ANNEX III

Filling the capacity gap for application of DNA technologies in taxonomy

Section 1 - Background on the Training Proposal

Project Title

Capacity building for plant quarantine officers for the rapid identification of insect pests in imported consignments

Preamble

Sri Lanka is considered as one of the biodiversity hot spots in the world. The known species richness is very high, including the density of endemics. Therefore, the government is highly concerned with biodiversity conservation.

However, the international trade activities are very frequent, and Sri Lanka imports a large quantity of goods which need to be inspected for detection of unwanted alien pests. For instance, seeds are imported both for consumption and as planting material, however, unintentional imports of pests are a major issue for Sri Lanka. At present the Plant Quarantine Authorities are solely dependent on morphological data which is not competent enough for the taxonomic identification of pest species. Therefore, necessity of using barcodes in combinations with morphological data will provide a coherent identification capacity.

The NBSAPs developed for Sri Lanka has identified under the Target 2, the importance of having in place, a system to strengthen the capacity of border regulatory authorities in alien pest detection. Further the Strategic Goal B (Reduce the direct pressures on biodiversity and promote sustainable use) set under the Aichi biodiversity targets, the target 9 explains the importance of managing invasive alien species (IAS), specifically the importance of having a system in place for managing the entry, establishment and spread of IAS by 2020.

Project Outline

The training programme will be designed for 20 participants for the duration of 10 days (2 weeks), 8 hours per day (80 hours maximum).

Expected number of instructors are composed of experts in plant quarantine, relevant national legislations and international agreements (CBD, IPPC among others) and DNA technologies for rapid taxonomic identification.

The targeted trainees will be plant quarantine officers, forestry research teams, herbarium management team, customs officers and biodiversity conservation experts on the ground.

The training programme will be structured as follows:

- There will be one site visit to understand management of museum collections;
- 12 hours – Collection of specimens, preservation of specimens, maintenance and information management of a museum collection, sampling for molecular analysis, imaging (80% practical sessions including a visit to museum collection and 20 % presentations);
- 4 hours – Basic understanding of the importance of DNA barcoding, its applications and future developments (such as Next Generation Sequencing) (100% presentations);
- 40 hours – Laboratory safety, DNA extraction, PCR and sequencing (100% Laboratory sessions), hands-on experience provided to all the participants

- 16 hours – Bioinformatics (sequence editing and alignment, analytics, data interpretation and data presentation (100% computer);
- 8 hours – Policy - international treaties and agreements, NBSAPs and Plant Quarantine legislation, New IAS act, Material transfer agreements (100% presentations).

The training will focus on insects and the standard barcode markers for this group will be sequenced (cytochrome oxidase *c* subunit 1, COI). The standardized GTI training package will be implemented.

Post-Project Follow-up Activities

After the training programme is conducted, the effectiveness of the programme will be evaluated based on the capacity demonstrated by the trainees on improved capacity in identification of unknown species, both as part of border regulatory activities, and in the field.

- The number of correct identification incidences needs to be improved compared to the present status;
- The existing laboratory capacity will be upgraded with molecular diagnostic techniques facilitating rapid identification of species, which will facilitate the rapid response in compliance with the NBSAPs;
- The laboratories will be further equipped to provide diagnostic services to other interested parties;
- Setting up new laboratory protocols, and establishing new standard operating procedures for species identification and decision support for regulatory procedures.

Section 2 - Logic Model

Project Objectives

1. To improve the technical capacity in identifying unknown species detected in imported commodities;
2. To support stakeholder institutes to identify species and be a centre for providing DNA barcoding of species;
3. To improve national IAS early warning systems of Sri Lanka by establishing bio-surveillance;
4. To establish checkpoints with trained field officers and a coordination mechanism, including a portal for online data sharing;
5. To build the national reference library of DNA barcodes for agricultural pests;
6. To develop laboratory protocols and standard operating procedures for molecular identification techniques.

Expected Project Outcomes

- A group of technically skilled officers will be established that can use DNA barcoding techniques in border regulatory activities
- A DNA barcode library will be developed for a subset of regulated insects of Sri Lanka, thereby assisting border regulatory activities;
- National pest interception database created with strong support of correct species identification using DNA barcodes, hosted through the National Plant Protection Organization (NPPO);

- The barcode library established through this training event will be developed to provide regional level services, to monitor establishment and spread of quarantine/invasive pests;
- Achieving reduced impact on biodiversity imposed by introduction of new alien species through international trade in long term.

Performance Indicators

- Within the timeframe of the training, the performance will be indicated using photographs, email sharing of presentations and responses to evaluation questionnaires/comments from participants
- Dataset of DNA barcodes for Sri Lankan pests uploaded to BOLD;
- The increase in the number of successful species identifications made at border regulatory activities per year (at present, average of 26 species are identified per year, out of which confirmed identifications are about 7 per year)
- Number of samples analysed per year for the samples submitted by other institutes (it is expected to establish an average of 1000 samples analysed per year);
- Number of accessions in the barcode library (of detected alien pests in imported consignments) per year.

Section 3 - List of Organizers and Facilitators

Lead Organizer: Name	Dr. D. M. J. B. Senanayake
Institution	National Plant Quarantine Service, Sri Lanka
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Co-organizers

Name	Institution	Email
Jayani Nimanthika, Wathukarage	National Plant Quarantine Service, Sri Lanka	jayaninimanthika@gmail.com
Ms. R. H. M. P. Abeykoon	Director (Biodiversity), "Sobadam Piyasa", 416/C/1, Robert Gunawardana Mawatha, Battaramulla, Sri Lanka.	dirbio@environmentmin.gov.lk

Training team members

Name	Institution	Primary Role
Dr. Junko Shimura	Secretariat of the Convention on Biological Diversity	Instructor on the international regulatory framework relevant to invasive alien species
Dr. Adriana Moreira	Secretariat of the International Plant Protection Convention	Instructor on the International Standards for Phytosanitary Measures

Dr. Adriana Radulovici	Biodiversity Institute of Ontario, University of Guelph	Training Instructor
Dr. Siril Wijesundera	Institute of Fundamental Studies, Sri Lanka	Training Instructor
Prof. Buddhi Marambe	University of Peradeniya, Sri Lanka	Training Instructor
Mr. Jagath Gunawardena	Freelance expert	Training Instructor
Ms. Madhuka Chithrapala	National Plant Quarantine Service, Sri Lanka	Event Coordinator
Ms. Ruth Sasini	National Plant Quarantine Service, Sri Lanka	Support staff

The GTI DNA-tech training Instructors

Name	Area of Expertise	Instruction Topic
Dr. Adriana Radulovici	Insect barcoding	DNA Barcoding for fauna (insect taxa)
Dr. Siril Wijesundera	Plant Taxonomy	Morphological identification of plants and use of DNA barcoding for species identification
Prof. Buddhi Marambe	Pests, weeds and invasive alien species	National List of Invasive Weeds and Weed Risk Analysis Protocols
Mr. Jagath Gunawardena	Environmental Law	International treaties and local legislation related regulation of invasive alien plants
Dr. D. M. J. B. Senanayake	Biotechnology	Practical sessions on DNA barcoding and informatics
Ms. W. J. Nimanthika	Molecular Plant Systematics	Practical Sessions on DNA barcoding and informatics in collaboration with the previous instructor and the introduction to Barcode of Life Programme.

Section 4 - Background Information on Facilitators and Participants

Background of Applicants and Instructors

The lead applicant for this programme, Ms. Nimanthika (attached to the NPPO of Sri Lanka) in collaboration with Dr. D. M. J. B. Senanayake who is the IPPC Contact Point for Sri Lanka , establish a DNA barcoding laboratory at NPPO to be initiated in 2018. Ms. Nimanthika has obtained the GTI hands-on training on DNA barcoding in 2016 in support of the Global Taxonomy Initiative of the Convention on Biological Diversity. Dr. Senanayake is a leading molecular biologist, the chairperson of the Biotechnology & Molecular Biology Research Committee in the Sri Lanka Council for Agriculture Research Policy, and has a broad experience in molecular biological research related to agro-biodiversity protection. Mrs. Abeykoon played a major role in developing NBSAPs. She is playing a successful role in implementing various activities related to NBSAPs. Prof. Buddhi Marambe is attached to the University of Peradeniya, eminent scientist who led the development of NBSAPs for Sri Lanka and is the leading scientist who developed the weed risk assessment protocol as well as established the list of invasive plants. Dr. Siril

Wijesundera, who is at present attached to the Institute of Fundamental Studies, is the former Director General of the Department of Botanical Gardens, and eminent scientist, one of the few most senior botanists in Sri Lanka. He is the founder for many biodiversity protection initiatives. Mr. Gunawardena is a senior lawyer (environment law), who supported almost all biodiversity protection initiatives and is at present very active in initiatives related to NBSAPs.

Partners and Stakeholders

National Plant Quarantine Service, being the hosting institute, is supported by the Department of Agriculture. Ministry of Environment and Mahaweli Development, the CBD contact authority will be one of the partners, in overseeing the activities.

Trainees

Trainees will be selected from plant quarantine officers, forestry research teams (Department of Forests), herbarium management teams (National Herbarium), customs officers (Sri Lanka Customs) and related officers on a priority basis through a competitive selection process. Priority will be given for the officers engaged in related aspects, basically regulatory activities related to biodiversity protection and functions addressed by the NBSAPs. A call for application will be made through newspaper advertisements and information brochures disseminated among related institutes in consultation with the CBD National Focal Point.

Trainee Selection Criteria

Almost all the ground level staff engaged in the biodiversity protection activities in Sri Lanka are either diploma holders or Bachelors degree holders. However, there is a large number of NGOs engaged in studies related to biodiversity protection and which support regulatory activities. It is expected that those communities are empowered, therefore the experience and activities they demonstrated in biodiversity conservation and related activities is the basic requirement that the selection of trainees will be performed. The contribution they made on such activities and the applicability of training outcomes in their future activities are considered.

Expected Number of Trainees

20 trainees (equal opportunity for both genders)

Section 5 - Training Venue and Logistics

Hosting Institution

The hosting institute is the National Plant Quarantine Service (NPQS) of the Department of Agriculture, which is now well equipped with a laboratory required for the training. The institute is mandated for border regulatory activities, and provides major relevance with the NBSAPs implementation in Sri Lanka. NPQS is a purely government-owned institute and the financial resources for its functioning are directly provided by the government treasury through the Department of Agriculture. There are four laboratories, Weed Science, Pathology, Entomology and Nematology, who are engaged in this programme. The biotechnology lab, which is a common resource for all the above mentioned technical labs, will be utilized for 2-week programme, and allocation of its resources is approved by the head of the institution (which is one of the partners). Overhead cost will be supported by the institute in agreement with the Director General of Agriculture.

Training Venue

The NPQS is equipped with all the facilities except sequencing facilities. Therefore, it is expected that the entire training (molecular processing up to the PCR products ready for sequencing), all discussions, presentations, collection management and informatics are conducted at the NPQS. In addition, participants will visit National Museum Collections, to study how the collections and the data are managed (trainees will be provided with the transport facility to visit the museum collections).

Specimen collection and preservation, photography and data management will be done at the training venue. Collection techniques will be discussed for all groups investigated at NPQS (insects, nematodes, plants and pathogens considering their applicability in plant quarantine activities).

The training samples will be sequenced by an external institute and, therefore, will be ready after the training. Test data will be used for the bioinformatics session while the real data will be sent to trainees by email and will be used as part of a proficiency test (trainees will need to edit sequences and use public databases for assigning the sequence to a known species).

NPQS is well-equipped with a computer room having 12 computers, a training room with multimedia connectivity and network connection. Software required for image processing data basing, sequence editing etc will be installed prior to the workshop.

Training Activities

Day 1 Policy – International Agreements and related standards and guidance, GTI, NBSAPs and Plant Quarantine legislation, New IAS Act, Material transfer agreements and implications of the Nagoya Protocol;

Day 2-3 Presentations – Basic understanding on DNA barcoding, morphological and molecular approaches, laboratory safety, collection management (visit to National Collections);

Day 4-7 Laboratory training – sample databasing, tissue sampling, DNA extraction, PCR and PCR gel check;

Day 8-9- Informatics (sequence editing, aligning, and analysing), data interpretation and data presentation in a regulatory framework

Day 10 – Discussion on follow-up activities and application of DNA technologies for plant protection and biodiversity conservation. Training evaluation,

Logistics

- Communication – Formal invitations will be sent to relevant stakeholders in consultation with the Biodiversity Secretariat of Sri Lanka;
- Training venue – NPQS. All the training facilities (laboratory space, training room with multimedia facility and computer room equipped with network connection and relevant software) will be provided as in-kind contribution;
- Transportation and accommodation (a nearby facility) for facilitators, instructors and participants (local travels) will be provided. Transport facility for the field visit will be an additional cost (a bus for all the participants);
- Meals will be provided: lunch and coffee breaks at the training venue, breakfast and dinner at the accommodation facility;
- Reagents and other consumables required for the training have to be purchased, sample sequencing will be outsourced to a third party institute;

- Documentation – Cost of printing laboratory manuals, presentation slides and reports.