

Evaluation of a Lure Efficiency towards Green Lacewings in Organic Apricot Orchard

F. Baldacchino
ENEA C.R. Trisaia - BAS-BIOTECAGRO
Rotondella (MT)
Italy

A. Letardi^a
ENEA C.R. Casaccia - BAS-BIOTECASIC
Maria di Galeria (RM)
Italy

M.R. Tabilio
Centro di Ricerca per la Frutticoltura
Fioranello, Roma (RM)
Italy

P. Santarcangelo
BBCA onlus
Anguillara Sabazia (RM)
Italy

Keywords: *Chrysoperla carnea*, aphid, attractant, biological control, phenylacetadehyde, methyl salicylate, IPM

Abstract

Apricot is one of the least sensitive stone fruit to aphids, but infestations of the mealy plum aphid may commercially damage fruits ready to harvest. Management of aphid infestations in organic orchard should also consider enhancing beneficial insects and limiting aphid species hard to control (wax-protected aphids). Green lacewings management through lures should represent a potential way to enhance the efficiency of this generalist predator against aphids.

To evaluate this strategy, tests were performed in the frame of the P.O.N. BRIMET project (cod. MIUR 12929), between 2005 and 2007, in organic orchards in Southern Italy, near Nova Siri Marina (MT). Experimental design was used to assess attractiveness of a mixture of phenylacetaldehyde, methylsalicylate and acetic acid, and to evaluate the influence on oviposition of green lacewings.

The experimental field was parcelled out into two similar lots, one of which with the lure in the central area. Trials on apricot were compared to the results obtained in peach orchards of the Centro di Ricerca per la Frutticoltura, near Rome. Results prove the attractiveness of this chemical lure towards *Chrysoperla carnea* (Stephens), but with a slight increase of oviposition in the apricot parcel with tested substances through the years. Only in 2007 we could measure an evident increase of oviposition on apricot trees. Better results were achieved on peach orchard where we could notice a more complex entomofauna. On apricot, the aphid presence can be assumed as a key factor for lacewings oviposition, and the presence of this lure as a secondary factor for a higher oviposition rate.

Further basic researches on lacewings oviposition strategies are evidenced; moreover, an on-time application of lures upon the early symptoms of aphid infestations could represent the best application strategies to enhance natural population of lacewings on field.

INTRODUCTION

Surface of apricot orchards in Basilicata has recently changed from 1,925 ha (2004) to 1,829 ha (2006) (ISTAT, 2008). Basilicata is one of the most important Italian regions for apricot production and growing area. In Metaponto area, 15% of apricot farming is organic, 30% of which for consumer market and 70% for industrial processing (Mennone et al., 2005). More than other stone fruits, apricot is appropriate for organic farming due to its lesser susceptibility to aphid infestations. Nevertheless, in particular areas and years, infestations of Mealy plum aphid [*Hyalopterus pruni* (Geoffroy)] may exceed the economic threshold causing yield losses. This is a crucial factor in orchards for high quality products, as fruits ready to pick are stained with honeydew, and subsequently

^a aletardi@casaccia.enea.it

with sooty mould. Control of *H. pruni* in organic farming is very difficult, due to low efficacy of the substance application and to the peculiar wax-protection of this aphid. In this situation, a key strategy for aphid infestation management should be the enhancement of activity of natural enemies. For this purpose, an interesting possibility is field management with attractants of *Chrysoperla carnea* (Stephens) (Tóth et al., 2006; Tabilio et al., 2007), a key-predator of aphids. This study, in line with a contemporary test on peach in central Italy (Tabilio and Letardi, 2008), has investigated the applicability of this method on apricot in Metaponto area.

MATERIALS AND METHODS

The trials were conducted between 2005 and 2007 in an organic orchard near Nova Siri Marina (MT), cultivated with apricot 'S. Castrese' according to EU Reg. 2092/91. In 2005, a test of attractiveness of mixture of phenylacetaldehyde, methylsalicylate and acetic acid towards adults of green lacewings was scheduled. Ten traps (Traptest Isagro) were arranged along a line at a distance of 20 m between them. Alternately, five traps were baited with attractant and five traps used for control unbaited. Every week, from mid-April to the end of September, the sticky base of trap was replaced and transferred to laboratory for counting and separating sex at the stereomicroscope; the dispenser, realized by the Plant Protection Institute, HAS of Budapest, was replaced every three weeks. The number of capture was submitted to ANOVA analysis; means were separated by t-test (LSD).

The same mixture was tested between 2005 and 2007 to evaluate on field attractiveness through the ovideposition. The experimental plan compared two treatments (attractant and control) with five repetitions in randomized blocks, 15 trees each (tree rows of five trees); the dispenser was placed on the central tree of each block. Every week, from the end of April to the end of September, six shoots/tree were examined, counting eggs laid on the apical part along 20 cm. In 2006 and 2007, to highlight a possible short-range attractiveness, further "localized count" was overlapped only on the central plant of the block, examining 30 shoots/tree. Data related to the whole period and to the restricted ovideposition period were submitted to ANOVA analysis; means were separated by t-test (LSD).

The presence of aphid colonies was evaluated in line with eggs counting of green lacewings.

RESULTS AND DISCUSSION

Considerations on Attractiveness

The test of attractiveness performed during 2005 has shown the presence of *Chrysoperla carnea* (Stephens) in apricot orchard, with a flight period concentrated between mid-April and early August (Fig. 1).

Baited traps with phenylacetaldehyde, methylsalicylate and acetic acid yielded a significantly ($P < 0.05$) higher number of specimens than the control ones; considering the whole period of observation, treatments with attractant registered 0.800 adults/trap/week, whereas the control ones only 0.064. Moreover, baited trap recorded higher attractiveness toward female, with a sex ratio of 1:5.25 (1:1 in the control one). Statistical analysis of captures in treatments with attractant showed significant difference between sex, with mean value in the whole period of 0.672 females/trap/week and 0.128 males/trap/week. Tests with phenylacetaldehyde in different crops had shown similar results (Tóth et al., 2006).

Considerations on Ovideposition

In the whole period, treatments with attractant showed a higher number of ovideposition rate of green lacewing than the control ones, but this difference was never statistically significant (Table 1). The statistical analysis restricted to the ovideposition period doesn't change the results.

Otherwise, results of the “localized count” in 2006 and 2007 showed a higher oviposition on apricot plants with the attractant than in control ones; in 2007, this difference was statistically significant (Table 2). The statistical analysis restricted to the oviposition period doesn't change the results.

These results, and in particular what we observed in 2007, seem to support the hypothesis of a short-range attractive effect of the mixture.

It is worth noticing that, during the three years of this study, the presence of aphids on apricot shoots was sporadic and they never made colonies. This fact should have probably influenced oviposition. A positive correlation between aphid presence and oviposition was observed in two different species of genus *Chrysopa* Leach (*Chrysopa nigricornis* Burmeister (James, 2003), and *Chrysopa oculata* L. (Zhu et al., 2005)), whose adults are aphid predators. The presence of *Chrysoperla carnea*, whose adults are gliciphagous, is influenced by signals emitted by endangered plants, not by sexual aphid pheromones as for *Chrysopa oculata* L. (Zhu et al., 2005).

The lack of knowledge on the mechanisms that influence oviposition in *Chrysoperla* species makes the analysis of the results difficult, due to the fact that aphid presence is essential to correctly test the efficiency of attractants to get an increase in presence and oviposition of common green lacewing, as observed in peach orchards in tests conducted in the same period with the same attractants (Tabilio and Letardi, 2008). This is a key aspect of this preventive approach to aphid control. Concerning apricot crops, lack of knowledge could be a limit to this methodology, due to the fact that the key aphid pest, *H. pruni*, has a variable and localized presence, and usually appears late in the season.

CONCLUSIONS

The mixture of phenylacetaldehyde, methylsalicylate and acetic acid has confirmed its attractiveness of *C. carnea* near the dispensers, towards female specimens in particular. It has increased oviposition, but this result wasn't always statistically significant. Short-range attractiveness has shown the best results.

Further studies need deeper knowledge of the relationship between oviposition of common green lacewings and the presence of aphid colonies; nevertheless, a variable presence of aphid may represent a limit towards the use of attractive for a preventive strategy of pest control, which is a crucial approach in organic farming.

This approach should be applied in the frame of organic farming and/or industrial processing only in the presence of constant and timely monitoring of the presence of aphid colonies, and limiting their development.

ACKNOWLEDGEMENTS

We acknowledge Lunati farm that hosted the tests and Miklos Tòth (Plant Protection Institute, HAS, Budapest, Hungary) who supplied dispensers with attractive mixture. Work partially granted in the frame of the P.O.N. BRIMET project “Metodologie e sistemi integrati per la valorizzazione di prodotti ortofrutticoli di particolare interesse degli areali di Brindisi e Metaponto” (cod. MIUR 12929).

Literature Cited

- ISTAT, 2008. Dati Annuali sulle coltivazioni [on line]. Disponibile su <http://www.istat.it/agricoltura/datiagri/coltivazioni>. Roma: Istituto nazionale di statistica [data di accesso: 27 maggio 2008].
- James, D.J. 2003. Field evaluation of herbivore-induced plant volatiles as attractants for beneficial insects: methyl salicylate and the green lacewing, *Chrysopa nigricornis*. *Journal of Chemical Ecology*, 29(7):1601-1609.
- Mennone, C., Gioia, P., Orioli, G., Santangelo, G., Savino, A. and Mattatelli, B. 2005. Aspetti tecnici e commerciali dell'albicocco in coltura integrata e biologica in Basilicata. *Italus Hortus* 12(3):97-100.
- Tabilio, M.R., Letardi, A., Di Franco, F., Baldacchino, F., Mondatori, R., Quaranta, M.

and Toth, M. 2007. Gestione di un predatore chiave in un agroecosistema con un attrattivo chimico. Proceedings "XXI Congresso nazionale italiano di Entomologia". Campobasso, 11-16 Giugno 2007: 232.

Tabilio, M.R. and Letardi, A. 2008. Tecniche di manipolazione in campo di *Chrysoperla carnea* (Neuroptera Chrysopidae) in un pescheto a gestione biologica. Proceedings "VI Convegno Nazionale sulla Peschicoltura meridionale". Caserta, 6-7 marzo 2008 (in stampa).

Tóth, M., Bozsik, A., Szentkirályi, F., Letardi, A., Tabilio, M.R., Verdinelli, M., Zandigiaco, P., Jekisa, J. and Szarukán, I. 2006. Phenylacetaldehyde: a chemical attractant for common green lacewings (*Chrysoperla carnea* s.l., Neuroptera: Chrysopidae). Eur. J. Entomol. 103:267-271.

Zhu, J., Obrycki, J.J., Ochieng, S.A., Baker, T.C., Pickett, J.A. and Smiley, D. 2005. Attraction of two lacewing species to volatiles produced by host plants and aphid prey. Naturwissenschaften 92:277-281.

Tables

Table 1. Mean number per week of eggs of *C. carnea* in the two treatments in the period 2005-2007.

Treatments	2005	2006	2007
Attractant	2.34	1.75	0.74
Control	1.84	1.55	0.61
	NS ^x	NS	NS

^xNS, not significant (P<0.05)

Table 2. Mean number per week of eggs of *C. carnea* in the two treatments in the period 2006-2007: "localized count".

Treatments	2006	2007
Attractant	0.63 a	0.24 a
Control	0.43 a	0.02 b

Different letter in the same column means results statistically different, P<0.05 (LSD)

Figures

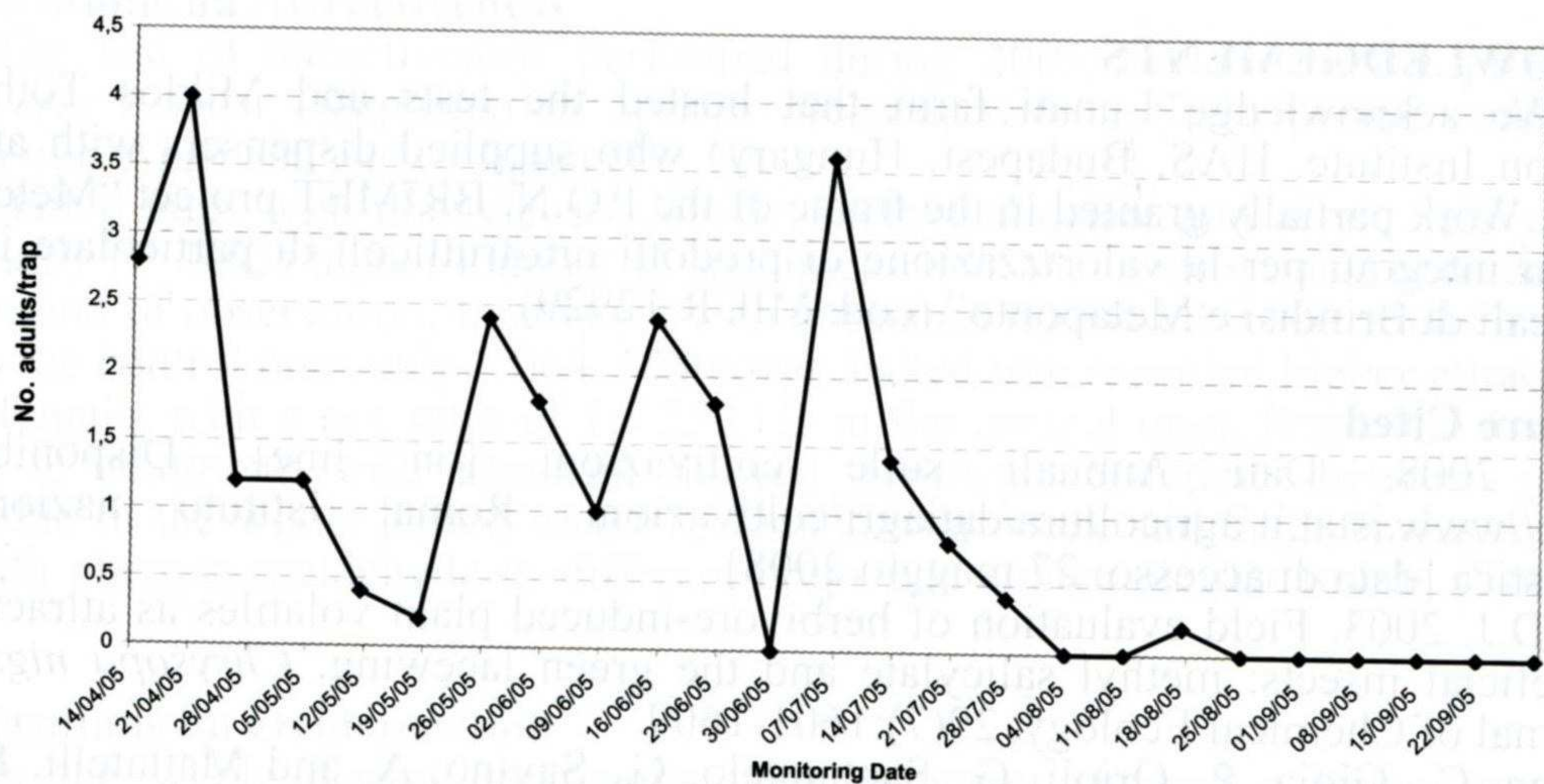


Fig. 1. Flight period of *C. carnea* in 2005 monitored by baited traps with attractant mixture.