

Project Update: April 2017

Through initial interactions with villagers of Xingxing we realised that they were sensitive to the issue of *Bhutanitis* collection and unwilling to directly discuss it; we decided to take an “indirect interview approach” by encouraging villagers to join our mark--recapture effort to study the *Bhutanitis* population, and casually conversing with them during mark recapture about their experience in *Bhutanitis* collection. We also focused on conversing with a wide range of villagers in daily encounters to have a basic understanding of their socio-economic status without the formality of a conservation awareness survey. We decided that immediate workshop-style information distribution would be inappropriate and ineffective; rather, in this first stage we focused on a basic lepidoptera population survey involving villagers and tried to think about conservation problems from Xingxing villagers’ perspective. Zhengyang stayed in Xingxing from May to August 2016 to understand the role *Bhutanitis* collection played in villager’s lives as well as conducting basic environmental survey involving many interested local conservationists.

Natural Resource Based Village Income

Xingxing village is located at the entrance of Yanzi Valley, which extends from one of the five existing glaciers of Mt.Gongga. The village population is 600, including both Han and Yi ethnicities. We investigated the current income source of individual households. Each household has about 1000 m² of crop field, which are planted with rapeseed, Chinese cabbage, corn, string beans or potato. Each household often has about 20 chickens and a few pigs. A few households have less vegetable fields but ranch their cattle and pigs in the mountain valley.

The majority of the Xingxing villagers’ income does not come from farming but rather from collection of a wide range of plant/animal products from the mountain valleys in the spring and summer such as Yartsagunbu, Matsutake, *Paris polyphylla*, *Gastrodia elata*, *Fritillaria* spp., etc. Collecting activities are labour intensive and sometimes dangerous; harvest varies from year to year because of changing natural conditions such as precipitation and temperature. Product price depends on demand from the market. Each natural product has its own middleman coming from nearby towns of Moxi or Kangding. *Bhutanitis* butterfly trade has its own middleman. Villagers collect from April to June and wait for a few middlemen coming in late August. From autumn to winter, younger villagers often leave their village to search for construction jobs in other townships, from as close as Moxi and Kangding, to as far as Tagong, Litang, Ganzi and even Chengdu. Local commerce and tourism--related employment is sparse. Although the village is located at the entrance of Yanzi valley, a national nature reserve, local villagers have not benefited from tourism (with the exception that roads built for tourist buses give villagers better access for natural resource collection in the mountains). Tourists prefer to stay in Moxi, the major town 10 km away from Xingxing. The nature reserve had employed a few villagers as guards for the reserve, but villagers gave up since the pay is minimum compared with what they could earn from collecting natural products.

In general, the elder generation (>60 y) prefers to take care of livestock and field crops in summer and rest in the winter; the middle-aged generation (30-50 y) prefer collecting natural products from mountains, having learnt how to identify them from the older generations; the

youngest generation in the village prefer seeking for opportunities outside of their own village.



Figure 1. A hilltop habitat of *Bhutanitis*.

Collecting Pressure for *Bhutanitis*

Middlemen pay less than \$1 for each *Bhutanitis* collected. In a good season about 200-300 samples are collected per person. The pay for *Bhutanitis* collection is much less than Yartsagunbu collection, from which people can earn around \$30-50 daily. On a good day, a *Bhutanitis* catcher collects up to 50 individuals, but average daily yield is about 10. Although collecting period is as long as 2 months, the amount of days suitable for collecting (sunny with interval clouds) is about half of that time. Villagers understand that collecting is illegal by local regulations; local forestry agencies have banned collection. As a result of the availability of other economically beneficial, legal income alternatives, especially recently, the trade of *Bhutanitis* has been limited to a few households that have maintained long-term ties with dealers. We have met only about five active collectors in the village. They are all older people who have experience identifying *Bhutanitis* habitat and understand the seasonality of butterflies; they prefer *Bhutanitis* collection because it is less labour intensive compared with activities such as Yartsagunbu collection. Another reason for collecting is maintaining good ties with local butterfly dealers.

Villagers with butterfly collecting experience are knowledgeable at identifying *Bhutanitis* habitats. The valley of Yanzi rises from 2000 m to the glacier terminus of Mt Gongga at 4000 m. *Bhutanitis* is most abundant at the temperate forest along the valley from 2600 to 2800 m, although individuals can occasionally drift to lower altitude. Along several hilltops from 2600 to 2800 m, patches of vegetation have been cleared out for cattle herding. These patches are often on relatively flat hilltops. Villagers with collecting experience are sharp at spotting *Bhutanitis*

from as far as 50 m. An abundance of *Byasa* butterfly also occur in the same habitat. *Bhutanitis* are often seen hill-topping, resting on a vegetation, visiting nectaring plants or engaged in territorial fighting with another male. Since butterfly dealers only pay for samples with near perfect wing condition, any samples collected that have damaged wings are killed and disposed by village collectors to avoid the waste of time in recapturing the same sample. At the end of the season, only about one out of five individuals caught were collected.



Figure 2. Left: hostplant of *Bhutanitis*. Right: one of the nectar plants of *Bhutanitis*.

***Bhutanitis* Mark-recapture**

During our survey we were amazed by the abundance of *Bhutanitis* in the region. During our field survey, on average we marked 20 individual *Bhutanitis* daily (with an estimated 30% capture rate of all seen *Bhutanitis*). In a 3-day survey at two hilltops less than 1 km apart, we marked 64 different individuals (13 females) with 15 recaptures. This capture rate is in agreement with village collectors' reported yield. Detailed population data analysis is in progress.

We have not spotted any individuals outside the 2600-2800 m range, with the exception of a few stragglers. *Bhutanitis* distribution reflects the range of its *Aristolochia* hostplant, which we only find above 2600 m, and gradually become less abundant above 2800 m, as they become replaced by more cold-tolerant cloud forest species. *Aristolochia* is abundant in this small altitudinal range.

We do not know of any other *Bhutanitis* population in other parallel valleys at Mt Gongga, but similar habitats with *Aristolochia* do exist.

Local villagers' understanding of the butterfly is more focused on the butterfly's distribution and seasonality than other aspects of its biology. The particular villagers with experience collecting *Bhutanitis*: (1) have a very good understanding of the seasonality of *B.thaidina* and *B.mansfieldi*, but (2) have difficulty distinguishing between males and females, and (3) have little understanding of the butterflies' lifecycle and dependent relationship with *Aristolochia* hostplant.

Our lack of knowledge about the hostplant is alarming, since this particular aspect of the butterfly's biology is highly relevant to its persistence in a habitat. From literature review, we found that there are only rare cases in which butterflies are driven to extinction because of collection pressure (and from our assessment, current level of collecting pressure is not likely to drive *Bhutanitis* population to extinction), but the disturbance of habitat can cause wholesale population extinction. Local stakeholders will benefit by thinking about a single species in association with the environmental interactions and be prepared to defend against environmental threats that do not seem to have direct impact on natural products of their economic concern. The same lesson applies to understanding the connection between alpine grassland and the production of Yartsagunbu, or between soil quality and production of Matsutake. Many older collectors recall that *Bhutanitis* was more abundant when collection started in the early 1990s and when there were more collectors. A drop in the butterfly population and stricter forestry regulation enforcement, as well as the existence of more profitable alternatives led to a drop in collection pressure. Outside the few collectors, most of the people in the village have heard of *Bhutanitis* and are aware of policies forbidding its collection. We plan to quantify these results in a more in-depth survey this field season.

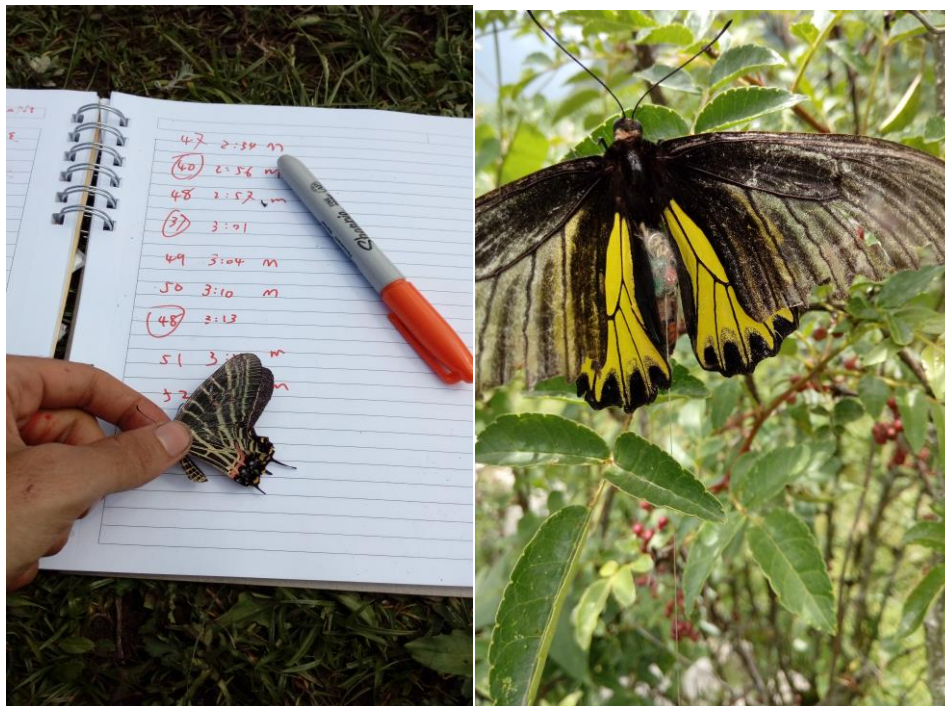


Figure 3. Left: Mark recapture of *Bhutanitis*. Right: *Troides* with transmitter attached.

Lepidoptera Survey

We have surveyed the Lepidoptera diversity from August 13th to 22nd along an altitudinal transect at the foothill of Mt Gongga, from 2000 to 3800 m, using automated UV light traps. Four sampling sites were selected from montane agricultural fields (2000 m), through cloud forest (2600 m and 3200 m, to grassland above timber line (3800 m). A total of 379 individuals were collected. Interested villagers took part in sorting samples into 151 morpho-species and the curated collection is deposited as a local reference. Among the 151 morpho-species, 109 were successfully barcoded. Clustering suggests that the 109 morpho-species contain 80 genetically distinct species.

Survey results indicate how understudied the lepidoptera of the region is. When the 109 sequences are blasted on NCBI, only 36 have a higher than 95 % identity (commonly denoted as “genus level” identity) with any existing identified NCBI sequences; only 20 of them have a higher than 98 % identity (commonly used as “species level” identity) with existing NCBI sequences among communities of lepidoptera samples, there is no overlap in species composition across altitudinal gradients (high beta diversity). Diversity follows a unimodal curve, is lowest at 2000 m agricultural fields, peaks at 3200 m, at the transition zone between alpine forest and grass land, and slightly drops at 3800 m.

Telemetry

Bhutanitis species flight was affected when 0.2g transmitters were attached, so we decided to apply this new conservation monitoring technique to another butterfly species of the same family, *Troides aeacus*, which shares the same *Aristolochia* hostplant with *Bhutanitis*.

Transmitters that emit signals at 144 to 151 MHz were attached to the upper abdomen of two adult individuals, which were then tracked simultaneously for a week. After a few minutes of recovery, *T. aeacus* had little observable change in flight behavior after a transmitter is attached. The radio tagged butterfly can be detected within a 1.5 km range from the receiver, and signal strength accurately reflects both the direction and proximity of the transmitter.

Together with local villagers, we have confirmed several patterns of *Troides* flight and their dispersal range. The butterflies disperse away from a 1.5 km range in 2-4 days and show strong preference for forested valley landscapes to farmland. Detailed data analyses are in progress. In the next stage, we hope to train a few local conservationists to individually monitor butterflies and interpret their data.

Summary

(1) In the first stage of the project, we focused on indirectly assessing local economic status, conservation awareness, and obtaining descriptive data for the local environment. We consider it important to have a qualitative understanding of the local lifestyle and environment before moving on to make any conservation suggestions. Three months of living in the village ensures we understand the economic and cultural impact of any possible conservation policies.

(2) We conducted a quantitative survey of local *Bhutanitis* population and identified its hostplants; we surveyed local lepidopteran communities along an altitudinal gradient and built both a reference collection and a DNA barcode collection; we tested the effectiveness of insect telemetry using transmitters.

(3) Our next major goals include: continuing the *Bhutanitis* population survey and *Troides* telemetry survey, but gradually transfer the initiative from us to interested local conservationists; quantitatively assessing conservation awareness; distributing informative scientific knowledge that will empower local stakeholders into making conservation decisions to the best of their interest.