

# NBAIR Newsletter

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ICAR–National Bureau of Agricultural Insect Resources



## Validate the technology and stimulate its utility

Speaking on the science of biological control, Brodeur *et al.* (2018)\* said: “Our analyses revealed a thriving scientific discipline with several major research trends in arthropod, plant pathogen and weed biological control”. This was on the basis of investigations by the team on recent changes in public interest, international networking and peer-reviewed research. Though a Google Trends analysis revealed that the search hits on biological control aspects on the internet was indicating a decreasing trend, there was a significant increase in international coauthorship and multilateral collaborations in the biological control sector. We strongly feel that besides the above, national networking for validation of the biocontrol modules in different states and commercialisation of the validated technologies are of prime importance to evoke public interest nationwide. To achieve this, NBAIR, the nodal centre of the AICRP on Biological Control held two important meetings in June. These two meetings brought out the results of existing national networking and collaborations and set the stage for future commercialisation of farmer-friendly technologies developed by NBAIR, which are based on non-chemical modes of pest management and insect utilisation.

The first meeting was the XXVIII AICRP Biocontrol Workshop held during 6–8 June 2019 at Anand Agricultural University, Anand. This workshop brought together the investigators from 11 regular SAU centres, 17 contingency centres (SAUs and ICAR centres) and four new voluntary centres of AICRP-BC. Results of various trials conducted by the centres were presented and discussed. The prime focus, however, was on two recent invasives: *Spodoptera frugiperda* (the fall armyworm or FAW) infesting maize and the rugose spiralling whitefly (RSW) infesting coconut. Though FAW has been recorded as one of the most notorious pests in several countries and attempts have been made to manage it using various

chemical and non-chemical modes by those countries, India has taken the lead in identifying indigenous natural enemies, both macrobials and microbials, which could be effectively utilised for managing the pest. This was only possible through the research efforts of NBAIR and the coordinating centres of AICRP-BC. The workshop also brought out the clear and validated information that RSW could be managed through conserving a parasitoid, *Encarsia guadeloupae*, and spraying an indigenous entomofungal pathogen, *Isaria fumosorosea*.

The second meeting was the one-day NBAIR–Industry Interface Meeting, which was jointly organised by the Institute Technology Management Unit of NBAIR and the Society for Biocontrol Advancement in Bengaluru on 26 June 2019. The 50 industry partners from different parts of the country, who participated in the meeting, were very keen to understand and take up the NBAIR biocontrol and pheromone technologies. The novel “Waste to Wealth” technology had several takers, especially from the poultry sector.

It was most appropriate to have Dr T.M. Manjunath as the chief guest as besides being a consultant on agri-biotechnology and integrated pest management, he was the person who had set up the first commercial biocontrol company, BioControl Research Laboratories, in India. He strongly conveyed to the audience that though there are real challenges to be faced in commercialisation of biocontrol technologies, there are ways and means to address these challenges and make these sustainable pest management methods available to the farmers.

Chandish R. Ballal  
Director



\*Brodeur, J., Abram, P.K., Heimpel, G.E., & Messing, R.H. (2018). Trends in biological control: public interest, international networking and research direction. *BioControl*, 63: 11–26.

## Research Highlights

### Revision of the genus *Halys* with description of a new species

The species of the genus *Halys* (Hemiptera: Heteroptera: Pentatomidae: Pentatominae: Halyini) from India were redescribed and revised. Four species, including a new species for *Halys*, were described from India based on both male and female genitalia: *Halys mudigerensis*, *H. serrigera*, *H. shaista* and *H. sulcata*. The following synonymies were published: *H. sulcata* = *Halys sindillus*, syn. nov. = *Halys spinosus*, syn. nov. = *Halys mulberriensis*, syn. nov. = *Halys noakoatensis*, syn. nov.; *H. serrigera* = *Halys fabricii*. The status *incertae sedis* has been assigned to the species *Halys neelgiriensis*, *H. rugosa* and *H. persa*. Keys to males and females of *Halys* species occurring in India were prepared and published. Based on the original description, short notes on other species of *Halys* occurring in Asia, Africa and Saudi Arabia were also published. The holotype (male) and a paratype (female) of *Halys mudigerensis* (Fig. 1) were deposited at the University of Agricultural Sciences, Bengaluru.

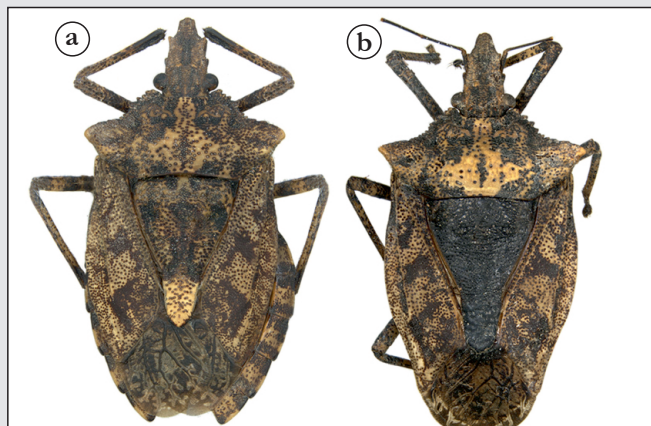


Fig. 1: *Halys mudigerensis*: male (a) and female (b)

### Checklist of vespid fauna

An illustrated checklist of the vespid fauna (Hymenoptera: Vespidae) with 33 species belonging to 22 genera and four subfamilies from Goa was published. Of these, 26 species, 18 genera and 2 subfamilies (Stenogastrinae and Vespinae) were newly recorded from Goa. The subfamily Eumeninae had the highest diversity with 23 species belonging to 18 genera. *Antepipona pruthii* (Fig. 2) was previously recorded from Himachal Pradesh, Jammu and Kashmir, Uttarakhand and West Bengal. This was the first report of *A. pruthii* from the Western Ghats (Goa). *Phimenes indosinensis*, a rare species reported earlier from Meghalaya, was collected for the first time from the coastal mangrove vegetation in Goa. *Stenodyneriellus praeclusus* (Fig. 3) was also recorded for the second time from India, the earlier report being from Rajasthan. The other uncommon species were

as follows: *Eumenes belli*, *Parancistrocerus vicinus* (Fig. 4), *Ropalidia tamila* and *Eustenogaster eximia eximioides* (Fig. 5).



Fig. 2: *Antepipona pruthii*



Fig. 3: *Stenodyneriellus praeclusus*



Fig. 4: *Parancistrocerus vicinus*



Fig. 5: *Eustenogaster eximia eximioides*

### A simple method for sexing live larvae of pink bollworm, *Pectinophora gossypiella*

Lepidopteran adults can be sexed using different morphological characters because sexual dimorphism is prevalent in most species. But sometimes, necessity arises for the sexual differentiation of immature stages like larvae so that virgin females can be studied. A straightforward, reliable and non-invasive method that permits sexing of *Pectinophora gossypiella* larvae during their fourth instar was found out. Male *P. gossypiella* were identified by their testes, which were visible through the dorsal integument of the fifth abdominal segments. The testes were observed as two dark elliptical bodies, one on either side of the midline of the fifth abdominal segment in the fourth instar of *P. gossypiella*. The visual sexing of male and female larvae of *P. gossypiella* (Fig. 6) saves time in separating the sexes to carry out studies on sex-specific responses, hybrid mating, and/or inheritance of insecticide resistance.

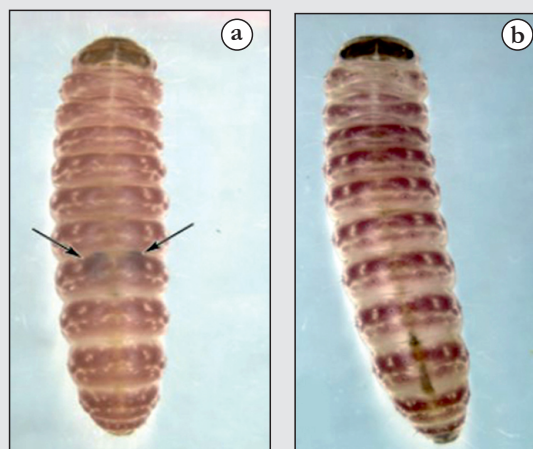


Fig. 6: Dorsal view of *Pectinophora gossypiella* larvae: male (a) and female (b)

## Research Advisory Committee Meeting

The “XXIII Meeting of the Research Advisory Committee” was held at NBAIR on 4 May 2019. The committee consisting of Drs S.N. Puri (Chairman), P.K. Chakrabarty, S. Rajan, S. Lingappa, V.V. Ramamurthy, D.J. Bagyaraj, Suresh Nair, P.K. Mukherjee and Suraj Singh Rajput (Members) reviewed the research achievements and progress, and gave suggestions for future research. At the outset, Dr Chandish R. Ballal, Director of NBAIR, welcomed the committee and provided a glimpse of the previous year’s salient findings. The divisional heads, Drs Sunil Joshi, M. Nagesh and N. Bakhavatsalam, presented the research achievements. The committee opined that an initiative has to be made to document the indirect revenue generated through the use of biocontrol technologies.



## XXVIII Workshop of AICRP on Biological Control

The “XXVIII Workshop of All-India Coordinated Research Project (AICRP) on Biological Control of Crop Pests” took place at Anand Agricultural University (AAU), Anand, during 6–8 June 2019. After inaugurating the workshop, Dr N.C. Patel, Vice-Chancellor of AAU, highlighted the various issues pertaining to crop protection in the state of Gujarat. He expressed his concern over the ill effects of indiscriminate use of chemical pesticides, and advocated the increased uptake of biocontrol agents, especially to manage invasive insects. Dr Rajan, Assistant Director-General (Plant Protection & Biosafety), ICAR, underscored the need to reduce pesticide usage by 25% before 2025 through augmentation and conservation of potential biocontrol agents. Dr S.N. Puri (Former Vice-Chancellor, CAU, Imphal), Dr B.V. Patil (Former Vice-Chancellor, UAS, Raichur), Dr M. Anandaraj, (Former Director, ICAR–IISR, Kozhikode) and Dr D.J. Bagyaraj (INSA Honorary Scientist & Chairman, CNBRCD, Bengaluru) participated in the meeting as external experts. Dr Chandish R. Ballal (Project Coordinator, AICRP-BC & Director, NBAIR), presented the previous year’s research highlights from the 28 centres of the AICRP-BC. The more than 100 participants included researchers from the centres at SAUs and ICAR institutes besides private biocontrol entrepreneurs. The work done by the centres on biodiversity documentation, evaluation of different biocontrol modules and large-scale demonstrations under different crop ecosystems was presented, and the results were discussed in detail to arrive at clear recommendations.



## NBAIR–Industry Interface Meeting

The “NBAIR–Industry Interface Meeting” was jointly organised by NBAIR’s Institute Technology Management Unit (ITMU) and the Society for Biocontrol Advancement (SBA) on 26 June 2019. The aim of the meeting, which was held on the Yelahanka campus of NBAIR, was to showcase, promote and commercialise the biocontrol and biocontrol-compatible technologies developed by the institute over the past many years. Commercial biocontrol producers, NGOs and other agripreneurs who are engaged in the production of various biocontrol agents, microbial biopesticide formulations and other non-chemical modes of pest management participated in the meeting. Dr Chandish R. Ballal, Director of NBAIR, delivered the inaugural address and emphasised the need for commercialisation of biocontrol technologies, especially macrobials with reference to production of quality agents, storability and upscaling. She also focussed on NBAIR’s efforts to register selected microbials with the CIB & RC for the management of both indigenous and invasive insect pests and diseases. Chief guest Dr T.M. Manjunath, Consultant, Agri-Biotechnology & Integrated Pest Management, briefed the audience on the history of commercialisation of biocontrol technologies in India. He listed out the real challenges faced in commercial production of biocontrol agents, especially with reference to infrastructure requirements, large-scale production of host insects, parasitoids and predators and availability to farmers. The participants had active discussions with the inventors of different technologies. Around 100 participants, including 50 industry partners, attended the meeting.



## NBAIR organises training for differently abled people

NBAIR organised an introductory biological control awareness programme for differently abled people at BEL Ashankura Silver Jubilee Trust (BELASJIT), Jalahalli, Bengaluru, on 3 April 2019. Mass production protocols of biocontrol agents were explained to the participants in the local language. A demonstration on how to fill up pots with potting mixture and the method of application of the antagonistic fungus *Trichoderma viride* was also conducted.



## International Yoga Day at NBAIR

NBAIR celebrated the “Fifth International Yoga Day” on 21 June 2019. Ms Rajalakshmi Sampathkumar and Ms Mamtha Ramesh from The Art of Living conducted a session on ‘Sri Sri Yoga’ for the staff of NBAIR. The programme started with *asanas*, *pranayama*, followed by *dhyana* and concluded with *sankalpa*.



## NBAIR scientists at the World Pest Day event

Drs T.M. Shivalingaswamy and A.N. Shylesha, Principal Scientists of NBAIR, participated in the “World Pest Day” event organised by the Indian Pest Control Association at Hotel Citadel, Bengaluru, on 6 June 2019. Their respective lectures were entitled ‘Pest control and conservation of bee pollinators’ and ‘Invasive insect pests and their management’.



## Regional Workshop on Fall Armyworm Management in Asia

Dr Chandish R. Ballal, Director of NBAIR, participated in the “Regional Workshop on Fall Armyworm Management in Asia” at ICRISAT, Hyderabad, during 1–3 May 2019 .



## Maria Sibylla Merian: *retold biographical memoir and tribute to a pioneer insect biologist*

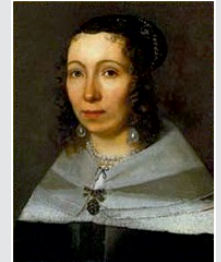
– T.P. Rajendran

To pen the biographical memoir of an illustrious painter and biologist, Maria Sibylla Merian, who lived over 350 years ago, is real adventure. And to condense to *NBAIR Newsletter* is hard. I venture into it simply because I was alerted to her biography as Google made a doodle on her recently. The lady naturalist who took pains to study the various insect forms and relate them to one life cycle process called metamorphosis was a sensation of her times. It ensued in the process of storytelling on advances in science as by ‘science-story-telling’.<sup>1</sup> A number of biographers have made Merian very popular in Europe.<sup>2</sup> The late 17th and early 18th centuries witnessed the birth of new knowledge on metamorphosis of insects due to the intense interest shown by her.

Maria Sibylla Merian<sup>3</sup> alias Anna Sibylla Merian<sup>4</sup> (born on 2 April 1647 in Frankfurt, Germany – died on 13 January 1717 in Amsterdam, the Netherlands) was an incredibly methodical explorer and naturalist. This diligent naturalist had the flair to illustrate flora and fauna. Merian had the hereditary temperament for tasteful natural illustration of flora and insects. She inherited the taste of artistic temperament from her father, Matthäus Merian de Oude (1593–1650), an engraver who ran a publishing house. She could acquire early training from her stepfather, still-life painter Jacob Marrel. Merian lost her father when she was just three years old. Her mother, Johanna Sibylla Heim, and stepfather brought her up. Married to Johann Andreas Graff (1637–1701), an apprentice with her stepfather, Merian had two daughters, Johanna Helen (b. 1668) and Dorothea Maria (b. 1678). Her detailed biography published in both Wikipedia and Britannica Biography provided me with adequate material to develop this memoir.

Merian was known as a botanical artist in her early years. In 1675, she commenced publication of a three-volume series, each with 12 plates depicting flowers. These were published in *Blumenbuch*, and in 1680, she published *Neues Blumenbuch*, combining the earlier plates with the subsequent plates. The art work had the influence of the contemporary drawings that were copied as part of the training. In those days, embroidery was taught as part of education for privileged European young women. She composed compartment style of the contemporary European scrolling stem embroidery designs. Butterflies and damselflies interspersed with plants became decorative compositions. Her subsequent *Raupen* books were used as

patterns for paintings, drawings and sewing. One has to notice and appreciate the struggle that women underwent in that patriarchal era where ‘*the guild*’—the group of artisans and merchants who oversee the art work and trade of a given area—did not permit women to use oil colours. She used vellum, a fine animal skin supported by white coat, as surface for her drawings.



Maria Sibylla Merian  
in 1679

She is known to have published her first book of natural illustrations in 1675. She got interested in insects in her early adolescence. Merian cared to observe insects in nature, collected them from natural habitats, reared and created drawings with all details from those live specimens that she handled and recorded in her study journal. In her times, insects were treated as ‘beasts of devil’ and hence their detailed biology was unknown. She took pains to carefully observe with intense curiosity, and improved the existing knowledge from contemporary scholars who described insect, moth and butterfly lifecycles in the belief that they were born out of mud by spontaneous generation. Merian’s contrarian views, born out of her persistent and tenacious field work, brought out the knowledge on metamorphosis of insects from the egg to imago. She was curious to study the change of forms from egg to larva, pupa and imago in silkworm that she reared at her home. She went on to describe the documented evidence on the process of metamorphosis as observed in many butterflies. In 1679, the first of her two-volume series on caterpillars was published, followed by the next volume in 1683. Each volume had her signature engravings of 50 plates along with those of the host plants of 186 European insect species with detailed descriptions of their life cycles. The black and white edition, *Metamorphosis*, came out in 1730. This was reprinted in 1719, 1726 and 1730.

In the preface to *Metamorphosis insectorum Surinamensium* she writes: ‘From my youth, study of insects occupied me constantly. At first they were silkworms in my hometown, Frankfurt am Main, then I watched much more beautiful butterflies and moths that hatched from other type of larvae. This encouraged me to collect all the caterpillars that I could find, in order to study their metamorphosis and develop my painting skills, so that I could sketch them live and represent the true color.’

<sup>1</sup>science-story-telling.eu/files/Biographies/Biography\_Merian\_ENG.pdf (Accessed on 07.03.2019)

<sup>2</sup><https://www.theguardian.com/science/.../maria-sibylla-merian-artist-insects-science> (Accessed on 07.03.2019)

<sup>3</sup>[https://en.wikipedia.org/wiki/Maria\\_Sibylla\\_Merian](https://en.wikipedia.org/wiki/Maria_Sibylla_Merian) (Accessed on 07.03.2019)

<sup>4</sup><https://www.britannica.com/biography/Maria-Sibylla-Merian> (Accessed on 07.03.2019)

Prior to her research studies, Jan Goedart's publications<sup>5</sup> on the life stages of European moths and butterflies that had very brief and raw diagrams of larva, pupa and adult were only available. Goedart believed that larvae arose from water. Through her deep studies on the metamorphic stages of moths and butterflies, Merian could pictorially depict how one stage led to the other over a definite period of time. We may have to involve our imagination to appreciate how Merian could bring out the nature-biology with such accuracy that the posterity could not contest any of these findings on the ecology, habitat and biology of the 186 European insects. These independent findings were supported further by the findings of contemporary researchers (Francesco Redi, Marcello Malpighi and Jan Swammerdam) subsequently.

She changed her course of study at the age of 52 when she travelled along with her second daughter, Dorothea, to the Dutch colony Suriname, probably at the instance of her elder daughter and merchant son-in-law. She received a loan granted by the city of Amsterdam. She was confident to pay this loan back through her paintings and publications. She arrived on 18/19 September 1699 in Suriname and met with the Governor, Paulus van der Veen. Merian could make history after undertaking this unprecedented expedition by any European naturalist. Her life in Suriname with her daughter for just 21 months brought out several paintings and descriptions of insects from her garden in Parmaribo or from the hinterlands that she visited in search of new caterpillars. Her 40 miles (100 km) canoe trips on Suriname river resulted in the rich observations, descriptions, paintings and collections of 90 species of animals and 60 or more species of plants. By June of 1701, a serious malarial infection prompted her to return to the Netherlands. Together with her daughter, she left Suriname and returned to Amsterdam, bringing images on parchment and collection of specimens (butterflies

preserved in brandy, bottles of crocodiles and snakes, lizards, eggs, root crops, pupae and boxes of desiccated insects), which she intended to sell. She opened a shop and sold specimens and her engravings of plants and animal life of Suriname.

Her studies on tropical insects made out a unique publication of her times, *Metamorphosis insectorum Surinamensium* (Metamorphosis of insects of Suriname), in 1705. This highly influential work made naturalist commentators such as David Attenborough, a renowned natural historian, to rate her as one of the significant contributors in Entomology. As leader in insect biological studies with her meticulous illustrations arising out of her field studies in Suriname, she could eclipse all the colour images of the New World (the Americas) that bore very sketchy pictures of the biology of insects.

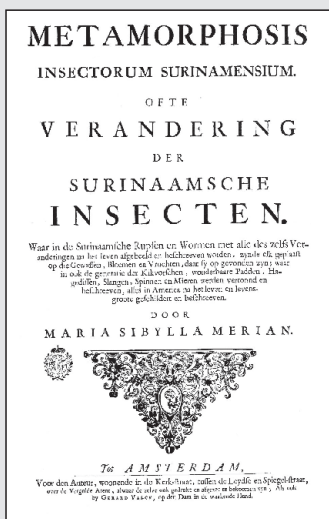
It is very interesting to record that Peter I, the Tsar of Russia, purchased many of her paintings. Her daughter, Dorothea, was summoned to St Petersburg to work as a scientific illustrator for the Tsar, and she was the first woman to be employed by the Russian Academy of Sciences. Her elder sister, Joahanna Helena, who moved with her husband to settle in Suriname in 1711, became a noted artist in her own right.

Merian continued her work despite a stroke she suffered in 1711. She breathed her last on 13 January 1717. Her daughter Dorothea published *Erucarum Ortus Alimentum et Paradoxa Metamorphosis*, a collection of her mother's work, posthumously.

*The author is Adjunct Fellow, Research Information System for Developing Countries, New Delhi & former Assistant Director-General (Plant Protection), ICAR & Officer on Special Duty, ICAR-National Institute of Biotic Stress Management, Raipur. The views, thoughts and opinions expressed in this column belong solely to the author and not necessarily to ICAR or NBAIR.*

<sup>5</sup>[https://en.wikipedia.org/wiki/Jan\\_Goedart](https://en.wikipedia.org/wiki/Jan_Goedart) (Accessed on 07.03.2019)

Note: All the images in this article are from Wikipedia.



Merian's major work, *Metamorphosis insectorum Surinamensium*



*Metamorphosis insectorum Surinamensium*, Plate XVIII



*Metamorphosis insectorum Surinamensium*, Plate LX

## Foreign Visit

**Dr Ankita Gupta** was deputed as a visiting scientist to the Natural History Museum, London, and CABI, Egham, UK, from 5 May to 7 June 2019, during which she examined and studied Hymenoptera types and voucher specimens mainly from India and digitised them for future reference. She delivered a talk at CABI on the achievements of NBAIR, especially in the field of taxonomy.



## Obituary

**Mr Ajit Desai**, Assistant Administrative Officer at NBAIR, passed away due to illness on 19 May 2019. He served ICAR for 36 years. May his soul rest in peace!



## Superannuation

**Mr K.N. Visweswara**, Private Secretary to the Director, NBAIR, superannuated from service on 31 May 2019 after serving ICAR for 35 years. To commemorate his retirement, colleagues at NBAIR organised a farewell function and felicitated him and his family.



## Selected Publications

- Amala, U., Shivalingaswamy, T.M., Veeresh Kumar & Pratheepa, M. 2019. Pruned petioles of papaya as nesting sites of the leaf cutting bee, *Megachile laticeps* Smith and its pollen fidelity. *Journal of Apicultural Research*, 58(5): 660–664.
- Ballal, C.R., Varshney, R. & Joshi, S. 2019. Morphology, biology and predation capacity of *Amphiareus constrictus* (Stal) (Hemiptera: Anthocoridae). *Neotropical Entomology*, 48: 668–677.
- Gawas, S.M., Girish Kumar, P., Gupta, A. & Sureshan, P.M. 2019. Checklist of vespid wasps (Hymenoptera: Vespidae) of Goa, India, with new records and a key to species. *Zootaxa*, 4585(2): 269–294.
- Ghosh, E. & Ballal, C.R. 2019. Effect of host egg storage on the storage amenability of *Trichogramma chilonis* Ishii (Hymenoptera: Trichogrammatidae). *Phytoparasitica*. doi:10.1007/s12600-019-00749-8
- Ramya, R.S., Mohan, M. & Joshi, S. 2019. A simple method for sexing live larvae of pink bollworm, *Pectinophora gossypiella* (Lepidoptera: Gelechiidae). *Animal Biology*. doi: 10.1163/15707563-20191136
- Salini, S. 2019. Revision of the genus *Hahys* (Hemiptera: Pentatomidae) with description of a new species from India. *Zootaxa*, 4586(2): 351–375.

Compiled and edited by: **P. Sreerama Kumar, U. Amala & Chandish R. Ballal**

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