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Tree Height Influences Flight of Lesser Peachtree Borer and Peachtree Borer (Lepidoptera: Sesiidae) Males

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Abstract Capture of male lesser peachtree borer, *Synanthedon pictipes* (Grote & Robinson), and peachtree borer, *S. exitiosa* (Say) (Lepidoptera: Sesiidae), in pheromone traps positioned from 0 m to 6 m above ground was affected by surrounding tree height. In a peach orchard with a 3 m canopy height, more *S. pictipes* were captured within the canopy zone at 1.8 m than above at 5.5 m. Trap capture was similar for *S. pictipes* in a mating disruption orchard with more caught at 2 m than at 4 m or 6 m. Capture at 1.8–5.5 m in mixed deciduous woods, with an average canopy height of 22 m, was not significantly different. In orchards, more *S. exitiosa* were captured at 1.8 m rather than at 5.5 m but no difference was detected in numbers captured from 0 m to 5.5 m in mixed deciduous woods. In a peach-pecan interplanted orchard, where pecan trees were three times taller but only one-ninth the density of peach, capture of both species was similar to capture in peach orchards when traps were entirely surrounded by peach. However, when traps were adjacent to a single, taller non-host pecan tree, capture was similar to mixed deciduous woods. These data suggest that habitat structure supersedes presence/absence of host plants affecting vertical flight activity of male *S. pictipes* and *S. exitiosa*.

Keywords *Synanthedon pictipes* · *Synanthedon exitiosa* · pheromone · mating disruption · vertical distribution

Lesser peachtree borer, *Synanthedon pictipes* Grote & Robinson (Lepidoptera: Sesiidae) and peachtree borer, *Synanthedon exitiosa* (Say) (Lepidoptera: Sesiidae) are indigenous to much of eastern North America where they attack native and exotic,

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cultivated *Prunus* spp. A common, native host plant is black cherry (*P. serotina* Ehrh.) while exotic hosts include peach (*P. persica* [L.] Batsch), sour cherry (*P. cerasus* L.), and European plum (*P. domestica* L.) (Girault 1907; Vogel and Neiswander 1933). Although larvae of both borer species feed largely on the cambium of host plants, damage by *S. pictipes* occurs on the trunk and structural scaffold limbs with pupation at the feeding site. In contrast, *S. exitiosa* attacks the trunk and roots near and below the soil line and can sometimes be found away from the trunk in association with exposed roots. Unlike *S. pictipes*, mature *S. exitiosa* larvae leave the host plant and pupate nearby in soil (Johnson et al. 2005a, b; Horton et al. 2008, Cottrell et al. 2008).

Synthetic sex pheromones of *S. pictipes* and *S. exitiosa* have been used for both monitoring and mating disruption in orchards (Yonce et al. 1977; Yonce and Pate 1979); however, our understanding of these moths' behavior in response to pheromone sources or pheromone permeation of orchards is generally limited. We do not know how males of these species respond to pheromone sources located away from positions (i.e., much higher or lower) where a female would be expected nor what the male does when the orchard is permeated with pheromone. For some pest Lepidoptera attacking orchard crops, an assessment of factors affecting attraction to pheromone sources has included trap height (with and without pheromone permeation of orchards) (Riedl et al. 1979; McNally and Barnes 1981; Howell et al. 1990; Weissling and Knight 1995; Nansen et al. 2004; De Lame and Gut 2006; Kovanci et al. 2006) and host plants within natural habitats (Hoffman and Dennehy 1989; Botero-Garces and Isaacs 2003). For example, vertical placement of pheromone traps within the host plant canopy affects moth capture but it is also known that vertical placement of pheromone dispensers can lower the average height of male codling moths (*Cydia pomonella* L. [Lepidoptera: Tortricidae]) within host trees (Riedl et al. 1979; Weissling and Knight 1995). In peach orchards, McLaughlin et al. (1976) demonstrated that male *S. pictipes* were captured more frequently in pheromone traps placed at the tops of peach trees when pheromone dispensers for mating disruption had been placed at the middle of the peach canopy.

Native host trees of *S. pictipes* and *S. exitiosa* generally represent a different physiognomy than the typically smaller, more compact and predictably shaped peach, plum and cherry cultivars manipulated by breeding and cultural practices. These differences offer an opportunity to explore pest behavior in response to natural and orchard settings. As expected in natural habitats, the occurrence of hosts across landscapes differs markedly from orchard habitats where trees are relatively dense and uniform; except for a scattering of fruit trees in backyards or as volunteers along woodland edges and roadways. Native hosts typically occur at random or in small aggregations amongst a diverse array of unmanaged woody and herbaceous plant species. Local abiotic factors, including air movement and shading will differ vertically (Schulze et al. 2001) in orchards as opposed to natural settings, i.e., woods.

Our objective was to evaluate the response of male sesiids to pheromone traps placed below, within or above the canopy of host plants in orchard settings (with and without pheromone permeation), and to examine the effect of elevating traps in settings different from typical peach orchards in that much taller trees were included. Thus, we assessed *S. pictipes* and *S. exitiosa* trap capture at different heights in conventional peach orchards (with and without pheromone permeation) and in nearby woods. Secondly, we examined the effect of tree height on trap capture of both species by using peach orchards sparsely interplanted with non-host pecan, *Carya illinoinensis* (Wangenh.) K. Koch, trees that had grown 3× taller than peach; traps were either placed near peach away from the taller pecan or adjacent to pecan.

Materials and Methods

We examined the effect of trap height (0–6 m above ground) on capture of male *S. pictipes* in peach orchards and woods (2008) at the USDA, ARS, Southeastern Fruit and Tree Nut Research Laboratory in Byron, GA, USA and in a large, commercial peach orchard under mating disruption (2004) near Marshallville, GA, USA. Additionally, we examined the effect of height on capture in a commercial peach orchard sparsely interplanted with pecan (2008) near Ft. Valley, GA, USA. Using this same setup, except for the mating disruption orchard, male *S. exitiosa* were then trapped in subsequent tests.

Peach Orchards and Woods—2008 Four peach orchards with adjacent woods were selected. Each orchard consisted of mixed cultivars with orchard ages ranging from 8 yrs to 12 yrs. Orchard pest management and cultural practices mimicked commercial orchards (Horton et al. 2009). Woods included both late successional species such as oak (*Quercus* spp.) and black cherry (*P. serotina*) in addition to early successional species such as privet (*Ligustrum* spp.), honeysuckle (*Lonicera* spp), pine (*Pinus* spp), brambles (*Rubus* spp.), greenbriers (*Smilax* spp.), Virginia creeper (*Parthenocissus quinquefolia* [L.] Planchon), and wild grape (*Vitis* spp.). Peach trees in orchards were uniformly distributed (6.1×6.1 m) and more uniform in height (about 3.0 m) than naturally distributed tree species in woods, which had an expected variation in height but with an average upper canopy height of 21.98 ± 3.75 m (n=24) as determined using a clinometer (model PM-5/360 PCP, Suunto Precision Instruments, Finland).

Interplanted Orchard—2008 A 12-yr-old, 17.5 ha commercial peach-pecan interplant orchard was planted to both species at establishment. The peach trees were planted on a standard 6.1×6.1 m spacing (i.e., 269 trees per ha) with pecan planted among these peach trees at about 1/9 the density of peach by replacing peach trees in the orchard at a typical pecan orchard spacing of 18.3×18.3 m (i.e., 30 trees per ha). During the current study, the pecan trees had outgrown the peach trees and were 9.1 ± 0.3 m tall extending about 6 m above the surrounding 2.9 ± 0.2 m-tall peach canopy. Standard pruning practices maintain the peach canopy at this height whereas commercial pecan trees in the southeastern U.S. are not pruned to maintain height. After peach production declines in an interplanted orchard, i.e., typically after 14–16 years in the southeastern U.S., the peach trees are removed leaving behind a bearing pecan orchard that will likely be productive over the next century.

Mating Disruption Orchard—2004 A 150 ha contiguous peach orchard near Marshallville, GA was put under *S. pictipes* mating disruption during 2004. This orchard contained mixed cultivars of different ages (from 10 yrs to 15 yrs old). The orchard was heavily infested with *S. pictipes* (TEC, unpublished data) and Isomate®-LPTB pheromone dispensers (Pacific Biocontrol Corp., Vancouver, WA, USA) were applied from middle to late February at the rate of four dispensers/tree (about 1,075 dispensers/ha).

Traps and Sampling Bamboo poles (5.6 m) were used to support traps at heights of 0 m, 1.8 m, 3.6 m and 5.5 m above ground except in the mating disruption orchard where traps were placed at 0 m, 2 m, 4 m and 6 m above ground using 6.4 m bamboo poles. Four sticky traps (Pherocon® 1C Trap, Trécé® Inc., Adair, OK, USA), each baited with a pheromone lure (as described later), were affixed singly at one of the randomly assigned heights with poles being aligned, 15 m apart, across the orchard (without mating disruption) in a North–South orientation. The same was done at each woods site with poles being within the woods and away from edges. Each of the four orchards and woods sites served as a replicate. For ease of lowering traps, the bamboo pole was secured to a 1.5 m steel T-post driven about 30 cm into the ground. The pole was secured to the post with a 7.6-cm-long bolt welded perpendicular on the post about 45 cm from the bottom. This bolt passed through a hole drilled near the bottom of the bamboo pole which was also wired to the top of the T-post holding it vertical against the supporting post. Undoing the wire allowed the bamboo pole to pivot on the bolt and be lowered to sample traps. Poles with traps attached at 0 m above ground (i.e., attached trap rested on the ground) did not need to be lowered for sampling. At the interplant orchard, traps were randomly assigned to one of the four height positions on a bamboo pole, as previously described. Here each of the four traps were either placed adjacent to a taller pecan tree (on one side of the trap but with peach trees on three sides) or away from pecan trees with each trap entirely surrounded by the much shorter peach trees (on all four sides). Trap placement, adjacent to pecan or not, was replicated four times. Each of the four aligned traps, whether adjacent to pecan or not, were spaced 18.3 m apart and each of the replicates was separated by 18.3 m. Within the large mating disruption orchard, each of the six replicates of traps was spaced at least 120 m apart and these North–South aligned traps were spaced 61 m apart within each replicate.

All traps were sampled weekly for Sesiidae. S*ynanthedon pictipes* was sampled concurrently in non-mating disruption peach orchards and woods from 20 May–17 June 2008. During this time, each trap was baited with a *S. pictipes* sex pheromone lure (L304, Scentry Biologicals, Inc., Billings, MT). This same setup was used from 15 July–12 Aug 2008 to sample *S. exitiosa* with traps baited using a sesiid spp. sex pheromone lure (L103, Scentry Biologicals, Inc., Billings, MT) attractive to *S. exitiosa*. Again, trap heights were randomized in orchards and woods before the start of this experiment trapping *S. exitiosa*.

At the interplant orchard, *S. pictipes* was sampled at the different trap heights from 3 Sept–1 Oct 2008 and *S. exitiosa* was sampled from 1 Oct–29 Oct 2008. Only *S. pictipes* was sampled from height traps placed in the mating disruption orchard (5 May–13 Oct 2004).

Height traps in the mating disruption orchard were sampled weekly from May 5 to Oct 13, 2004. Pheromone baits in traps were changed monthly and liners changed as needed.

Statistical Analyses We compared capture of each species at the different trap heights within orchards, within woods, at the same height between orchard and woods and within the mating disruption orchard. In addition we compared average capture per trap (all heights combined) in orchards versus woods during 2008. These same comparisons were done for data from the interplant orchard during 2008. The mean number of males captured at each trap height for each location (i.e., orchard, woods, interplant orchard with peach surrounding, interplant orchard with pecan adjacent, mating disruption orchard) was square root transformed (Zar 1999; JMP 2007). Transformed data were analyzed using analysis of variance and mean separation performed using Tukey's Honestly Significant Difference test when $P \leq 0.05$ (JMP 2007). Non-transformed means are presented.

Results

Orchards and Woods Average numbers (± SE) of male *S. pictipes* captured in orchards (89.3±15.7) and woods (89.5±18.2) were very similar (F=0.2595; df=1, 7; P=0.6456). Trap height did affect capture of male *S. pictipes* in orchards (F= 18.55; df=3, 15; P=0.0003) (Fig. 1). More moths were captured in traps at 1.8 m than any other height. Ground level traps captured similar numbers of moths as did traps at 3.6 m and 5.5 m; however, fewer moths were captured in the highest traps at 5.5 m than in traps at 3.6 m. In woods, the fewest *S. pictipes* moths were captured at ground level (F=13.41; df=3, 15; P=0.0011) (Fig. 1); trap capture at 1.8 m, 3.6 m and 5.5 m was similar (Fig. 1). A comparison of trap capture at the same height in

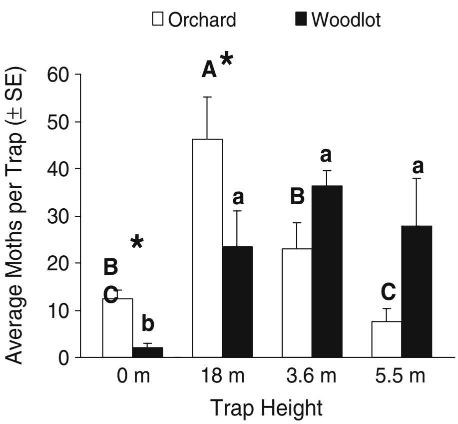

Fig. 1 Average number of male *S. pictipes* captured in peach orchards over 4 wk using pheromone-baited traps placed 0 m, 1.8 m, 3.6 m and 5.5 m above ground. In peach orchards, traps at 1.8 m were within the canopy zone, whereas, traps at 0 m and 3.6 m or 5.5 m were below and above the orchard canopy, respectively. All traps in woods were within the understory. *Upper* or *lower* case letters above columns separately indicate significant difference (P<0.05) in capture at different trap heights in orchards or woods, respectively. *, indicates significant difference (P<0.05) between paired columns.

the two different habitats revealed that significantly more moths were captured in orchards than woods at 0 m (F=192.31; df=1, 7; P=0.0008) and 1.8 m (F=10.48; df=1, 7; P=0.0479) (Fig. 1); trap capture in both habitats was similar at 3.6 (F= 6.70; df=1, 7; P=0.0812) and 5.5 m (F=4.67; df=1, 7; P=0.1195) (Fig. 1).

Average numbers (± SE) of male *S. exitiosa* captured in orchards (31.0±6.9) and woods (40.0±7.8) were not significantly different (F=2.70; df=1, 7; P=1987). In peach orchards, capture varied significantly by trap height (F=4.36; df=3, 15; P=0.0372) with more *S. exitiosa* captured at 1.8 m than 5.5 m (Fig. 2). Trap captures at 0 m and 3.6 m were not different from those at 1.8 m or 5.5 m. In woods, trap capture of *S. exitiosa* was similar at all trap heights (F=1.29; df=3, 15; P=0.3358) (Fig. 2). A comparison of trap capture at the same heights in the two different habitats revealed that significantly more *S. exitiosa* moths were captured in woods than orchards at 5.5 m (F=12.34; df=1, 7; P=0.0391) (Fig. 2); trap capture was similar in both habitats at 0 (F=0.44; df=1, 7; P=0.5550), 1.8 (F=0.9455; df=1, 7; P=0.4026) and 3.6 m (F=5.88; df=1, 7; P=0.0938) (Fig. 2).

Peach Interplanted with Pecan Average numbers (± SE) of male *S. pictipes* captured were similar (F=0.38; df=1,7; P=0.5832) when traps were entirely surrounded by peach (115.1±20.72) or adjacent to a pecan tree (92.3±16.6). When surrounded by peach, a significant effect of trap height on capture was detected (F=15.57; df=3, 15; P=0.0007). Fewer moths were captured in traps at 5.5 m than at other trap heights; capture at 0 m, 1.8 m, and 3.6 m was similar (Fig. 3). However, when traps were placed adjacent to the taller pecan trees, no significant effect of height on trap capture was detected (F=0.10; df=3, 15; P=0.9553) (Fig. 3). Additionally, comparing capture at the same height when a trap was surrounded by peach versus adjacent to pecan revealed no difference at 0 m (F=1.05; df=1, 7; P=0.3819), 3.6 m

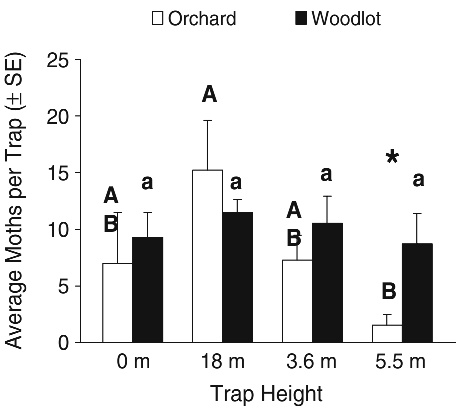

Fig. 2 Average number of male *S. exitiosa* captured in peach orchards over 4 wk using pheromone-baited traps placed 0 m, 1.8 m, 3.6 m and 5.5 m above ground. In peach orchards, traps at 1.8 m were within the canopy zone, whereas, traps at 0 m and 3.6 m or 5.5 m were below and above the orchard canopy, respectively. All traps in woods were within the understory. *Upper* or *lower* case letters above columns separately indicate significant difference (P<0.05) in capture at different trap heights in orchards or woods, respectively. *, indicates significant difference (P<0.05) between paired columns.

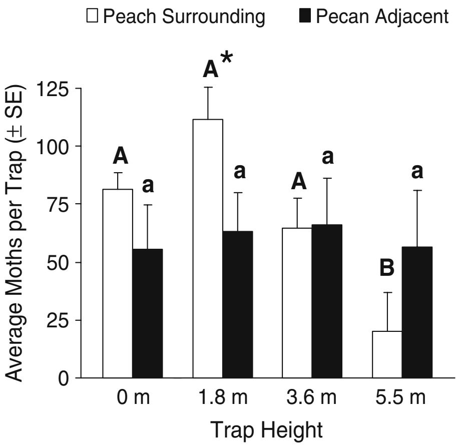

Fig. 3 Average number of male *S. pictipes* captured in a peach-pecan interplanted orchard over 4 wk using pheromone-baited traps placed 0 m, 1.8 m, 3.6 m and 5.5 m above ground. Traps were either surrounded by peach trees away from pecan or placed adjacent to a pecan tree that was 3× taller than peach trees. When surrounded by peach trees, traps at 1.8 m were within the canopy zone, whereas, traps at 0 m and 3.6 m or 5.5 m were below and above the orchard canopy, respectively. No traps adjacent to a pecan tree exceeded the height of that tree. *Upper* or *lower* case letters above columns separately indicate significant difference ($P<0.05$) in capture at different trap heights when surrounded by peach or adjacent to pecan, respectively. *, indicates significant difference ($P<0.05$) between paired columns.

($F=0.01$; df=1, 7; $P=0.9306$) or 5.5 m ($F=3.53$; df=1, 7; $P=0.1568$). The difference was significant at 1.8 m ($F=10.28$; df=1, 7; $P=0.0491$) where more *S. pictipes* moths were captured when traps were surrounded by peach (Fig. 3).

Average numbers (± SE) of male *S. exitiosa* were similar ($F=0.21$; df=1, 7; $P=0.6788$) when traps were surrounded by peach (2.38±1.14) or adjacent to pecan (2.44±0.91). When surrounded by peach trees, a significant effect of trap height on capture was detected ($F=5.63$; df=3, 15; $P=0.0188$). Fewer moths were captured in traps at 5.5 m than any other height (Fig. 4). There was no effect of trap location, i.e., surrounded by peach or adjacent to pecan, on capture at 0 ($F=0.84$; df=1, 7; $P=0.4263$), 1.8 ($F=3.00$; df=1, 7; $P=0.1818$), 3.6 ($F=0.77$; df=1, 7; $P=0.4460$), or 5.5 m ($F=2.92$; df=1, 7; $P=0.1859$).

Mating Disruption Orchard Capture of male *S. pictipes* within the heavily infested mating disruption orchard was significantly higher for traps placed 2 m above the orchard floor than traps at 4 m or 6 m ($F=6.08$; df=3, 23; $P=0.0064$). Moth capture for traps on the orchard floor, i.e., 0 m, was not different than capture at either 2, 4 or 6 m (Fig. 5).

Discussion

In the southeastern U.S., the multivoltine *S. pictipes* is generally more abundant than the univoltine *S. exitiosa* (Sharp et al. 1978). In fact, Snow et al. (1985) showed that of 22 species of Sesiidae captured in pheromone-baited traps near Byron, GA, USA, *S. pictipes* was by far the most abundant.

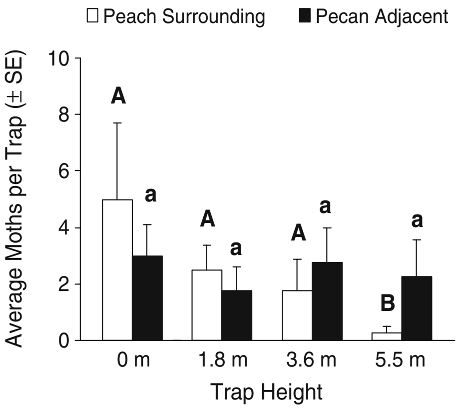

Fig. 4 Average number of male *S. exitiosa* captured in a peach-pecan interplanted orchard over 4 wk using pheromone-baited traps placed 0 m, 1.8 m, 3.6 m and 5.5 m above ground. Traps were either surrounded by peach trees away from pecan or placed adjacent to a pecan tree that was 3× taller than peach trees. When surrounded by peach trees, traps at 1.8 m were within the canopy zone, whereas, traps at 0 m and 3.6 m or 5.5 m were below and above the orchard canopy, respectively. No traps adjacent to a pecan tree exceeded the height of that tree. *Upper* or *lower* case letters above columns separately indicate significant difference ($P<0.05$) in capture at different trap heights when surrounded by peach or adjacent to pecan, respectively. *, indicates significant difference ($P<0.05$) between paired columns.

Total capture of *S. pictipes* or *S. exitiosa* in orchards versus woods was similar in the present study although orchard versus woods abundance has differed in other studies (Yonce et al. 1979). Compared with woods, peach orchards present a highly uniform, abundant supply of host material for infestation and would be expected to serve as a greater source of these moths.

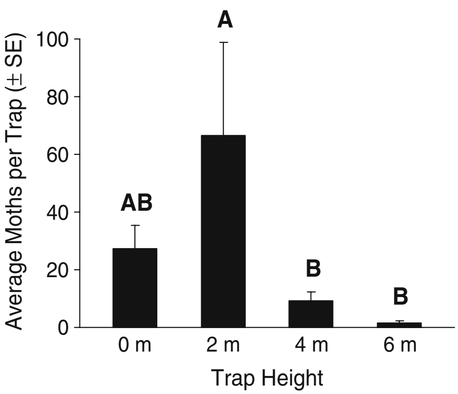

Fig. 5 Average number of male *S. pictipes* captured in pheromone-baited traps within a peach orchard (from 5 May–13 October, 2004) that had been treated with Isomate®-LPTB pheromone dispensers. Traps had been placed at 0 m, 2 m, 4 m and 6 m above ground. Traps at 2 m were within the canopy zone, whereas, traps at 0 m and 4 m or 6 m were below and above the orchard canopy, respectively. Different letters above columns indicate significant difference ($P<0.05$) in capture at different trap heights.

Similar capture trends within orchards at different trap heights were noted for both *S. pictipes* and *S. exitiosa*. Those traps placed above or below the orchard canopy (i.e., at 0 m and 5.5 m) always caught fewer moths than traps within the canopy (i.e., at 1.8 m). Even traps positioned <1 m above the orchard canopy (i.e., at 3.6 m) tended to catch fewer moths than those within the canopy zone (i.e., at 1.8 m). It appears that flight activity of these sesiid moths, as indicated by trap capture, is closely associated with proximity to the canopy. Interestingly, the response of male *S. pictipes* to trap height, i.e., fewer captured above the canopy, was similar in the large orchard placed under mating disruption. Riedl et al. (1979) and McNally and Barnes (1981) both found that codling moth capture increased with higher trap placement on the host tree.

Changing from orchards to woods habitats impacted capture of *S. pictipes* and *S. exitiosa* in traps at different heights. Significantly fewer *S. pictipes* were captured at ground level than at 1.8 m, 3.6 m and 5.5 m with no difference between those traps above ground level. Similar numbers of *S. exitiosa* were captured in all traps, including at ground level. Except for *S. pictipes* captured at 0 m, numbers of moths captured were consistent at different heights in the woods. In woods, no trap extended above the canopy. Being entirely within the understory would certainly affect the microclimate (e.g., shading, temperature and air movement) around all of the elevated traps, making conditions more uniform for these traps even at different heights. As such, it is not surprising that similar numbers of *S. pictipes* were captured in all elevated traps within woods. This sesiid attacks host plants above ground level and the native host *P. serotina* certainly grows much taller than 5.5 m. Natural *S. pictipes* infestations on *P. serotina* appear as blackened cankers that are easily observed on trunks and limbs. Snow et al. (1985) reported *S. pictipes* infestations on *P. serotina* occurring as high as 10 m above ground. It is reasonable to expect male *S. pictipes* to fly throughout the understory and canopy of woods in search of females that may call near cankers from which they emerge. On the other hand, *S. exitiosa* females oviposit on host plants or nearby vegetation around the base of the host plant (Johnson et al. 2005a) making it somewhat surprising that *S. exitiosa* males were captured equally at all trap heights in woods. However, it might be explained that calling females scattered, spatially and temporally, across a natural landscape facilitate male response by moving higher on plants to call with air currents likely carrying sex pheromone plumes farther and attracting males from a greater distance. But previous research already has shown that some moths are more abundant at certain heights within trees (Riedl et al. 1979; Barrett 1995; Weissling and Knight 1995). Thus, higher moth abundance near traps positioned at preferred heights for males might be expected to capture more males than traps positioned at heights where fewer males occur or frequent. This could explain trap differences in peach orchards where traps within the canopy zone at 1.8 m typically captured more moths (i.e., more moths were available to respond) and similarly so for capturing more moths at 2 m in the mating disruption orchard. An explanation for trap captures in woods may be that the woods canopy serves to temper extremes in ambient conditions throughout the understory allowing moths to move more freely, with regard to vertical position, throughout this shaded habitat. In contrast, the mostly black-bodied moths of both species above the orchard canopy would be exposed to full sun and presumably higher temperatures. Gentry et al. (1977) report that peak activity of male *S. pictipes* (typically from 10 to 11 AM) and *S. exitiosa* (typically from 12 to 1 PM) in central Georgia occurred at 26°C and 28°C, respectively. Gorsuch et al. (1975) earlier reported that the optimum temperature range for female *S. pictipes* was between 27°C and 32°C. Given the lower trap captures above the orchard canopy, more uniform captures at all heights in woods (except *S. pictipes* at 0 m), and the strong flight capability of these moths, it appears that ambient conditions may play a larger role in trap capture than does presence of host plants or pheromone permeation. Similarly, Howell et al. (1990) found that *Cydia pomonella* (L.) (Lepidoptera: Tortricidae) males were trapped in much greater numbers when pheromone traps were placed within, rather than outside, the canopy of apple trees; trap height within the apple canopy did not affect capture and would seem to indicate, as in the present woods study, that canopy shading was important to capture.

Additionally, the impact of taller trees affecting capture at different heights is not limited to woods providing a shaded understory. When we placed traps at different heights in a peach-pecan orchard, capture of *S. pictipes* and *S. exitiosa* males in traps surrounded by peach was similar at 0 m, 1.8 m and 3.6 m but lower at 5.5 m. However, in this same orchard, but with traps adjacent to a much taller pecan tree, no difference was detected in capture of either species at any trap height. These data strongly suggest that the tall, non-host pecan trees altered microenvironment conditions (e.g., possibly shading, temperature, and/or air currents) around the 5.5 m traps leading to similar trap capture at all heights. It is also possible that the taller pecan trees provided resting sites for the moths that may be important for male interaction with calling females and even pheromone traps. Nansen et al. (2004) report that differences in Indianmeal moth, *Plodia interpunctella* (Hübner) (Lepidoptera: Pyralidae), captures based on trap height were negated when traps were positioned vertically near a wall. Those authors postulated that males prefer pheromone traps adjacent to surfaces, possibly for mating.

We have shown that non-host trees can have a significant impact on flight activity of *S. pictipes* and *S. exitiosa*. It is likely that other *Synanthedon* spp. are similarly affected as are other pest Lepidoptera. This research allows us to better understand those factors governing movement of male *S. pictipes* and *S. exitiosa* to better facilitate control through mating disruption. For example, different orchard management practices resulting in different tree heights will likely contend with vertical placement of dispensers in orchards at heights that provide permeation of the entire canopy where males occur.

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