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**Subject:** 2006 Trip Report - *Tomicus* and *Hylobitelus* Projects in China

**To:** Field Office Representative, Alexandria Field Office

March 25 – 27. Lufkin, TX to Houston, TX to Beijing, China. Met at airport by Jianghua Sun. We flew to Chengdu, China.

March 28. Met with Zhou Jianhua, Deputy Director and Associate Professor, Sichuan Academy of Forestry. Flew to Xichang, Sichuan Province. Visited a hillside near town, the site of a previous outbreak of *Tomicus*. To suppress the infestation, all pines had been injected. I was never able to get a definitive answer as to what species of *Tomicus* was responsible or what insecticide was used. The treatment appeared to be working.

March 29. Drove to Dechang. We went up into the mountains to an infestation of *Tomicus* in Yunnan pine (Fig. 1). The Chinese believe it is the new species of *Tomicus*, tentatively called *T. yunnanensis*. This species aggregates during the maturation feeding phase on the shoots, then attacks the bole of the weakened tree, leading to tree death. We collected infested shoots, and also beetles from infested logs. The use of trap logs to reduce populations apparently is effective, but they are reluctant to cut trees. Therefore, they are seeking semiochemical methods to reduce tree mortality.



Fig. 1. Yunnan pine stand, Sichuan Province



We returned to town and went to the Department of Forestry. I placed adult *Tomicus* from the shoots and logs in conical vials containing a small amount of Porapak. The vials were provided by Brian Sullivan, SRS. The purpose was to collect volatiles produced by the beetles to help identify possible attractants and deterrents.

March 30. Drove to another pine stand in the mountains and collected more infested shoots. The attacks appeared to be aggregated. Most trees had no attacks, but infested trees generally had 2 or more infested shoots. The shoot-feeding phase generally lasts from March-December, and an adult may infest 18-20 shoots during this period. Trunk attacks peak from January-March. Returned to Xichang.

March 31. Flew to Chengdu. We discussed trapping experiments. I had supplied them with lures used for *T. piniperda* (alpha-pinene and trans-verbenol), lures designed for *T. yunnanensis* (65% alpha-pinene, 15% beta-pinene, 15% terpinolene, and 5% myrcene), verbenone, and non-host volatiles. The two “attractive” lures had been tested during the trunk feeding phase with little success. We planned to test them during the shoot-feeding phase. The goal was to find an attractive lure that could be used for population monitoring and possible suppression. If one of the lures appeared to be working, they would rerun the experiment adding a treatment of the attractive lure plus non-host volatiles. If non-host volatiles appeared to shut down trap catch, they would then treat trees with infested shoots with NHVs to try to prevent additional shoot damage and subsequent trunk attacks. These experiments would start in April. Verbenone had been very effective in protecting trap logs from infestation in the Yunnan province, but NHVs had no effect. I suggested testing the area effect of verbenone. In January, a verbenone bubblecap would be placed on a stake directly over a trap log bundle. Other trap log bundles would be placed at 3-5 m and at 7-10 m from the stake (3-4 bundles per distance). Again the Chinese balked at cutting trees. I explained that the use of trap logs would guarantee infestation of the check treatment. They were still hesitant. As an alternative, they could select pines with evidence of aggregated shoot feeding and place verbenone on the boles of half of the trees at the time of trunk feeding and oviposition. Infestation rates would be compared between treatments. We visited the Wuhou Temple, a national historic site.

April 1. We flew to Nanchang. We met Brian Sullivan, who had flown in the previous evening, plus Wen Xiaosui and You Dekang, scientists working on *Hylobitelus xiaoi*, a weevil infesting slash pine. We drove to Xinfeng. Brian began aerations on some of the shoots infested with *Tomicus*.

April 2-4. We visited several pine stands infested by *H. xiaoi*. The majority of pines were slash pine, but some native Masson pine was intermixed. The weevil also has an oviposition phase and a maturation feeding phase. They apparently prefer Masson pine for shoot feeding and slash pine for oviposition. Slash pine has thicker bark and produces more resin, providing better protection for the larvae. The weevils do not mine the shoots as do *Tomicus*. The adult weevils also do not fly readily, and usually crawl to trees. Shoot feeding by emerging adults occurs from March through the summer. Adults spend the evening in the duff around the base of the tree or in bark crevices. At night they move to the crown for maturation shoot feeding. Oviposition begins in May and lasts through the summer. Larvae remain under the bark through the winter and continue feeding the next year. Pupation is in August, and adults remain under the bark

through the second winter. The Chinese have tried various control strategies. Scraping away the duff from around the base of the tree removes hiding places for the adults, though they may still hide in the crevices. They have also tried shaving the bark near the base of the tree to reduce suitability for the larvae. Both of these methods have been somewhat successful. They have also constructed water-filled trenches around the base of the trees to prevent adults from attacking (Fig. 2).



Fig. 2. Trench around base of slash pine tree to prevent attack by *Hylobitelus xioai*.

While this treatment was effective, it was not that much better than scraping away the duff. Perhaps a better attractant than turpentine would increase efficacy. We tested pitfall traps baited with slash pine or Masson pine resin, with and without ethanol. We also tested split bolts to catch adults. None of these traps successfully collected beetles. These traps may work during the oviposition period, and they will try them again in May and June. They will also bait traps with cages containing males or females. Brian showed them how to place burlap around the base of the tree or around the bole to try to collect adults, and they will test this technique. We collected adults for GC-EAD tests, but populations were fairly low in these stands and adults were hard to collect. One group went to another site with higher populations to collect adults. They also showed us sites used in previous studies by U.S. researchers (Don Owen?). Sticky bands had been placed around the boles in one treatment, and in another cloth strips impregnated with *Beauveria bassiana* had been used. We did not learn if the treatments had been successful.

Brian suggested that they try polyester quilt batting in any future fungal treatments, as it might increase the infection rate of the weevils.

In the evenings, Brian and I excised *Tomicus* from the shoots I had collected. Some of them were caged in pits cut into the bark of a slash pine bolt to encourage them to enter the phloem so they could be used later. Others were used immediately in aerations. Brian also began aerations of the weevils feeding on shoots.

On April 4 we held a close-out meeting. The Chinese will continue to test the pitfall traps baited with live adults (males or females). We encouraged them to run the tests in sites with high weevil populations. They will run these tests year-round to determine when the adults are attractive. The Chinese were worried that males in a cage may attack each other, and they will run a test to determine how many males can safely be placed in one cage. They will also test the split-bolt technique in May and June during the oviposition period. They will test burlap on the ground and around the tree as well. I stressed prevention. They need to examine what stand conditions appear to lead to high weevil populations, and take measures to reduce hazard. Slash pines are heavily utilized for turpentine production, and most of them had had bark stripped away for resin production (Fig. 3).



Fig. 3. Turpentine of slash pine, Jiangxi Province.

They need to examine the relationship between turpentine and weevil infestation. Since adults spend time on the ground, prescribed fire in the spring could reduce populations. However, the turpentine on the trees may lead to excessive fire damage. I will send them information on prescribed fire. The Chinese expressed interest in continued cooperation between the U.S. and China on *H. xiaoi*, as ca. 90% of their slash pine stands have been seriously affected by this weevil.

April 5. Drove to Nanchang, then flew to Beijing.

April 6-8. We worked with Jianghua at the Institute of Zoology, Chinese Academy of Sciences. Brian used their GC-EAD and began running analyses of the *Tomicus* and *Hylobitelus* we had collected. I helped Jianghua and his graduate students revise some articles for publication.

April 9. I met with the Chinese committee involved in publication of the 3rd edition of Forest Insects of China. This edition will have Chinese and English publications. Meeting notes are in a separate document.

April 10. Returned to U.S.

*/s/ Stephen R. Clarke*  
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cc: Wesley Nettleton, William Carothers, James Ward, Iral Ragenovich