)

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References

Chandra, K. 2011. Insect fauna of states and Union territories in India. *ENVIS Newsletter*, 14 (1): 189-218.

Hampson, G. F. 1892. *The Fauna of British India. Moths* Vol.I. Taylor and Francis, London: 1-527.

Meyrick, E. 1912-1936. *Exotic Microlepidoptera*. E. W. Classey, Hampton, Middlesex, I-V: 1-640.

Van Nieukerken, E. J, Kaila, L., Kitching, I.J., Kristensen, N. P. et al., 2011. Order Lepidoptera Linnaeus, 1758. In: Zhang, Z.-Q. (Ed.), Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. *Zootaxa*, 3148: 212-221.

Zhang, Z. Q. 2011. Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. *Zootaxa*, 3148: 1–237.

Zhang, Z. Q. 2013. Phylum Arthropoda. In: Zhang, Z.-Q. (Ed.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness (Addenda 2013). *Zootaxa*, 3703: 17–26.

Green Zone along Sabarmati Waterfront

Not far from the densely packed industrial belt in Ahemdabad's Pirana-Piplaj areas where 1,500 factories and warehouses jostle for space, a 29-acre green zone, packed with 47,000 trees, now brings a whiff of fresh air to the Sabarmati, named the third most polluted river in the country by the Central Pollution Control Board some years ago.

The Gyaspur forestry experiment of the Ahmedabad Municipal Corporation (AMC), 2km from 50-metre high smouldering garbage mounds in Pirana landfill, is partially responsible for the transformation.

The experiment was undertaken to mask the stench from Pirana's four garbage mounds that have 78 lakh tonnes of waste accumulated over 30 years and smoulder throughout the year.

The green zone was also AMC's attempt to compensate for the trees cut to pave the way for development in the city and complement the state's efforts to develop the environs of the river in the city.

The thick plantation has started attracting birds, animals, and insects driven away by rapid industrialization and pollution. It's now home to 110 species of birds, including migratory varieties. Further, hundreds of species of insects, around 40 peacocks, 30 nilgais, 10 hedgehogs, jackals, a few mongoose and 15 species of snakes have been seen here.

AMC parks and gardens director said that in 2005, they had started it with around 100 trees to offset loss of trees cut in the city. "I had no idea that this place will turn into a rich bio-park."

Naturalist Haseeb Sheikh, who rescues wild animals, prefers to release them here. "Gyaspur is an example of how trees and plants beside a polluted river become ecosystem engineers... You allow trees and plants to colonize a bare river sediment patch and they will do everything—from trapping of sediments to retention of seeds," he says.

In the past seven years, the locals have put up water pots at 13 places on this patch. "The river water is toxic with sewage and chemicals and we didn't want the animals and birds here to drink it."

As a result, Gyaspur has also become the go-to place for researchers. Riddhi Shah, a college lecturer and amateur entomologist, takes her BeeZone Club members to the Gyaspur site to study caterpillars. "We never miss going to the Gyaspur site during monsoon to study caterpillars."

However, some say more needs to be done. Irfan Thebawala, a bird watcher from Ahmedabad, said, I suggest more trees which usually grow on the banks of rivers in the wild. For instance, neem is literally dominated by raptors for nesting. The AMC should plant more fruit trees."

Ahmedabad's lifeline has got a fresh look. Its promenade is 23 km long and has two levels. Lower level is for pedestrians, cyclists and upper one is for hosting cultural, educational and leisure activities. Around 70 hectares of reclaimed land has parks, gardens and shaded plazas.

—Paul John

Research Notes

EFFECT OF NICOTINE ON DEVELOPMENTAL PERIOD AND POPULATION OF THE PUPAE OF SEPIA MUTANT OF THE FLY, *DROSOPHILA MELANOGASTER*

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Human population mainly depends upon crops for their food. But the insect pests destroy about 70% of the world's crops every year. *Drosophila* flies have been reported as pest in tomato fields. The eggs are oviposited on the damaged parts or cracks of tomatoes thus leading to the problem of food contamination. Efforts to get relief from this problem by use of safe products have been successful. Hence, Nicotine was chosen as an insecticide because of its broad spectrum and low mammalian toxicity. Toxic effect of Nicotine against different strains of *Drosophila* has been reported by several workers, such as Choudhary (2002), Choudhary & Razdan (2003) and Akhter & Bahadur (2002).

A pure culture of flies was obtained from *Drosophila* Stock Centre, School of Life Sciences, Indore. It contained the sepia mutant. The flies were reared on artificial diet which was prepared, according to the method described by Aijaz et al. (1987). Flies were used for experiment after 5-6 generation, when they were fully acclimatized to the laboratory conditions, at 25±5°C.

The sub-lethal dose (0.132 µl / 100 ml food) of test chemical was selected after the determination of LC_{50}. The flies were grouped as sets and cross- combined into treated sets as (i) T♀ x U♂, (ii) T♀ x T♂, (iii) U♀ x T♂ and control set (U♀ x U♂). The selected sub-lethal dose was given to the treated (T) sets according to the method described by Dhingra et al. (1988), where as control set was not given any chemical treatment.

Observations revealed that Nicotine affects on the rate of development of *D. melanogaster*, which supports the view of Choudhary (2002). Table 1 shows that developmental period (in days) increased due to overcrowding (Choudhary, 2003). The population decreased in second set as compared to the first, third and control sets respectively, due to larval mortality and number of larval – pupae intermediates were also observed, which supports the findings of Akhter (1999, 2002) using Fenvalerate and Nicotine.

References

Aijaz, R. P., Samad, M.F. Khan & Baig, M.M.H. 1987. Evaluation of best and cheapest artificial diet for *Drosophila melanogaster. Pakistan J. Zool.*, 19(3): 302-306.

Akhter, S. 1999. *Susceptibility index of certain mutant forms of Drosophila melanogaster after Fenvalerate 20 EC intoxication.* M. Phil. Dissertation, Dr. B.R. Ambedkar University, Agra.

Akhter, S. 2002. *Comparative toxicity of different formulation of plant production (Nicotine) and synthetic pyrethroid (Fenvalerate) against different mutant forms of Drosophila melanogaster (Meigen).* Ph.D. thesis, Dr. B.R. Ambadkar University, Agra.

Akhter, S. & Bahadur, R.R. 2002. Toxic effect of Nicotine 20 EC (plant extract) against different mutant forms of *Drosophila melanogaster* (Meigen). *Int. J. Mendel*, 19 (1-2): 19-20.

Choudahry, S. 2002. Effect of Nicotine on the rate of development of *Drosophila melanogaster. Bionotes*, 4 (3) : 68.

Choudahry, S. 2003. Effect of Nicotine on the growth and development of *Drosophila melanogaster. Bionotes*, 5(1) : 21.

Choudhary, S. & Razdan, T. 2003. Effect of Nicotine (Plant extract) on fecundity of mutant form (Curled) *Drosophila melanogaster* (Meigen). *Poll. Res.*, 22(4): 531-532.

Dhingra, G.B., Chowdhary, B. & Sareen, P.K. 1988. Genotoxic effect of a synthetic pyrethroid insecticide on *Drosophila. Drosophila Inform Serv.*, 67:27.

Table 1. Development period and population of pupae of mutant Sepia *Drosophila melanogaster* after the treatment of Nicotine.

Nature of Cross	No. of larvae emerged	No. of Pupae formed	Average % of pupation	% mortality	Developmental period
T♀ x U♂	308.66	258.33	83.69	16.30	9.20
T♀ x T♂	292.33	215.66	73.77	26.22	12.00
U♀ x T♂	325.33	296.66	91.18	8.81	5.33
U♀ x U♂	350.66	346.66	98.85	1.	2.00

CONFIRMATION OF THE OCCURRENCE OF THE COMMON GRASS DART BUTTERFLY *TARACTROCERA MAEVIUS* IN DELHI (LEPIDOPTERA: HESPERIIDAE)

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The butterflies of Delhi were surveyed by Julian Donahue (1966) and Torben Larsen (2002). In these surveys, *Taractrocera maevius* was not recorded. Varshney & Smetacek (2015) also do not include the Gangetic Plain in the range of the species. Biswas et al. (2017) reported this species from Delhi with no supporting evidence.

Dr Surya Prakash (pers. comm.) informed the authors that this species had been observed previously by Dr Aysha Sultana in Aravali Biodiversity Park (Vasant Vihar, Delhi). However, the authors could not find any photographic or voucher evidence for the presence of the species in Delhi.

On 13th February, 2018, a single individual of *T. maevius* was observed in Asola Bhatti Wild Life Sanctuary inside the rockery. The individual was perched on a cornflower but not feeding. It was observed for a period of 15-20 minutes. It was photographed and the identity suggested by Aniruddha Singhamahapatra and Fahim Shahriyar Labab and confirmed by consulting Kehimkar (2017).

The species was not observed in that location subsequently, although authors diligently searched for it in the following days. Since the first record mentioned by Dr Surya Prakash as found by Dr Aysha Sultana is also of a single individual it is likely that both specimens observed so far in Delhi were not part of a resident population.

In the case of the Large Cabbage White (*Pieris brassicae* (Linnaeus, 1758)) it was reported from Delhi for the first time by Smetacek (1997) on the basis of specimens. As mentioned in Larsen (2002), only two ♀ specimens of Large Cabbage White were observed by his friend B. Bogh-Anderson in 1961. Although recorded during the winter months from Delhi frequently this species has been unable to colonise the area because the larvae are unable to tolerate the summer heat.

It is possible that, like the Large Cabbage White, the Common Grass Dart is also a winter migrant to the Gangetic plains and is unable to colonise here due to unknown limiting factors.

References

Biswas, J., Dookia, S. & Faisal, M., 2017. Butterflies of Delhi with new additions and an annotated Checklist from Delhi, India. *Internat. J. Zool. Studies*, 2(6) : 4-10.

Kehimkar, I. 2016. *Butterflies of India*. Bombay Natural History Society, Mumbai: xii + 528 pp.

Larsen, T.B. 2002. The Butterflies of Delhi, India – An Annotated Check-List. *Esperiana*, 9: 459-479.

Smetacek, P. 1997. *Pieris brassicae* in Delhi. *J. Bombay Nat. Hist. Soc.*, 94: 584-585.

Varshney, R.K. & Smetacek, P. (eds.) 2015. *A Synoptic Catalogue of the Butterflies of India*. Butterfly Research Centre, Bhimtal and Indinov Publishing, New Delhi: ii + 261pp., 8pl.

Illegal Trade of *Keeda Jadi*

As snow begins to melt in the alpine meadows of Uttarakhand in May and June, tents spring up overnight on the green pastures. Come morning, and a treasure hunt of sorts starts.The occupants of the camps, mostly residents of nearby villages, children in tow, scamper around in search of a prized commodity—a yellow brown mummified caterpillar (*Cordyceps sinensis*) also known as Keeda Jadi.

At the end of the day the lucky ones are able to spot as many as 15 pieces while their not-so-nimble counterparts will renew their quest next morning. By the end of August 2017, much of the Keeda Jadi has been 'harvested', the camps are gone and the flurry of activity in the bugyals has died down. The gatherers of the herb, now back in their villages in Pithoragarh, Chamoli and Bageshwar sell their bounty to middlemen, each kilo fetching anywhere between Rs.-10 lakh to 15 lakh. These middlemen use far-flung hill routes to smuggle the Keeda Jadi across the border to Nepal and China where the aphrodisiac is in high demand in the black market.

General Manager of the Uttarakhand Forest Development Corporation, said, "In 2003 the state government empowered van panchayats to grant license to local residents for collection of the herbs." Over 12,000 van panchayats issue permits to local residents to collect Keeda Jadi. But local residents often bypass van panchayats as it is more lucrative for them to sell it to middlemen.

Additional Superintdendent of police, special task force, said "It is illegal to sell the fungus to anyone other than van panchayats. While an individual will get Rs. 2 lakh for 1Kg of Keeda Jadi from the van panchayat, selling 1 kg of it to middleman will fetch them Rs. 8 lakh to Rs 12 lakh per kg. This is why they prefer bargaining with the latter."

ON A COLLECTION OF COLLEMBOLA FROM AMAGHATA FOREST, DHANBAD, JHARKHAND

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The present communication is based on a survey conducted by Apterygota section, Zoological Survey of India, Kolkata in September-October, 2013, from Amaghata forest, Dhanbad district, Jharkhand. The Amaghata forest is situated near the Amaghata village of Gobindpur Tehsil of Dhanbad district, at a distance of approx. 9 kms from Dhanbad City. Its altitude is 216 m and lat./long. is 23.821949^{0}N and 86.502181^{0}E. The total geographical area of village Amaghata is 358.07 hectares.

The collembolans are small, wingless, entognathous hexapods with a spring-like forked jumping organ and the furcula situated below the fourth abdominal segment. They are minute in size, range from 0.25 mm to 6 mm in length and with 4 segmented antennae. A total of 10 species under 9 genera belonging to 6 families of Collembolan insects have been recorded in this study. All the collections were made by G.P.Mandal. Identification of specimens was done using a phase contrast compound microscope, following Christiansen & Bellinger (1998).

Collembola were extracted from soil samples by employing stainless steel corers. Cores were then placed on modified high gradient extraction apparatus. Specimens were mounted under a coverslip in Hoyer's solution, and were studied under a Leica Digital Module (DM 2500) microscope. All specimens are deposited in the Apterygota Section, Zoological Survey of India, Kolkata.

Collected species are shown in Table 1.

Acknowledgements : The authors are grateful to Dr. Kailash Chandra, Director, Zoological Survey of India, for giving opportunity to study the materials. Thanks are also due to Dr. C. Raghunathan, Scientist-E for encouragement, and to staff of Apterygota section for co-operation.

References

Christansen, K.A. & Bellinger, P. 1998. *The Collembola of North America North of the Rio Grande. A taxonomic analysis*. Grinnel College, Iowa: 1-1520.

Table 1. List of species of Collembola from Amaghata Forest, Dhanbad, Jharkhand.

Family	Species	Distribution in India
Isotomidae	*1. Isotomurus jharkhandensis* Mandal, Suman & Bhattacharya, 2017	Jharkhand
	2. Isotomurus dhanbadensis Mandal, Suman & Bhattacharya, 2017	Jharkhand
Entomobryidae	*3. Alloscopus tetracanthus* Borner, 1906	Jharkhand, Meghalaya, West Bengal
	4. Lepidocyrtus (Acrocyrtus) heterolepis Yosii, 1959	Jharkhand, Kerala, Himachal Pradesh, Manipur, Arunachal Pradesh, Andhra Pradesh, Uttarakhand, Andaman & Nicobar Is., West Bengal
Paronellidae	*5. Yosiia dehradunia* Mitra, 1967	Jharkhand, Himachal Pradesh, Kerala, Odisha,Tripura, Uttarakhand, West Bengal
	6. Dicranocentroides flavescens Yosii, 1966	Jharkhand, Andaman & Nicobar Is., Kerala, Himachal Pradesh, Manipur, Nagaland, Arunachal Pradesh, Sikkim, Tripura, Uttarakhand, Uttar Pradesh, Odisha, West Bengal
	7. Salina indica (Imms, 1912)	Jharkhand, Andaman & Nicobar Is., Arunachal Pradesh, Himachal Pradesh, Maharashtra, Manipur, Sikkim, Tripura, Uttarakhand, Uttar Pradesh, West Bengal
Sminthuridae	*8. Sphyrotheca gangetica* Yosii,1966	Jharkhand, Himachal Pradesh, Uttar Pradesh, West Bengal
Dicyrtomidae	*9. Calvatomina pagoda* Yosii, 1966	Jharkhand, West Bengal
Sminthurididae	*10. Sminthurides parvulus* (Krausbauer,1898)	Jharkhand, Himachal Pradesh, Uttar Pradesh

SECOND REPORT OF *HYBLAEA PUERA* INFESTATION ON *AVICENNIA* SPP. FROM THE MANGROVES OF WEST BENGAL (LEPIDOPTERA : HETEROCERA : HYBLAEIDAE)

BALARAM PANJA, OLIVE BISWAS, PUJA PATI and BULGANIN MITRA

Zoological Survey of India, Kolkata.

Moth *Hyblaea puera* (Cramer, 1777), belonging to Hyblaeidae family, is commonly known as the 'Teak defoliator' and is regarded as a notorious pest of Teak (*Tectona grandis* L.f.) plantations. This major pest of teak is now underway to damage mangroves and is alarmingly found to infest *Avicennia* spp. in varying zones, with varying seasonal occurrence in the world. It is reported as a pest of *Avicennia officinalis* in Bangladesh, on *Avicennia marina* in Maharashtra and on *Avicennia alba* from Sundarban Biosphere Reserve, India (Biswas et al., 2017).

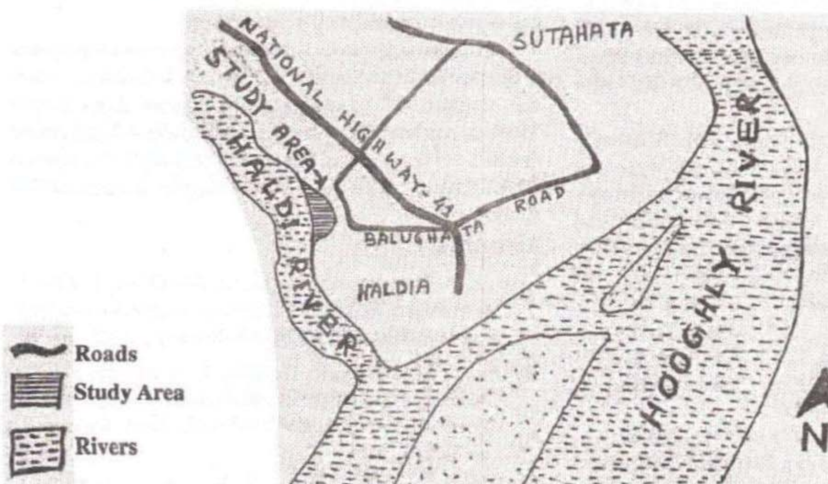
Genus *Avicennia* holds three species in India, namely, *Avicennia officinalis* L., *Avicennia marina* (Forsk.) Vierh. and *Avicennia alba* Blume. The dominant species is *Avicennia officinalis*. During a recent survey (from mid-November, 2017 to mid-January, 2018) of insect fauna at the mangrove forest patches in coastal areas, along Haldi River, at Haldia of Purba Medinipur, West Bengal, complete defoliation on the all three *Avicennia* species by a lepidopteran insect was observed . The defoliator was later identified as *Hyblaea puera* (Cramer, 1777).This is the first report of infestation from the mangroves of Purba Medinipur and the second report of infestation on *Avicennia* spp. from West Bengal.

The infested plants were completely defoliated and turned brown like a dead tree, at the study site (Map 1). The type of infestations, pupation and conditions of the trees were very much similar to the observation of Biswas et al. (2017). Photographs were taken in the field and the coordinates of the collection sites were recorded using GPS (Garmin Etrex-22x).

According to Biswas et al. (2017), *Hyblaea puera* outbreak in mangroves occurs between March and July in Equatorial Brazil and September to January in Mumbai and in the months of August to October in Indian Sundarban. In the year 2016, an early outbreak of *Hyblaea puera* was observed during February to May in Indian Sundarban. In Haldia, the infestation of this major pest was observed during November to January.

Being a polyphagous pest in agricultural sector, *Hyblaea purea* has adapted to survive in mangroves as an alternate host, where its population management is a big challenge as the mangrove ecosystem is ecologically sensitive zone where conventional control measures for pest control are difficult issue.

This communication reports the initial findings of the infestation of *Hyblaea puera* on *Avicennia* spp. in mangroves of Purba Medinipur. Further studies and monitoring, are required to understand the nature and extent of damage of this moth species, besides observations of changing infestation time, impact on climate change and other environmental factors.



Map. 1.-Study site of occurrence of *H. puera*.

Reference

Biswas, O., Panja, B., Garain, P.K., Roy, S., Shah, S.K., Modak, B.K., & Mitra, B. 2017. *Hyblaea puera* (Crammer, 1777) [Lepidoptera : Hyblaeidae] infestation on *Avicennia alba* Blume in Sundarban Biosphere Reserve. *Proc. Zool. Soc.* DOI 10.1007/s 12595-017-0216-0

BUTTERFLY DIVERSITY IN AND AROUND KALYANI, A SUBURBAN CITY NEAR KOLKATA, WEST BENGAL

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Butterflies have been reported as significant indicator organisms, because of their hypersensitivity to the changes in environmental factors. The diversity and distribution of butterflies depend on specially three types of vegetation populations, e.g. larval food plants, nectar plants and shade plants (Manzoor et al., 2013).

Though some works on butterfly diversity have been done in and around Kolkata metropolitan region, Kalyani has never been assessed for its butterfly fauna. Earlier in the year 1882, Moore worked on the butterflies of Calcutta and the collections were made from Barrackpore Park. Afterwards, Niceville (1885), and recently Chowdhury & Chowdhury (2007), Ghosh (2008), Biswas et al. (2012), Mukherjee et al. (2016) and other workers have done studies on the butterfly diversity of this region. Biswas et al.(2016) compiled 132 species of butterflies from Kolkata region.

Present study was carried out in Kalyani, a suburban city [22° 58' 30" N, 88° 26' 4" E], located around 50 kilometers away from Kolkata, in the Nadia district of West Bengal, India. The survey was conducted during 2017-2018, for about a year to explore the butterfly fauna of the area. Identifications were done from the photographs taken in the field with the help of Kehimkar (2008).

Present communication reports a total of 26 butterfly species, under 23 genera distributed in 4 families. Maximum species were reported from the family Nymphalidae (14 species) followed by Pieridae (6 species), Papilionidae and Lycaenidae (3 species in each), respectively.

List of Butterflies recorded from Kalyani city :

Lycaenidae

1. *Castalius rosimon* (Fabricius, 1775). Common Pierrot.
2. *Chilades pandava* (Horsfield, 1829). Plains Cupid.
3. *Zizeeria karsandra* (Moore, 1865). Dark Grass Blue.

Nymphalidae

4. *Acraea terpsicore* (Linnaeus, 1775). Tawny Coster.
5. *Ariadne merione* (Cramer, 1779). Common Castor.
6. *Danaus chrysippus* (Linnaeus, 1758). Plain Tiger.
7. *Elymnias hypermnestra* (Linnaeus, 1763). Common Palmfly.
8. *Euploea core* (Cramer, 1780). Common Crow.
9. *Euthalia aconthea* (Cramer, 1779). Common Baron.
10. *Hypolimnas misippus* (Linnaeus, 1764). Danaid Eggfly.
11. *Junonia almana* (Linnaeus, 1758). Peacock Pansy.
12. *Junonia lemonias* (Linnaeus, 1758). Lemon Pansy.
13. *Melanitis leda* (Linnaeus, 1758). Common Evening Brown.
14. *Mycalesis perseus* (Fabricius, 1775). Common Bush Brown.
15. *Neptis hylas* (Linnaeus, 1758). Common Sailer.
16. *Ypthima baldus* (Fabricius,1775). Common Five ring.
17. *Ypthima huebneri* Kirby, 1871. Common Four Ring.

Papilionidae

18. *Papilio demoleus* Linnaeus, 1758. Lime Butterfly.
19. *Papilio polytes* Linnaeus, 1758. Common Mormon.
20. *Graphium agamemnon* (Linnaeus, 1758). Tailed Jay.

Pieridae

21. *Catopsilia pyranthe* (Linnaeus, 1758). Mottled Emigrant.
22. *Cepora nerissa* (Fabricius, 1775). Common Gull.
23. *Delias eucharis* (Drury, 1773). Common Jezebel.
24. *Eurema hecabe* (Linnaeus, 1758). Common Grass Yellow.
25. *Leptosia nina* (Fabricius, 1793). Psyche.
26. *Pareronia hippia* (Fabricius, 1787). Indian Wanderer.

An assessment for the butterfly fauna of the study area (Kalyani) suggests that fast developing semi-urban cities of India still harbor high insect diversity. Kalyani shows good diversity of butterflies as compared to other Indian cities. This high diversity of butterflies calls for an extensive survey of this fauna and their conservation.

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References

Biswas, O., Chakraborti, U., Das, A., Chatterjee, S., Das, S., & Mahajan, B. 2012. Lepidoptera and Araneae diversity of Saltlake City, Kolkata. *Bionotes*, 14(3): 95-96.

Biswas, O., Chakraborti, U., Roy, S. & Kumar, J. 2016. Butterfly faunal diversity of Kolkata Metropolitan Region, West Bengal. *ENVIS-Newsl., Zool. Surv. India*, 22(2): 2-6.

Chowdhury, D. & Chowdhury, S. 2007. Butterfly Fauna in Mudialy Ecological Park, Kolkata, West Bengal. *Bionotes*, 9(1): 25.

Ghosh, S. 2008. Birds and butterflies in the grounds of the Raj Bhavan, Kolkata. Occ. Paper No. 6. Raj Bhavan, Kolkata, Jan., 2009.

Kehimkar, I. 2008. *Book of Indian Butterflies.* Bombay Natural History Society. Mumbai, and Oxford Univ. Press, Delhi : 1-513 pp.

Manzoor, F., Sadat, H.B. & Hina, 2013. Butterflies as indicator of climate change. *Zoo's Print*, 27(2): 19-21.

Moore, F. 1882. A list of the butterflies captured in Barrackpore Park. *Ent. Mon. Mag.*, 19: 33-36.

Mukherjee, S., Aditya, G., Basu, P. & Saha, G.K. 2016. Butterfly diversity in Kolkata Metropolis: A synoptic checklist. *Check List*, 12(2): 1-9.

Nicéville, L.de, 1885. List of Butterflies of Calcutta and its neighbourhood with notes on habits and food plants. *J. Asiatic Soc. Bengal.*, 54(2): 39-54.

Grow Your Own Jungle Using a Japanese Technique

How it's done : Japanese scientist Akira Miyawaki's technique involves planting native species close together so that they grow into dense forests that support local biodiversity. Experts identify soil type and add locally available biomass as nutrients. No pesticides are used. The trees grow 10 times faster, and are 30 times denser than a normal plantation.

100sqm minimum area required for a Miyawaki forest. 3 yrs for the forest to become self-sustaining. 10 yrs for it to grow into a mature, native forest.

Some time back, Taimur Ali Khan received a rather unusual gift for his first birthday. His mother, the Indian actress Kareena Kapoor's nutritionist Rujuta Diwekar presented him a 1,000sqft forest in Sonave on the outskirts of Mumbai. The trees are as young as Taimur, even younger actually, and each one of them is a local, native, climate resilient species.

Seven years ago, engineer Srinivasan Ramadorai and his wife decided to keep aside a tenth of the land on which they were building their sprawling home in Bengaluru for a grove. "We had a lot of land behind the house and wanted to cut the noise and pollution from outside" says Ramadorai. Today, the trees are over 30 feet high, and home to birds, squirrels, cats and a few non-poisonous snakes.

Afforestt, the Bengaluru-based startup that helped Ramadorai plant the grove of 150 trees, draws upon a technique created and named after Japanese botanist Akira Miyawaki. The concept aims to grow dense, self-sustaining forests of native trees quickly: while a typical forest takes 100 years to mature, the technique accelerates the process ten times.

Afforestt founder Shubhendu Sharma discovered Miyawaki in 2008 when the environmentalist came to plant a forest at Toyota's Bengaluru campus. Fascinated, Sharma decided to create a small forest in his parent's house in Kashipur in Uttarakhand, planting 224 trees of 42 species in 2010. The 70sqm grove taught Sharma an important lesson—while native trees such as mulberry, guava and mango thrived, non-native ones didn't do well. "Exotic species will die or dominate," says Sharma, who is creating a seed bank for indigenous trees. "We are creating the forest that would have existed in an area without human intervention".

Today, *Afforestt's* portfolio spans 38 cities in nine countries. He raised forests in hotels and ashrams, Bengaluru airport and Chennai metro. For instance, in a naturopathy resort in Telangana the forest is "so dense that you can get lost in it".

He recommends a minimum area of 100sqm for the forest to make an impact. His own mini-forest in Kashipur attracts a variety of birds such as bulbuls, cuckoos, parrots and hornbills, besides squirrels and honey bees.

Last year, non-profit *Say Trees* made news when it used the same technique to turn barren plot of land belonging to the railways in Bengaluru's KR Puram into a verdant forest in just five months. Earlier in 2017, the NGO created the city's first vertical garden on the pillars of a flyover. It's also trying to increase the green cover near lakes and on hillocks outside Bengaluru. Its recent project involves creating Miyawaki forests in government schools in Tamil Nadu.

"It is a misconception you need a large plot of land to grow a forest," says Dipen Jain of Mumbai-based NGO *Forest Creators*. He discovered Miyawaki's technique during work visits to Toyota, Honda, and Panasonic factories in Japan. His challenging project was in a textile mill in Tarapur, Maharashtra, where Jain and his partner had to convert a chemical waste dumpyard into a forest with 27,000 trees. "In just over a year, many trees have touched 15 feet," he says.

Others are discovering newer applications for Miyawaki's technique. Shaillie Mehta of Ahmedabad-based startup *Acacia Eco*, collaborating with a professor from HNGU university in Patan, recently created a mini-forest of 14,000 trees within the premises of a local school.

—Sonam Joshi

Obituaries

A. K. GHOSH

Dr. Asis Kumar Ghosh born in 1938 at Rourkela (Orissa), had his education at the University of Calcutta and later at the University of Wisconsin (USA). He carried out his researches on the Indian Aphidoidea (Hemiptera), first at the University of Calcutta and later at Wisconsin till 1965, to work on the long range dispersal of aphid vectors of plant viruses, with a Fullbright Grant for higher studies.

On his return to India, he resumed his studies at the University of Calcutta, and subsequently joined the Zoological Survey of India from 1972, first at Shillong and then permanently at Calcutta (Kolkata) till his superannuation in Feb. 1996. He served as the Director ZSI for about 3 years from 1993 to 1996.

He has more than 200 research publications to his credit, including monographs on the Aphids of Economic Importance (1974); Aphid Parasitoids of India and adjacent countries (with P. Stary); Aphids of North-East India and Bhutan (ed. D. N. Raychaudhury); and 7 Parts on Aphidoidea in the *Fauna of India* series (a few with either of B. K. Agarwala, Sameeran Chakraborty, F. W. Quednan or L. K. Ghosh). He had major interest in the biosystematics of the aphids of India and their natural enemies.

Besides his academic excellence, Dr. Ghosh was a very good orator, writer and organizer. He was a leading biodiversity conservationist. He participated in the Indian delegation to the Convention on Biodiversity at Geneva. In fact, he travelled extensively in Europe, USA, Latin America and China, participating in conferences. He represented India in various Committees, besides his active role in National Biodiversity Authority.

Dr. Ghosh served as the National Coordinator for India in an international SACEP Project on Faunal Biodiversity in the South Asian countries, funded under NORAD. He was Principal Investigator of many research projects and guided several students for their Ph.D., on various insect groups. He surveyed Namdapha Biosphere Reserve in Arunachal Pradesh, and edited a 12 Part State Fauna Series on the *Fauna of West Bengal*. At the Calcutta High Court, he served as Amicus Curie for the environmental degradation of the Eastern Calcutta Wetlands.

Even after retirement, he continued to visit and guide ZSI programmes. He was actively engaged in teaching as a Guest Lecturer in various Universities and IIM Calcutta. He was Director of ENDEV, a non-govt. organisation in the field of socio-economic studies. He was examiner at many universties. After retirement, he formed the Centre for Environment and Development at Kolkata and as its Director conducted environmental impact assessment studies for various industrial proposals.

In his free time, he was a knowledgable person on the western music and took much interest in bengali literature and cultural activities. He wrote extensively on the historical aspects of Indian science, particularly zoology. He was a food and drink connoisseur and interested in sports. Dr. Ghosh was unmarried.

Personally I was intimately associated with him, from the period of beginning of the Marine Aquarium-cum-Research Centre at Digha Coast, to the present time, discussing various aspects of Biodiversity conservation. He foresaw and gave direction to the ecosystem studies at Nayachar Island, near Haldia in the Hooghly river, about which I have published a book recently with Dr. A. K. Ghosh as one of the co-authors.

He will be remembered by one and all in the ZSI as a scientist, as a Director and as a mentor with due respect. He passsed away on 2nd April, 2018, after some hospitalization. May his soul rest in peace.

—Dr. A K. Hazra

(With inputs from Dr. A. K. Sanyal,
Dr. R. K. Varshney and others)

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Dr. Asish kumar Ghosh is no more ! He (1938-2018) was suffering from some ailments for last several months and ultimately left us forever on 02.04.2018. I am extremely shocked at his sad demise. I was fortunate enough to be associated with a great personality like Dr. Ghosh who always inspired me to contribute in Science. As a result, I had the opportunity to work with him in writing monumental work – 'Fauna of India : Aphidoidea pt. 7(1): Aphidini : 244 pp.; 371 figs and pt.7(2): Macrosiphini ; 835pp., 318 illustrations'.

Dr. Ghosh was educated in Calcutta University and Wisconsin University (1965). Later, he was awarded Rockfeller field Grant and received Fullbright post doctoral fellowship from University of Wisconsin, U.S.A. He published more than 400 research papers, several books and monographs from 10 countries. He joined Zoological Survey of India in 1972 and thus served Z.S.I. for 24 years (1972-1996) and retired as an able Director in 1996. During the tenure of his directorship, he left no stone unturned to bring Z.S.I in its peak position with active help and cooperation from every corner.

He also worked as founder Dirctor of Centre for Environment and Development, Kolkata (non govt.) for 21 years . He represented Govt. of India in several International meets in Japan, Kenya, U.K., Argentina, U.S.A., Russia and France. Moreover, he acted as a visiting faculty at the University of Calcutta and Jadavpur University, Kolkata. Besides his academic excellence, Dr. Ghosh was a leading Biodiversity conventionalist, represented India in the Convention of Biodiversity at Geneva. He had active role in National Biodiversity Authority also. Dr. Ghosh was not only a good researcher but also an excellent orator. At any circumstances, he could speak well.

His death is indeed a great personal loss to me because he very often advised me as to how to smoothly run our Academy of Biodiversity Conservation (N.G.O.) where I have been acting as founder president for last several years. He was the chief advisor of our Academy about which he was much concerned. It is a great loss on the part of our Academy (ABC) also.

I personally miss him as a friend, philosopher and guide. Dr. Ghosh's sad demise has caused irrepairable loss in the scientific world. We have lost a great soul indeed !

May his soul rest in peace.

—Dr. L.K. Ghosh

President, Academy of Biodiversity Conservation, Kolkata

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G. K. SRIVASTAVA

It is very sad for me to learn that my dear friend Dr. G. K. Srivastava is no more. He left for his heavenly abode on 10th February 2018 at Lucknow (U. P.).

Gyanendra Kumar Srivastava was born in Lakhimpur Kheri (U. P.). His father was a Jail Superintendent in the U. P. services. He got his higher education at the Department of Zoology, Agra College, Agra, and got his Ph.D. on the taxonomy of Dermaptera insects (earwigs) under the supervision of Dr. H. N. Baijal, from the then Agra University. Now called as the Dr. B. R. Ambedkar University, Agra, from where G. K. received D. Sc. degree subsequently.

Srivastava slowly became an authority on the taxonomy of the Indian Dermaptera. He did lot of field surveys and his contributions are considered the best, since the volume on Dermaptera, in the series *Fauna of British India* by M. Burr (1910).

Besides studying the earwig materials in the Indian Museum, Calcutta (presently in the Zoological Survey of India), he also studied materials from American Museum of Natural History, New York; Zoologisk Museum, Copenhagen; Institut fur Pflanzenschutz forschung Kleinmachnow, Eberswalde-Finow, DDR; Rijksmuseum Van Natuurlizke Historie, Leiden; California Academy of Sciences, San Francisco; and Bishop P. Museum, Hawaii. He also received collections from Burma (Myanmar), Pakistan, Ceylon (Sri Lanka), Malaya, Philippines and Brazil.

Srivastava first published a *Catalogue of Oriental Dermaptera* (1976) and then in his later years, wrote two volumes on Dermaptera in the *Fauna of India* series (1988, 2003). He published about 100 research papers.

G. K. started his carrer as a teacher in different Inter Colleges of western U. P., served for a brief period as research assistant in the then Allahabad Agricultural Institute, and then from August 1961 joined the Zoological Survey of India, where he rose to the high post of Additional Director. Almost throughout he worked at Calcutta (now Kolkata), except for a brief period at Shillong (1997-98).

After retirement from the service (2002), he settled at Lucknow. He is survived by his wife, Mrs. Kiran Srivastava nee Verma, a daughter Surabhi (Bengaluru) and son Rahul (Mumbai).

—Dr. R.K. Varshney

Artificially created Bacteria

Craig Venter has taken genetic modification to its logical extreme by synthesising an artificial lifeform. Strictly speaking, he has not created life. He has created an unnatural DNA nucleus and successfully had it take over a bacteria which now eats, breathes and reproduces at the behest of that DNA. The geneticist, already famous for mapping the human genome, dubbed it the first species on earth "whose parent is a computer".

What has been accomplished is strictly not wholly original—bits and pieces of functional DNA have been synthesised before. But no one has done this on a scale sufficient to create a new species. Also, what has been done is more technology than pure science. Mr. Venter took ten years and $40 million to produce his synthetic genome. Because of his trailblazing, the next such genome will now be produced at a fraction of the time and cost.

For thousands of years mankind has sought to reshape nature to meet its needs.Wheat is a forced hybrid from wild grasses. Corn is a mutation of a weed. Potatotes are edible only because of a millennia of selective breeding. The same is true for every domesticated animal that exists. But where manipulation was once a painful business of hit-and-miss that could span centuries, genetic modification—and now genetic creation—allows such shape-shifting to be rapid and targeted. Mankind still needs to compel nature to do its bidding.

Mr. Venter's immediate goal is the construction of a micro-organism designed to be a biofuel factory.

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