Syrphid captures on red sphere traps deployed for the apple maggot fly, *Rhagoletis pomonella* (Walsh)

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Abstract: The sticky, red sphere visual trap has been used to monitor and control apple maggot flies for several decades. Despite the wide use of these spheres, captures of insects other than apple maggot flies have frequently been overlooked. These captures may be important as they may be beneficial insects in the orchard environment. In the summer of 1993, large numbers of hover flies (Syrphidae) were captured on the spheres. These syrphids were captured late in the season when the number of apple maggot flies was diminishing. Temporal deployment of spherical traps may be a viable solution for maintaining the number of beneficial insects in the orchard setting.

Keywords: Tephritidae, *Rhagoletis*, trapping, sticky spheres, beneficial insects, Syrphidae.

Résumé: Le piège à insectes visuel constitué d'une sphère rouge engluee a été utilisé pendant plusieurs décennies pour suivre et contrôler les populations de mouche de la pomme. Ce piège a fait l'objet d'un usage généralisé, mais l'impact du piège sur les insectes autres que la mouche de la pomme a rarement été pris en considération. Ce facteur peut être d'une grande importance puisque le piège peut attirer des insectes bénéfiques aux cultures. Durant l'été 1993, un grand nombre de syrphes (Syrphidae) ont été capturés par les sphères. Ces syrphes ont été pris à la fin de la saison estivale, au moment où les populations de mouche de la pomme étaient décroissantes. Un usage plus rationnel des pièges sphériques pourrait être une solution valable pour ne pas nuire aux populations d'insectes bénéfiques dans les vergers.


Introduction

The apple maggot fly (AMF), *Rhagoletis pomonella* (Walsh) is one of the most destructive pests of apples in North American orchards (Reissig *et al.*, 1983). The problem however is not restricted to commercial orchards, as the fly also infests small plantings such as homeowner's backyard apple trees (AliNiazee & Brunner 1986; Mondor, 1994a). In both cases control has relied principally upon the application of pesticides; however, these chemicals are also poisonous to some beneficial insects (Prokopy, 1967). As a consequence of this drawback, researchers have attempted to develop visual traps that selectively attract AMFs (Oatman, 1964; Prokopy, 1967; 1968a; Kring, 1970, etc.). One common visual trap used for this purpose is the sticky, red sphere first implemented by Oatman (1964).

While visual traps are deployed primarily for monitoring purposes (Ontario Ministry of Agriculture and Food, 1990), red spheres have also been used for direct AMF control as an alternative to the spraying of pesticides (Prokopy, 1968b; Prokopy, 1975; Reissig *et al.*, 1984). Mass trapping AMFs using sticky, red spheres has since become an integral part of integrated pest management programs in orchards (Prokopy, 1985; Prokopy, Johnson & O'Brien, 1990; Prokopy *et al.*, 1990; Van-Driesche, Prokopy, & Christie, 1994).

Despite the use of sticky, red spheres for almost 30 years, capture of non-target insects has been overlooked. Mass trapping may have the dramatic effect of reducing populations of non-target beneficial organisms. Capture of beneficial insects and significant reductions in their abundance can lead to an increase in the number of harmful insects in the planting such as aphids and AMFs. Moore (1969) periodically counted flies larger than the common house fly, *Musca domestica* L. found on AMF traps. He found beneficial flies of the family Tachinidae in great abundance on the decoys. Prokopy (1975) also found tachinid flies in large numbers on the AMF traps. He reported that at some points in the season, insects larger than AMFs were so abundant that the trap surface area was almost completely covered, rendering the devices useless. Chrysopids, coccinellids, syrphids, and parasitic hymenoptera have been captured on AMF traps (Dolphin *et al.*, 1970). Insects smaller than AMFs do not usually cover much of the trap surface area and consist mostly of homopterans, non-beneficial dipterans, and hymenoptera (Prokopy, 1975). By knowing the peak AMF infestation relative to that of the beneficial insects, decoys could be deployed (or not deployed) to capture the fewest number of beneficial insects, thereby optimizing the control of AMFs and other pests.

Materials & methods

The study was conducted using residential apple trees in Brandon, Manitoba, Canada while determining the optimum size of red sphere for AMFs on trees bearing crabapple and standard-apple fruit (Mondor 1994b). Twenty crabapple trees (*i.e.* Chestnut, Rescue, Renown, and largely unknown varieties) and 20 standard-apple trees (*i.e.* Battleford, Goodland, Heyer 12, Miami, and largely unknown varieties) which harbored small to large populations of AMFs were chosen for the investigation. The resulting monitoring area was approximately 27 km\(^2\).
Apple maggot traps were styrofoam spheres painted with Lewiscraft® 'Flag Red' water based acrylic enamel (Lewiscraft; Toronto, Canada) spray paint. The spheres were of 4 distinct diameters: A: 2.5 cm, B: 3.8 cm, C: 6.3 cm, and D: 7.6 cm. Forty of each sphere size were employed in the experiment. Spheres were covered with Tree Tanglefoot® (Tree Tanglefoot Company; Grand Rapids, Michigan) adhesive to capture the alighting flies. To monitor the emergence of the flies, several of the largest spheres were hung throughout the city on 12 July 1993. When the first AMF was detected (26 July) traps were prepared and hung on the trees bearing crabapple and standard-apple fruit, three and four days later, respectively.

Trap captures were recorded once a week. As the AMFs were removed from the spheres, other insects were also removed and a coating of Tree Tanglefoot® was reapplied if necessary. Flies were collected weekly until the overall AMF count for the 160 traps was less than five for the week.

Results & discussion

Throughout the growing season, low numbers of ladybird beetles (Coccinellidae), dragonflies (Aeshnidae), and parasitic flies (Tachinidae) were captured on the traps. The catch of beneficial insects peaked in the week ending 18 September 1993. On that week large numbers of hover flies (Syrphidae) (n = 195) were captured on traps. This pattern was consistent among five apple trees (one standard-apple and four crabapple) distributed throughout the city (Figure 1). Trapped hover flies created substantial problems by saturating the traps and preventing capture of AMFs. At several sites the trap surface was almost completely covered by syrphids. Saturation of traps would not have substantially influenced the AMP captures because the latter had been tapering off for several weeks by this time (Figure 2).

Syrphids are predators whose larvae feed principally on aphids (Ontario Ministry of Agriculture and Food, 1990). While resident syrphid populations are strongly impacted by the strict spraying regimen common in commercial orchards (Tracewski, Johnson & Eaton, 1984), syrphid communities can exist on at least some urban apple trees because of infrequent pesticide applications. Capturing syrphids may result in increased aphid abundance on apple trees. Honeydew, produced by aphids, is a natural source of food for the AMP (Neilson & Wood, 1966). This source of free amino acids could increase the fecundity of female AMFs. By inadvertently capturing the beneficial syrphids on the sticky, red sphere traps the number of aphids present on the tree would increase and AMP damage could subsequently increase.

A solution to the problem of capturing beneficial insects, can be derived from knowing the phenology of various insect taxa surrounding the apple trees. For example, in Mondor (1994b) during the week of 18 September 1993, only 6 AMFs were present on the 160 red spheres, but the capture of syrphids was peaking. Simply taking down the AMP traps before peak hover fly emergence would maintain syrphid abundance, and likely reduce aphid levels the following spring and summer.

Though the capture of syrphids on AMP traps is just one example, it is representative of the type of ecological-interrelationship of which every fruit grower should be aware. While growers require constant information on the number of AMFs surrounding their apple trees, the timing of trap deployment should be strictly limited to the period of AMP abundance. Trap removal would certainly be feasible at the beginning and end of the AMP season when AMFs are in low abundance. Though labor intensive, the impact on beneficial insects of using a selective visual trap at properly timed intervals throughout the growing season would be less severe than using a relatively non-selective insecticide.

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Literature cited


