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Survival of *Psytalia concolor*: Do flowers make the difference?

Lara A. Pinheiro^{1,2}, José Alberto Pereira¹, Pilar Medina³ & Sónia A.P. Santos^{4,5}

¹ Mountain Research Center, School of Agriculture, Polytechnic Institute of Bragança, Campus Sta. Apolónia, 5300-2535 Bragança, Portugal. lara_alina@ipb.pt; jpereira@ipb.pt

² University of León, Avda. Portugal, 24071 León, Spain.

³ Unidad de Protección de Cultivos, E.T.S.I. Agrónomos, Universidad Politécnica de Madrid, 28040 Madrid, Spain. pilar.medina@upm.es

⁴ CIQuiBio, Barreiro School of Technology, Polytechnic Institute of Setúbal, Rua Américo da Silva Marinho, 2839-001 Lavradio, Portugal. Sonia.Santos@estbarreiro.ips.pt

⁵ LEAF, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal.

Abstract

In sustainable olive groves, the biological control of the olive fruit fly *Bactrocera oleae* (Rossi) (Diptera: Tephritidae) should be achieved by maximizing the action of its natural enemies. In this work, we are focused on *Psytalia concolor* (Szépligeti) (Hymenoptera: Braconidae), a synovigenic koinobiont larval-pupal endoparasitoid of many Tephritidae that has been released in several Mediterranean and Californian (USA) olive-groves against *B. oleae* reaching different levels of success. In this context, the diversification of non-crop plants within and around olives groves is an effective strategy to support the population of this parasitoid. Plants provide nutritional supplements (pollen and/or nectar) for maintenance, survival and egg maturation but also shelter and alternative hosts. In this study, ten flowering non-crop plants that naturally occur in olive groves, distributed throughout six different families: Apiaceae (*Daucus carota* L. and *Foeniculum vulgare* L.); Asteraceae (*Bellis perennis* L.; *Calendula arvensis* L.; *Crepis vesicaria* L.; *Dittrichia viscosa* (L.) Greuter); Brassicaceae (*Brassica barrelieri* (L.) Janka); Geraniaceae (*Geranium molle* L.) Malvaceae (*Malva sylvestris* L.) and Plantaginaceae (*Veronica persica* Poir) were tested in order to identify flowers with capacity to increase survival of *P. concolor*. Parasitoids exposed to flowers increased their survival to, on average, three to five days, except for *M. sylvestris*, *V. persica* and *F. vulgare* that significantly increased longevity of females and males of *P. concolor*. Interestingly, for males, all Asteraceae species tested improved their longevity, when compared to females. These findings suggest that species such as *M. sylvestris* could be a suitable species for establishing in olive groves.

Key-words: Biological control, non-crop plants, parasitoid, *Bactrocera oleae*, olive grove

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²University of León, Avda. Portugal, 24071 León, Spain.

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Introduction

- ✓ In sustainable olive groves, the biological control of the olive fruit fly *Bactrocera oleae* (Rossi) (Diptera: Tephritidae) should be achieved by maximizing the action of its natural enemies.
- ✓ *Psytalia concolor* (Szépligeti) (Hymenoptera: Braconidae), a synovigenic koinobiont larval-pupal endoparasitoid of many Tephritidae that has been released in several Mediterranean and Californian (USA) olive-groves against *B. oleae* reaching different levels of success.
- ✓ The diversification of non-crop plants within and around olives groves is an effective strategy to support the population of this parasitoid.
- ✓ Plants provide nutritional supplements (pollen and/or nectar) for maintenance, survival and egg maturation but also shelter and alternative hosts.

Material and Methods – Survival assays

Plant species tested

✓ Apiaceae

[Dc] *Daucus carota* L.
[Fv] *Foeniculum vulgare* L.

✓ Plantaginaceae

[Vp] *Veronica persica* Poir.

✓ Asteraceae

[Bp] *Bellis perennis* L.
[Ca] *Calendula arvensis* L.
[Cv] *Crepis vesicaria* L.
[Dv] *Dittrichia viscosa* (L.) Greuter

✓ Brassicaceae

[Bb] *Brassica barrelieri* (L.) Janka

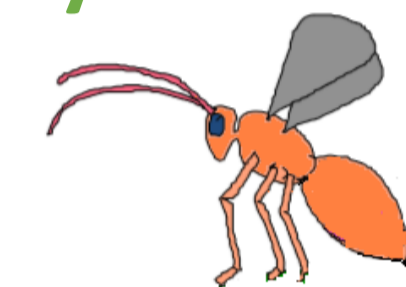
✓ Geraniaceae

[Gm] *Geranium molle* L.

✓ Malvaceae

[Ms] *Malva sylvestris* L.

Bioassays



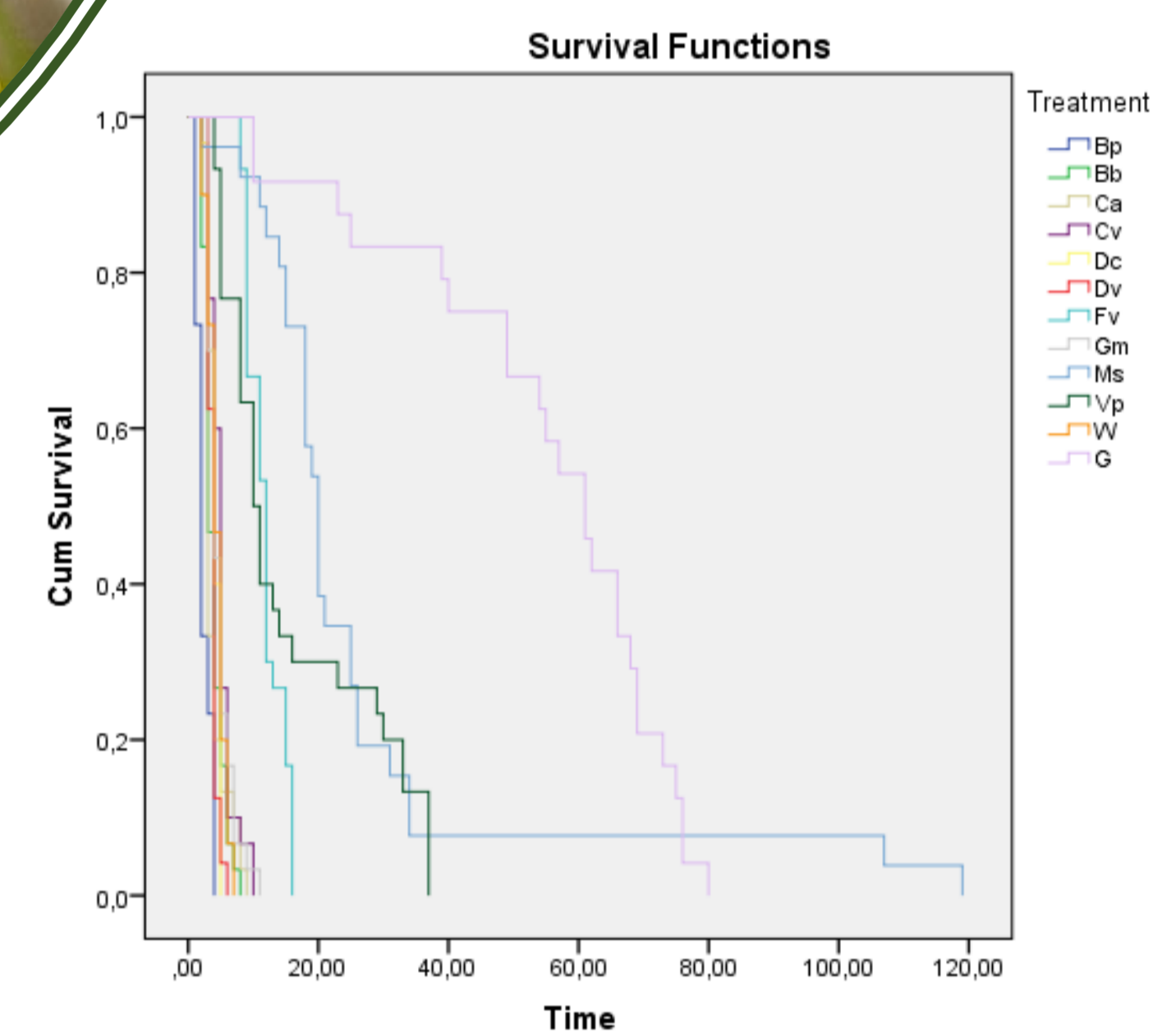
Psytalia concolor
30 ♀ + 30 ♂
<24 horas

Water
(negative control)
Glucose 1 M
(positive control)

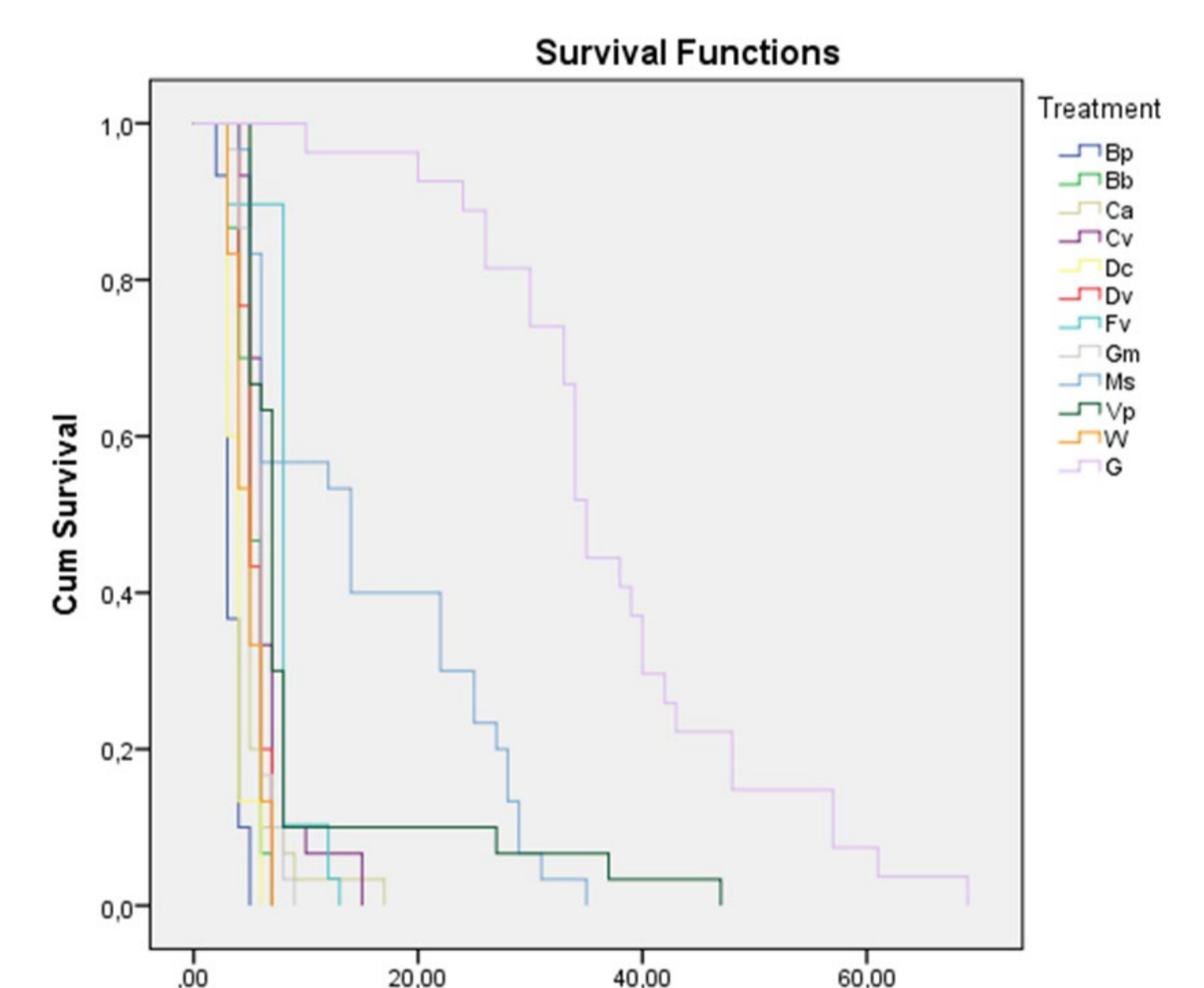
- T=24±2°C;
- HR=75±5%;
- 16:8h L:D



Figure 1 – Survival curves, estimated using Kaplan-Meier survival curves for each treatment tested and sex.



Females



Males

Objective

Study the influence of flowers-food resources with capacity to increase survival of *P. concolor* in order to choose the best management practices in olive groves.

Results

Table 1 – Longevity of females and males of *P. concolor* (mean ± standard error of the mean) of each treatment tested. Different letters on the table indicate significant death hazard differences among treatments (significance level < 0.05).

Treatments	Common name	Family type	Longevity (days)	
			Females	Males
Water			4.37 ± 0.25 ^{ab}	4.83 ± 0.24 ^{ab}
Glucose 1M			54.71 ± 4.19 ^c	37.78 ± 2.48 ^c
<i>Bellis perennis</i> L.	English daisy	Asteraceae	2.30 ± 0.20 ^a	3.40 ± 0.14 ^a
<i>Brassica barrelieri</i> (L.) Janka		Brassicaceae	3.83 ± 0.28 ^{ab}	5.10 ± 0.22 ^{ab}
<i>Calendula arvensis</i> L.	Field Marigold	Asteraceae	3.83 ± 0.33 ^{ab}	5.73 ± 0.42 ^{ab}
<i>Crepis vesicaria</i> subsp. <i>taraxacifolia</i> (Thuill.) Thell.	Beaked Hawksbeard	Asteraceae	4.93 ± 0.34 ^{ab}	6.60 ± 0.47 ^{ab}
<i>Geranium molle</i> L.	Dove's-foot Crane's-bill	Geraniaceae	4.73 ± 0.35 ^{ab}	5.80 ± 0.23 ^{ab}
<i>Veronica persica</i> Poir.	Bird's-eye speedwell	Plantaginaceae	15.90 ± 2.18 ^d	9.50 ± 1.78 ^d
<i>Daucus carota</i> L.	Wild carrot	Apiaceae	4.07 ± 0.17 ^{ab}	3.87 ± 0.18 ^{ab}
<i>Dittrichia viscosa</i> (L.) Greuter	False yellowhead	Asteraceae	3.79 ± 0.16 ^{ab}	5.40 ± 0.20 ^{ab}
<i>Foeniculum vulgare</i> L.	Fennel	Apiaceae	11.80 ± 0.50 ^{bd}	7.93 ± 0.40 ^{bd}
<i>Malva sylvestris</i> L.	Mallow	Malvaceae	26.77 ± 5.19 ^e	15.43 ± 1.87 ^e

Conclusion

- ✓ *Malva sylvestris* and *Veronica persica* increased longevity of females and males of *P. concolor* and proved to be the best food source tested.
- ✓ These two food items represent an important source of pollen and sugar able to support the population of this parasitoid in olive grove.

