Neglected insect diversity in the Lost World of Southwest China: Darwin wasps (Hymenoptera, Ichneumonidae) and beetles (Coleoptera)

Programme:BIFA
Project ID: BIFA6_006
Project lead organization: Xishuangbanna Tropical Botanical Garden, CAS Key Laboratory of Tropical Forest Ecology
Project implementation period:1/9/2021 - 28/2/2023
Report approved: 21/6/2022

Narrative Midterm report

Executive Summary

As we proposed at the beginning, up today, the project (BIFA6_006) has managed to achieve some of the core activities included in the project. Such as publishing one data set, sample sorting, taxonomic identification using morphology and part of the digitizing of the data for both beetles (Coleoptera, Scarabaeidae and other families) and Darwin wasps (Hymenoptera, Ichneumonidae) from Yunnan province of China. Darwin Wasps collection of our laboratory (IEHBR) is sufficient sampling efforts we made since 2018. We digitize part of the collection and prepared sampling efforts datasets. We made photos of representative specimens of some species. Our sampling, sorting, identification and digitization protocols imply regular records accounting results. Also, we have managed to publish two data sets so far from the project. Also, we managed to hold the workshop on “Beetle taxonomy, sequencing and ecology” incorporate with Advanced Field Course in Ecology and Conservation-XTBG by Nakamura (assist by Nimalrathna). Also, two members of the project joined the BIFA capacity building workshop, and one participant received the certification for the workshop. At the beginning of each activity, the team gathered online and make sure the team understood the activity and the procedure and at the end, the team gathered and evaluate the activity to ensure the team has managed to achieve the expected quality of the work. In addition, the project has its own “Slack” group to discuss issues and monitor ongoing activities.

Progress against milestones

Has your project published at least one dataset through GBIF.org?: Yes

Dataset published:

Dataset	DOI
Coleoptera (beetles) from tropical forests (Bubeng), Yunnan, China_BIFA6_006	0198a33e-7b7c-430d-86fa-6f429da2e7f7

Has at least one member of your project team received certification following the BIFA capacity enhancement workshop?: Yes

Name of the workshop participant: Thilina Sudarshana Nimalrathna

Certification obtained: Basic Badge

Report on Activities

Activity progress summary

Imaging- Photos of representative specimens of each species/morphospecies will be taken with photosystems. The collections are already existing (IEHBR - Ichneumonidae, XTBG - Coleoptera), identified and curated.

Current progress- Photographing representative specimens for each species has begun. Yet, due to the larger number of species available, the proposed activity couldn't able to finish before the interim report. However, the activity is currently ongoing and is planned to finalize before the end of August 2022.

Sorting dung beetles Dung beetle survey in tropical forests and rubber plantations (Bubeng and Menglun). Sorting specimens to higher taxa and morphospecies.

Current progress- The activity manages to finish before the mid report. Currently, specimens collected from these locations have been sorted down to morphospecies and ready to identify into proper taxonomic categories with the help of a taxonomist and using sequence data derived from collected specimens.

BIFA Workshop The project team will attend the BIFA Capacity Enhancement Workshop.

Current progress- Two members from the project took part in the capacity enhancement work workshop and one has successfully completed the workshop with a "Basic badge".

Higher taxa sorting and morphospecies identification Identifying specimens to higher taxa such as family and genus and then giving morphospecies numbers for ecological and biodiversity studies. PI will travel to BIZ to get taxonomist expertise for beetle identification. Darwin wasps will be identified at IEHBR by Prof. Alexey Reshchikov.

Current progress- As we planned, beetle data sets and Darwin wasp data sets are able to identify at the family or subfamily level. However, the dung beetle data set is unable to identify into the fine taxonomic level (genus level or species level). Due to the pandemic situation, the travel restriction makes it difficult for project team members to travel to BIZ and get expert helps for the identification. However, current travel restrictions are getting easy so we may be able to manage to visit BIZ to finalize the identification. If not, we are planning to post some representative specimens to the BIZ for identification. Somehow, we are planning to finalize the activity at the end of July 2022. Also, will use sequence data also to identify species at to fine taxonomy level.

Data entry Data will be continuously filled into the datasets from identified collections. Beetle collection (XTBG) and Darwin wasps collection (IEHBR) are already existing and well-curated. The dung beetle collection (XTBG) is partly shaped and will be filled with fresh specimens after the dung beetle survey in the tropical forests will be done.

Current progress- The data entry currently has been finished as we planned. The entered data includes Beetle collection (XTBG) and Darwin wasps collection (IEHBR) from preserved specimens. Also, partially collected and curated data for dung beetle collection (XTBG) was also completed along with finalizing beetle sorting from new collections.

DNA sequencing In case of difficulties in identification using morphological characters, sexual dimorphism, COI genes of freshly collected specimens (dung beetles and Darwin wasps) will be sequenced. The sequences will be uploaded to BOLDSYSTEMS

Current progress- Currently we have extracted dung beetle legs from fresh specimens (~240) to extract DNA for species identification and verify the identification of species that show sexual or other colour variations. Currently samples we have sent to the company for sequencing and waiting for the results. We estimated that the final results will arrive in mid-June 2022, and we may be able to manage the sequence data at the end of June 2022.

First evaluation and monitoring All project participants will get together at XTBG to check the progress and discuss any issues arising during the key period of specimen sorting, data entry, DNA sequencing and higher taxonomic identification. The evaluation will be done in XTBG.

Current progress- The project team members couldn't be able to physically meet at XTBG as we planned due to the current pandemic situation. However, we managed to gather the team online and discussed issues raised and prepared the final evaluation for the Interim report

Sequence data entry Taxonomic and DNA information of the specimens (for freshly collected beetles and for Darwin wasps) will be uploaded into the system.

Current progress- Sample separation and extraction of legs from freshly collected beetles have been

finalized already and the samples have been sent to the company for sequencing. We estimated that the final results will arrive in mid-June 2022, and we may be able to manage the sequence data at the end of June 2022.

Interim report preparation PI and project partners will prepare the interim report to evaluate the sorting, identification, and digitizing progress. The report will prepare remotely in collaboration with the team

Current progress- As we planned earlier, we gathered the team (via zoom) under the supervision of the PI. There we have gathered the current progress in preparing the data sets and publishing them before the Interim report. Also, the main members of the team divide responsibility to prepare the progress issues and the backup plans for the delaying datasets. Final Interim report prepared based on the information received from team members.

We planned to hold the workshop on “Beetle taxonomy, sequencing and ecology” incorporate with Advanced Field Course in Ecology and Conservation-XTBG by Nakamura (assist by Nimalrathna) in 2022. However, we managed to link that for the 2021 workshop. This allowed us to finish part of this activity before the time we planned to do.

Due to the Covid-19 pandemic, Alexey Reshchikov did not work with the Darwin Wasps collection physically but should base his identification on photos. Photos were made by Alexey Reshchikov’s (IEHBR) team for every single specimen of some sampling efforts and uploaded to the institution's server. All specimens digitized were sorted by higher taxa successfully. Data of Darwin Wasps were filled into the datasets from identified specimens photos. DNA barcoding of Darwin Wasps specimens was postponed due to travel restrictions and difficulties in sending insect samples within China during the Covid-19 pandemic. We plan to reschedule this activity and use additional specimens that are available for our project team at the XTBG. It should be done at the XTBG on new dates planned in September 2022 together with an identification workshop that also was delayed due to travel restrictions. In case of further difficulties, we plan to perform the online workshop.

Completed activities

Activity name: BIFA Workshop

Description: The project team will attend for the BIFA Capacity Enhancement Workshop.
Start Date - End Date: 25/10/2021 - 12/11/2021
Verification Sources: I have attached the link to the awarded badge as a proof for the activity. https://openbadgefactory.com/v1/assertion/2311680acc4537a26222d530899f9cba60b80006

Activity name: Sorting dung beetles

Description: Dung beetle survey in tropical forest and rubber plantations (Bubeng and Menglun). Sorting specimens to higher taxa and morphospecies. Species of dung beetles identified will be ground of relevant GBIF dataset.
Start Date - End Date: 1/4/2021 - 30/4/2022
Verification Sources: See the attachment (Appendix_02_dung_beetle). The attachment includes number of morpho species recorded in each site and their relative abundance as a proof foe the activity.

Activity name: DNA sequencing

Description: In case of difficulties in identification using morphological characters, sexual dimorphism, COI genes of freshly collected specimens (dung beetles and Darwin wasps) will be sequenced. The sequences will be uploaded to BOLDSYSTEMS. GBIF datasets based on DNA-barcoding
Start Date - End Date: 1/3/2022 - 20/5/2022
Verification Sources: Sample has been send to the company. Sequencing haven't finalise yet

Activity name: Beetle taxonomy, sequencing and ecology workshop

Description: The first beetle identification training program incorporate with Advance Field Course in Ecology and Conservation -XTBG by Nakamura and Nimalrathna. This will give basic understanding about identification taxonomy, sequencing and ecology of beetles for post graduate students.
Start Date - End Date: 5/11/2021 - 9/11/2021
Verification Sources: See the Attachment_01_Workshiop_images

Report on Deliverables

Deliverables progress summary

Coleoptera (beetles) from tropical forest (Bubeng) already published through GBIF. Rest of the Coleoptera (beetles) sets have been completely digitized and identified in the collection at family and subfamily level. Currently the rest of the data sets are preparing according to Darwin-Core standards to publish via GBIF. With the current speed of work, we assume we may be able to complete publishing data sets before preparing the final report.
• Coleoptera (beetles) from sub-tropical forest (Ailao Shan)
• Coleoptera (beetles) from sub-alpine forest (Lijiang)
Identification of dung beetle data set has been delay due to travel restrictions to visit for taxonomic experts as well as visit to museum specimens. Currently sequence data for dung beetle data is with the company. When sequence data arrive, we will identify tehm in to species level before end of 2022.
• Scarabaeinae (Dung beetle) from tropical forest (Bubeng)
• Scarabaeinae (Dung beetle) from tropical forest (Menglun)
• Scarabaeinae (Dung beetle) DNA sequences

Following data sets have been delayed due to pandemic caused absence of Alexey Reshchikov in IEHBR. We reschedule this work on August using stab photos sorting system we developed working with collection online.
• DarwinWasps (Hymenoptera, Ichneumonidae) from sub-alpine forests Mt. Baima (Diqing)
• DarwinWasps (Hymenoptera, Ichneumonidae) from sub-alpine forests Mt. Lasha (Lanping)
Specimens of 147 year/traps sampling efforts involved. Dataset should be added later this year (see delay explanation above).
• DarwinWasps (Hymenoptera, Ichneumonidae) from sub-alpine forests Mt. Cang (Dali)
Specimens of 137 year/traps sampling efforts involved. Dataset includes 116 eventIDs to date. The rest of material should be added later this year (see delay explanation above).
• DarwinWasps (Hymenoptera, Ichneumonidae) DNA sequences-01
a. Dataset Description and Scope: DNA sequences of COI genes belongs to Ichneumonidae collected from Mt. Baima (Diqing)
DNA barcoding of Darwin Wasps specimens (below mentioned datasets) was postponed due to travel restrictions and difficulties of sending insects samples within China during Covid-19 pandemic. We plan to reschedule this activity and use additional specimens that are available for our project team at the XTBG. It should be done at the XTBG on new dates planed in September 2022 together with identification workshop that also was delayed due to travel restrictions.
• DarwinWasps (Hymenoptera, Ichneumonidae) DNA sequences-01
• DarwinWasps (Hymenoptera, Ichneumonidae) DNA sequences-02
• DarwinWasps (Hymenoptera, Ichneumonidae) DNA sequences-03

Progress towards deliverables

Title: Coleoptera (beetles) from tropical forest (Bubeng)

Type: Dataset
Status update: The dataset already published
Dataset scope: Coleoptera beetles collected from five 20m x 20m five sampling points separated 150m each with in three elevational transects (200m interval) starting at 800m from tropical forest.
Expected number of records: 1200
Data holder: AKIHIRO NAKAMURA
Data host institution: Xishuangbanna Tropical botanical garden
Sampling method: Litter extraction, Bark spray, Malaise traps, Pitfall traps, Hand collection.
% complete: 100
DOI: 0198a33e-7b7c-430d-86fa-6f429da2e7f7
Expected date of publication:

Title: Coleoptera (beetles) from sub-tropical forest (Ailao Shan)

Type: Dataset
Status update: Currently fully digitized.
Dataset scope: Coleoptera beetles collected from five 20m x 20m five sampling points separated 150m each with in three elevational transects (200m interval) starting at 2000m from sub-tropical forest.
Expected number of records: 4000
Data holder: AKIHIRO NAKAMURA
Data host institution: Xishuangbanna Tropical botanical garden
Sampling method: Litter extraction, Bark spray, Malaise traps, Pitfall traps,
% complete: 60
DOI:
Expected date of publication: 2022-07-01

Title: Coleoptera (beetles) from sub-alpine forest (Lijiang)

Type: Dataset
Status update: Currently fully digitized.
Dataset scope: Coleoptera beetles collected from five 20m x 20m five sampling points separated 150m each with in three elevational transects (200m interval) starting at 3200m from sub-alpine forest.
Expected number of records: 2000
Data holder: AKIHIRO NAKAMURA
Data host institution: Xishuangbanna Tropical Botanical Garden
Sampling method: Litter extraction, Bark spray, Malaise traps, Pitfall traps.
% complete: 60
DOI:
Expected date of publication: 2022-06-30

Title: Scarabaeinae (Dung beetle) from tropical forest (Bubeng)

Type: Dataset
Status update: Currently fully digitized. Species have been identify according to morph species. Now waiting until the sequence data arrive to identify them into species level.
Dataset scope: Scarabaeinae beetles collected from 100mx100m five sampling plots separated minimum 200m each from tropical forest.
Expected number of records: 1000
Data holder: Thilina Nimalrathna
Data host institution: Xishuangbanna Tropical Botanical Garden
Sampling method: Baited (with human feces) pitfall trap for rain and dry season.
% complete: 70
DOI:
Expected date of publication: 2022-08-01

Title: Scarabaeinae (Dung beetle) from tropical forest (Menglun)

Type: Dataset
Status update: Currently fully digitized. Species have been identify according to morph species. Now waiting until the sequence data arrive to identify them into species level.
Dataset scope: Scarabaeinae beetles collected from 100mx100m five sampling plots separated minimum 200m each from tropical forest.
Expected number of records: 1000
Data holder: Thilina Nimalrathna
Data host institution: Xishuangbanna Tropical Botanical Garden
Sampling method: Baited (with human feces) pitfall trap for rain and dry season.
% complete: 70
DOI:
Expected date of publication: 2022-09-30

Title: Scarabaeinae (Dung beetle) DNA sequences

Type: Dataset
Status update: The extracted body parts for sequencing now is with the company. Waiting for the final sequencing results.
Dataset scope: DNA sequences of COI genes belongs to Scarabaeinae beetles collected from two tropical forests
Expected number of records: 230
Data holder: Thilina Nimalrathna
Data host institution: Xishuangbanna Tropical Botanical Garden
Sampling method: DNA barcoding
% complete: 50
DOI:
Expected date of publication: 2022-06-15

Title: DarwinWasps (Hymenoptera, Ichneumonidae) from sub-alpine forests Mt. Baima (Diqing)

Type: Dataset
Status update: Delayed due to pandemic caused absence of Alexey Reshchikov in IEHBR. We reschedule this work on August using stab photos sorting system we developed working with collection online
Dataset scope: Darwin wasps collected from four sampling sites separated by elevation equal 400m asl starting at 2100m.

Expected number of records: 1500
Data holder: Alexey Reshchikov
Data host institution: Institute of Eastern-Himalaya Biodiversity Research
Sampling method: Malaise traps
% complete: 40
DOI:
Expected date of publication: 2022-10-31

Title: DarwinWasps (Hymenoptera, Ichneumonidae) from sub-alpine forests Mt. Lasha (Lanping)

Type: Dataset
Status update: Specimens of 147 year/traps sampling efforts involved. Dataset should be added later this year . Delayed due to pandemic caused absence of Alexey Reshchikov in IEHBR. We reschedule this work on August using stab photos sorting system we developed working with collection online
Dataset scope: Darwin wasps collected from four sampling sites separated by elevation equal 400m asl starting at 2500m.
Expected number of records: 2000
Data holder: Alexey Reshchikov
Data host institution: Institute of Eastern-Himalaya Biodiversity Research
Sampling method: Malaise traps
% complete: 40
DOI:
Expected date of publication: 2022-09-30

Title: DarwinWasps (Hymenoptera, Ichneumonidae) from sub-alpine forests Mt. Cang (Dali)

Type: Dataset
Status update: Specimens of 137 year/traps sampling efforts involved. Dataset includes 116 eventIDs to date. The rest of material should be added later this year. Delayed due to pandemic caused absence of Alexey Reshchikov in IEHBR. We reschedule this work on August using stab photos sorting system we developed working with collection online.
Dataset scope: Darwin wasps collected from four sampling sites separated by elevation equal 400m asl starting at 2100m.
Expected number of records: 1500
Data holder: Alexey Reshchikov
Data host institution: Institute of Eastern-Himalaya Biodiversity Research
Sampling method: Malaise traps
% complete: 40
DOI:
Expected date of publication: 2022-11-30

Title: DarwinWasps (Hymenoptera, Ichneumonidae) DNA sequences-01, 02, 03

Type: Dataset
Status update: DNA barcoding of Darwin Wasps specimens was postponed due to travel restrictions and difficulties of sending insects samples within China during Covid-19 pandemic. We plan to reschedule this activity and use additional specimens that are available for our project team at the XTBG.
Dataset scope: DNA sequences of COI genes belongs to Ichneumonidae collected from Mt. Baima (Diqing)
Expected number of records: 300
Data holder: Alexey Reshchikov
Data host institution: Institute of Eastern-Himalaya Biodiversity Research
Sampling method: DNA barcoding
% complete: 10
DOI:
Expected date of publication: 2022-12-15

Communications and visibility

First, when the project page has been created by GBIF, we share our project webpage via Facebook and WeChat (a widely used social media platform in China). This could be able to get more attention from different parties engaged in academia regarding the data we are aiming to publish as well as the GBIF-BIFA grant. Also, the 8th International Canopy Conference in 2021 was hosted by Prof, Nakamura online (due to the pandemic) and we were able to share among participants about our

contributions to the GBIF community. After we published our first two data sets (up to date), we shared access links to published data sets via social media, so the availability of the data set was spread among the scientific community. In addition, this year “Advance Field Course Ecology and Conservation” was successfully held at XTBG and Prof, Nakamura has conducted an insect sampling and identification workshop (in the collaboration with our BIFA project). This helped to capture the wide range of young scientists’ attention to our project. The combination of these efforts made a huge impact to promote our dataset among the scientific community.

Monitoring and evaluation

Monitoring and evaluation findings

At the beginning of the project, some samples related with the datasets haven’t finalized sorting from the collection. Before the midterm report, we managed to finish sorting and identify species based on the morphology for sorted specimens. Until now, we managed to digitize all the undigitized and partially digitized occurrence records. But, due to pandemic situation couldn’t not able to get expert support to identify dung beetle into species level which we planned to finalize before the midterm report. However, we able to come up with a backup plan to send some representative samples to experts via post and identify beetles.
During monitoring activities, we could not meet at the XTBG to check the progress, but we regularly met in Zoom and discussed issues we faced during period of specimen sorting, data entry, problems with DNA sequencing and species identification. The main issue appeared delay with DNA sequencing of specimens of Darwin wasps’ collection. In condition of travel restrictions and shipping material we came to conclusion additional material for Darwin wasps DNA sequencing will be obtained from Xishuangbanna fresh samples with selected species sorted. The issue with Darwin wasps’ identification was solved by introduction of the system of digital collection when every single specimen was digitized that made higher taxa identification possible.

Impact of COVID-19 pandemic on project implementation

Covid-19 pandemic impacted to finalize of some of the datasets promised to deliver via GBIF. The dung beetle data set is planned to be finalized including identifying individuals at to species level. However, travel restrictions due to the pandemic situation, team members could not able to travel to BIZ to check museum specimens and get expert opinions for identification. However, current travel restrictions are getting easy so we may be able to manage to visit BIZ to finalize the identification. If not, we are planning to post some representative specimens to the BIZ for identification. Due to the Covid-19 pandemic, Alexey Reshchikov did not work with the Darwin Wasps collection physically but should base his identification on photos. Photos were made by Alexey Reshchikov’s (IEHBR) team for every single specimen of some sampling efforts and uploaded to the institution's server. DNA barcoding of Darwin Wasps specimens was postponed due to travel restrictions and difficulties in sending insect samples within China during the Covid-19 pandemic. We plan to reschedule this activity and use additional specimens that are available for our project team at the XTBG. It should be done at the XTBG on new dates planned in September 2022 together with an identification workshop that also was delayed due to travel restrictions. In case of further difficulties, we plan to perform the online workshop.

GBIF leads the Biodiversity Information Fund for Asia (BIFA), a programme funded by the Ministry of the Environment, Government of Japan. The programme provides supplementary support for activities addressing the needs of regional researchers and policymakers through mobilization and use of biodiversity data.