

## Remembering T. V. Ramakrishna, the doyen of Indian entomologists

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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 and Rao<sup>1</sup>, 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 and Rao<sup>1</sup> 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 and Rao<sup>1</sup>, 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<sup>2</sup>, 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, Rama-

krishna officiated as the Madras-State Entomologist (Figure 1). 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 and Rao<sup>1</sup>, ‘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



**Figure 1.** Ramakrishna (acting Government Entomologist, Coimbatore), fourth from right in the front row, during the Third Entomological Meeting at Pusa (3–19 February 1919). Harold Maxwell-Lefroy is seventh from left in the front row; Cyril Beeson is fifth from left in the front row; Y Ramachandra Rao is fifth from left in the last row.

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 hand-written 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.

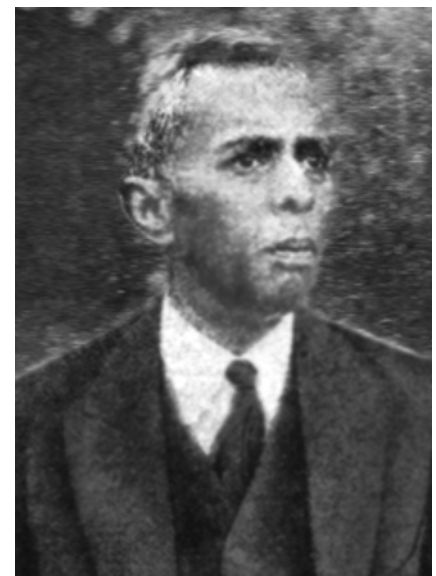
I have already submitted my credentials etc. to Professors Doane and Ferris, and I believe reference may kindly be made to them with regards to my eligibility. As a foreigner and as one anxious to get some wider experience on my subject by a stay in California, I am anxious to do some work there. As 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 (Figure 2). 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)



**Figure 2.** T. V. Ramakrishna (Photo possibly made during his stay at Stanford, because of the awning evident in the background of the original; not shown in this edited copy). Source: Mani and Rao<sup>1</sup>.

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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 (Figure 2) 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 McCracken, *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<sup>3</sup> presents a colourful 'crop-pest calendar' at the Fourth Entomological Meeting at Pusa, 1920 (Figure 3). 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 (*Di cladispa 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 mealybug (*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<sup>3</sup>.

In p. 50, he<sup>3</sup> 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.

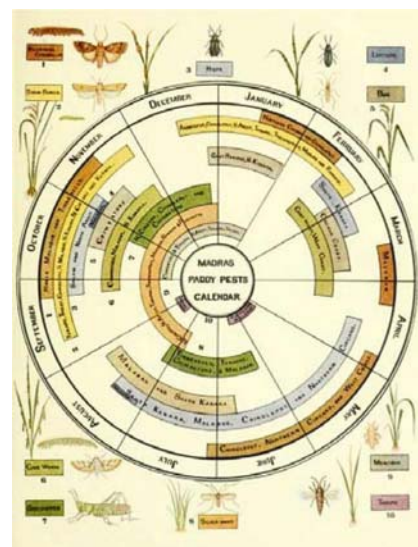


Figure 3. Paddy pest calendar for South India. (Source: Ayyar<sup>3</sup>).

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 acetarsenite of Cu (Paris green), arsenite of Ca (arsenite of lime, London purple) and arsenite of lime (gypsin) 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<sup>4</sup>. (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<sup>5</sup>. 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<sup>6</sup> 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<sup>7</sup>, we know that a majority of them occur in the tropics, feeding on algae, ferns and gymnosperms; most of them being apterous and displaying camouflaging capability<sup>8</sup>. Before his note<sup>6</sup>, William Kirby<sup>9</sup> 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<sup>10</sup>, Madrid (Spain) (note 8), who described *Phyllochoreia ramakrishnai* (referred as *Phyllochoreia 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<sup>11</sup>. 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<sup>12</sup> 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<sup>13</sup>. 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<sup>14</sup> from Queensland (Australia). Ramakrishna challenged the contents of a letter to the editor of *Nature* by Wilfred Backhouse Alexander<sup>15</sup>, 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*<sup>16</sup>, 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*<sup>17</sup> 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

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from his early career. The short notes ( $\approx$  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. Subramanian, 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-wob85w4mmolwv/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 PhD 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, Tiruchirappalli. 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 Joseph'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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