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Flight detection of *Caliroa cerasi* L. (Hymenoptera: Tenthredinidae) adults in the Andean Region of Parallel 42, Argentina

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Caliroa cerasi L., the cherry sawfly or pear slug, is a serious pest that affects cherry crops (*Prunus avium* L.) in the Andean Region of Parallel 42, Argentina. This slug causes an extended damage to the foliage of different Rosaceae species (such as cherry) becoming a serious pest in this region, where orchards under organic management are very common. These orchards require an adequate monitoring to control the pest without the use of synthetic pesticides. Chromotropic yellow sticky traps (12 x 20 cm) were installed at 1.8 m height in the east and west side of *P. avium* CV Stella trees. *C. cerasi* adults were sampled during two consecutive growing seasons (2007/2008 and 2008/2009). A non linear Quasi-Newton multivariate optimization method was used to analyze the results. Data distribution highlighted a typical bicyclical pattern characteristic of a bivoltine species, in the location under study. Adults coming from the winter (whose prepupae and pupae spent winter in the soil) began to emerge in the spring producing the first or spring generation (first peak) in November- December. After that, the second or summer generation belonging to the second peak was observed in February-March. These data are useful to concentrate the efforts to control adults in these months.

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Key words: cherry sawfly, pear slug, growing cycles pattern.

INTRODUCTION

Cherry production (*Prunus avium* L.) is a very interesting and profitable crop in the Andean Region of parallel 42 (hereafter ARP42), Argentina, and its cultivated surface has increased 371% over the last years (Ministerio de Agricultura, Ganadería y Pesca de la Nación, 2011). The main market is the northern hemisphere, where consumers find products with low agrochemical levels highly desirable. Organic production system requires an adequate monitoring of the pests and a biologically based control strategy where the use of synthetic pesticides is replaced by entomopathogenic fungi (Aslantas *et al.*, 2008), neem oil (Smirle and Wei, 1996), other natural insecticides (Pino *et al.*, 2007) and biological control with trichogrammatid and ichneumonid wasps (Carl, 1976).

One of the most serious *P. avium* pests is *Caliroa cerasi* L. (Hymenopthera, Tenthredinidae), the cherry or pear slug, a sawfly which is found widespread through the Northern Hemisphere (Europe, North Africa, North America, Japan) and has been introduced to

Australia, New Zealand, South Africa and also in some South American countries, such as Argentina, Colombia, Chile and Uruguay (Naumann *et al*., 2002). *Caliroa cerasi* slug produces an extended damage to the foliage of different Rosaceae species such as *P. avium* L. (cherry), *Prunus cerasus* L. (sour cherry), *Prunus amigdalus* L. (almond), *Prunus domestica* L. (plum) and *Pyrus communis* L. (pear) (Rocca *et al*., 2005). There are also other reports on crops of lesser importance being attacked by this sawfly, such as the ornamental crops *Cotoneaster* spp. and *Crataegus* spp.) (Naumann *et al*., 2002, Edwards, 2006). This slug is not a problem in orchards under conventional management, but it becomes a serious pest in organic ARP42.

The sawfly, which emerges in the spring, is a little black wasp with a wingspan of approximately 10 mm. It has thelytokous parthenogenesis and the presence of males is very uncommon in South America and elsewhere. Raddatz and Carrillo (2008) have found a sex ratio of 1.27 males: 98.73 females in Chile, with no reports in Argentina. The spring females slit the leaves, laying the eggs inside the leaf tissues with its serrated ovipositor (hence the name sawfly). After 10 to 15 days the larvae emerge. At first, they feed on the upper surfaces of leaves producing a scorched or curled appearance (Naumann *et al*, 2002). The latest instars continue feeding, but large leaf veins and lower surface areas are rarely damaged, producing a skeletonized aspect (Shaw *et al*., 2003). When the larvae reach 10 mm length at the sixth moult, they form a cocoon (prepupae) in an earthen cell dug in the soil. All these stages, adult, eggs, larvae, prepupae and pupae, constitute the first or spring generation. In general, the adults emerge after 18 to 28 days (Naumann *et al*, 2002), giving place to the second or summer generation. Larvae from this second generation continue their damage and generally overwinter in the soil as prepupae, depending on the country (Bado, 2010; Carl, 1972; Raddatz and Carrillo, 2008; Raffa and Lintereur, 1988). Later, they emerge as adults in the spring.

A very good knowledge of *C. cerasi* and its dynamics is the best way to achieve an optimum control (Shaw *et al*, 2003). However, more investigations about adult flight and the number of adult peaks in ARP42 is needed to improve organic management, a condition to participate in international markets. To partially achieve this objective, *C. cerasi* adult sawflies were sampled in one commercial cherry orchard of ARP42 during two consecutive growing seasons (2007/2008 and 2008/2009). This is the first report of sawfly adult flight in this Andean region. Published data from Argentina (Bado, 2010) belong to the Lower Valley of the Chubut River (VIRCH), approximately 800 km far from ARP42. VIRCH belongs to the Atlantic region (43°16' S, 65°18' W, 30 meters above sea level) while ARP42 belongs to the Andean region (42°11' S, 71°42' W, 200 meters above sea level). VIRCH annual medium temperature is 12.7°C and annual precipitation is 196,1mm while ARP 42 annual medium temperature is 16.6°C and annual precipitation is 898 mm. These great geographic and climatic differences between VIRCH and ARP42 show the relevance of research on C. *cerasi* growing cycle pattern in ARP42 region.

MATERIALS AND METHODS

Study Site and Sampling

The work was carried out in ARP 42 (42º 11' S, 71º 42' W), Argentina, in an organic *P. avium* L. CV Stella orchard plot formed by 28 trees, eight years old. Eight trees were selected for sampling, following a "zig-zag" trajectory, avoiding the edges of the plot.

Caliroa cerasi (Hymenoptera: Tenthredinidae) adults were sampled during two consecutive periods (2007/2008 and 2008/2009), from October to April of each period. The data of hanging the traps was selected taking into account previous observations (Mareggiani y Collavino, 2008; Mareggiani y Collavino, 2009; Laffaye *et al*, 2010). Two chromatographic yellow sticky traps (12 x 20 cm) were installed at 1.8 m height, in the the east and the west side of each of the eight selected trees. Traps were changed every 15 days and the individuals caught were transported to the laboratory for later identification with a binocular microscope. The number of adults for each date was recorded for the east and the west traps. The number of selected trees and the sampling methodology employed was based upon observations of Bado (2007) and Raddatz and Carrillo (2008).

Statistical Analyses

Observed data were used to analyze the growing cycle pattern. Any deviation of an observed score from a predicted score signifies some loss in the accuracy of predictions. Several function minimization methods can be used to minimize any kind of loss function. A non linear estimation procedure was used, the Quasi-Newton multivariate optimization method, which reasonably minimizes inconsistency and errors (Prasad *et al.*, 2005).

Data distribution showed the existence of two *C. cerasi* generations or growing cycles in both periods (2007/2008 and 2008/2009). Then, data for each sampling period were divided in two sub-set ranges belonging to each period. A symmetric power function with an offset parameter was adjusted to each of the four cases. These function have a general form with four parameters:

$$Y = Y_0 + B * |t - X_c|^p$$

Where Y is the number of *C. cerasi* adults, Y_0 is the vertical displacement, B is the amplitude, t is the observation day, X_c is the center and p is the power.

RESULTS AND DISCUSSION

The number of *C. cerasi* adults in each calendar date for both periods (2007/2008 and 2008/2009) was calculated separately for the east and the west side traps. Adults number showed a similar distribution for both trap groups, and the existence of two *C. cerasi* generations or growing cycles in both periods, with a typical bicyclical pattern, characteristic of a bivoltine species. (Figure 1 and 2).

Then, data for each sampling period were divided in two sub-set ranges belonging to each period (Model I and Model II). A symmetric power function with an offset parameter was adjusted to each of the four cases.

Model I (period 2007/2008). The growing cycle was divided in $t < 90$ and $t > 90$, where t denotes time elapsed (in days) from the beginning of the sampling, with a difference of 90 days between both peaks.

For $t < 90$ the adjusted function was: $Y = 15.997 - 6.303 * |t - 45|^{0.243}$

For $t > 90$ the adjusted function was: $Y = 42.020 - 10.999 * |t - 135|^{0.331}$

Model II (period 2008/2009). The growing period was divided in $t < 110$ and $t > 110$, where t denotes time elapsed (in days) from the first observations, with a difference of 90 days between both peaks.

For $t < 110$ the adjusted function was: $Y = 20.989 - 6.221 * |t - 75|^{0.314}$

For $t > 110$ the adjusted function was: $Y = 43.574 - 11.414 * |t - 165|^{0.336}$

The data obtained with both models were plotted to analyze the growing cycle patterns.

In the period 2007/2008 (Model I), two peaks of *C. cerasi* adult flights were observed (Figure 1). The first one ($t < 90$) was produced in November 15 (Spring) while the 2nd ($t > 90$) in February 15 (Summer), with an interval of 90 days between each one. The variance explained was 97.47% ($R^2 = 0.9872$) for the first peak, while for the second, the variance explained was 95.34% ($R^2 = 0.976$).

The period 2008/2009 (Model II) also showed two peaks (Figure 2) along the population growing cycle, with a similar pattern found in 2007/2008 (Figure 1). The first peak was recorded in December 15 (Spring) while the second in March 15 (Summer), with and interval of 90 days between each one. The variance explained for the first peak ($t < 110$) was 86.87 % ($R^2 = 0.93$), while for the second was 81.12 % ($R^2 = 0.90$).

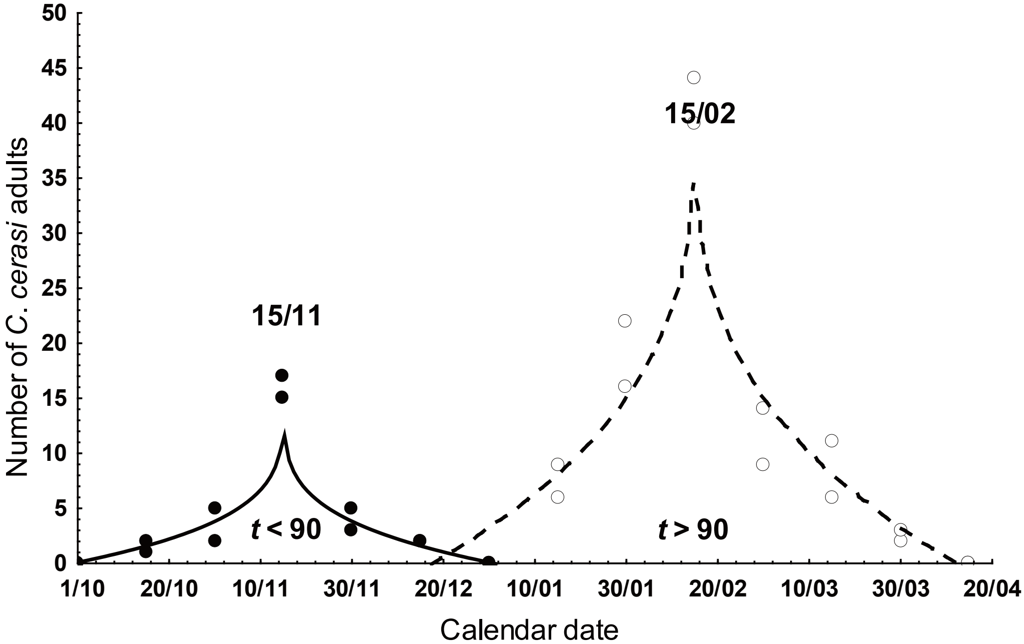

Figure 1. Representation of the number of *Caliroa cerasi* adults during the period 2007/2008 with Quasi-Newton analysis. Each dot, in each calendar date, represents the data corresponding to 8 east and 8 west side traps respectively

Data exposed in figures 1 and 2 show that, in both periods under study, *C. cerasi* adults coming from the summer generation (whose prepupae and pupae spent winter in the soil) begin to emerge in the spring producing the first or spring generation. After that, a second peak belonging to the second or summer generation was observed. Similar results have been obtained by other authors in both hemispheres. In the northern hemisphere Raffa and Lintereur registered two adult flight peaks in May-June and in September-October (1988). In the south hemisphere Van Epenhuijsen and De Silva recorded two peaks in December and in February-March (1991) and Raddatz (2004) observed also two peaks, the first in October-November and the second in January-February. Other authors from the northern hemisphere (Carl, 1972) and the southern hemisphere (Bado, 2010) have found not only bivoltine populations but also populations with and additional third generation. Carl (1972) found the first peak in May-July and the 2nd (or the 2nd and 3rd in other cases) in August-September. Bado (2010) found the spring peak in October-November and the second (or the 2nd and 3rd in some populations) in January-March. All these data are fairly similar to ours (Spring peak in November-December and Summer- peak in February-March).

Data presented in this paper could be useful for a successful organic management of *C. cerasi* in ARP42, because they will help to concentrate the efforts to control the pest, during the adult flight peaks.

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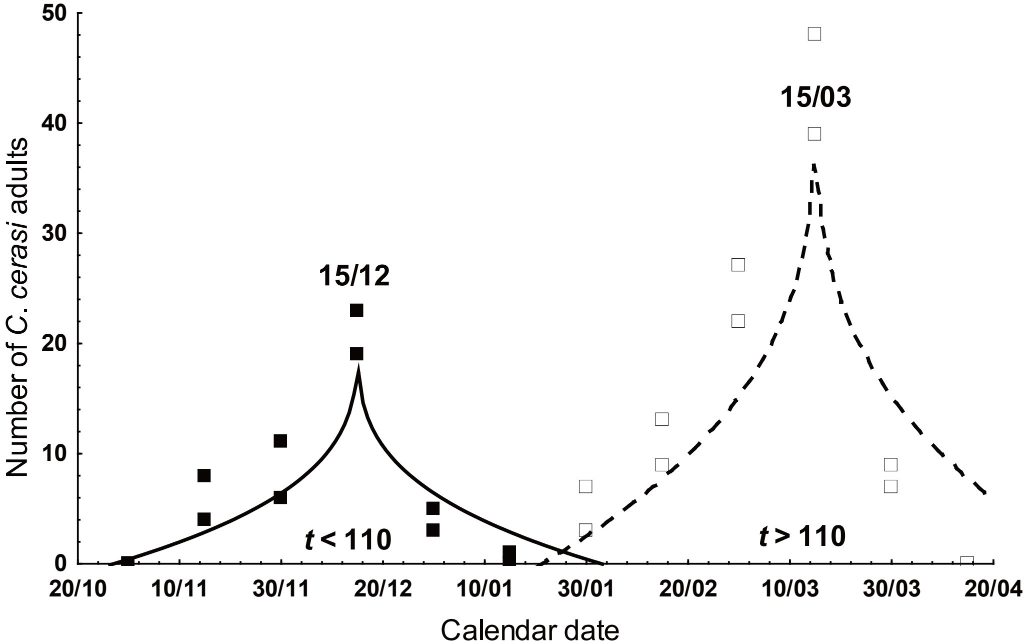

Figure 2. Representation of the number of *Caliroa cerasi* adults during the period 2008/2009 with Quasi-Newton analysis. Each dot, in each calendar date, represents the data corresponding to 8 east and 8 west side traps respectively

RESUMEN

Mareggiani, G., N. Bartoloni, N. Gorosito, C. Laffaye**.** 2012. Detección del vuelo de adultos de *Caliroa cerasi* L. (Hymenoptera: Tenthredinidae) en la Región Andina del Paralelo 42, Argentina. *Bol. San. Veg. Plagas*, **38**: 233-238

Caliroa cerasi L., la mosca sierra del cerezo o babosita del peral, es una plaga importante en los cultivos de cerezo (*Prunus avium* L.) en la Región Andina del Paralelo 42, Argentina. Esta babosita causa intensos daños en el follaje de diversas especies de Rosaceae, como cerezo, convirtiéndose en una grave plaga en esta región donde las producciones orgánicas son muy comunes. Estas producciones requieren un adecuado monitoreo para controlar la plaga sin utilizar insecticidas sintéticos. Se instalaron trampas cromotróficas amarillas adhesivas (12 x 20 cm) a 1.8 m de altura en el lado este y oeste de árboles de *P. avium* CV Stella. Los adultos de *C cerasi* se muestrearon durante dos temporadas consecutivas (2007/2008 y 2008/2009). Se utilizó el método de optimización multivariado no linear Quasi-Newton para analizar los resultados. La distribución de datos destacó un patrón típicamente bicíclico característico de una especie bivoltina, en la localidad bajo estudio. Los adultos provenientes del invierno (cuyas prepupas y pupas pasaron el invierno en el suelo) comenzaron a emerger en la primavera produciendo la primera generación, primaveral (primer pico), en Noviembre-Diciembre. Posteriormente, se observó un segundo pico, perteneciente a la segunda generación (estival) en Febrero-Marzo. Estos datos son útiles para concentrar los esfuerzos destinados a controlar los adultos durante esos meses.

Palabras clave: mosca sierra del cerezo, babosita del peral, patrón de crecimiento cíclico.

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