

Full Length Research Paper

# Use of pheromone traps against *Tomicus piniperda* and *Tomicus minor* in the Kazbegi National Park, Georgian Republic

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In the forested lands of Georgia Kazbegi National Park, some kinds of insects have been significantly harming the bark beetle of trees as their population increases. The most harmful species within the 100 ha area of the national park, where *Pinus sylvestris* L. var. *hamata* (Steven) (Scots Pine) trees settle have been identified as *Tomicus piniperda* (L.) and *Tomicus minor* (Hartig) using bio-technic method (pheromone traps), has been implemented against them. The damages of *T. piniperda* and *T. minor* were measured from all the Scots Pine in Kazbegi National Park in 2008. One of the newly developed control methods used in the field with intensive *T. piniperda* and *T. minor* populations is the bio-technic method. Prepared pheromone traps were hung up on trees located in various places and captured insects were counted and the results recorded in 2008. *T. piniperda* and *T. minor* trapped in pheromone traps, hung from the pines of the Scots Pine outbreak area were significantly greater in study area (109.5±2.1 and 118.2±1.8 beetle/trap, both species respectively).

**Key words:** *Tomicus piniperda*, *Tomicus minor*, pheromone trials, Kazbegi National Park, Georgia.

## INTRODUCTION

Bark beetles are important in natural ecosystems as they attack weakened or dead trees, thus contributing to the decomposition and mineralization in the forest, but some species are tree killers and can cause extensive damage (Berryman and Pienaar, 1973; Christiansen et al., 1987). The subfamily Scolytinae (Coleoptera: Curculionidae), with more than 6000 described species, is one of the largest group of Coleoptera. Scolytinae species typically cause secondary damage, but during occasional outbreaks, they are capable of killing relatively vigorous trees (Borkowski, 2006).

The pine shoot beetles belong to the genus *Tomicus* Latr. (Synonym *Blastophagus* Eichh., synonym *Myelophilus* Eichh.). This is a worldwide genus with 14 species (Ruhm, 1976). The former is called "the common pine shoot beetle" (Bevan, 1962). The pine shoot beetles (*Tomicus* sp.) have been recognized as major forest pests. Hundreds of studies have been carried out on

various aspects concerning the life cycle, ecology and economic importance of these beetles. These bark beetles have a major role in the decline of many pine forests growing in both Europe and Mediterranean countries, including Northern Africa (Pfeffer, 1995). This species is widely distributed in the pale arctic region from Europe throughout Siberian to Japan (Browne, 1968; Lekander et al., 1977).

Kazbegi National Park is located on the south of Georgia and 167 km away to Tbilisi. Mount Kazbegi, being one of the highest mountains of the country and the third highest after Mount Shkhara and Janga (5042 m), is included within the National Park property (URL 1). In the field, there are partially forested lands consisting of Scots Pine, Birch, Aspen and Wild rose trees. In recent years, these forested lands have been harmed by the detrimental effects of insect species and some trees have been dried following over nutrition. The existence of many insect species is known to be harmful in forests and cultivated areas and break down the ecosystem. The Pine Shoot Beetle *Tomicus piniperda* (L.) and Lesser Pine Shoot Beetle *Tomicus minor* are two of the most important forest insects of Scots Pine in Kazbegi

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*T. piniperda* and *T. minor* are widely distributed in the Pale arctic region, inhabiting different pine species within boundaries of their natural ranges. These insects are the most destructive insect pests, affecting pines in its native range of Europe and Asia (Amezaga, 1997; Langstrom, 1980; Hui, 1991; Langstrom and Hellqvist, 1993; Schroeder and Eidmann, 1987; Poland et al., 1988; Hui, 1991; Eidmann, 1992; Eager et al., 2004). *T. piniperda* was first found in Georgia in the 1940s and its primary host plant is Scots Pine, but it is capable of colonizing, developing and shoot feeding in other pine species, such as Eldari pine (*Pinus eldaric* Medw.), European Black pine (*Pinus nigra*) (Kanchaveli and Supatashvili, 1968).

*T. piniperda* is the first pine bark beetle to fly in spring within Europe, often flying several weeks before the others (Bakke, 1968; Bouhot et al., 1988). Under favorable weather conditions, the main flight period and the main period of gallery initiation last for only a few days (Bakke, 1968; Eidmann, 1974; Haack et al., 2000). The beetles may be already active in February or March (Amezaga, 1997; Langstrom and Hellqvist, 1985). The beetles reproduce in logs, stumps and pines that are wind broken, wind thrown, or otherwise weakened this species using host volatiles to locate breeding substrate (Kansas et al., 1967; Jordal, 1979). These species hibernate as adults and disperse in the spring as soon as the daily temperature exceeds about 12°C and usually establish galleries in the phloem of wind thrown or otherwise weakened trees. *T. piniperda* and *T. minor* prefer the thicker bark. Females in both species initiate galleries in the bark and are followed by a male. After two to three months, the brood emerges and flies to the shoots of the current year's growth, where they feed and mature. As a result of this feeding, both species cause growth losses and pruning of shoots. Overwintering adults become active in the early spring (Bakke, 1968). Adult females bore individually into the bark of suitable hosts and excavate a nuptial chamber where each female is joined by a single male. Females excavate a gallery and lay eggs in the phloem. Larvae tunnel in the phloem and pupate at the ends of their larval galleries. Most adults emerge in the early summer and feed in the shoots of healthy pine trees. Maturation feeding within shoots continues until temperatures cool down in autumn when beetles move down the trunk and construct niches in the outer bark at the base of trees to overwinter (Petrice et al., 2002).

*T. piniperda* and *T. minor* cause huge growth losses due to the shoot-feeding in the crowns of the pines. However, the attacks on the bole usually kill only weakened trees and do not cause extensive damage. In Europe and North America, the feeding of pine shoot beetles in pine shoots causes losses in the growth of trees (Legowski, 1987; Czokajlo et al., 1997; Borkowski, 2001).

*T. piniperda* seems to be able to attack and kill healthy

trees over large areas. Pine trees contain large amounts of terpenes, a few of which are known to be important for conifer bark beetle interactions. *T. piniperda* is strongly attracted by the host mono terpenes released through an injury on the tree or through the holes made by the Pioneer beetles in the trunk. This can in fact induce a mass attack comparable to that induced by the aggregation pheromones in other species (Byers, 1995).

Control of bark beetles is difficult because of their secluded life. Bark beetles are controlled by means of the trap tree method and biotechnical (pheromone traps), and widely used in recent years (Hui and Lieutier, 1997; Poland et al., 2003). Biological control with the use of predators, parasitoids or pathogens may help curb this problem. There is apparently no practical chemical control for this pest. Cultural practices used in Europe include precise timing of cutting operations and the debarking of cut timber. A predatory beetle, *Thanasimus formicarius* Linnaeus, can eat several pine shoot beetles daily (Czokajlo, 1998; McCullough, 2004).

This paper summarized data obtained from *T. piniperda* and *T. minor* control with pheromone traps in Kazbegi National Park, Georgia in 2008.

## MATERIALS AND METHODS

### Study area

The research was conducted in the year 2008 in Kazbegi National Park (Georgian). Kazbegi National Park is located on the northern slopes of Main Caucasus range, in the basin of the Tergi River, Kazbegi district; lower marker of its territory is at a height of 1400 m above sea level, and the upper one is within 300 – 4100 m. The establishment of Kazbegi National Park serves the purpose of protecting high mountain ecosystems.

The forests of Kazbegi National Park are located on the steep slopes. 105 species of wood plants can be found in the Strict Nature Reserve, though there are Litvinov's birch (*Betula litvinovi*), Scots Pine (*Pinus sylvestris* var. *hamata*), junipers (*Juniperus* - 3 species) and Sea-buckthorn (*Hippophae rhamnoides*). The dominant tree species of the study area was 40-140 years old Scots Pine, growing on the southern and southeastern slopes at altitudes ranging from 1970 to 2420 m a.s.l. High hypsometry of the relief and complex morphological conditions are main factors for developing the vertical zonality of the climate. Climate of study area is moderately humid, with relatively cold winter (-8 to 11°C) and short summer (10 to 14°C), the absolute maximum temperature being 30°C. Snow cover remains for 5-7 months (URL 2) (Figure 1).

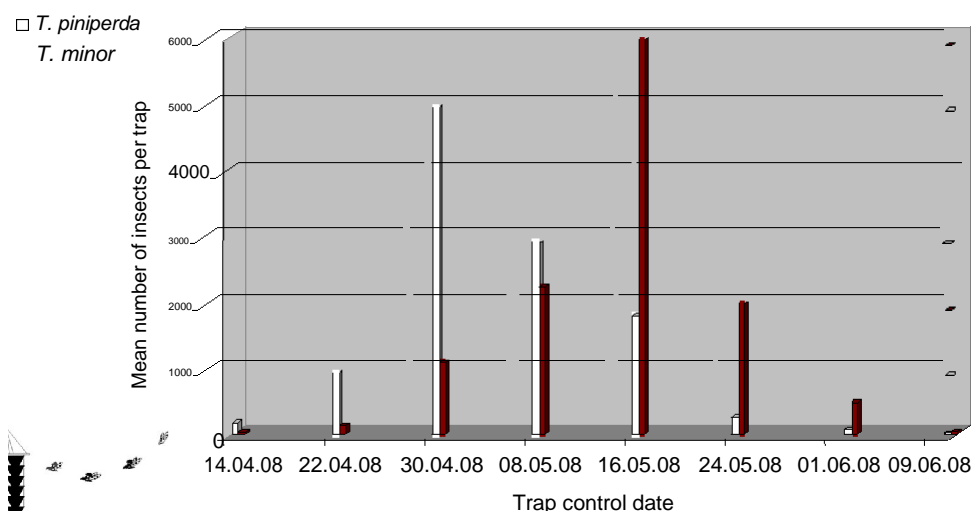
### Pheromone traps and dispensers

Baits releasing synthetic aggregation pheromone of *T. piniperda* and *T. minor* respectively, were used in the present study. TOMPIN © commercial lure release components of the aggregation pheromone of *T. piniperda* and *T. minor*. 100 traps were setup in Kazbegi National Park. In 2008, multiple funnel traps (8 units : Lingren, 1983) were used, pheromone traps were cylindrical, 122 cm tall, with diameters of 33 cm, made of 6 mm mesh screening material to minimize air damming and silhouette effects. Each trap was hung at a height of 1.5 m. The distance between traps was



**Table 1.** Summary of the result number of *T.piniperda* and *T.minor*, average number of these insects per trap in Kazbegi.

Year	Piece trap	Date of control	Captured insects		Catches per trap	
			<i>T. piniperda</i>	<i>T. minor</i>	<i>T. piniperda</i>	<i>T. minor</i>
2008	100	14.04.2008	160	21	1.6	0.2
	100	22.04.2008	910	120	9.1	1.2
	100	30.04.2008	4920	1060	49.2	10.6
	100	08.05.2008	2870	2220	28.7	22.2
	100	16.05.2008	1780	5940	17.8	59.4
	100	24.05.2008	240	1960	2.4	19.6
	100	02.06.2008	60	470	0.6	4.7
	100	10.06.2008	10	30	0.1	0.3
		Total	10.950	11.821	109.5±2.1	118.2±1.8



**Figure 2.** Mean number of *T.piniperda* and *T.minor* per trap and trap control date.

period in lasting only 1-2months. During the control period, it is possible to detect one period of capture of *T. piniperda*, in spring (early April and May). *T. piniperda* has one generation per year. The development of the generation, beginning from early April, takes 6-8 weeks depending on weather conditions. When the mean air temperature is about 12°C, they take flight, looking for suitable Scots Pine trees in order to start generation. Some authors (Amezaga, 1997; Bakke, 1968) have reported that this insect may be active during February and March. However, their numbers in Kazbegi National Park are on the rise.

The males of *T. piniperda*, which were in captured traps, numbered more than females. The percentage of males was 79.6; the percentage of females was 20.4. Similarly, the percentage of males of *T.minor* was 75.8, while the percentage of females was 26.2. Although, in considering only the number of captured adult insects as a mistake, their potential propagation must also be taken into consideration. The trials lasted until May (about 7-8

weeks) and data were reported as mean captures per trap. The flight activity of *T. piniperda* and *T. minor* is limited to smaller period of about 2 months (April-May) (Figure 2).

The flight periods varied greatly during in 2008. The majority of beetles flew during a few days and this main flight varied from mid April to the end of May. Flight activity started when maximum air temperature exceeded 10 to 12°C. The flight culmination was also related to air temperature. The higher the temperature at the beginning of the main flight, the larger the proportion of beetles flying on that day.

In 2008, pine shoot beetles initiated flight in the middle of April. Seasonal periodicity of the bark beetle, which captures the averaged overall levels of defoliation, indicates that peak flight of *T. piniperda* occurred during the last 3 days of April and declined rapidly in May. Unlike these findings, *T. minor*'s flight occurred earlier than *T. piniperda*. Peak flight of *T. minor* occurred during the middle of May. *T. piniperda* flight decreased in the

last week of May, while *T. minor* flight continued until the first week of June. According to Valenta (2000), in Lithuania, *T. piniperda* is reported to initiate flight in March and *T. minor* begins flight activity few weeks later. However, captures observed of *T. minor* are higher than *T. piniperda*. In 2008, 10950 *T. piniperda* and 11821 *T. minor* adults fall in traps hung in Kazbegi National Park.

In addition, other insect species were captured in the traps. These are more of Cerambycidae and Buprestidae family. Also, the controls seem to fall *Thanasimus formicarius* in traps.

Using pheromone traps alone does not seem to be enough to combat this pest's species. Besides, a clean actuation must be executed in the forest. Spindly trees being knocked down, collapsed and infected must be removed from the forest during cutting operations for maintenance purpose. It is worth keeping in mind that these type of trees left in the area serve as nest trees for insects. If the cut barked trees should be transported to another location, they must be absolutely peeled, otherwise, we may accelerate the diffusion of the insect. To increase the efficiency of pheromone traps and to get the maximum output, times of hang up, control and preparation change must be well defined. Moreover, hang up locations, distances to each other and trees must be well arranged for the traps. Biological combat works must be given importance and developed, and especially, *Thanasimus formicarius* must be grown in the laboratory.

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