

Population density of the defoliator *Dendrolimus punctatus* correlates with the changes of masson pine induced by extreme draught*

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Abstract: Southwest China has experienced a long term of drought and heat wave from late 2009 to early 2010. *Dendrolimus punctatus* (Walker), the most serious pest of masson pines in China, broke out during that period in Guangxi. The outbreak was punctiform distribution. Even adjacent spots showed totally different condition. Large-scale climatic events have been considered as the important factors for the organization and functional change of forest ecosystems. The stress from water deficiency and high temperature may directly influence the physiology of plants. Substantial evidences indicate that drought stress promotes the outbreak of plant-eating insects by changing plant nutrients, allelochemicals and volatile metabolites. Abundant nitrogen can accelerate females' oviposition behavior and the larvae reared on unfertilized needles can exhibit high mortality, lower weight of larvae and pupae and prolonged development stage. At the same time, carbon-based defensive chemicals in host plants can be accumulated due to the elevation of carbon. Monoterpenes are the major components of volatile terpenes. *Dendrolimus punctatus* reared on *Pinus elliottii* exhibit a high mortality and rare oviposition for the profusion of β -pinene on the slash pines. The β -pinene-treated masson pines moths evoking a higher mortality when compared to the control pines also predict high content of β -pinene, which results in the resistance for tree to herbivore defoliation. Production and emission of terpenes is influenced by several biotic and abiotic factors. The stress of water deficiency is one of the most important abiotic limit factors. The increased concentration of terpene has been generally observed in drought conditions. By sitting eight spots with different defoliate, nutrient, moisture level in host plant and soil were tested. Volatile components of foliage were collected at early April using the dynamic headspace absorption method. Chemical analyses were carried on gas chromatography using a HP-5 5% Phenyl Methyl Siloxan capillary column. The number of *D. punctatus* cocoons (including the empty pupae) and larvae were collected to test if there was any relationship between the pest and plant or soil. Similar experiment was carried on one year later to examine the correlation between drought alternative host condition and the outbreak of *D. punctatus*. The total number of cocoons was consistent with the needle damage of each sample. The variance analysis also showed that the nitrogen, carbon and moisture in soil and pines were significantly different

among different groups in drought year. A significant correlation between the number of larvae and 3-carene content in needles was observed. The total number of *D. punctatus* had a significantly positive correlation with the content of total nitrogen in foliage. Our results support the early comments about the herbivorous insect reaction to nitrogen that high content of nitrogen provide the possibility for defoliate outbreak. High content of β -pinene in slash pines protected them from defoliation. The masson pines exhibited a weak position with a lower level of moisture. At the same time, ANOVA results between both years show that the total nitrogen and organic carbon in soil under drought condition (2010) has a higher level when compared with the normal year (2011). Moreover, a lower level of 3-carene content under drought was an import factor to the outbreak.

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