

# Feed the Future: Innovation Lab for Integrated Pest Management Trip Report

**Country(s) Visited:** India

**Dates of Travel:** 24 September – 1 October 2018

**Travelers' Names and Affiliations:** Lorraine Strathie, Agricultural Research Council – Plant Health and Protection, Private Bag X6006, Hilton, 3245, South Africa

## **Purpose of Trip:**

i) Attend the First international Conference on Biological Control, the Third IOBC International Workshop on Biological Control and Management of *Parthenium hysterophorus* and Workshop of the IAPPS Working Group on *Tuta absoluta* in Bengaluru, India, during 27-29 September 2018;

(ii) Organise and lead the Third IOBC International Workshop on Biological Control and Management of *Parthenium hysterophorus*;

(iii) Deliver two oral presentations, chair and lead sessions at IOBC Parthenium Weed Workshop

(iv) Organise and participate in field visit for Parthenium Weed Workshop

**Sites Visited:** Bengaluru, India

## **Description of Activities/Observations:**

*Parthenium hysterophorus* (parthenium weed) is a severe invader and continues to expand its distribution and density in more than 40 countries. It affects agricultural production, biodiversity conservation, and human and animal health in South Africa and more broadly on the African continent, as well as Asia and Australia. The South African biological control project on parthenium undertaken by ARC-PHP has been ongoing since 2003, supported by the Department of Environmental Affairs: Natural Resources Management Programme, and the USAID-funded Integrated Pest Management Innovation Lab (managed by Virginia Tech).

A Global Working Group on Biological Control and Management of Parthenium Weed was established in 2009, under the auspices of the International Organisation of

Biological Control (IOBC). The First International Workshop of this Global Working Group was held in 2010 in Nairobi, Kenya, followed by a second workshop in 2014 in Addis Ababa, Ethiopia. These Working Group workshops aim to bring together international researchers working on parthenium weed to disseminate information on the weed and its management, to increase collaboration among researchers regionally and globally, to optimize resources for the control of this weed and for technology transfer.

The Third International Workshop of the IOBC Global Working Group on Biological Control and Management of Parthenium Weed was held on 27–29 September 2018 at Le Meridien Hotel in Bengaluru, India, in conjunction with the First International Conference on Biological Control: Approaches and Applications ([www.icbc2018bengaluru.com](http://www.icbc2018bengaluru.com)). The conference was organized by the Society for Biocontrol Advancement and the Indian Council of Agricultural Research – National Bureau of Agricultural Insect Resources (ICAR–NBAIR), in collaboration with CABI, the International Association for the Plant Protection Sciences (IAPPS *Tuta absoluta* Working Group workshop) and the International Organization for Biological Control (Third International Workshop of the IOBC Global Working Group on Parthenium Weed).

As Convenor of the IOBC Working Group on Biological Control and Management of Parthenium Weed, Ms Strathie organized the Third International Workshop of the IOBC Working Group on parthenium weed, in collaboration with international researchers from India and the USA, who organized the First International Conference on Biological Control and the IAPPS Working Group on *Tuta absoluta*. Ms Strathie travelled from South Africa to Bengaluru, India from 24 September to 1 October 2018 (including travel dates) to lead and participate in this Workshop, chair sessions, deliver two oral presentations, organize and participate in a field visit to view parthenium biocontrol, as well as attend the associated IAPPS Working Group Workshop on *Tuta absoluta* and First International Conference on Biological Control.

Itinerary:

Mon 24 Sept 2018	Departed Pietermaritzburg 14h00; flight Durban to Dubai.
Tues 25 Sept	Flight Dubai to Bengaluru, arrived 22h00 Le Meridien hotel.
Wed 26 Sept	Met with Dr Sreerama Kumar Prakya (Indian Council of Agricultural Research – National Bureau of Agricultural Insect Resources, India) to organize final logistics

	for parthenium workshop. Worked on workshop presentations.
Thurs 27 Sept	Opening of First International Conference on Biological Control (ICBC 2018). Day 1 of Third International Workshop of the IOBC Working Group on Biological Control and Management of <i>Parthenium hysterophorus</i> in parallel.
Fri 28 Sept	Day 2 of IOBC Parthenium Workshop presentations (in parallel with ICBC 2018). Attended and judged presentations at Workshop of the IAPPS Working Group on <i>Tuta absoluta</i> .
Sat 29 Sept	Day 3 of IOBC Parthenium Workshop – field visit for <i>Parthenium hysterophorus</i> and <i>Tuta absoluta</i> . Attended final presentations of ICBC 2018. Met with Dr Wondi Mersie (Virginia State University) and Dr Richard Molo (NARO, Uganda) to discuss IPM Innovation Lab project on biocontrol of parthenium weed in East Africa. Presented summary of IOBC Parthenium Workshop highlights to ICBC 2018. Conference awards ceremony and closure. Dinner with CABI delegates.
Sun 30 Sept	Visited sites around Bangalore. Departed hotel at 0h00.
Mon 1 Oct	Flight 04h00 Bangalore to Dubai; Dubai to Durban. Arrived Pietermaritzburg 19h00.

Oral presentations:

- **Strathie, L.**, Sambo, S., Den Breeyen, A., Chidawanyika, F., Goodall, J., Gareeb, M. and Magoso, X. Establishment and early impact of introduced natural enemies to control *Parthenium hysterophorus* in South Africa
- Gareeb, M., **Strathie, L.**, Sambo S. and Magoso, X. Techniques to rear three insect agents for the biological control of *Parthenium hysterophorus* in South Africa

**Strathie, L.** at IOBC Parthenium Workshop:

- Welcome and Housekeeping;
- Chaired Opening, Spread and impact of *Parthenium hysterophorus* sessions, and Development of recommendations arising from Parthenium Weed Workshop;
- Future actions and directions of the IOBC Global Working Group on Parthenium Weed;

- Closing remarks and closure of IOBC Parthenium Weed Workshop;
- Summary highlights of IOBC Parthenium Workshop presented to First International Conference on Biological Control

First International Conference on Biological Control (ICBC 2018):

This conference was attended by 246 delegates, 43 from 20 countries other than India. One hundred and eighteen orals and 103 posters were presented during nine sessions. The conference opened with speeches by T. Mohapatra (Secretary, Department of Agricultural Research & Education and Director General, ICAR, New Delhi), David Smith (Director Biological Resources, CABI, UK) and R. Muniappan (Director, Virginia Tech, USA). A keynote address by Quirico Migheli, Editor-in-Chief of Biocontrol Science and Technology journal, discussed rejection of manuscripts submitted for publication.

Conference sessions included: (i) Biodiversity, Biosecurity and Conservation Strategies, (ii) Biotechnological Approaches in Biological Control; (iii) Production and Utilization of Microbials for Insect Pest and Disease Management; (iv) Biological Control Compatible Approaches, (v) Biological Control of Invasive Pests and Weeds; (vi) Production and Utilization of Macrobiotics for Insect Pest Management; (vii) Biological Control: Industrial Perspectives and Policy Issues; and the workshops on parthenium weed and *Tuta absoluta*. Awards for best orals and poster presentations were presented at a Valedictory Function.

As the IOBC Parthenium Workshop, followed by the IAPPS *Tuta absoluta* Workshop, ran in parallel with the conference proceedings, Ms Strathie could only attend the opening and final presentations of the First International Conference on Biological Control.

Third International Workshop of the IOBC Working Group on Biological Control and Management of *Parthenium hysterophorus*

About 23 representatives from 10 countries (India, Australia, USA, South Africa, Ethiopia, Uganda, Switzerland (for Pakistan), China, Nepal and Bangladesh) participated in the Third International Workshop of the IOBC Working Group on Biological Control and Management of *Parthenium hysterophorus*. Presentations and discussions related to various topics on parthenium weed were held during 27–28

September and a field visit on 29<sup>th</sup>. Some countries (e.g. Australia, South Africa) have extensive biocontrol programmes to manage parthenium weed, while some such as Uganda and Pakistan are just beginning programmes, and others such as Nepal and Bangladesh do not yet utilize biocontrol although there is interest to do so. Seventeen oral presentations on parthenium weed were presented under three themes (Spread and impact of *Parthenium hysterophorus*; Evaluation of biological control; New initiatives). Australia forged the way with foundational work on parthenium biocontrol, as demonstrated in the keynote address. The situation in Bangladesh indicated the dire need for initiation of biocontrol and management intervention efforts there (as well as other countries without management interventions) as the weed has expanded exponentially within a decade from 8 to 45 invaded districts of 64 districts. Research by the University of Queensland indicated that elevated CO<sub>2</sub> levels altered the morphology and dormancy of parthenium weed seed, with implications for its invasive abilities. Presentations on *Zygogramma bicolorata* in India, Ethiopia and Nepal discussed the impact of altitude, leaf consumption, host range, and predictions for its potential distribution. The combined impact of rust fungus and insect agents was demonstrated to significantly reduce parthenium cover in a South African study, demonstrating impact as well as the benefit of using a combination of agents. Presentations on ethanolic extracts of other plants and mycoherbicides demonstrated that parthenium growth, germination and seedling growth can be impeded by these methods, within a short period. Recent or new biocontrol initiatives in India, Uganda, and Pakistan were encouraging as biocontrol begins to be more widely utilized. Representatives from Nepal and Bangladesh were interested in initiating biocontrol programmes in their countries. Active discussion sessions ensued. The workshop concluded with the group, led by Ms Strathie, developing a set of recommendations (see 3.1).

Future actions of the IOBC Global Working Group on Parthenium Weed were discussed. Future workshops would be best combined with the IOBC Global Working Group on *Chromolaena odorata* and Eupatorieae Weeds if suitable combinations arise, and with alternative timing to major international biological control conferences. The next workshop of the IOBC Working Group on Parthenium Weed will be held in about three years, with Nepal or South Africa as possible host countries. Summarized information on parthenium weed and its management, with links to other sources of information, will be developed and housed on the IOBC Global website.

A field visit for the parthenium weed workshop took place on the morning of 29 September, sponsored by the IOBC, concluding the parthenium workshop proceedings. The ICAR–NB AIR experimental farm in Bengaluru was visited, where tomato leaf and fruit damage by the invasive moth *Tuta absoluta*, which affects tomato production in many countries, was observed. A roadside infestation of parthenium weed within the Bengaluru urban area was visited to view *Zygogramma bicolorata*, the only agent to have been deliberately introduced onto parthenium weed in India. *Smicronyx lutulentus* is currently under consideration in quarantine there. Several *Zygogramma* adults, eggs and characteristic feeding damage on leaves were observed at the field site. Although disappointing not to view higher levels of defoliation by the beetle, given the time since its introduction into India, this is not the situation in all areas. However, together with the dense infestations of parthenium weed observed in many locations around Bengaluru, this reality only highlighted the need for a suite of natural enemies to be considered for introduction in any country, to consistently achieve measurable control throughout all seasons and habitats throughout the invasive range of parthenium weed. Additional control methods also need to be incorporated in an integrated management approach.

Two presentations from this workshop received ‘Best Paper Awards’ during the ICBC Valedictory Function. The ARC-PHP presentation on rearing techniques for parthenium weed agents, presented by Ms Strathie, was one of the recipients.

Ms Strathie organized this workshop and field visit, chaired sessions, led the development of recommendations and various sessions. Dr Sreerama Kumar Prakya assisted with local logistics. Ms Strathie presented a summary of the parthenium workshop and recommendations arising from the workshop at the concluding sessions of the First International Conference on Biological Control, together with chairs of other sessions.

#### Workshop of the IAPPS Working Group on *Tuta absoluta*

The Workshop of the IAPPS Working Group on *Tuta absoluta* held on 28 September was organized and led by R. Muniappan (Virginia Tech). The Workshop was attended by 50 participants from five countries, and included 11 presentations with active discussions. Ms Strathie judged the oral presentations for awards.

In the keynote address, Abhijin Adiga (Virginia Tech) discussed multi-pathway models. These models incorporate biological, climatic and anthropogenic drivers of the spread of invasive species, to understand weed spread. Hybrid models have been developed to study the role of natural and anthropogenic drivers of invasive species spread, with application to analysis of *T. absoluta* spread, by considering the role of the tomato trade, the effect of climate change, and economic impact.

The role of the IPM Innovation Lab in the management of *T. absoluta* around the world was reviewed. Presentations on the biology, host range, thermal requirements for pest development, population build-up and genetic diversity of the moth were discussed. Various biological control options, integrated pest management methods and sterile insect technique were discussed. The use of a nanomatrix for controlled release of *T. absoluta* female sex pheromone was presented. Various management options utilized in Nepal were presented, and another presentation discussed risk assessment and management of *T. absoluta* in Bangladesh.

The presentations on nanomatrix and another from Nepal won ‘Best Oral Presentation’ awards.

### Training Activities Conducted:

Program type (workshop, seminar, field day, short course, etc.)	Date	Audience	Number of Participants		Training Provider (US university, host country institution, etc.)	Training Objective
			Men	Women		
First International Conference on Biological Control	27- 29 Sept 2018	246 delegates, 43 from countries outside of India			ICAR- National Bureau of Agricultural Insect Resources, India	Conference to discuss biological control of invasive plants and insects
Third International Workshop of the IOBC Working Group on Biological Control and Management of <i>Parthenium hysterophorus</i>	27- 29 Sept 2018	23 scientists from 10 countries in Africa, Asia, Australia, Europe	16	7	IOBC Global Working Group on Parthenium Weed	Presentations and discussions on parthenium weed and its biology, impacts, biological control and management

Workshop of the IAPPS Working Group on <i>Tuta absoluta</i>	28 Sept 2018	~50 scientists from 5 countries			IAPPS Working Group on <i>Tuta absoluta</i>	Presentations and discussions on <i>Tuta absoluta</i> and its management options
Field visit for Third International Workshop of the IOBC Working Group on Biological Control and Management of <i>Parthenium hysterophorus</i>	29 Sept 2018	18 scientists from 10 countries, including several young scientists			IOBC Global Working Group on Parthenium Weed	Viewing of parthenium weed infestations around Bengaluru, and biocontrol agent <i>Zygogramma bicolorata</i> , as well as <i>Tuta absoluta</i> research at ICAR – NBAIR

### Suggestions, Recommendations, and/or Follow-up Items:

It is imperative that research on biological control of invasive plants and insects continues, to ensure cost-effective and sustainable management. Attendance at these international working group workshops and conference provided a valuable opportunity for scientists from around the globe to interact and to gain insights into new approaches and methodologies in weed and insect biocontrol. There is cooperation among affected countries for the transfer of technology on the biological control of various invasive plant and insect species; a need exists for further collaborations. For example, interest was expressed by scientists from India (for training and a starter culture of *Smicronyx lutulentus*), and Bangladesh (initiation of biocontrol) for training on biocontrol of parthenium weed (and other invasive plants) in South Africa.

The IOBC Workshops on Parthenium Weed and the International Conference on Biological Control are held every three to four years. Broad global representation at these meetings is important.

The First International Conference on Biological Control covered the disciplines of weed and insect biocontrol. In future, these conferences will be combined with the International Congress of Biological Control (Switzerland, 2021), that was also held for the first time in 2018, as they have overlapping aims to encompass all aspects of biological control.



An article on the IOBC parthenium weed workshop was produced: Strathie, L. and Prakya, S.K. 2018. IOBC Working Group Workshop on Parthenium Weed. *Biocontrol, News and Information* 39 (4): 29N-30N. Summaries of the conference and *Tuta absoluta* Workshop were published by others in this edition of *Biocontrol, News and Information*. Additional articles on the IOBC Parthenium Weed Workshop will be produced in the International Parthenium Network Newsletter and IOBC Global Newsletter in 2019.

Proceedings of the Conference and Workshops are being compiled and will be published in *Biocontrol Science and Technology* journal.

As Convenor of the IOBC Working Group on *Parthenium hysterophorus*, Ms Strathie will continue to attend to related IOBC Working Group matters.

Recommendations from the Third International Workshop of the IOBC Working Group on Biological Control and Management of *Parthenium hysterophorus*:

- (i) All countries where parthenium weed is present are urged to take action to intervene in the spread and impact of the weed, as the current situation will worsen without broader, urgent management interventions.
- (ii) The group recognized the progress made with regional projects such as the IPM Innovation Lab project in East Africa and recommended continued efforts and the introduction of additional agents.
- (iii) Countries and regional projects were encouraged to quantify the spread and economic, social and health impacts of the weed and its introduced agents.
- (iv) The FAO code of conduct should be followed for the import and release of exotic biocontrol agents into countries.
- (v) Countries that have introduced only one or two biocontrol agents were urged to introduce additional agents as a suite of natural enemies are required to achieve desirable levels of control.
- (vi) Damaging agents besides *Z. bicolorata* are known and available. Some agents may be more suitable for certain conditions than others so area-specific selection should be considered.
- (vii) Regional and international collaborative programmes were encouraged for cost effective technology transfer, and donor agencies were urged to support such programmes.

(viii) Countries without biocontrol programmes such as Pakistan, Nepal, Bangladesh, Sri Lanka, Kenya, Swaziland, Mozambique and others were encouraged to initiate programmes. Technical support including capacity building and training should be provided to interested countries to develop biocontrol and other management options.

(ix) The workshop recognised that disturbance and lack of competitive vegetation cover hamper the management of parthenium weed and encouraged the development of improved land management practices.

Recommendations from the Workshop of the IAPPS Working Group on *Tuta absoluta*:

(i) Classical, augmentative and conservation biological control to be encouraged.

(ii) Modelling of *Tuta absoluta* around the world to be continued.

(iii) Pesticide resistance management to be emphasized, including rotation of insecticides with different modes of action.

(iv) Donor agencies to be encouraged to support *Tuta* management research and outreach.

(v) Support to be given for host plant resistance research using a collaborative mode.

(vi) Emphasis to be placed on area-wide management through use of pheromones, SIT/IPM, etc.

(vii) Information on *Tuta* management to be produced in local languages and disseminated.

(viii) Information on *Tuta* on the IPM Innovation Lab website and CABI portal to be consolidated.

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