

LEPIDOPTERA COLLECTING IN TAIWAN

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ABSTRACT.— Taiwan, located near the east coast of mainland China, supports a rich butterfly and moth fauna across its range of temperate and tropical habitats. This paper reports general observations made on Lepidoptera during a July-August 1988 expedition across Taiwan, with comments on some of the most outstanding collecting areas.

KEY WORDS: *Acraea*, *Atrophaneura*, *Borbo*, *Byasa*, *Calaenorrhinus*, *Celastrina*, *Cercyonis*, Choreutidae, *Delias*, *Eurema*, *Graphium*, *Hebomoia*, *Heliophorus*, Hesperidae, *Histia*, *Hypolimnas*, *Isoteinon*, *Kallima*, *Kaniska*, Lycaenidae, Lymantriidae, *Megisba*, *Melanitis*, *Menelaides*, *Minois*, *Neominois*, *Neptis*, Nymphalidae, *Papilio*, Papilionidae, *Penthema*, *Perina*, Pieridae, *Polygonia*, *Polytremis*, *Precis*, *Saptha*, *Suaspes*, *Symbrenthia*, *Timelaea*, *Tirumala*, Zygaenidae.



Fig. 1. Map of Taiwan showing itinerary and points of interest (see Appendix).

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Taiwan is a large island (Fig. 1) located off the east coast of the mainland of China, separated from the province of Fukien by the shallow Taiwan Strait that narrows to as little as 90 miles (144 km). Its rugged peaks and luxurious vegetation make the land seem quite tropical, although actually the island barely enters the northern edge of the tropics. It straddles the Tropic of Cancer, extending from 21° 53' N to 25° 17' N. The island is about 240 miles (394km) long, with a maximum width of 90 miles (144 km). Almost 70% of the island is mountainous and above 100m elevation. There are many swiftly flowing rivers coming out of the Central Range, and some of the peaks rise to great heights, with numerous peaks over 3,000 meters in elevation. The highest peak on Taiwan is 3,997 meters (Yushan or Jade Mountain).

Because of Taiwan's location on the Tropic of Cancer and the proximity of either coast to two branches of the warm Japanese Current, the climate is quite tropical, with a long warm summer. The short, mild winter is most pronounced in the northern part, at Taipei, and in the upper elevations of the mountains, where skiing is possible. The lush vegetation supports a great variety of insects, including a butterfly fauna of 400 species (Fig. 2-3) and a moth fauna of over 5,000 species. Much of the fauna is representative of the tropical Asian mainland, often ranging from India to China and Indonesia, as well as through Taiwan. Another faunal segment involves northern species which are also found in Japan and in the eastern Palearctic. The most interesting segment, however, is a relic fauna of species found only in the high mountains of Taiwan and in the Himalaya Mountains of Nepal and southwestern China. Likewise, some of the mountain plants of Taiwan represent a relic flora existing in Taiwan since at least the Tertiary Period.

We led a group of lepidopterists to Taiwan from July 30 to August 14, 1988, and had spectacular collecting and photography. H. Y. Wang (Taiwan Museum) and Giovanna Holbrook (Holbrook Travel) coordinated logistics. This article briefly describes that expedition.



Fig. 2. Scenes around Taiwan in August 1988: a) *Papilio memnon heronus* Fruhstorfer (Papilionidae) females at Wulai, Taipei Co., visiting *Ixora* flowers; b) *Papilio helenus fortuneus* Fruhstorfer (Papilionidae) at Wulai; c, d) *Kallima inachus formosana* Fruhstorfer (Nymphalidae) at Fu Min Valley, Hualien Co.; e) *Salatura genutia* (Cramer) (Danaidae) at Nanshan Chi east of Puli, Nantou Co.; f) *Tirunala limniace limniace* (Cramer) (Danaidae) at Nanshan Chi; g) John B. Heppner and Hsiau-Yue Wang of the Taiwan Museum, Taipei; h) *Precis almana almana* (Linnaeus) (Nymphalidae) at Hui-Sun Forest Recreation area, Nantou Co.; i) *Tirumala hamata septentrionis* Butler (Danaidae) at Nanshan Chi east of Puli. (Photos © Thomas C. Emmel and James L. Nation, Jr.)



Fig. 3. Some of the 400 tropical and temperate butterfly species found on Taiwan: a, b) *Heliophorus ili matsumurae* Fruhstorfer (Lycaenidae), male; c) *Megisba malaya sikkima* Moore (Lycaenidae); d) *Suastus gremius gremius* Fabricius (Hesperiidae); e) *Borbo cinnara* Wallace (Hesperiidae); f) *Polytremis lubricans taiwana* Matsumura (Hesperiidae); g) *Celaenorrhinus ratna ratna* Fruhstorfer (Hesperiidae); h) *Isoteinon lamprospilus formosanus* Fruhstorfer (Hesperiidae); i) *Symbrenthia hypselis scatinia* Fruhstorfer (Nymphalidae); j) a mating pair of *Acraea issoria formosana* Fruhstorfer (Nymphalidae). (TCE)



Fig. 4. Scenes across Taiwan: a) An overlook by a superb collecting site near Wulai, Taipei Co.; b) a stream through an ancient cedar forest near Upper Palin, Taoyuan Co. (1200m); c) the mature fifth-instar larva of *Papilio memnon heronus* Fruhstorfer at Nanshan Chi, Puli; d) the larva of the fig tussock moth, *Perina nuda* (Fabricius) (Lymantriidae), near Wulai; e) mounted Lepidoptera specimens for sale at the gift shop of the Mokusei Museum of Entomology, Puli, Nantou Co. (TCE)



Fig. 5. Wulai, Taipei Co., upper canyon (ca. 250m). (© J. B. Heppner)

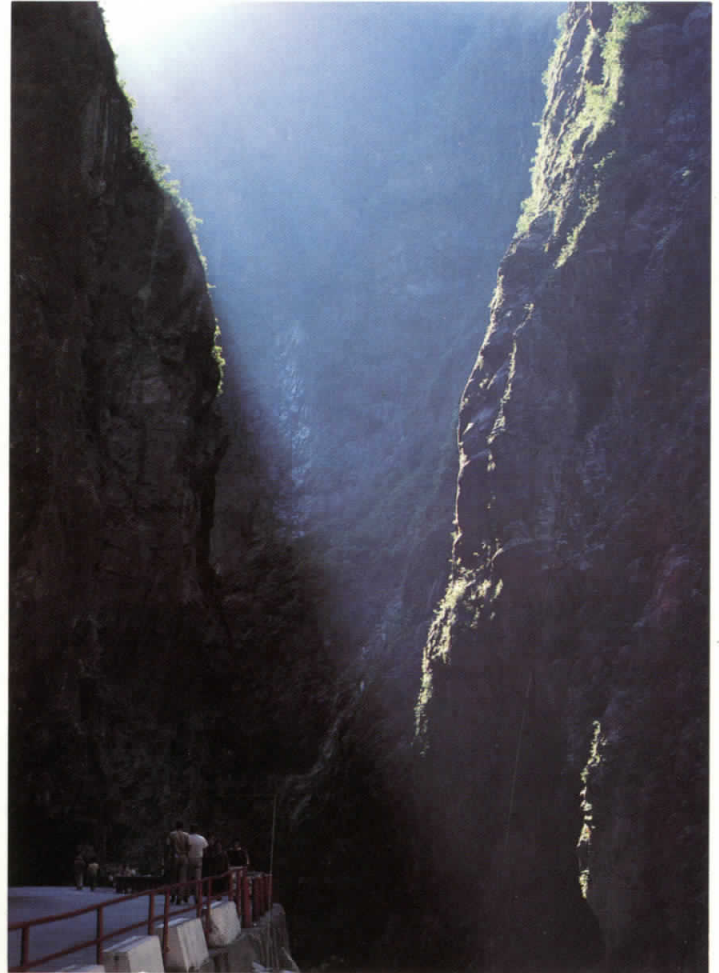


Fig. 6. Taroko Gorge: part of the central canyon. (JBH)

Arriving in Taipei on July 31 in the evening, a number of our party went collecting the next morning about 4km south of the center of the city, near the Wulai Road and Taipei City Zoo, Taipei County. While very warm (over 33°C), collecting was excellent for many of the northern lowland butterfly species in Taiwan. On August 2, we moved to Wulai (Fig. 4-5) at 750ft (228m) elevation, about 23km south of Taipei. Great patches of flowering *Ixora* and *Salvia* flowers were planted along the roadside here in this spectacular canyon, where many papilios and pierids swarmed. A number of hairstreaks and skippers of all sorts also joined the great nectar feast.

On August 3, we stopped near Hsing Tien at 1,100ft (332m) elevation located about 25km east of Taipei, and collected in a rich stream canyon with tropical forest. Here, *Papilio memnon* flew in abundance. We found it to be a very slow, low-flying species, especially the several mimetic forms of the females (females are tailed, while the males are tailless in this species). Loads of papilios and other butterflies swarmed over the purple Convolvulaceae vines and flowering trees; these specimens included our first leaf-wing butterfly, *Kallima inachis*. After spending the early morning collecting here, we continued on south to a monastery near Nanao on the east coast, where many kinds of hairstreaks, nymphalids, and satyrids were abundant. That night we stayed in fabulous Taroko National Park where the scenery was magnificent as we entered through Taroko Gorge

(Fig. 6-7). The following morning, as we exited through the same gorge, we used many rolls of film taking pictures before heading out to collect in the lowlands at Fu Min Valley, in Hualien County south of Hualien City.

Here at Fu Min, we found a beautiful river valley with well-forested surrounding mountain slopes, and lots of papilios, danaiids, pierids and satyrids. Two snout butterflies were captured. Jim Nation was able to take extreme close-ups of several leaf-wing butterflies (*Kallima inachis*) in the woods.



Fig. 7. Native people at east coast entrance to Taroko National Park. (JBH)



Fig. 8. Upper canyon at Chihpen Hot Springs, Taitung Co. (JBH)

Masses of papilios landed on the river sand to drink the water in the heat of the noon hour. We finally and reluctantly continued our journey and stayed the night at Chihpen Hot Springs (Fig. 8), Taitung County. The next morning we had outstanding collecting in a canyon just up the road from our hotel in a beautiful green forest and mountain valley. A rich variety of all species, especially danaids, was found here. In the afternoon we went to Taimali Valley, further south, for collecting at about 250ft (76m) elevation where along the river, clusters of *Graphium sarpedon* landed and drank. A few *Neptis* nymphalid species also alighted here on the wet sand. The southeastern coast (Fig. 9) is often spectacular.



Fig. 9. Southeast coast near Taimali, with Taitung in background. (JBH)

On August 6, we went back into the mountains, out of Taitung, and ascended to 9,100ft (2750m) at Yakou Lodge (Fig. 10) at the border of Yushan National Park [Jade Mountain N.P.] on Highway 20, Southern Cross-Island Highway. Here we found quite a different kind of collecting, in grassy meadows and pine forests on very steep mountain slopes. Two *Celastrina* blue species flew along the road, and one satyrid and a large *Delias* species flew here, too. Fog and clouds swirled around the spectacularly steep and rugged mountains on either side of us throughout the morning. We continued on over the pass through the park and saw endless spectacular vistas of giant cedars, mountains and rugged canyons as we descended towards 2,200ft



Fig. 10. Yakou, on the border of Yushan National Park, Taitung Co. (JBH)

(665m) at Km 105, about 11km east of Meishan, where *Acraea issora formosana* were abundant along with many *Eurema pierids*.

On the morning of August 7, we visited the Miao Ton Temple near Baolai, before heading on through tropical forested areas with tall bamboos to the forest at Sanpen Forest Station, Liukuei, Kaohsiung County. Here, from 1,700-2,200ft (514-665m) elevation, we had excellent montane collecting, including many nymphalids, hairstreaks, blues, papilios, and other butterflies flying along the forested slopes and by the streams. A nice small white-spotted *Hypolimnas* (*H. bolina kezia*) species attracted much attention, as did various satyrids. We visited Wen Lung Chen's shop at Liukuei City in mid-afternoon, where butterflies were for sale at modest prices. We then headed north to Hui-Sun Forest Recreation Area, Taichung County, where we stayed at the lodge overnight for excellent moth catches.

The next morning, everyone walked down to about 1,600ft (484m) elevation from the lodge area at 2,200ft (665m) and spent the whole morning collecting a wide diversity of species, including *Papilio paris* with its brilliant green patches on jet black wings, the richly ocellated *Precis almana*, and other butterflies new to everyone. We then visited the remarkable butterfly museum at Puli, the Mokusei Museum of Entomology, with its rich collections of Asian species and an excellent worldwide representation of a great number of other faunas. This site was discovered 80 years ago by Japanese collectors as being outstanding for butterflies, and we had an excellent afternoon in Puli with the descendents of the founder of the butterfly museum. In 1919, the grandfather of the present manager began to collect butterflies. His father, Chin-Kin Yü, and now Chii-Yunn (3 generations) have collected and managed this museum of butterflies for visitors. In a typical year, some 500,000 visitors come, and up to 52 tour buses a day stop here. While many Japanese tourists as well as other Asians visit, we were the first American lepidopterist group, they said, to ever visit Puli.

We collected east of Puli in a valley near Nan Shan Chi, about 500 meters elevation, our guide being Chii-Yunn Yü, the son of Chin-Kin Yü who is the present owner and curator of the Mokusei Museum in Puli. We also had the opportunity to visit a local breeder here who had a big garden of butterfly nectar plants as well as foodplants. The entire group had outstanding

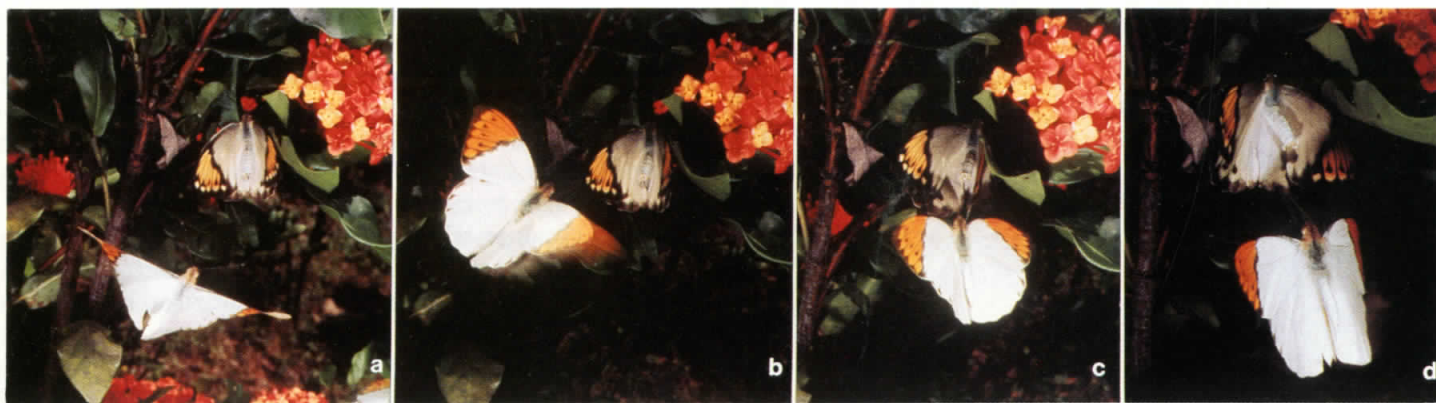


Fig. 11. A sequence of four scenes of *Hebomoia glaucippe formosana* Fruhstorfer (Pieridae) showing, (a) the attempted courtship approach of a male (bottom specimen) to a perched female; the female then progressively raises the end of her abdomen higher in a rejection response (b, c), and finally flares out her wings in addition to exposing several brushes and glandular areas at the tip of her abdomen (d). (TCE)

collecting up the trails of several canyons here, and had excellent photography in the butterfly garden. Many swallowtail species, including *Papilio paris*, *P. hoppo*, *P. bianor*, *P. memnon*, *P. helenus*, *P. protenor*, *P. castor*, *P. polites*, and the wonderful

pink-spotted tailed papilio, *Menelaides aristolochiae interpositus*, were abundant here. In addition, there were countless danaiids, nymphalids, pierids, and other butterflies swarming on the flowers on all sides. Even two strangely North American-looking angle-



Fig. 12. Taiwan scenes: a) Hohuanshan summit area, at 3300m elevation, 32km southeast from Lishan, Taitung Co.; b) *Minois nagasawae matsumura* (Satyridae) in the alpine zone on Hohuanshan; c) *Melanitis leda leda* (Linnaeus) (Satyridae) feeding on rotting fruit juices at Nanshan Chi, east of Puli, Nantou Co.; d) collecting in a river canyon at Nanshan Chi, 15km east of Puli, at about 1500m elevation. (TCE)



Fig. 13. Hohuanshan from Tayuling-Taroko Road, Hualien Co. (JBH)

wing species, *Polygonia c-aureum lunulata* and *P. c-album asakurai*, were found in numbers at this site. On the rotting fruit under a Chinese jujub tree across the road were many satyrids, leaf-wing butterflies (*Kallima*), and the marvelous blue-striped anglewing species, *Kaniska canace drilon*. The fruit-visiting butterflies were so drunk from the alcoholic content of the fermenting fruit that many could hardly fly, and giant wasps flying all over the area made both collecting and close-up photography "interesting!"

On August 9th, our group split up, one party collecting at 7,300ft (2205m) elevation near Lishan, Taichung County, where scores and scores of the incredible swallowtail *Atrophaneura horishana* were taken in the forest and along the open roadside. The lovely salmon-colored hindwings and the jet black forewings of this slow-flying species were unbelievable. Part of the group ascended Hohuanshan (Fig. 13) to over 10,000ft (3023m) elevation near the mountain summit area, about 32km southeast from Lishan, in Nantou County. Here we collected in the alpine zone above timberline (which was at about 9,800ft [2962m]). There were many *Minois nagasawae* flying in the alpine meadows of grasses and stunted bamboo (Fig. 12a). These flew very much like the North American *Cercyonis* or *Neominois* species, and looked remarkably similar on the underside. Another satyrid species, several blues, and a danaid and swallowtail were



Fig. 12. River view from Chilán Forest Station, Ilan Co. (JBH)

collected here or seen flying over the mountain crests. The main action was at the lower elevation site around 7,300ft (2205m) near Lishan, however. Fabulous moth collecting later at Lishan resulted in our filling the interior of the hotel with thousands of moths (due to various windows being left open during that night near the bright lights!). The hotel management was **not** very pleased the next morning.

On the evenings of August 10th and 11th, we stayed near Chilán (Fig. 14) at the former summer home of Chang Kai-Shek. On the morning of the 11th, we ascended Taipingshan Mountain,



Fig. 15. Upper Palin, Taoyuan Co. (JBH)

collecting particularly hard between 1,800-3,200ft (544-967m) elevation. A great many *Acraea* adults and immature stages were found here, many *Papilio memnon* males and a few females, brilliant golden-yellow nymphalids (*Timelaea albescens formosana*), yellow and red hairstreaks (*Heliophorus ila matsumurae*) on the flowers, a number of danaiids, and a huge black-and-white satyrid species (*Penthema formosanum*), which flitted frequently out of nearby woods and overhead like a stubby-winged monarch.

The next day, on August 12, we drove from Chilán to Palin, Taoyuan Co., at high elevations between 3,400-4,000ft (1028-1209m), and found a great number of swallowtails and skippers, including the rare reddish, broad-tailed black swallowtail, *Byasa*

polyeuctes termessus. As we approached Lower Palin, the number of gorgeous *Papilio paris* swallowtails and perfect examples of *Papilio bianor* adults, with iridescent green and blue on their wings, became too great to be ignored, and we stopped to collect again before stopping at the town. That night, when we stayed at the hilltop hotel at Upper Palin (Fig. 15), at 3,800ft (1149m) elevation, the group experienced absolutely fantastic moth collecting. By 9:30 p.m., there were at least several hundred thousand moths, stag beetles, etc., covering the entire roof patio of the hotel and every hanging sheet and light. The next morning, it took 10 people several hours to sweep and wash the flat roof (several thousand square feet) clean of tens of thousands of walked-on moths and hemipterans so the owners would not be permanently unkind to future entomological visitors.

Throughout our stay we were struck by the overall friendliness of the Taiwanese citizens and the absolutely outstanding collecting here at this time of year. The senior author (TCE) and two student assistants collected over 250 of the 400 species known for the Taiwan butterfly fauna and took over 2,000 specimens in the two week trip, including over 700 fixed testes for chromosome studies. It was by all odds the most successful two-week trip in terms of number of new taxa collected for chromosome studies that we have ever experienced. The specimens collected on this trip will be deposited in the Florida State Collection of Arthropods, as our researches on Taiwan butterfly chromosomes and other taxonomically interesting problems are addressed and published on during the next several years. We are already



Fig. 16. Kuangwu Forest Station area, with view to coast, Hsinchu Co. (JBH)



Fig. 17. Snow Mountains from Kuangwu Forest Station (Miaoli Co.). (JBH)

looking forward to the next expedition to this fascinating country of Taiwan! Areas of particular interest for future butterfly field work include the "butterfly-valleys" of southern Taiwan, where millions of adults of nine danaine species have been found to overwinter from December to February.

Following the departure of the butterfly group, the junior author (JBH) continued with field work as part of the long-term Lepidoptera of Taiwan faunal survey project, together with Hsiau-Yue Wang, Taiwan Museum, Taipei. This project was begun in 1981 as a cooperative project between the Taiwan Museum and the Smithsonian Institution, Washington, with the Florida State Collection of Arthropods becoming the main American collaborating institution after 1983. The goal is to document the extensive Lepidoptera fauna of Taiwan in a series of illustrated monographs, planned under authorship of over 28 contributing specialists from several nations. Drs. J. B. Heppner and H. Inoue are the editors. The catalog and illustrated introduction to the known species are planned for publication in 1991, with probably over 4,000 species listed and over 1,200 species illustrated.

Since 1981 over 200,000 specimens of Lepidoptera have been collected in the survey, with support from the National Science Foundation, Washington, and the Taiwan National Science Council, as well as the Taiwan Museum and Taiwan Forestry Research Institute. Most specimens currently are being curated at the Florida State Collection of Arthropods, ultimately to be divided among the cooperating institutions.

The rest of August and part of September were spent visiting other localities, primarily for moth collecting. The first location was Kuangwu Forest Station (Fig. 16), at about 6,600 ft (2000m) elevation, in northern Taiwan on the border of Miaoli and Hsinchu counties. The area here has remnants of original forest and spectacular views of the Snow Mountains (Fig. 17), where numerous peaks rise above 12,500ft (3800m). Moth collecting here was fabulous, with many unusual Himalayan species and endemics. Other excellent forest sites visited were Anmahshan (2250m) in Taichung County, as well as Chingshan Hostel (1100m) on the road to Lishan. Excellent original forest is also found at Meifeng Horticultural Station, south of Hohuanshan in Nantou County (2100m), where we stayed the last few days of



Fig. 18. Oluanpi Peninsula, Kenting, Pingtung Co. (JBH)

the trip. Total moth specimens for the 1988 trip came to over 27,000 specimens for the project, mainly collected using various traps.

Taiwan is a microcosm of China and as long as it remains open for collecting and serious field projects, visitors will have a spectacular site for studies. Many of the mainland species, often as Taiwan subspecies, can be found in Taiwan, and the high mountains also have the remnant relic Himalaya fauna mentioned earlier. Particularly among the moths, numerous species are found only in the mountains of Taiwan and similar elevations of the Himalaya Mountains of Nepal and parts of southwestern China, but not in the remainder of mainland China. Strictly tropical elements are also prevalent, particularly at Kenting National Park (Fig. 18), at the southernmost end of Taiwan, where many species of plants and animals are related to Philippine species or other tropical species (Fig. 19-20). So, Taiwan is well worth the visit!



Fig. 19. Day-flying *Saptha beryllitis* (Meyrick) (Choreutidae), Kenting.(JBH)



Fig. 20. Day-flying *Histia flabellicornis ultima* Hering (Zygaenidae) at Kenting. (JBH)

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APPENDIX: Locality List (see map)

- A Wulai, Taipei Co. (200-365m)
- B Tsing Tien, Taipei Co. (332m)
- C Nanao, Ilan Co. (50m)
- D Taroko Gorge, Hualien Co. (50-435m)
- E Fumin Valley, Hualien Co. (300m)
- F Chihpen Hot Springs, Taitung Co. (100-400m)
- G Taimali, Taitung Co. (76m)
- H Yakou, Taitung Co. (2750m)
- I Meishan, Kaohsiung Co. (665m)
- J Baolai, Kaohsiung Co. (395m)
- K Shanpen Forest Station, Kaohsiung Co. (600-750m)
- L Huisun Forest, Nantou Co. (665m)
- M Puli, Nantou Co. (450m)
- N Sun Moon Lake, Nantou Co. (750m)
- O Lishan, Taichung Co. (2205m)
- P Hohuanshan, Nantou/Hualien Co. (3000-3200m)
- Q Chilun Forest Station, Ilan Co. (480m)
- R Upper Palin, Taoyuan Co. (1000-1650m)
- S Kuangwu Forest Station, Hsinchu/Miaoli Co. (2000m)
- T Chingshan, Taichung Co. (1100m)
- U Meifeng, Nantou Co. (2100m)
- V Kenting Park, Pingtung Co. (255m)