Biodiversity Challenge Funds Projects
Darwin Initiative, Illegal Wildlife Trade Challenge Fund, and Darwin Plus
Half Year Report

Submission Deadline: 31st October 2023

Project reference	**29-012**
Project title	Protecting biodiversity through biocontrol of papaya mealybug in East Africa
Country(ies)/territory(ies)	Kenya, South Sudan, Uganda
Lead partner	CABI
Partner(s)	Kenya Plant Health Inspectorate Service (KEPHIS), Kenya Agricultural and Livestock Research Organization (KALRO), National Museums of Kenya (NMK), National Agricultural Research Organization (NARO), University of Juba (UoJ)
Project leader	Ivan Rwomushana
Report date and number (e.g. HYR1)	HYR2
Project website/blog/social media	*https://www.cabi.org/projects/biocontrol-of-papaya-mealybug-in-east-africa/*

Outline progress over the last 6 months (April – Sept) against the agreed project implementation timetable

Output 1: The *A. papayae* parasitoid released and naturalized in East Africa for the sustainable biological control of papaya mealybug and protection of native insect biodiversity

In the first half of Year 2, several mass releases of the parasitoid were undertaken in three counties of Kilifi, Mombasa and Kwale in Kenya against the papaya mealybug (PMB) pest. These efforts have reached over 200 papaya farms with about a million parasitoids released. At the farm level, the establishment of parasitoids has been facilitated by the construction of Natural Enemy Field Reservoirs (NEFRs). The project has successfully erected a total of 22 NEFR prototypes across the three Kenyan counties, alongside several others managed by local farmers. Furthermore, an extension of the release permit has been authorized by the Kenya Standing Technical Committee on Imports and Exports (KSTCIE) for an additional four counties, in addition to the original three coastal counties.

In Uganda, the National Task Force (NTF) authorized the release of the parasitoid and the rearing efforts and the import permit was issued. Consequently, the quarantine facility at NARO, Kawanda, was refurbished, and a starter colony of 2,000 parasitoids imported from CABI's biocontrol laboratories in Kenya. At least 1,000 of these were released directly in the field and the rest of the batch is slated to undergo two generations of mass rearing, with the ultimate goal of releasing them on a large scale into papaya fields in Uganda.

In South Sudan, field surveys were undertaken to identify additional release and learning sites within Central, Western, and Eastern Equatoria states. The primary objective was to identify farms suitable for biodiversity assessments and the initial release of parasitoids. This led to the identification of purely organic farms, intensively sprayed farms, and farms located on islands, offering valuable opportunities for counterfactual studies. Additionally, biodiversity assessments were performed at the identified learning sites, and data processing and analysis are currently

underway at the NMK. With regard to the checklist of insect and plant diversity, baseline studies have been fully compiled and reported for both Kenya and Uganda.

Output 2. Capacity of crop inspectors, small-holder farmers, extension providers and the general public enhanced on *in situ* management of *A. papayae* on sustainable management of papaya mealybug and biodiversity conservation.
Three technicians from NARO, were trained at CABI Kenya in PMB biocontrol and quarantine procedures, and they will play a pivotal role in managing the quarantine facility and maintaining the parasitoids. Concurrently, in South Sudan, the project made significant strides in building the capacity of extension staff in the country through comprehensive training on PMB identification and symptoms, and management with strong emphasis on biocontrol, NEFRS and in-situ production and conservation. Notably, training sessions for ten extension staff from the central state have already been successfully conducted. Furthermore, plans are in place to ensure the completion of training for the remaining extension staff and farmers and introduction of the parasitoid. In Kenya, an additional 83 farmers (10 females) from the three coastal counties were also trained on the control of papaya mealybug using the parasitoid prior to release on the farms.

Output 3: Scientific evidence-base generated on impacts of classical biological control of *A. papayae* on livelihoods and native insect biodiversity.
Post-parasitoid release surveys show that the parasitoid has become established at Coastal Kenya with parasitism rates of up to 53% after one release and nearly 72% after the second release. Nearly 85% of farmers view the release of the biological control agent to manage the PMB positively, and most farmers (94%) support the biological control programme for the pest in their community. Within one year following the parasitoid release, there has been very minimal incidence of PMB infestations at release sites, which correlates with an increase in papaya production and income and a decrease in average spending on chemical pesticides. Farmers also reported to have stopped nearly all pesticide use because the agent was working and had started replanting previously cut papaya orchards. There is also increased awareness about biological control and biodiversity, and farmers who had heard of biological control increased to 62%. Ecological niche modelling for the parasitoid has also shown fair to excellent probability for establishment at the coastal areas of Kenya, suggesting the agent will establish successfully.

Within the reporting period, we successfully developed and completed checklists for both Kenya and Uganda to understand the existing biodiversity and the potential ecological impacts associated with routine farming practices and the biological control strategy. In Kenya, the survey identified 211 invertebrate species from twelve different orders. Notably, 73% of these species were found to be beneficial to the ecosystem, with pollinators accounting for 33.65% and parasitoids making up 4.27% of the recorded species In Uganda, the survey documented 170 invertebrate species, spanning eleven orders. Of these, 68.82% were identified as beneficial to the ecosystem, with pollinators representing 30.7% and parasitoids constituting 28%. Additionally, we completed the manuscript on the classical biocontrol of Papaya Mealybug (PMB) in Kenya and submitted to the Crop Protection Journal. This publication represents a significant milestone in sharing our research and insights with the wider scientific community.

Output 4. Information on classical biocontrol of papaya mealybug and conservation biocontrol approaches to support natural pest regulation and better management of biodiversity packaged and disseminated to increase farmer knowledge and technology adoption
A dedicated project webpage has been developed, aimed at consolidating the project's progress and achievements to date. The page can be accessed using the following link: https://www.cabi.org/projects/biocontrol-of-papaya-mealybug-in-east-africa/. This webpage offers a concise overview of the project and will remain dynamic, and continuously updated to reflect the most recent status, completed activities, and any noteworthy success stories that emerge throughout the project's implementation. To raise awareness about the biocontrol program and the project, a video was also produced featuring farmers in Kenya.

Other administrative activities in the half-year.

A planning and review meeting was held in September 2023 to take stock of Year one. The specific objectives were: (i). Peer review of the activities implemented in year 1; (ii). Review of the feedback from DEFRA on the year 1 report and activities; (iii) Workplan and budget phasing for Year 2 and (iv) Operations including contracting, procurement and fiduciary responsibilities of partners. During this meeting, key steps forward were agreed encompassing various critical elements, notably the revision and updating of the project log frame, and the development of work plans for various partners. Additionally, the sub-grant agreement between CABI and NARO was finally signed allowing for the disbursement of budget allocations to facilitate activities.
2. Give details of any notable problems or unexpected developments/lessons learnt that the project has encountered over the last 6 months. Explain what impact these could have on the project and whether the changes will affect the budget and timetable of project activities.
Majority of activities are underway, and the project is on course to achieving the targets in Kenya. In Uganda, acquiring the import permit was delayed affecting the timely establishment of the parasitoid culture. However, with the training of technical staff on various aspects of PMB biocontrol and quarantine procedures and the initiation of the culture, it is expected that time will be recovered. For South Sudan, the initial plan to introduce the parasitoid will require re-assessment during Year 2 due to fewer number of organised farms because of farmers cutting down majority of infested trees. Consequently, a delay in the introduction and field release of the parasitoid is envisaged. However, with the import permit already acquired, introduction of the parasitoid into quarantine for rearing and training is expected in the short term and thus the refurbishment of a rearing facility and training of the technical personnel will be required.
3. Have any of these issues been discussed with NIRAS and if so, have changes been made to the original agreement?
Discussed with NIRAS: No/Delays don't pose risk to overall delivery
Received confirmation of change acceptance No/Logframe to be resubmitted
Change request reference if known:

4a. Please confirm your actual spend in this financial year to date (i.e. from 1 April 2023 – 30 September 2023) **Actual spend:** £[redacted] **4b. Do you currently expect to have any significant (e.g. more than £5,000) underspend in your budget for this financial year (ending 31 March 2024)?** **Yes** ☐ **No** ☑ Estimated underspend: £
4c. If yes, then you need to consider your project budget needs carefully. Please remember that any funds agreed for this financial year are only available to the project in this financial year.
5. Are there any other issues you wish to raise relating to the project or to BCF management, monitoring, or financial procedures?
No.

Please send your **completed report by email** to BCF-Reports@niras.com. The report should be between 2-3 pages maximum. **Please state your project reference number, followed by the specific fund in the header of your email message e.g. Subject: 29-001 Darwin Initiative Half Year Report**