Comparison of Parasitoid Retention on Yellow Sticky Card Traps

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Scientific Notes

Comparison of parasitoid retention on yellow sticky card traps

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Insects are one of the most diverse multicellular life forms on Earth and provide critical services such as pollination, pest suppression, and nutrient cycling (Losey & Vaughan 2006; Raven & Yeates 2007). In the US, it is estimated that insect services contribute more than USD $57 billion towards ecosystem health, agriculture, and recreation (Losey & Vaughan 2006). Insect abundance and diversity are important measures of ecosystem function and useful metrics in agricultural management (DeBach 1958; Hairston et al. 1960). Sticky card traps are a common sampling method for monitoring insects and calculating biodiversity in natural and agroecosystems (Gerling & Horowitz 1984; Collier et al. 2000; Hall 2009; Domingue et al. 2012). Yellow sticky card traps have been used in integrated pest management for over 50 yr (Maxwell 1968; Wiseman et al. 1972; Quinn et al. 2019). In many cases, parasitoid wasps are of special interest due to their strong negative effects on insect population dynamics in both agricultural and natural habitats (Quicke 1997; Quinn et al. 2019). For example, the samurai wasp (*Trissolcus japonicus* Ashmead; Hymenoptera: Scelionidae) parasitizes up to 70% of brown marmorated stink bug (*Halyomorpha halys* [Stål]; Hemiptera: Pentatomidae) in its native region (Yang et al. 2009). In this study, parasitoid species' retention on sticky card traps was evaluated.

The retention of 3 parasitoid wasp species on 2 yellow sticky card traps was compared: Pherocon AM no-bait traps (22.86 cm × 27.94 cm; Trécé Inc., Adair, Oklahoma, USA) and Alpha Scents folding yellow card traps (22.86 cm × 27.94 cm; Alpha Scents Inc., Canby, Oregon, USA). *Aphidius colemani* Viereck (Hymenoptera: Braconidae) and *Aphytis melinus* DeBach (Hymenoptera: Aphelinidae) were obtained from Rincon-Vitova Insectaries (Ventura, California, USA) and a laboratory colony of *T. japonicus* was established at Rutgers University (Bridgeton, New Jersey, USA). In laboratory trials, yellow sticky card traps were hung 3 cm from the top center of mesh cages (34.29 cm × 34.29 cm × 60.96 cm) (BioQuip, Rancho Dominguez, California, USA) with binder clips and twist ties. In Missouri, vials containing 75 wasps of *A. colemani* or *A. melinus* were placed on the bottom center of the cage. In New Jersey, vials containing 10 to 25 *T. japonicus* were placed on the bottom center of the cage. Experiments were replicated 15 times in Missouri and 8 times in New Jersey. Vials were removed from cages after 4 h and the number of wasps on each card recorded. The location of each captured wasp was marked with a pushpin. Pushpins were placed approximately 2 to 3 mm from captured wasps. Yellow sticky card traps were removed from cages and hung on wires in a grass field in New Jersey and an open air shed in Missouri approximately 1 to 1.5 m above the ground. The presence of captured wasps was monitored at 12, 24, 48, and 72 h.

Wasp movement on yellow sticky cards after capture also was quantified. The movement of 15 female *T. japonicus* on Alpha Scents yellow sticky cards using EthoVision (Noldus, Wageningen, Netherlands) behavior tracking software was characterized. Female *T. japonicus* were aspirated into individual vials, and then placed onto a yellow sticky card and flipped upside down to allow the parasitoids to alight naturally onto the cards. The yellow sticky cards then were placed vertically with the camera positioned horizontally. EthoVision recorded total movement and velocity of captured *T. japonicus* for 1 h.

Pherocon AM no-bait traps captured 133 *A. colemani*, 8 *A.* melinus, and 47 *T. japonicus*. After 12 h, 10.5% *A. colemani* escaped from traps. All *A. melinus* remained on the traps for 48 h, but 12.5% escaped after 72 h. After 24 h, 23.4% of *T. japonicus* escaped and 31.9% escaped at 48 h. After 72 h, a total of 34% *T. japonicus* escaped from Pherocon AM no-bait traps (Fig. 1).

Alpha Scents folding yellow card traps captured 166 *A. colemani*, 8 *A.* melinus, and 57 *T. japonicus* and retained 100% *A. colemani* and *A. melinus* for the duration of the experiment. However, 7% *T. japonicus* escaped after 24 h and 10.5% after 48 h. After 72 h, a total of 24.6% *T. japonicus* escaped from Alpha Scents folding yellow card traps. In EthoVision trials, female *T. japonicus* on average moved a total distance of 1,245.4 mm (± 279.6 mm) with an average maximum velocity of 497.8 mm per s (± 289.6 mm) during a 1 h period, suggesting they may be able to remove themselves from yellow sticky cards after initial capture (Fig. 2).

It was found that yellow sticky cards may not retain all captured parasitoid wasps, and therefore may underestimate parasitoid abundance and diversity. When sticky cards are deployed in the field, debris and other insects stick to the cards, potentially aiding in insect escape, just as our pushpins may have done. Quantifying parasitoid wasp population dynamics within agricultural systems helps to successfully use integrated pest management, such

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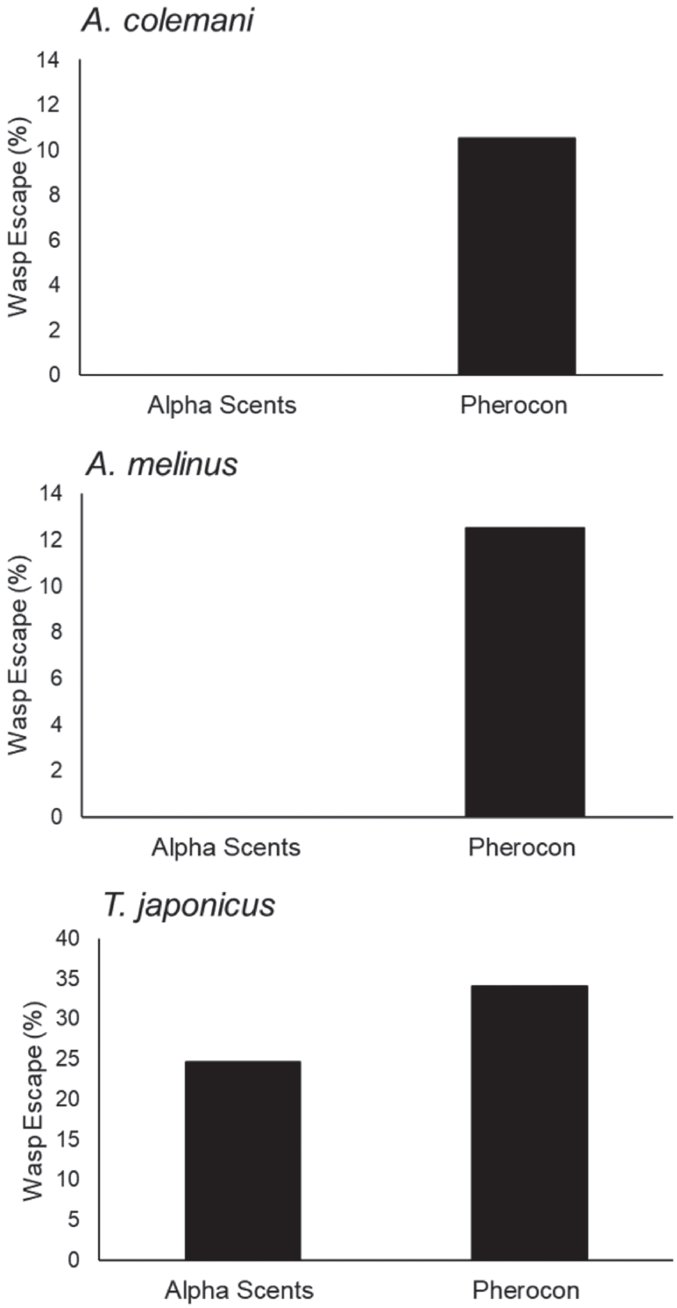

Fig. 1. Percentage of parasitoid escape after 72 h on Alpha Scents folding yellow card traps and Pherocon AM no-bait traps.

Fig. 2. Yellow sticky card containing pushpins marking the location of captured parasitoid wasps. Pushpins were placed approximately 2 to 3 mm from each captured wasp and their movement on the sticky card can be observed with the wasp's varying distance from pushpins.

as biological control, potentially reducing insecticide applications (Geiger et al. 2010). Because parasitoids are essential in trophic interactions within terrestrial ecosystems, more accurate sampling methods may help estimate their populations, potentially leading to increased conservation and preservation (LaSalle & Gauld 1991; Hughes et al. 2000). During these trials, a few wasps may have used pushpins to escape from the cards. However, in preliminary studies, wasps escaped from yellow sticky cards when the location was marked with ink pens.

A statistical analysis comparing the 2 types of yellow sticky cards is not provided because the goal of this study was not to thoroughly compare retention or captures between sticky card types. Data was collected on 3 species and found retention varied by species; therefore, it is highly likely that variables such as behavior, morphology, and environmental conditions also may affect retention rates. Other taxon (such as coleoptera, lepidoptera, etc.) might have different retention or escape rates on both yellow sticky card types. Insight into not only sticky card retention, but potential repellency should be studied as well. The walnut twig beetle (*Pityophthorus juglandis* Blackman; Coleoptera: Curculionidae) recently was found to be repelled by Tree Tanglefoot adhesive (Audley et al. 2020). Our results highlight the need for more research on commonly used sampling methods that quantify insect biodiversity and abundance such as sticky cards.

Summary

Parasitoid wasps play a vital role in regulating insect population dynamics in both agricultural and natural ecosystems. Yellow sticky card traps are a key component in integrated pest management and the primary sampling method for estimating parasitoid abundance and diversity. Retention of 3 parasitoid wasp species on 2 yellow sticky card traps was compared and it was found that up to 34% of parasitoids escaped within 72 h, suggesting this commonly used sampling technique may underestimate parasitoid abundance and diversity.

Key Words: insect sampling; *Aphidius colemani*; *Aphytis melinus*; *Trissolcus japonicus*

Sumario

Las avispas parasitoides desempeñan un papel fundamental en la regulación de la dinámica de poblaciones de insectos tanto en ecosistemas agrícolas como naturales. Las trampas adhesivas amarillas son un componente clave en el manejo integrado de plagas y el principal método de muestreo para estimar la abundancia y diversidad de parasitoides. Se comparó la retención de 3 especies de avispas parasitoides en 2 trampas de tarjetas adhesivas amarillas y se encontró que hasta

el 34% de los parasitoides escaparon dentro de las 72 h, lo que sugiere que esta técnica de muestreo comúnmente utilizada puede subestimar la abundancia y diversidad de parasitoides.

Palabras Claves: muestreo de insectos; *Aphidius colemani*; *Aphytis melinus*; *Trissolcus japonicus*

References Cited

Audley JP, Dallara PL, Nelson LJ, Hamud SM, Bostock RM, Seybold SJ. 2020. Trapping failure leads to discovery of potent semiochemical repellent for the walnut twig beetle. Journal of Economic Entomology 113: 2772–2784.

Collier KJ, Smith BJ, Quinn JM, Scarsbrook MR, Halliday NJ, Croker GF, Parkyn SM. 2000. Biodiversity of stream invertebrate faunas in a Waikato hill-country catchment in relation to land use. New Zealand Entomologist 23: 9–22.

DeBach P. 1958. The role of weather and entomophagous species in the natural control of insect populations. Journal of Economic Entomology 51: 474–484.

Domingue MJ, Lelito JP, Fraser I, Mastro VC, Tumlinson JH, Baker TC. 2012. Visual and chemical cues affecting the detection rate of the emerald ash borer in sticky traps. Journal of Applied Entomology 137: 77–87.

Geiger F, Bengtsson J, Berendse F, Weisser WW, Emmerson M, Morales MB, Ceryngier P, Liira J, Tscharntke T, Winqvist C, Eggers S, Bommarco R, Pärt T, Bretagnolle V, Plantegenest M, Clement LW, Dennis C, Palmer C, Oñate JJ, Guerrero I, Hawro V, Aavik T, Thies C, Flohre A, Hänke S, Fischer C, Goedhart PW, Inchausti P. 2010. Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland. Basic and Applied Ecology 11: 97–105.

Gerling D, Horowitz AR. 1984. Yellow traps for evaluating the population levels and dispersal patterns of *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae). Annals of the Entomological Society of America 77: 753–759.

Hairston NG, Smith FE, Slobodkin LB. 1960. Community structure, population control, and competition. American Naturalist 94: 421–425.

Hall DG. 2009. An assessment of yellow sticky card traps as indicators of the abundance of adult *Diaphorina citri* (Hemiptera: Psyllidae) in citrus. Journal of Economic Entomology 102: 446–452.

Hughes J, Daily GC, Ehrlich PR. 2000. Conservation of insect diversity: a habitat approach. Conservation Biology 16: 1788–1797.

LaSalle J, Gauld ID. 1991. Parasitic Hymenoptera and the biodiversity crisis. Redia 74: 315–334.

Losey JE, Vaughan M. 2006. The economic value of ecological services provided by insects. BioScience 56: 311–323.

Maxwell CW. 1968. Interception of apple maggot adults on colored traps in an orchard. Journal of Economic Entomology 61: 1259–1260.

Quicke DLJ. 1997. Parasitic Wasps. Chapman & Hall, London, United Kingdom.

Quinn NF, Talamas EJ, Leskey TC, Bergh JC. 2019. Sampling methods for adventive *Trissolcus japonicus* (Hymenoptera: Scelionidae) in a wild tree host of *Halyomorpha halys* (Hemiptera: Pentatomidae). Journal of Economic Entomology 112: 1997–2000.

Raven PH, Yeates DK. 2007. Australian biodiversity: threats for the present, opportunities for the future. Australian Journal of Entomology 46: 177–187.

Wiseman BR, Widstrom NW, McMillian WW. 1972. Flight movements and color preference of the sorghum midge. Journal of Economic Entomology 65: 767–770.

Yang Z-Q, Yai Y-X, Qui L-F, Li Z-X. 2009. A new species of *Trissolcus* (Hymenoptera: Scelionidae) parasitizing eggs of *Halyomorpha halys* (Heteroptera: Pentatomidae) in China with comments on its biology. Annals of the Entomological Society of America 102: 39–47.