

China Trip Report  
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We arrived in Beijing on September 13. Unfortunately Dr. Clarke's luggage did not arrive until September 15. We were met at the airport by Dr. Jianghua Sun, and we immediately flew to Kunming in the Yunnan Province. On Friday the 14<sup>th</sup>, we met with Lu Jun, a graduate student at Yunnan University. Lu Jun has been working with *Tomicus yunnanensis* under the direction of Dr. Ye Hui. We discussed several experiments we wished to set up and began to gather equipment. That afternoon we visited the Provincial Forest Pest Control Station and met with Station scientists. We also examined the insect rearing facilities as well as the Station's collection of Scolytid specimens.

The next morning we picked up the late-arriving luggage at the Kunming airport and began our journey to the town of Shilin. We were driven by two representatives of the Provincial Forest Health Management Group. Once we arrived in Shilin (a trip of several hours), we met with the local forest pest control personnel, and then went to the Stone Forest National Park. The Park currently has a severe infestation of *T. yunnanensis*. *Tomicus yunnanensis* is a serious pest of pines in the Yunnan and Sichuan Provinces. In early spring, brood adults emerge from the trunks and fly to the shoots for maturation feeding. Adults may feed within numerous shoots during their lifespan. The beetles aggregate on focal trees during the shoot feeding phase. In the



Yunnan pine shoots damaged by *T. yunnanensis* feeding. Note beetle at apical tip of gallery.

winter, the adults emerge from the shoots and attack the boles, in most cases on the same trees

upon which they had been shoot feeding. They create galleries and eggs are laid. If the tree has been severely stressed from shoot feeding, the trunk attacks may kill the tree. Most of the pines at the park exhibited signs of infestation, with up to 90% of shoots killed on some trees. Swift sanitation cutting of infested trees and/or the use of trap logs can greatly reduce damage. However, cutting is restricted within the Park, so the infestation continues to increase and expand.

That afternoon we set up an experiment to test verbenone for protecting trees from trunk attacks. We selected 20 pines that had numerous shoot attacks, and which we expected would have trunk attacks in the coming

winter. Half of the trees were randomly selected to be treated with verbenone, with the other 10 serving as untreated controls. Trees were at least 40 m from other study trees. A verbenone pouch was attached to treated trees at a height of ca. 2 m. Each pouch contained 7.5 ml verbenone and was expected to release verbenone for two months or more.

The pouches were supplied by Synergy. Pouches were to be replaced every 60 days. A GPS point was taken for each study tree. On a subsequent visit, Lu Jun measured tree height and diameter at breast height of all study trees. He estimated the percent of shoots killed. He also took similar data on all pines within a 10 m radius of the study trees, as well as the

azimuth from the study tree. The trees will be checked monthly, and tree mortality recorded.



Emergence holes of *T. yunnanensis* from over-wintering attacks.



Tom Eager and Mr. Lu examining damaged pine.

The next morning we established a trapping study. Three treatments were used: turpentine only, trans-verbenol, and trans-verbenol and turpentine. The turpentine was locally produced, and was released from glass bottles with cotton wicks. The trans-verbenol was in bubblecaps supplied by Synergy. Trans-verbenol was selected as it was found in beetles collected the previous year. Traps were separated by at least 30 m, with five replicates per treatment. The beetles will readily attack cut bolts, but in 6 weeks of trapping no beetles have been collected in the traps. We are not sure whether the beetles are not attracted to the baits or if the beetles are not flying at this time.

The general condition of the Yunnan pines within the Stone Forest National Park could be characterized as poor. The pine stands were heavily cut over between 20 and 25 years ago. Subsequent reforestation efforts utilized aerial seeding to re-establish the pine here. Although it would be difficult to access the administrative records for this area, it appeared as though the seed used may have come from an off-site location. The trees were extremely spindly, with a very low live crown ratio and poor annual growth. The overall appearance was similar to off-site pine plantations observed in Colorado, USA. It was difficult to determine the relationship between poor tree condition and beetle infestation. However, the combination of these 2 factors was severely affecting the pines.

While examining these sites, we discussed a number of ideas for future work with Dr. Sun and Mr. Lu. Spraying individual trees with an insecticide would remove the impact of the *Tomicus* beetles and help determine the impact of shoot feeding on overall stand appearance. The aggregation mechanism for the beetles during the shoot-feeding is largely unknown. Olfactometer studies could be used to determine if infested shoots with or without beetles are attractive to later-arriving beetles. In conjunction



Typical Yunnan pine affected by *T. yunnanensis*.

with olfactometer work, collecting volatiles from the beetles at different points during their life cycle and at different times of the year could help pinpoint the cues for aggregation.

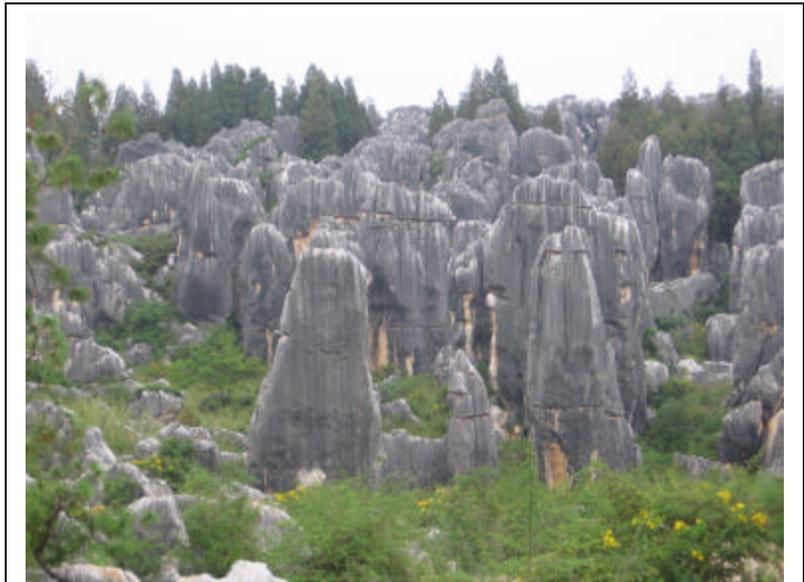
After establishing the trapping study, we visited the official Stone Forest National Park. The stone forest is a karst formation sculpted over millions of years. The limestone peaks and towers cover the countryside. We took a tour of this wonderland with a guide named Alice. The tour included a visit with the “Master”, who drew our names in fancy Chinese characters. He then hit us up for donations, but we masterminded an escape. Unfortunately, this side trip cut into valuable time that could have been spent viewing natural wonders.

The next day was spent at the Yunnan Minorities Village. The culture and folklore of the various minorities in Yunnan Province are displayed in this large park. Amazingly, you can also purchase souvenirs. A heavy rainstorm cut the visit short.

We met with Lu Jun on the 18<sup>th</sup> to discuss future work on *Tomicus yunnanensis*. We suggested that he test beetle response to infested shoots with

and without beetles as well as uninfested shoots using an olfactometer. We proposed collecting pheromones using conical vials containing Porapak. This method had been used by Dr. Brian Sullivan for other bark beetles and we had collected a few samples the previous year in the Sichuan Province. We promised to send articles detailing olfactometer design and use, and complete instructions on collecting pheromones with the conical vials. Lu Jun was very interested in the work and said he needed to clear it with his major Professor, Dr. Ye. Dr. Ye was away at a meeting, but we talked on the phone after our visit. The phone call and subsequent e-mails indicate that they are willing to proceed with the trials next year.

On the afternoon of the 18<sup>th</sup> we flew to Beijing. The next day we visited Dr. Sun’s office and lab and met with his graduate students. We learned about their projects, including biological



Stone Forest National Park

control of Chinese privet. We discussed current and future work on *Dendroctonus terebrans*, pinewood nematode, and *Oracella acuta*. That afternoon we met with another delegation sponsored by USDA Agricultural Research Stations. They were in China to evaluate control efforts for several species of whiteflies. That evening we arrived at the Fragrant Hill Empark Hotel for the Workshop on Biological Control of Invasive Species.

On the 20<sup>th</sup> of September, we had a free afternoon and were able to visit the Summer Palace. We were lucky to have very nice weather, and the highlight of the trip for Tom was viewing the famous “Scenes of Weaving and Farming”, some spectacular etchings on dark, black basalt tablets.

The following three days were spent at the workshop. We presented papers and interacted with scientists from China and other countries. Additional information on this meeting has been reported by Yun Wu of the FHTET office in Morgantown, West Virginia.

We met with the Forest Insects of China Book Committee at the Chinese Academy of Sciences on the 24<sup>th</sup>, and then met with the student translators the next day at Beijing Forestry University. Details of those meetings are given in a separate report. We returned home to the US on the 26<sup>th</sup> of September, although it took us both until the 27<sup>th</sup> to finally arrive home due to plane delays.



Astute Chinese recognition of Emperor-like qualities  
in USFS employee Tom Eager