Detection and Seasonal Abundance of *Sirex nigricornis* and *Eriotremex formosanus* (Hymenoptera: Siricidae) Using Various Lures and Trap Trees in Central Louisiana, U.S.[1]

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Abstract The recent introduction and spread of the nonnative woodwasp *Sirex noctilio* F. in North America has generated interest in the ecology of resident Siricidae. In 2 trapping experiments we compared 8 treatments for attractiveness to siricids. Four treatments consisted of traps baited with one of the following lure combinations: 70:30 α-β-pinene alone (Sirex lure); Sirex lure + 95% ethanol; Sirex lure + ipsenol + ipsdienol; Sirex lure + 95% ethanol + ipsenol + ipsdienol. The remaining treatments consisted of blank traps adjacent to standing, chemically debilitated *Pinus taeda* L. trap trees, created with either sodium N-methyldithiocarbamate (Woodfume®) and dimethyl sulfoxide, or Vanquish® herbicide (dicamba), on 2 separate dates. In a third experiment we compared trap catches among these 2 trap tree treatments and an ethanol lure using traps placed at 2 heights. We collected *Sirex nigricornis* F. in the fall months, with a peak in midNovember, and *Eriotremex formosanus* Matsumura in the spring, summer and fall, with a peak in midOctober. We collected no *S. noctilio,* nor males of any siricid species. The addition of ethanol and/or *Ips* sp. pheromones to the Sirex lure did not significantly improve collection of any siricids, and all semiochemical treatments were more effective for detecting *S. nigricornis* than trap trees. Traps positioned low upon dicamba-created *P. taeda* trap trees were most effective for detecting *E. formosanus*; however, no progeny emerged from trap trees. We provide detailed phenology and baseline data not previously reported on 2 species of Siricidae in central Louisiana.

Key words *Sirex nigricornis, Eriotremex formosanus*, insect-detection

Sirex noctilio F. (Hymenoptera: Siricidae), a wood-boring wasp native to Eurasia and North Africa, has caused significant mortality in exotic pine plantations since its introduction in the Southern Hemisphere in 1900 (Rawlings and Wilson 1949, Carnegie et al. 2006, Hurley et al. 2007). Established populations of *S. noctilio* were discovered in the U.S. following detection of a single specimen in a funnel trap in New York in 2004 (Hoebeke et al. 2005, Dodds et al. 2010). Subsequent spread of *S. noctilio* in North America and associated tree mortality have resulted in an increased interest in the life histories of native Siricidae. Most Siricidae in their native ranges are attracted to dying or dead trees and are not primary pests of trees (Morgan 1968), and such is the case for native Siricidae in the U.S. As a result, the habits and phenology of many siricids that occur in North America are poorly understood. However, a number of

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recent studies of Siricidae occurring in North America have reported comparisons of attractants and trap trees for detecting these species (Costello et al. 2008, Coyle et al. 2012, Ulyshen and Hanula 2010). Such an investigation of Siricidae in Louisiana has not been previously published.

The success of trapping efforts for these species depends on knowledge of their chemical ecology. It is unknown whether the siricids we collected possess long-range sex pheromones, but based on work with *S. noctilio*, it is unlikely. Females possess a contact sex pheromone (Böröczky et al. 2009) but are not known to possess a long-range pheromone (Crook et al. 2012). This limits trapping to the use of host odors and pheromones of competing or associated insects. We selected the commonly-used host volatiles α-β pinene and ethanol, and pheromones of the *Ips* engravers bark beetles, which potentially cohabit dead or dying hosts of pine-infesting siricids. Combinations of these attractants were compared with 2 methods of creating chemically-debilitated trap trees proven effective for attracting *S. noctilio* and other pine-infesting insects (Neumann et al. 1982, Roton 1987, Miller et al. 1995, Strom et al. 2004).

The selection of α-β pinene as an attractant in this study was based on efforts for detecting *S. noctilio.* Simpson (1976) and Simpson and McQuilkin (1976) determined that α- and β-pinene were major constituents of compounds emanating from decaying *Pinus radiata* D. Don in Australia, and later determined these monoterpenes elicited significant antennal responses in *S. noctilio*. In a series of trapping experiments in Australia, it was later determined a mix of 70:30, α- and β-pinene (Sirex Ultra High Release lure, Synergy Semiochemicals Corp., Burnaby, Canada) was the most attractive mix of these 2 antennally-active compounds to *S. noctilio* (Bashford 2008). The Sirex Ultra High Release lure (hereafter referred to as Sirex lure) has since been widely used as a survey tool in the U.S. for *S. noctilio* (APHIS 2009), and has proven attractive to native Siricidae (Coyle et al. 2012). Electroantennogram analysis of *Sirex nigricornis* F., a siricid native to eastern North America and commonly collected in Louisiana, indicated females of this species also were antennally responsive to α- and β-pinene from *Pinus taeda* L. aerations, as well as verbenone, a pheromone of a scolytine (W.P. Shepherd and B.T. Sullivan, USDA F.S, pers. comm.). In addition to the Sirex lure, other attractant blends containing additional compounds have been evaluated for attractiveness to *S. noctilio* in the field, but none have proven more attractive to *S. noctilio* than herbicide-created trap trees (Crook et al. 2012, Zylstra et al. 2010). We selected the use of the herbicide dicamba to create *Pinus taeda* L. trap trees based on results illustrating its effectiveness when used on *Pinus radiata* D. Don in attracting *S. noctilio* in Australia (Neumann et al. 1982). We also evaluated the attractiveness of a trap tree created using the soil fumigant N-methyldithiocarbamate and the carrier dimethyl sulfoxide, proven to render *P. taeda* attractive to bark beetles (Roton 1987, Miller et al. 1995, Strom et al. 2004) but never specifically evaluated for attractiveness to Siricidae. In addition to these treatments, we combined the Sirex lure with an ethanol lure. There are numerous examples illustrating the effectiveness of combining the host odors ethanol and various monoterpenes in attracting woodborers, such as *Monochamus* sp. (Coleoptera: Cerambycidae) (Billings and Cameron 1984, Miller 2006, Allison et al. 2001; de Groot and Nott 2004). Although siricids are of a different order, the pine-infesting siricids in the southern U.S. likely compete with *Ips* engravers (i.e., *Ips avulsus* (Eichoff), *I. grandicollis* (Eichoff) and *I. calligraphus* [Germar]) for host material. When the pheromones attractive to these species (Miller et al. 2005) are combined with host volatiles such as α-pinene, collections of *Monochamus* sp. and other pine woodborers are significantly improved (Miller and

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Asaro 2005). The attraction of competing insects to traps baited with host odors, plus ethanol and/or the pheromones of conspecific species, warranted investigation as potential attractants for resident siricids.

We present the phenology and relative attractiveness of trap trees created using 2 known methods, as well as combinations of the host odors ethanol and α-β pinene (Sirex UHR lure) and *Ips* engraver pheromones, to the siricids collected in this study, *S. nigricornis*, *Eriotremex formosanus* Matsumura, *Urocerus cressoni* Norton, and *Tremex columba* L. in central Louisiana. We also collected the former species *Sirex edwardsii* Brullé; however, Schiff et al. (2012) now consider this a color morph of *S. nigricornis* based on morphology and DNA comparisons. We, therefore, recognize the total of the 2 solely as *S. nigricornis.* This is the first study to compare these attractants for detecting Siricidae resident to central Louisiana and contributes toward a better understanding of the life history of Siricidae in Louisiana and other parts of eastern North America.

Materials and Methods

Experiments 1 and 2. Eight treatments were compared in Experiments 1 and 2 (Table 1). Trap tree treatments consisted of treating loblolly pine (*P. taeda*) 15 - 20 cm in diameter at breast height at 2 dates to vary the state of attractiveness to available Siricidae (Table 1). Two methods were used to create trap trees: (1) Application of *N*-methyl-dithiocarbamate (Vapam, Woodfume®, Osmose, Inc., Buffalo, N.Y.) plus dimethyl sulfoxide (DMSO; hereafter the treatment is called Vapam-DMSO) at a 4:1 (v:v) ratio onto cotton wicks in evenly-separated hatchet frills 5 cm apart around the tree trunk at 31 cm above ground line (Roton 1987 as modified by Strom et al. 2004), and (2) Application of 1 mL of a 20% solution of the herbicide dicamba (Vanquish®, Syngenta Crop Protection, Inc., Greensboro NC) based on the weight of active ingredient in solution with distilled water (Neumann and Morey 1984, Neumann et al. 1982). Replicates of treatments were spaced at least 30 m apart.

Experiment 1 ran from 23 August 2006 - 17 August 2007. Three replicates of each treatment were deployed in 5, 25 yr-old *P. taeda* stands, previously thinned in the summer of 2006, in Winn Parish, LA ($n = 15$ traps per treatment). Two dicamba trap trees with the greatest observed trap catch of *E. formosanus* were felled on 13 June 2007 and a third of the main bole of the tree dissected on site, a third placed in screen enclosures at the study site, exposed to natural weather conditions, and a third returned to the laboratory and placed in rearing drums. Only portions of the trees up to the base of the crown (approx. 10 cm diam.) were sampled.

Experiment 2 was initiated in undisturbed forests of mixed pine-hardwood species composition and varying ages, adjacent to 3 pine-processing woodmills: Hunt Products Plywood Mill (Grant Par., LA), International Paper Corp. Paper and Container Board Mill (Rapides Par., LA), and Weyerhauser Corp. Pine Lumber Mill (Winn Par., LA). Based on results from Experiment 1, Experiment 2 targeted *S. nigricornis* and was initiated in October 2007 and ceased on 15 January 2008. Three replicates of the 8 treatments were deployed at each mill ($n = 9$ traps per treatment). Based on the *S. nigricornis* collections in trap tree treatments in Experiment 1, the treatment dates of the dicamba and Vapam DMSO-treated trap trees were altered in an attempt to refine the timing of the treatments and improve attractiveness of trap trees at the time of *S. nigricornis* flight (Table 1). No trap trees were felled as in Experiment 1.

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Table 1. Treatments compared in Experiments 1 and 2 for attractiveness to Siricidae in Louisiana.

Treatment abbreviation	Treatment	Trap Tree creation date Experiment 1	Trap Tree creation date Experiment 2
Early Dicamba	Dicamba traptree early treatment date	17-August	4-September
Late Dicamba	Dicamba traptree late treatment date	19-October	3-November
S*	Sirex UHR[1]	na	na
SE**	Sirex UHR + 95% ethanol	na	na
SI+	Sirex UHR + ipsenol + ipsdienol	na	na
SEI	Sirex UHR + ipsenol + ipsdienol + 95% ethanol	na	na
Early Vapam	Vapam-DMSO traptree early treatment date	17-August	4-September
Late Vapam	Vapam-DMSO traptree late treatment date	19-October	3-November

* Sirex Ultra High Release, 70% α-pinene [75% (+), 25% (-)] ; 30% β pinene [95% (-)] (Synergy Semiochemicals Corp., Burnaby, Canada); elution rate ca. 2.5 g per d in first 30 d at 27°C; see http://www.fs.fed.us/foresthealth/technology/elutionrate/lure.htm

** Ethanol treatment consisted of a 250 ml plastic bottle containing denatured 95% ethanol (Carolina Biological Supply Co., Burlington, NC); a wire brush pipe cleaner was inserted as wicks in drilled holes (9/64") in the bottle cap; elution rate ca. 3.2 g per d in first 35 days at 27°C; see http://www.fs.fed.us/foresthealth/technology/elutionrate/lure.htm

+ *Ips* engraver pheromones–racemic ipsenol and ipsdienol (bubble cap IP034 and IP035, Elution rate: 200 and 100 μ grams per d, respectively, at 25°C) Synergy Semiochemicals Corp., Burnaby, Canada).

Note: In Experiment 1, all attractants replaced each mo from April through November; every other mo for remainder of trapping period; Experiment 2, each mo; Experiment 3, ethanol treatment replaced each mo.

Experiment 3. Based on collection of relatively numerous *E. formosanus* in Experiment 1, Experiment 3 targeted this species by conducting trapping from 15 August 2007 through 14 November 2007. Three attractant treatments were compared: the dicamba trap tree and Vapam-DMSO trap tree treatments described previously, and a 95% ethanol-only treatment (described in Table 1). In addition to the attractants, we also fastened a high trap (cup 2.5 m from ground) and a low trap (cup 1.5 m ground) to each trap tree. Traps baited with 95% ethanol were suspended one above the other from a pair of lines between 2 trees at the stated heights. Each treatment was replicated 5 times, and replicates were spaced at least 30 m apart in a 25 yr-old *P. taeda* stand (thinned 2 months prior) in Winn Par., LA. Ethanol bottles were refilled monthly. No trap trees were felled for rearing.

Intercept panel traps (Alpha-Scents, Inc., Portland, OR) were used in each experiment. Traps associated with trap trees were unbaited and attached to metal poles fastened to the bole of the tree such the collection cup rested 1.5 m from the ground.

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Propylene glycol was used as a killing and preserving agent in collection cups, and collections were made every 2 wks in each experiment.

Statistical analyses. Analyses of total *S. nigricornis* and *E. formosanus* collections were conducted separately in all experiments. Due to several replicates in Experiments 1 and 2 with zero collections (for the entire trapping period), data were subjected to a non-parametric multiple response blocked permutation procedure (MRBP; McCune et al. 2002), appropriate for complete randomized block designs, using PC-ORD 5.0 (MjM Software Design, Gleneden Beach, OR). Euclidean distances were calculated to construct the distance matrix and blocks were aligned prior to analysis (McCune et al. 2002). Post hoc multiple comparisons were subjected to a Bonferroni adjustment to maintain an experiment-wide type 1 error rate of $\alpha = 0.05$. In Experiment 3, data were log-transformed and analyzed as a split-plot design with trap tree treatment as the whole plot factor and trap position as the subplot factor (Littell et al. 2002). Because no *E. formosanus* were collected in the 95% ethanol treatment in this experiment, the treatment was excluded from the analysis. Tukey's HSD mean comparison test was used for all post hoc testing of treatments (maintaining an experiment-wide critical value of $\alpha = 0.05$).

Results

Experiment 1. Ninety-seven *S. nigricornis* (35% of which were the former *S. edwardsii* color morph) were collected between 12 October 2006 and 13 January 2007. Initial analysis indicated a significant treatment effect (T= -8.14, $P = 0.0000001$), and subsequent pairwise comparisons of treatments (at the adjusted critical value of $P = 0.0017$) indicated semiochemical lures were generally more attractive to *S. nigricornis* than trap trees; however, no semiochemical treatments were decisively more attractive than another (Table 2). Sixty-four *E. formosanus* were collected between 14 September and 15 December 2006, and 7 specimens were collected between 5 April and

Table 2. *Sirex nigricornis* collection totals followed by the treatment mean ± SEM from Experiments 1 and 2 in central Louisiana. Differing letters indicate a significant difference (experiment-wise error rate α=0.05) among treatments within an experiment.

Treatment	Experiment 1	Experiment 2
EarlyDicamba	(6) 0.4 ± 0.13 ab	(17) 1.9 ± 1.0 a
Late Dicamba	(2) 0.1 ± 0.09 ab	(8) 0.9 ± 0.3 a
Early Vapam	(1) 0.1 ± 0.06 b	(20) 2.2 ± 0.9 a
Late Vapam	(4) 0.3 ± 0.12 ab	(16) 1.8 ± 0.8 a
S*	(25) 1.6 ± 0.36 a	(27) 3.0 ± 0.7 a
SE**	(23) 1.5 ± 0.29 a	(39) 4.3 ± 1.1 a
SI+	(17) 1.1 ± 0.39 a	(48) 5.3 ± 1.9 a
SEI++	(17) 1.1 ± 0.26 a	(29) 3.2 ± 1.6 a

* Sirex Ultra High Release lure

** Sirex UHR + 95% ethanol

+ Sirex UHR + ipsenol + ipsdienol

++ Sirex UHR + ipsenol + ipdienol + 95% ethanol

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14 June 2007. Although there were no significant differences among treatments, a mean (± 1 SD) 2.5 ± 0.9 *E. formosanus* were collected from the early dicamba-treated trap trees, more than twice the mean collection from other treatments; however, variation was high among trap trees. Mean collection of *E. formosanus* in the remaining treatments ranged from 0.1 - 0.5 specimens per trap. Three *U. cressoni* Norton (2 in the Sirex lure, and 1 in the Sirex lure + ethanol combination), were collected between 20 October and 7 November. One *T. columba* L. (Sirex lure + ethanol combination treatment), was collected between 7 and 16 November. No progeny of any Siricidae were collected from felled trap trees. Neither *S. noctilio* nor male specimens of any species were collected. Although the egg parasitoid *Ibalia leucospoides* Hochenwarth may have been collected, they were not identified in Experiment 1.

Experiment 2. Two hundred and four *S. nigricornis* (35% of which were the former *S. edwardsii* color morph) were collected between 11 October 2007 and 12 December 2008. There were no significant differences among attractants in collection of *S. nigricornis* (T= -2.73, P = 0.0122), but as in Experiment 1, semiochemical-baited traps were generally more attractive than trap trees (Table 2). Thirty-one adults of the *Sirex* sp. egg parasitoid *I. leucospoides* also were collected between 25 October 2007 and 10 January 2008; mean collections among treatments did not exceed 1.0 per trap. Analysis of *I. leucospoides* indicated no significant differences among treatments (T= - 0.42, P = 0.2919). No *S. noctilio*, *U. cressoni*, *E. formosanus*, or *T. columba* were collected, nor were males of any species collected in Experiment 2.

Experiment 3. One hundred and forty-eight *E. formosanus* and 0 *Sirex* sp. were collected. No *E. formosanus* were collected in the 95% ethanol treatment. There was not a significant interaction between the trap tree treatment methods and trap height (F=2.13, df=1,8 P<=0.1822); nor was the difference between the Vapam-DMSO and dicamba treatment methods significant (F=4.31, df=1,4, P < 0.1066). Significantly more *E. formosanus* were collected in the low trap position on the dicamba trap trees (t=3.22, df=1,8, P < 0.0488; Fig. 1). Neither male *E. formosanus* nor either sex of any other Siricidae were collected in Experiment 3.

A compilation of total *S. nigricornis* and *E. formosanus* collected by date in Experiments 1 - 3 are presented in Fig. 2. One *S. nigricornis* was collected on 15 January

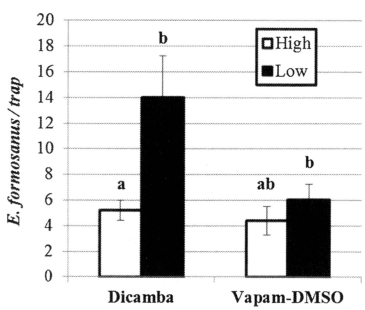

Fig. 1. Mean ± 1 SEM (n = 5) collection of *Eriotremex formosanus* Matsumura collected in Experiment 3 from high and low trap heights placed on *Pinus taeda* L. trap trees in Louisiana. Differing letters indicate a significant difference at α=0.05.

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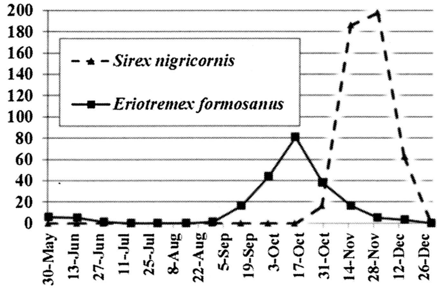

Fig. 2. ***Sirex nigricornis*** **and** ***Eriotremex formosanus*** **collection totals from Experiments 1 (17 August 2006 - 17 August 2007) and Experiments 2 and 3 (August 2007-January 2008) in central Louisiana.**

2007 but is not featured in Fig. 2. Very few *T. columba* and *U. cressoni* were collected and those only in Experiment 1, and are not featured in Fig. 2.

Discussion

This is the first published study to compare an array of attractants specifically targeting Siricidae in Louisiana and report their associated phenology. We selected the Sirex UHR 70:30 α-β pinene lure due to its use as an attractant in surveying for *S. noctilio*, and 2 bark beetle pheromones and ethanol, due to their common use in forest insect detection surveys. We also created trees likely to be more attractive and susceptible to insects using a herbicide and soil fumigant, based on the proven success of these treatments in attracting *S. noctilio* and other pine-infesting insects.

We collected 463 *S. nigricornis*, 216 *E. formosanus*, 3 *U. cressoni*, and 1 *T. columba*, all of which were female. Following mating, male *S. noctilio* do not seek hosts and are seldom seen away from the site of emergence (Morgan 1968), which may explain the lack of collection of a single male siricid in our experiments and trapping studies of others (McIntosh et al. 2001; Smith and Schiff 2002; Allison et al. 2011), and low numbers of males (relative to females) collected in other trapping studies (Sato and Maeto 2006).

Sirex nigricornis was the most commonly collected indigenous siricid in our study and, whereas the actual treatment means were consistently low, they are similar to those reported by others. Coyle et al. (2012) collected 531 *S. nigricornis* (when combined with *S. edwardsii*) from a total of 435 12-unit Lindgren funnel traps (multiple sites during a 3 year period) for an overall mean of 1.6 specimens per trap. Results from that study also indicated more *S. nigricornis* were collected from traps baited with the Sirex UHR lure than those baited with ethanol + α-pinene, ethanol alone, or a 3-part *Ips* pheromone lure. Others have found that adding ethanol or *Ips* pheromones to the Sirex UHR lure or α-pinene results in marginal (but insignificant) improvements in collection of other Siricidae, including *S. juvencus* (L.) in South Dakota (Costello et al. 2008) and *Urocerus japonicus* Smith in Japan (Sato and Maeto 2006). Collections of *S. nigricornis* among our trap tree treatments did not exceed 2.2 specimens per tree. Zylstra et al. (2010) created *P. sylvestris* trap trees using dicamba and collected up to a mean of 10.1 *S. noctilio* in Lindgren funnel traps suspended 6 m above the ground adjacent to trap trees, as was previously determined to be the optimal trap

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height for collecting *S. noctilio*. We did not compare multiple trap heights during the flight period of *S. nigricornis*, nor did we fell all trap trees and store in rearing containers in our study, both of which may have contributed to a clearer picture of the attractiveness and utilization of our trap trees by the existing siricid community.

The attractiveness of *P. taeda* trap trees to *E. formosanus* was unexpected given that this siricid is associated with hardwood species (Smith 1996). In addition to trap collections on pine trap trees in all experiments, this species was frequently observed ovipositing in dead pine trap trees characterized by numerous *Monochamus* sp. egg niches, reddened tree crowns, and ambrosia beetle frass at the base of trees. Ulyshen and Hanula (2010) created upright *P. taeda*, *Liquidambar styraciflua* L., and *Quercus nigra* L. trap trees and also felled trees of each of these species to compare their attractiveness and host suitability to *E. formosanus*. They neither collected *E. formosanus* from traps adjacent to the pine trap trees nor collected emerging progeny from these trees in rearing containers, whereas specimens were collected both from traps and in rearing devices from both hardwood species. Dead *P. taeda* apparently produce semiochemicals and ratios of such that are similar to those produced by hardwood species and attractive to *E. formosanus*. It is unknown if this occurs in pine species in *E. formosanus*' native range. Why more specimens were collected in the low trap position is not clear. Ulyshen and Hanula (2010) found similar emergence along the entire bole of *Q. nigra* trap trees, indicating each of the various portions were suitable for larval development and likely similarly attractive to ovipositing females; perhaps the lower bole of our pine trap trees was most similar to decaying hardwood species.

The low collection of *U. cressoni* is difficult to explain. *Urocerus cressoni* has been collected over much of eastern North America, and recorded hosts include *P. taeda* and *P. rigida* (Smith and Schiff 2002). In trapping studies which report on collections of this species, collection totals vary but are generally low relative to trapping intensity. In an evaluation of similar attractants using panel and Lindgren funnel traps, Costello et al. (2008) collected just 2 specimens in 220 traps over a 2-yr period in South Dakota (exact pine-volatile lures used to collect this species not reported). In an extensive survey of the Siricidae of Minnesota using 435 Lindgren funnel traps (pooled across a 3-yr period), Coyle et al. (2012) collected 70 specimens in traps baited with the Sirex UHR lure (53) or with α-pinene and ethanol (17); none were collected in traps baited with either ethanol alone or *Ips* pheromones alone. Others have collected greater numbers of this species using the same methods, suggesting region or site variability. In a survey for *S. noctilio* in Ontario, Canada using panel intercept and Lindgren funnel traps baited with the Sirex UHR lure at 193 sites, Hodge et al. (2007) collected 267 *U. cressoni*. Abundance of *Urocerus* sp., as well as other Siricidae, at a single site can also vary widely from year to year (Costello et al. 2008, Coyle et al. 2012).

The lack of greater collection of *T. columba* is most likely due to the treatments evaluated and the characteristics of the sites selected for the experiments. This species has been recovered from several dead or dying hardwood species, primarily during the spring and summer, throughout its northern range (Smith and Schiff 2002, Stillwell 1967). We collected the single specimen on 16 November 2006 in a pine plantation characterized by numerous decaying hardwood stumps and slash material. Had we created a trap tree of a hardwood species or used different attractants on a predominately hardwood site, we likely would have caught more.

The principle conclusions from this study are the Sirex UHR lure alone is basically as effective an attractant for *S. nigricornis* as the combinations of this lure with 95% ethanol and/or the *Ips* engraver pheromones ipsenol and ipsdienol, as well as trap

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trees using the methods we selected for creating them. We hypothesize that the higher collections of *S. nigricornis* we obtained in Experiment 2 in nearly every treatment were due to the relatively constant and abundant amounts of fresh pine volatiles emanating from the log piles and pine-processing at the mills; however, replication in time as well as sites would be necessary to test this hypothesis. More recent efforts have demonstrated the relative ineffectiveness of the Sirex UHR lure to attract *S. nigricornis* in central Louisiana when directly compared against traps baited with mesh bags of fresh split pine billets and foliage (authors unpublished). The lures used in Experiments 1 and 2 collected few to zero *E. formosanus*. The *P. taeda* trap tree treatments, specifically the dicamba trap tree treatment, were seemingly attractive to this hardwood-associated siricid *E. formosanus*, and collection significantly increased when traps were placed nearer the ground. However, no progeny of this species were collected in subsequent and limited rearing and dissections of pine. In central Louisiana, surveys for *S. nigricornis* should be conducted from October through December, and for *E. formosanus*, August through October. More research is necessary for determining the phenology and effective detection methods for other Siricidae in the region.

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