

Role of spontaneous plants as a reservoir of alternative hosts for *Semiela cher petiolatus* (Girault) and *Citrostichus phyllocnistoides* (Narayanan) (Hymenoptera, Eulophidae) in citrus groves

Maria Concetta Rizzo, Valentina Lo Verde, Virgilio Caleca

SENFIMIZO Department, Entomology, Acarology and Zoology Section, University of Palermo, viale delle Scienze 13, I-90128 Palermo, Italy, e-mail: macoriz@yahoo.it

Abstract: The significance of spontaneous plants for the populations of two exotic parasitoids, *Semiela cher petiolatus* (Girault) and *Citrostichus phyllocnistoides* (Narayanan), was investigated in five Sicilian citrus groves. Both species were obtained from two herbs typically growing beneath the citrus trees in the period of scarce availability of the target host, the citrus leafminer *Phyllocnistis citrella* Stainton. *S. petiolatus* was reared from *Cosmopterix pulcherimella* Chambers, a specific leafminer on *Parietaria diffusa* M. et K., while *C. phyllocnistoides* was reared from the same species and from a *Liriomyza* species associated to *Mercurialis annua* L. These last two host records are new and further broaden the known host range of these parasitoids, previously considered as specialists. Thus, natural vegetation diversity enhances the survival and maintenance of *S. petiolatus* and *C. phyllocnistoides* in citrus agroecosystems providing them with alternative hosts. Moreover, the incidence of parasitism of the two exotic parasitoids on non-target hosts was so low that a negative impact both on native leafminers and autochthonous parasitoid populations can be excluded.

Key words: natural vegetation diversity, host range, non-target effects, *Phyllocnistis citrella*

Introduction

Vegetation diversity in agroecosystems is considered the most important source of natural enemies (Altieri, 1991; Altieri *et al.*, 2003; Rossing *et al.*, 2003 and references therein; Gurr *et al.*, 2004) and its function is believed to be more significant for generalist species than for specialists (Coll & Bottrell, 1996; Tscharntke *et al.*, 2002). Therefore, we started to study the significance of spontaneous plants for the populations of *Semiela cher petiolatus* (Girault) and *Citrostichus phyllocnistoides* (Narayanan), two exotic Eulophid parasitoids of the citrus leafminer *Phyllocnistis citrella* Stainton. Both species were largely used in inoculative releases against *P. citrella* in many Mediterranean countries and are considered the most effective biological control agents of this pest (Schauff *et al.*, 1998; Garcia-Mari, 2003 and references therein; Garcia-Mari *et al.*, 2004). The aim of this study was mainly to investigate whether natural vegetation diversity could enhance the survival and maintenance of the populations of these two exotic parasitoids in citrus agroecosystems, especially when the target host species in the crop is scarce.

Materials and methods

Samplings were carried out from July 2002 to July 2003 every 15 days in five Sicilian citrus groves: Parco d'Orleans, S. Flavia and Zucco in the province of Palermo, and Ribera and Menfi in the province of Agrigento: at each site 50 shoots of citrus plants were gathered to study the parasitization trend on *P. citrella*. At the same time samples of spontaneous plants

with mines were collected in and around the citrus groves. For every site the infestation level of the citrus leafminer was evaluated by counting the number of larvae on 20 young leaves being 3-5 cm long (Caleca *et al.*, 1996; Caleca *et al.*, 1998). Leaves with mines both of citrus and spontaneous plants were placed separately into Petri dishes on wet paper and stored in an air-conditioned room (25°C, 70% r.h. and L14:D10) till the emergence of the leafminers and relating parasitoids. Each specimen was then mounted, labelled and identified. Parasitization has been calculated as the ratio between the emerged parasitoids and the total emerged insects.

Results and discussion

In many Mediterranean countries exotic parasitoids displaced native species in the control of *P. citrella* on citrus plants (Garcia-Mari, 2003 and references therein; Garcia-Mari *et al.*, 2004), while in Sicily the contribution of autochthonous species has always been rather low (9-10% average parasitization: Caleca *et al.*, 1996; Caleca *et al.*, 1998). In this study *C. phyllocnistoides* and *S. petiolatus* fully prevailed over native parasitoids (96 vs. 4%) during the whole summer 2002, the latter being mainly represented by *Cirrospilus pictus* (Nees) (Hymenoptera, Eulophidae) (3.4%). Neither *C. phyllocnistoides* nor *S. petiolatus* were obtained from any of the alternative hosts reared from 19 native plant species collected during summer 2002, even if they hosted a large community of parasitoids, mostly belonging to Eulophidae (83.6%).

In four out of five citrus groves the two exotic species alternated with each other: *S. petiolatus* dominated in the first half of the season (max.: 55.1% in mid July), while *C. phyllocnistoides* prevailed from the end of July onwards (max.: 72.1% in mid September) (Fig. 1, on the left). Only in one citrus grove *S. petiolatus* was very rare (max.: 1.1%), but, despite of this, *C. phyllocnistoides* showed the same parasitization pattern as in the four other citrus groves: very low in the beginning of the infestation (5.3%) and gradually increasing from August onwards (max.: 81.3% in mid September) (Fig. 1, on the right).

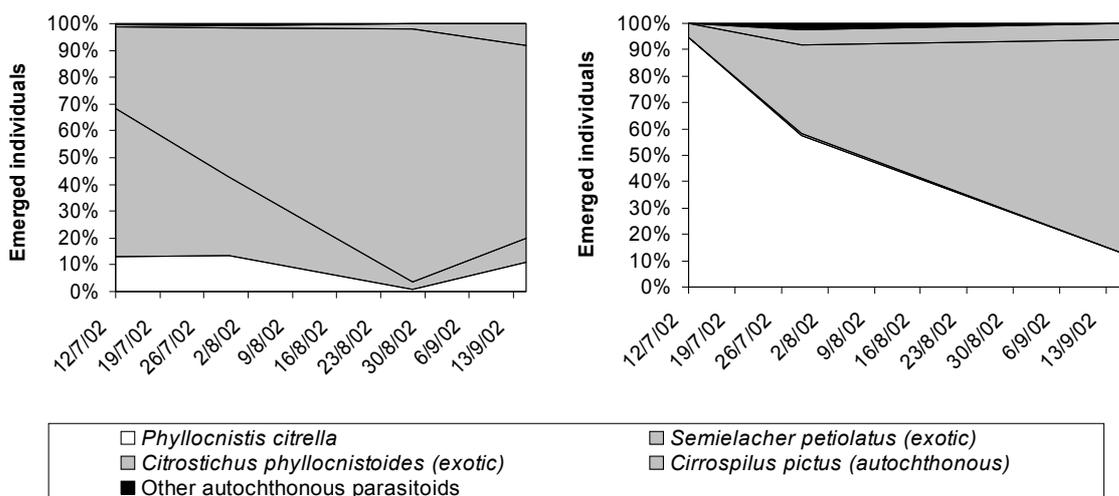


Figure 1. Parasitization trend on *P. citrella* in four Sicilian citrus groves where both exotic species were abundant (on the left) and in one citrus grove where *S. petiolatus* was rare (on the right) in summer 2002.

References

- Altieri, M.A. 1991: Agroecologia. Franco Muzzio Editore, Padova.
- Altieri, M.A., Nicholls, C. & Ponti, L. 2003: Biodiversità e controllo dei fitofagi negli agroecosistemi. Accademia Nazionale Italiana di Entomologia, Firenze, Italy, 223 pp.
- Bouček, Z. 1988: Australasian Chalcidoidea (Hymenoptera). A biosystematic revision of genera of fourteen families, with a reclassification of species. CAB International, Wallingford, Oxon, UK, 832 pp.
- Caleca, V., Lo Verde, G. & Massa, B. 1996: Indagine su *Phyllocnistis citrella* Stainton (Lepidoptera Gracillariidae) in un limoneto della Sicilia occidentale. Bollettino Zoologia agraria e Bachicoltura, Ser. II 28(2): 165-183.
- Caleca, V., Lo Verde, G., Blando, S. & Lo Verde, V. 1998: New data on the parasitism of citrus leafminer (*Phyllocnistis citrella* Stainton, Lep. Gracillariidae) in Sicily. Bollettino Zoologia agraria e Bachicoltura Ser. II 30: 213-222.
- Coll, M. & Bottrell, D.G. 1996: Movement of an insect parasitoid in simple and diverse plant assemblages. Ecological Entomology 21: 141-149.
- Garcia-Mari, F. (Ed.) 2003: Integrated Control in Citrus Fruit Crops. IOBC wprs Bulletin 26(6), 225 pp.
- Garcia-Mari, F., Vercher, R., Costa-Comelles, J., Marzal, C. & Villalba, M. 2004: Establishment of *Citrostichus phyllocnistoides* (Hymenoptera: Eulophidae) as a biological control agent for the citrus leafminer *Phyllocnistis citrella* (Lepidoptera: Gracillariidae) in Spain. Biological Control 29: 215-226.
- Gurr, G.M., Wratten, S.D. & Altieri, M.A. (Eds.) 2004: Ecological Engineering for Pest Management: Advances in Habitat Manipulation for Arthropods. CABI Publishing, Oxon, UK, 232 pp.
- Lo Duca, R., Massa, B. & Rizzo, M.C. 2002: Importanza dei frammenti di habitat naturale per le comunità di fillominatori (Insecta Diptera, Lepidoptera et Hymenoptera) e loro parassitoidi (Hymenoptera Eulophidae). Atti Accademia Roveretana degli Agiati, a. 252, ser. VIII, vol. II, B: 51-122.
- Massa, B. & Rizzo, M.C. 2000: Comunità di parassitoidi di fitofagi della flora spontanea antagonisti di *Phyllocnistis citrella* Stainton (Lepidoptera, Gracillariidae). Atti dell'Accademia Nazionale Italiana di Entomologia 48: 271-290.
- Massa, B., Rizzo, M.C. & Caleca, V. 2001: Natural Alternative Hosts of Parasitoids of the Citrus Leafminer *Phyllocnistis citrella* Stainton in the Mediterranean Basin. J. Hymenoptera Res. 10: 91-100.
- Rossing, W.A.H., Poehling, H.-M. & Burgio, G. 2003: Landscape management for functional biodiversity. IOBC wprs Bulletin 26(4): 220 pp.
- Schauff, M.E., LaSalle, J. & Wijesekara, G.A. 1998: The genera of chalcid parasitoids (Hymenoptera: Chalcidoidea) of citrus leafminer *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae). Journal of Natural History 32(7): 1001-1056.
- Tscharntke, T., Steffan-Dewenter, I., Kruess, A. & Thies, C. 2002: Characteristics of insect populations on habitat fragments: A mini review. Ecological Research 17: 229-239.