

Notes and Comments

Chrysopidae, Coccinellidae and Syrphidae in a *Pinus taeda* plantation, infested by *Cinara atlantica* (Hemiptera: Aphididae), in the Atlantic Forest biome

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In Brazil, the deforestation of native forests and the challenges to restoring these ecosystems for timber production increased the cultivation of exotic forest species. Species of the genus *Pinus* (Pinales: Pinaceae) stand out (Iede et al., 2000), with approximately 1.9 million hectares planted in Brazil (IBÁ, 2024). Forest plantations, especially in monocultures, favor native and exotic insect pests, but predators, such as those of the families Chrysopidae and Coccinellidae, are important in the biological control. This increases the need to identify natural enemies in forest plantations, where chemical control may not be economically or ecologically viable.

Species of the genus *Cinara* Curtis (Aphididae) stand out as pests of *Pinus* spp. in various countries (Blackman and Eastop, 1994). Individuals of *Cinara* spp. were first reported in *Pinus* spp. plantations in Brazil in 1996. Symptoms such as chlorosis, needle deformation and abscission, and reduced growth including stem bending and excessive sprouting due to the loss of the apical bud have been reported in *Pinus* spp. plants infested by *Cinara* spp. (Penteado et al., 2000).

Larvae of Chrysopidae (Neuroptera), and occasionally adults, are predators. This is an important group used in the biological control of agricultural pests (Morales and Freitas, 2010). Chrysopidae have been reported in natural ecosystems or those modified by men, primarily in areas with native or planted forests (Freitas and Penny, 2001; Cardoso et al., 2003; Corrales and Campos, 2004). Thirty-three and 81 species, including nineteen and 41 new species, were reported in the Amazon Basin (Adams and Penny, 1985) and the Brazilian states of Mato Grosso, Santa Catarina, and São Paulo, respectively (Freitas and Penny, 2001). Temperature and photoperiod affect Chrysopidae populations, whose larvae feed on different prey types, including aphids especially in temperate regions where they are studied for biological control programs (Venzon and Carvalho, 1993).

Cycloneda sanguinea (Linnaeus, 1763) and *Hippodamia convergens* Guérin-Ménéville, 1842 (Coleoptera: Coccinellidae) preyed on *C. atlantica* (Wilson, 1919) (Hemiptera: Aphididae) in *Pinus* spp. plantations (Oliveira et al., 2004).

Syrphidae are the most frequent and active predators of aphids (Coulson and Witter, 1984) in nearly all ecosystems (Sommaggio, 1999). Larvae of some species of the genus *Eupeodes* (Syrphidae) inserted their mouthparts into the bodies of these insects on *Pinus* spp. plants and suck out their fluids. On the other hand, adult Syrphidae feed on nectar, pollen, and sugary substances (Rotheray, 1986).

Natural enemies are important in pest management, especially in forest plantations. The objective was to evaluate and report the predator entomofauna of Chrysopidae, Coccinellidae, and Syrphidae in a *P. taeda* plantation infested by *C. atlantica* (Wilson, 1919) (Hemiptera: Aphididae) in Buri, São Paulo State, within the Atlantic Forest Biome of Brazil.

The study was conducted from November 2000 to August 2002 in a 17.7-hectare area planted with *P. taeda*, spaced 3.0 × 2.0 meters apart, and six months old at the beginning of the study. The site was located at Fazenda Sul Brazil (23°54'25.1"S, 48°36'48.1"W) with mean altitude of 668 m in the municipality of Buri, São Paulo State, within the Atlantic Forest Biome of Brazil.

Adults of the predatory families Chrysopidae (Neuroptera), Coccinellidae (Coleoptera), and Syrphidae (Diptera) were collected monthly from 320 *P. taeda* plants distributed over 24 sampling points, each composed of 10 plants arranged in a row and from the inter-row spaces between them. The collected coccinellid species were identified by Dr. Lúcia Massutti de Almeida from the Department of Zoology at the Federal University of Paraná (UFPR), and the Chrysopidae and Syrphidae using identification keys. Collections were performed

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manually using forceps, and in the inter-row spaces using a sweeping net.

Insects collected were placed in plastic tubes containing 70% ethanol, sent to the Forest Pest Biological Control Laboratory, identified, and deposited in the Entomological Collection of the São Paulo State University (UNESP), Botucatu Campus, São Paulo State, Brazil.

Two, seven, and one species of Chrysopidae, Coccinellidae, and Syrphidae, respectively, were collected, all of which except *Hyperaspis* (*Hyperaspis*) *festiva* Mulsant, 1850 (Coleoptera: Coccinellidae) on the *P. taeda* plants and in the inter-row spaces. A total of 422 adult predators were collected, with 248 and 174 individuals from the *P. taeda* plants and inter-row areas infested by *C. atlantica*, respectively. These included 27, 216 and five individuals of Chrysopidae, Coccinellidae, and Syrphidae from the plants, and 27, 147 and zero from the inter-row spaces, respectively (Table 1). The greater number of natural enemy species in the inter-row spaces of the *P. taeda* plantation than on these plants may be related to the vegetation diversity in the first environment, increasing the availability of prey and microhabitats, as well as the herbivore population and, consequently, those of natural enemies (Corrales and Campos, 2004). The collection of many Coccinellidae species on *P. taeda* plants infested by *C. atlantica* is similar to reports that predators from this family prefer to feed on aphids (Cardoso and Lázzar, 2003).

Cycloneda sanguinea, *Eriopis connexa*, *Hippodamia convergens*, *Hyperaspis* (*Hyperaspis*) *festiva*, *Hyperaspis* sp.,

Olla v-nigrum, and *Scymnus* (*Pullus*) sp. (Coleoptera: Coccinellidae) were collected (Table 1). The collection of these predators confirms the diversity of the Coccinellidae family, as reported for *C. sanguinea*, *Diomus* sp., *Eriopis* sp., *Hyperaspis* sp., *O. v-nigrum* (Mulsant), and *Scymnus* (*Pullus*) sp. on mango seedlings in Lavras, Minas Gerais State, Brazil (Santos et al., 1990). *Cycloneda sanguinea* preyed on aphids, including *Aphis gossipi* Glover, *A. maidis* Fitch, 1856, *A. papaveris* Fabricius, 1777, *Hyalopterus prumi* (Geoff.), *Macrosiphum euphorbiae* (Thomas), *M. rosae* (Linnaeus, 1758), *Myzus persicae* (Sulzer, 1776), *Toxoptera aurantii* (Boyer de Fonscolombe, 1841), *T. graminum* (Rondani) (Hemiptera: Aphididae) and *Daktulosphaira vitifoliae* (Fitch, 1856) (Hemiptera: Phylloxeridae) (Silva et al., 1968) and twenty-six species of the Coccinellidae genus *Scymnus* (Blackwelder 1945, cited by Santos, 1992). This confirms the importance of Coccinellidae species in biological control, as reported for *Cycloneda sanguinea*, *Pentilia egea* Mulsant, 1850, and *Scymnus* spp. (Coleoptera: Coccinellidae) preying on aphids in citrus plantations in Brazil, and for the former and *Scymnus* (*Pullus*) *suturalis* Thunberg on conifer plants (Gordon, 1982) and on *Pinus sylvestris* plantations in Michigan, USA (Hoebeke, 1984). *Scymnus nigrinus* Kugelann, 1794 preyed on aphids in *Pinus* crops (Mills, 1990), and larvae and adults of *Anatis ocellata* (Linnaeus, 1758) (Coleoptera: Coccinellidae) were reported associated with the aphid *Cinara pinea* (Mordvilko, 1894) (Hemiptera: Aphididae) on *Pinus nigra* Arnold in Turkey (Oğuzoğlu et al., 2017).

Two species of Chrysopidae were recorded in the *P. taeda* plantation (Table 1). The number of these species is fewer than that of this family on this host plant, including *Chrysoperla externa* (Hagen, 1861), *Leucochrysa* (*Nodita*) *intermedia* (Scheneir, 1851), and *Leucochrysa* (*Nodita*) *vieirana* (Navás, 1913), in addition to six specimens of the genus *Leucochrysa* (*Nodita*) sp. and another six identified at the family level, collected in areas of *P. taeda* infested by *C. atlantica* in the southern region of Paraná state, Brazil (Cardoso et al., 2003).

All Syrphidae specimens were of a single species of the genus *Allograpta*. (Table 1). The collection of all individuals of a single species of Syrphidae differs from a greater diversity of these natural enemies, such as *Allograpta exotica* (Wiedemann, 1830), *Ocyptamus gastrostactus* (Wiedemann, 1830), *Pseudodorus clavatus* (Fabricius, 1794), *Syrphus phaeostigma* Wiedemann, 1830, *Toxomerus dispar* (Fabricius, 1794) and *Toxomerus watsoni* Macquart, 1855 e *Allograpta* sp. (Wiedemann, 1830), *Palpada* sp., *Toxomerus* sp. (Fabricius, 1794) (Diptera, Syrphidae) on wheat and peach plantations in Paraná, Brazil (Schuber et al., 2012; Bortolotto et al., 2016), and *Allograpta neotropica* Curran, *Allograpta* sp., *Oncyptamus dimidiatus* (Fabricius), *Oncyptamus gastrostactus* (Wiedemann), *Oncyptamus* sp., *Pseudodorus clavatus* (Fabricius), and *Syrphus phaeostigma* Wiedemann predating *Brachycaudus schwartzi* (Börner) (Hemiptera: Aphididae) on peach trees in Jacuí, Minas Gerais state, Brazil (Auad et al., 1997).

The diversity of species collected, mainly Coccinellidae, highlights the importance of these natural enemies in the biological control of pests in *P. taeda* plantations. The number of species collected in the inter-row spaces

Table 1. Species of Coccinellidae, Chrysopidae, and Syrphidae collected on *Pinus taeda* plants and in their inter-row spaces (Inter). Buri, São Paulo state, Atlantic Forest biome of Brazil.

Family	Species	Plants	Inter
Coccinellidae		216	27
	<i>Cycloneda sanguinea</i> (Linnaeus, 1763)	x	x
	<i>Eriopis connexa</i> (Germ. 1824)	x	x
	<i>Hippodamia convergens</i> (Guérin-Meneville)	x	x
	<i>Hyperaspis</i> (<i>Hyperaspis</i>) <i>festiva</i> Mulsant, 1850	-	x
	<i>Hyperaspis</i> sp.1	-	x
	<i>Olla v-nigrum</i> (Germ. 1824)	x	x
	<i>Scymnus</i> (<i>Pullus</i>) sp.	x	x
Chrysopidae		27	147
	sp.1	x	x
	sp.2	-	x
Syrphidae		05	0
	sp.1	x	-

-: Species not collected

between plants of *P. taeda* is related to the greater vegetation diversity in this environment, increasing shelters prey shelter for predators. Vegetation diversification can increase the survival of natural enemies and, consequently, enhance biological control (Altieri et al., 2003).

The association of predators of the families with *C. atlantica* on *P. taeda* plants reinforces their preference to feeding on aphids and the need for management strategies to increase local diversity and populations of these natural enemies for the biological control of forest pests.

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Data Availability Statement

The entire data set that supports the results of this study was published in the article itself.

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