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PEST MANAGEMENT

Population Development of the Invasive Species *Thaumastocoris peregrinus* (Hemiptera: Thaumastocoridae) on four *Eucalyptus* Species of the Subgenus *Symphyomyrtus*

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Abstract

Thaumastocoris peregrinus Carpintero & Dellapé (Hemiptera: Thaumastocoridae) is a small sap-sucking insect that feeds on *Eucalyptus* L'Hér. leaves. Although it is native to Australia, it currently has a global distribution and it is considered as one of the big five pests of eucalypts around the world. We described the development of *T. peregrinus* population on four *Eucalyptus* species under the environmental conditions in Argentina. We also analyzed the use of yellow sticky traps as a monitoring method for this pest. The four *Eucalyptus* species were suitable for *T. peregrinus*. A cyclic pattern was observed in the development of the bronze bug population with an annual seasonal peak followed by a decrease in the abundance, reaching a minimum value during the unfavorable seasons. During the fall and winter seasons, epizootic events were registered in all the *Eucalyptus* species, caused by an entomopathogenic fungus. None of the meteorological variables had a clear influence neither on the bronze bug population nor with the occurrence of fungal infection. We found a significant relationship between the number of nymphs and adults of *T. peregrinus* in branches and the number of individuals caught in traps, suggesting that traps give actual information about the bronze bug abundance in the tree canopy.

Introduction

Thaumastocoris peregrinus Carpintero & Dellapé (Hemiptera: Thaumastocoridae), commonly known as the bronze bug, is a small sap-sucking insect that specifically feeds on *Eucalyptus* L'Hér. leaves. The interest on *T. peregrinus* started in Australia, its home range, round the year 2002 when a number of Sydney's *Eucalyptus* trees were heavily attacked by this bug (Noack & Rose 2007). Soon became one of the most important emerging pests of *Eucalyptus* plantations worldwide. The oldest record outside the bronze bug natural range was in South Africa in 2003 (Jacobs & Neser 2005); thereafter, it has rapidly established over several regions in South America (Noack & Coviella 2006, Martínez & Bianchi 2010, Wilcken *et al* 2010, Ide *et al* 2011), New Zealand (Sopow *et al.* 2012), North America (Jiménez-Quiroz *et al.* 2016), the Middle East (Novoselsky & Freidberg 2016), and Europe (Laudonia & Sasso 2012, Garcia *et al* 2013, van der Heyden, 2017) where it is currently a major pest on diverse *Eucalyptus* species. In Argentina, it was registered in 2005 and misidentified as *Thaumastocoris australicus* Kirkaldy (Jacobs & Neser 2005, Noack & Coviella 2006) and afterwards it was redescribed as the new species *T. peregrinus* (Carpintero & Dellapé 2006).

Thaumastocoris peregrinus has a gregarious behavior with both nymphs and adults living together on the same leaves (Wilcken *et al* 2010). It feeds from the mesophyll of *Eucalyptus* leaves producing chlorotic spots (Santadino *et al* 2017a) and causing the loss of photosynthetic surface (Jacobs & Neser 2005). It has been described feeding on several species of *Eucalyptus* and their hybrids, most of them within the subgenus *Symphyomyrtus* (Nadel *et al* 2010, Saavedra *et al* 2015b). However, despite having a wide host range, there are species considered to be more suitable for its development than others (Jacobs & Neser 2005, Noack & Coviella 2006, Martínez *et al* 2009b, Saavedra *et al* 2015b). The infested trees initially display a silvering of the leaves that spreads until the entire canopy turns reddish-yellow with these leaves often being shed (Laudonia & Sasso 2012). Sometimes, when the infestation is severe, branches may die back or the entire tree may even die (Jacobs & Neser 2005).

Thaumastocoris peregrinus is one of the most important pests in *Eucalyptus* plantations around the world. The importance of this species has motivated the interest of studying diverse aspects of its biology, the relation with the host plant, distribution patterns, among others. However, to date, there are few studies focused on knowing more basic aspects of the ecology of this pest in the field, such as seasonal variations in the abundance or the influence of meteorological variables on the bronze bug population (Mendieta *et al* 2012, Garlet *et al* 2012, Nadel *et al* 2014, Barbosa *et al* 2014). In the same way, it was observed that yellow sticky traps were used in many of these studies, although few authors have specifically analyzed to how large numbers of *T. peregrinus* individuals captured on traps reflects the real abundance in the trees (González *et al* 2009, Martínez *et al* 2010).

The present work aimed to describe the development of *T. peregrinus* population on different *Eucalyptus* species under the local environmental conditions in Argentina, and identify the main abiotic factors that affect their population abundance. We also assessed the relationship between the abundance of nymphs and adults on *Eucalyptus* branches, and the number of individuals captured on yellow sticky traps in order to validate the use of this monitoring method.

Materials and Methods

Thaumastocoris peregrinus population was monitored in four species of *Eucalyptus* of the subgenus *Symphyomyrtus* in three sites of the Buenos Aires province, Argentina. The trees were selected using a completely randomized design: ten *E. camaldulensis* and ten *E. dunnii* trees, belonging to different plantations spaced 300 m from each other in the experimental field of the "Instituto Nacional de Tecnología Agropecuaria" (INTA) (34°36′21″S 58°40′14″O) Castelar; eight *E. tereticornis* trees in the "Estación Forestal" INTA in 25 de Mayo (35°26′S 60°10′O); and ten *E. viminalis* trees in a commercial farm in Jauregui (34°36′11.8″S 59°11′31.5″O). *Eucalyptus camaldulensis* trees were the oldest with approximately 50 years old, followed by *E. tereticornis* and *E. viminalis* that were between 20 and 30 years and the youngest were *E. dunnii* trees with just over 10 years. The trees that made up each plantation were coetaneous. Considering Castelar as a point of reference, the distance between this site and Jauregui and 25 de Mayo is approximately 53 and 200 km westward, respectively. All the *Eucalyptus* plantations sampled were subject to minimum pruning and weeding, and managed without chemical control.

Population development of the bronze bug was quantified in a randomly selected branch per tree of about 40 cm long, bearing 30–50 leaves. Branches were cut off from a height of 4 m and quickly isolated into a plastic bag. The numbers of nymphs and adults of *T. peregrinus* were counted in the laboratory under a stereoscopic microscope (Leica S6 E®) using a × 40 magnification, discriminating between living and dead individuals with signs of fungal infection. Yellow sticky traps (Russell IPM®) were hung on a branch with abundant foliage, at a height of 1.8 m in each tree. The traps were affixed using a clip, with the top edge in contact with the branch in order to capture the individuals that were moving among the foliage and through the branch. The size of the traps was 6 × 7 cm and only one surface was used for trapping while the other side remained covered to prevent capturing insects. Nymphs and adults that walked on this sticky surface were caught and counted under a stereoscopic microscope (Leica S6 E®) using a × 40 magnification. Traps renewal and branch clipping were made fortnightly in Castelar (from December 2012 to December 2014), and monthly in 25 de Mayo (from May 2013 to May 2014) and Jauregui (from February to December 2015).

To assess if the relative composition of the developmental stages of *T. peregrinus* was similar in the two studied sampling methods, we compared the number of nymphs and adults in both of them, for every abundance period and *Eucalyptus* species. The analysis was conducted by a generalized linear model using r, version 2.15.3 (http://www.r-project.org). An abundance period was defined by the dates in which the mean number of *T. peregrinus* was greater than one individual per branch or trap. We used the function generalized least squares of the linear and nonlinear mixed effects models (Gaussian family and identity link function). The data were normalized using the Box-Cox transformation. An error structure was chosen where a correlation between the dates was assumed with the shape of a compound symmetric matrix. The structure of the variances-covariances matrix was evaluated with Akaike's information criterion and likelihood ratio tests were built to assess the factor effects. In the cases in which interaction between factors was significant, means were separated using Tukey's multiple comparison tests (lsmeanspackage in r).

The influence of the meteorological variables in the abundance of *T. peregrinus* and in the occurrence of fungal infections was assessed in branch samples. Daily minimum, mean, and maximum temperature; and mean relative humidity and rainfall were provided by the "Instituto de Clima y Agua"–INTA, for Castelar and 25 de Mayo and by the "Estación Experimental de Mercedes" of the Buenos Aires Province government, for Jauregui. Data was analyzed by a Spearman correlation test with the software INFOSTAT (Di Rienzo *et al* 2015). In addition, the number of generations of the bronze bug was assessed based on the average temperature in each sampling site and temperature thresholds (4°C) and number of degree days estimated (790°C days) by Saavedra *et al* (2015a).

In order to evaluate the reliability of yellow sticky traps for monitoring the bronze bug population, we assessed the relationship between the abundance of nymphs and adults of the bronze bug in branch samples and in yellow sticky traps. Data was analyzed by a Spearman correlation test with the software INFOSTAT (Di Rienzo *et al.* 2015).

Results

Throughout the sampled period, a cyclic pattern was observed in the development of the bronze bug population in Castelar. *Thaumastocoris peregrinus* increased during summer (January–February) reaching a maximum abundance at the end of the season and beginning of the autumn (February–April). Then the abundance decreased at the end of fall reaching, in some cases, null values (May 2013) (Figs 1 and 2). Each year, a pronounced peak in the abundance of nymphs and adults was identified. In general, adult abundance remained low as compared to nymphs in branch samples of both *Eucalyptus* species, although these differences were significant only in *E. camaldulensis* during 2013

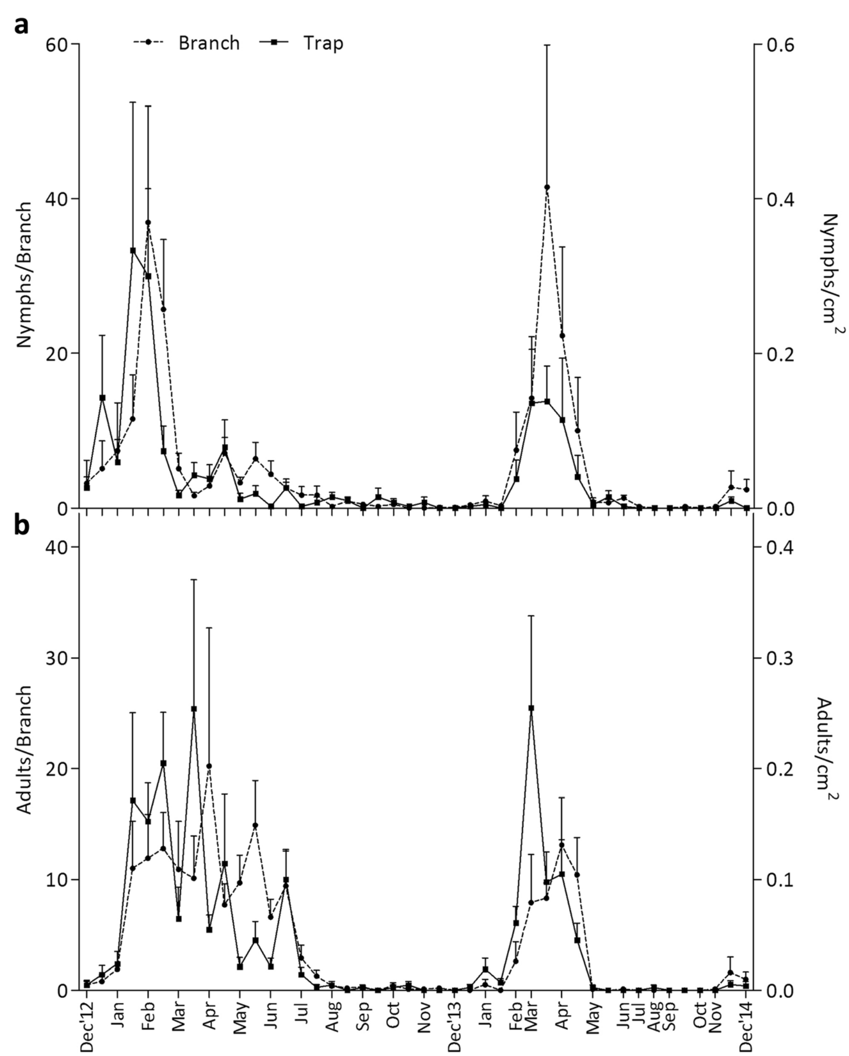

Fig 1 Number of *Thaumastocoris peregrinus* nymphs (**A**) and adults (**B**) on *Eucalyptus camaldulensis* branches (dotted lines) and traps (full line) (mean ± standard error).

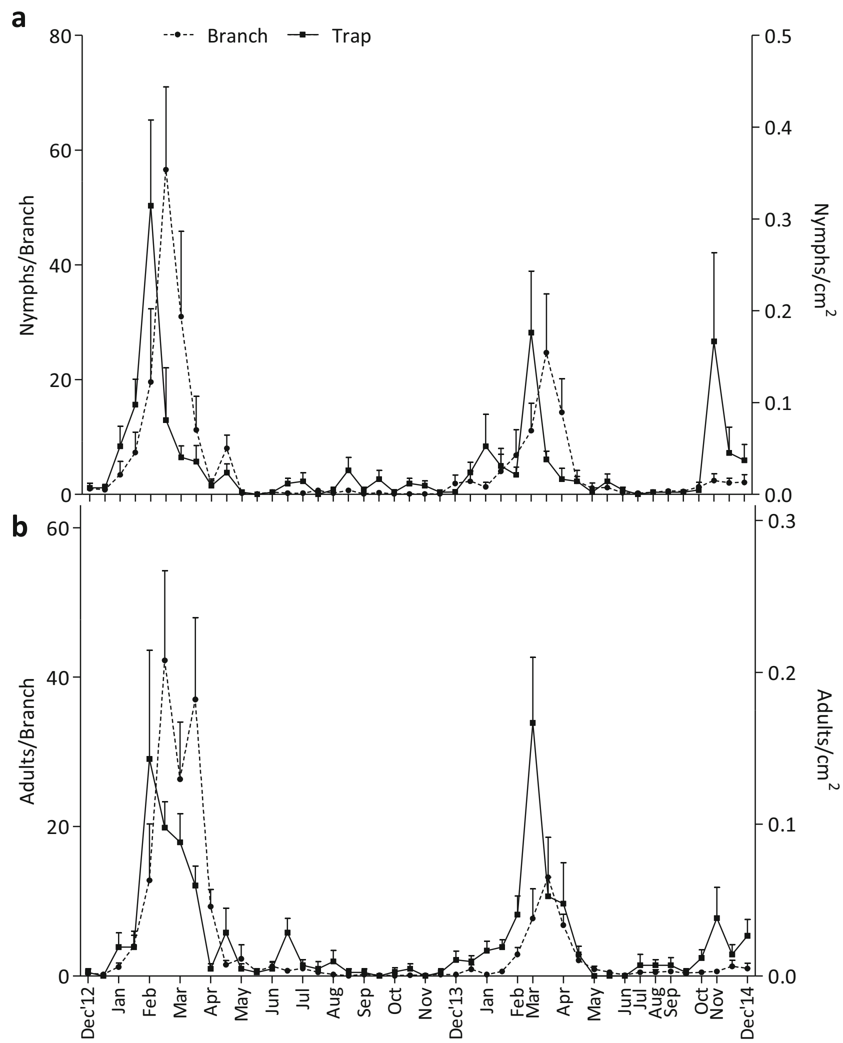

Fig 2 Number of *Thaumastocoris peregrinus* nymphs (**A**) and adults (**B**) on *Eucalyptus dunnii* branches (dotted lines) and traps (full line) (mean ± standard error).

(Table 1). In 25 de Mayo and Jauregui, we were able to record a single peak of abundance which was reached, in both cases, slightly later than in Castelar. In the westernmost site (25 de Mayo), nymphs peaked at the beginning of winter (Fig 3), while for the adults, the period of maximum abundance could not be recorded at the start of the sampling. In *E. tereticornis*, the number of nymphs exceeded the number of adults in branch samples; however, these differences were not significant (Table 1). In Jauregui, the population peaked at the end of fall (Fig 4). In branch samples of *E. viminalis*, the interaction between factors was significant and the multiple comparison test detected more nymphs than adults only in the sampling date of June (Table 1).

Variations in the abundance of the bronze bug captured in yellow sticky traps showed the same pattern as the described for branches. In *E. camaldulensis*, *E. dunnii*, and *E. tereticornis*, more nymphs were captured in traps compared to adults, although these differences were not significant (Table 1). On the contrary, in *E. viminalis* where the interaction between factors was significant, the multiple comparison test detected significantly more adults than nymphs in the dates of February and April ($P < 0.01$).

During the fall and winter seasons, nymphs and adults of *T. peregrinus* collected in branch samples of all *Eucalyptus* species were found dead with signs of a fungus infection, specifically mycelium covering the individuals. The fungus was identified as *Zoophtora* sp. (Entomophthorales) based on its morphology. The highest number of dead insects was recorded in the autumn months, while in winter this number decreased notably since the population of the bronze bug also dropped at that time. The highest percentage of infected nymphs and adults was recorded in *Eucalyptus dunnii* during the second sampling season (2014) with 70.20% of dead individuals out of a total of 2309 registered. Whereas for *E. camaldulensis* in the same period, only 12.68% of 1246 nymphs and adults presented fungus colonization. With respect to *E. viminalis* and *E. tereticornis*, a total of 17.28% (of

Table 1 Generalized linear model results for differences between *Thaumastocoris peregrinus* nymphs and adult's population in the *Eucalyptus* species.

Eucalyptus species	Year	Sample	Period	Stage		Date		Interaction	
				F	*P*	*F*	*P*	*F*	*P*
E. camaldulensis	2013	Branch	22 Jan–12 Aug	17.08	< 0.01	6.12	< 0.01	0.70	0.76
		Trap	22 Jan–6 May	3.36	0.07	4.15	< 0.01	1.79	0.09
	2014	Branch	17 Feb–4 May	0.27	0.60	6.75	< 0.01	1.72	0.15
		Trap	17 Feb–4 May	3.32	0.07	4.72	< 0.01	0.36	0.83
E. dunnii	2013	Branch	22 Jan–6 May	0.51	0.47	20.65	< 0.01	3.30	< 0.01
		Trap	18 Feb–10 Apr	0.89	0.35	2.59	0.06	4.25	< 0.01
	2014	Branch	17 Feb–4 May	0.05	0.83	4.71	< 0.01	0.74	0.57
		Trap	6 Mar–8 Apr	0.52	0.47	5.82	0.02	0.08	0.78
E. tereticornis	2013	Branch	7 May–28 Aug	1.61	0.21	12.96	< 0.01	1.82	0.16
		Trap	7 May–13 Jun	2.53	0.13	1.70	0.21	0.07	0.78
E. viminalis	2015	Branch	26 Jan–2 Jun	10.82	< 0.01	6.40	< 0.01	4.60	< 0.01
		Trap	26 Jan–5 May	8.32	< 0.01	26.04	< 0.01	13.17	< 0.01

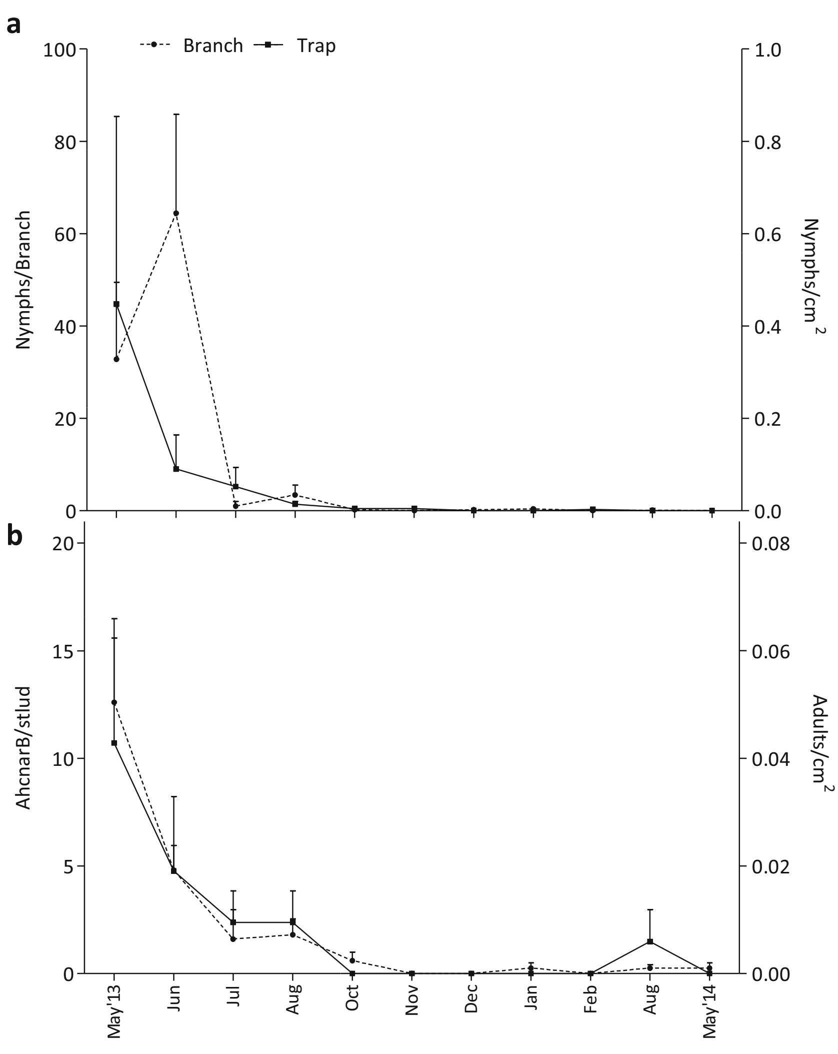

Fig 3 Number of *Thaumastocoris peregrinus* nymphs (**A**) and adults (**B**) on *Eucalyptus tereticornis* branches (dotted lines) and traps (full line) (mean ± standard error).

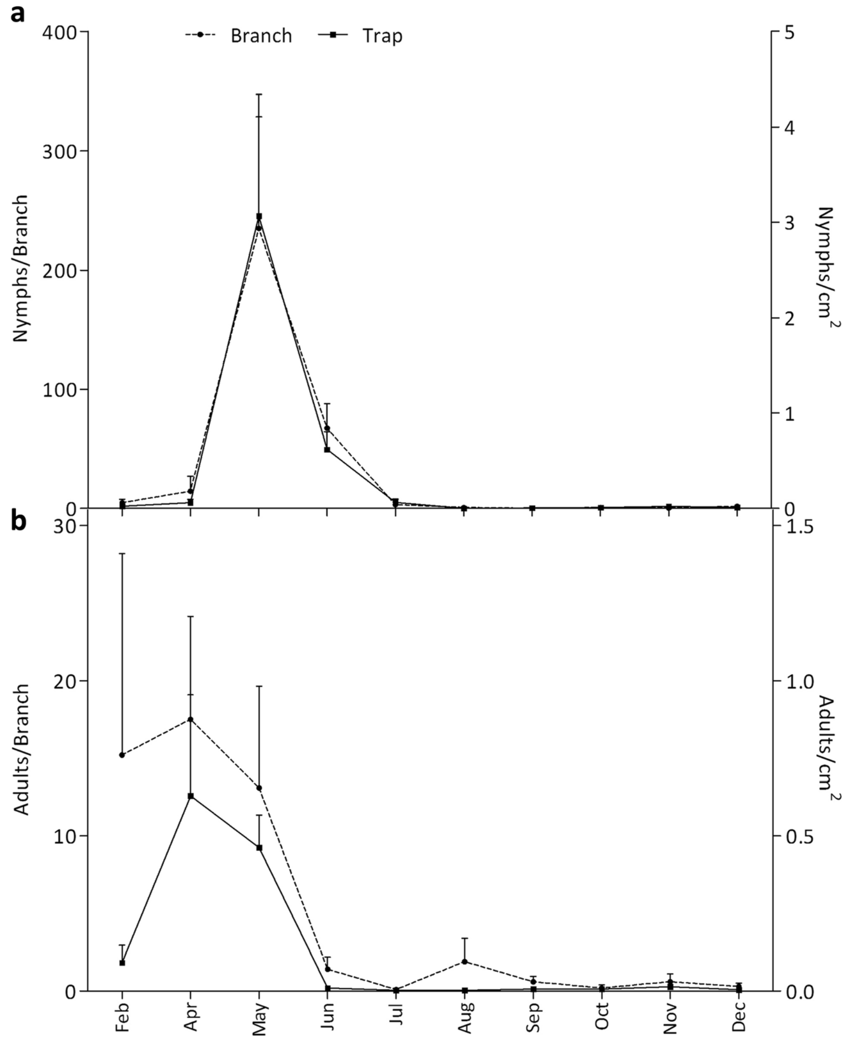

Fig 4 Number of *Thaumastocoris peregrinus* nymphs (**A**) and adults (**B**) on *Eucalyptus viminalis* branches (dotted lines) and traps (full line) (mean ± standard error).

4142) and 33.55% (of 927) infected *T. peregrinus* were recorded, respectively.

None of the meteorological variables considered had a clear influence neither on the bronze bug population nor with the occurrence of fungal infection. Only in *E. dunnii* a significant relationship was detected between the number of nymphs and temperature (maximum and minimum) and rainfall and in *E. viminalis* where maximum temperature correlated with the number of adults (Table 2).

Average temperature (°C) during the sampling period for each site (mean ± standard error) was as follows: 17.43 ± 0.22°C for Castelar, 16.11 ± 0.36 for 25 de Mayo, and 16.44 ± 0.29°C for Jauregui. The number of generations estimated for the bronze bug under the local environmental conditions was 5 to 6 generations per year in the three study sites.

There was a significant relationship between the abundance of nymphs and adults in branch samples and the number captured on yellow sticky traps in all the *Eucalyptus* species (Table 3).

Discussion

Thaumastocoris peregrinus was present at the three monitoring sites throughout the year. At each site, it was identified an annual seasonal peak of nymphs and adults followed by a decrease in their abundance and reaching to a minimum during the unfavorable seasons. The bronze bug has a short life cycle that may last between 30 and 60 days depending on the temperature (Noack & Rose 2007, Martínez *et al* 2014). This feature allows the occurrence of several generations per year (Jabobs & Neser 2005, Nadel *et al* 2014), for instance in its home range, Saavedra *et al* (2015a) predicted that *T. peregrinus* will undergo 6.2 generations per year. In

Table 2 Spearman correlation test between *Thaumastocoris peregrinus* abundance and weather variables in the *Eucalyptus* species of the three monitoring sites.

Stage	Host	MxT (°C)		MnT (°C)		RH (%)		Rainfall (mm)	
		r	*P*	*r*	*P*	*r*	*P*	*r*	*P*
Nymphs	*E. camaldulensis*	0.20	0.20	0.27	0.08	0.08	0.62	0.14	0.37
	E. dunnii	0.53	< 0.01	0.56	< 0.01	− 0.09	0.54	0.34	0.02
	E.tereticornis	− 0.34	0.30	− 0.41	0.21	− 0.12	0.72	− 0.42	0.20
	E. viminalis	0.44	0.17	0.29	0.39	0.28	0.40	− 0.29	0.38
Adults	*E. camaldulensis*	0.06	0.68	0.09	0.57	0.01	0.95	− 0.04	0.81
	E. dunnii	0.17	0.26	0.26	0.09	0.18	0.24	0.12	0.44
	E.tereticornis	− 0.58	0.06	− 0.56	0.08	0.26	0.44	− 0.15	0.66
	E. viminalis	0.67	0.03	0.59	0.06	0.00	0.99	− 0.33	0.32

r Spearman correlation coefficient, $P < 0.05$; *MxT* maximum temperature; *MnT* minimum temperature; *HR* relative humidity.

the present study, we estimated that the bronze bug presents five to six generations per year under the local environmental conditions.

All the *Eucalyptus* species sampled in the present work were suitable for the development of *T. peregrinus* population, as observed in several studies (Jacobs & Neser 2005, Noack & Coviella 2006, Martínez *et al* 2009b, Saavedra *et al* 2015b). In *E. camaldulensis* and *E. dunnii*, the bronze bug population showed a clear seasonality across the 2 years of sampling with a cyclic pattern of increase and reduction of the number of nymphs and adults. Although the sampling in *E. viminalis* and *E. tereticornis* was limited to a single period, the pattern of variation of *T. peregrinus* population was very similar to that observed in the previously mentioned species. In general, all the *Eucalyptus* species presented a similar relative abundance of nymphs compared to the adult stage of the bronze bug and this was the same for both sampling methods. An exception was observed in the months of February and April in *E. viminalis* where the relative abundance of adults was significantly greater than the abundance of nymphs, captured in sticky traps. In this eucalyptus species, the maximum temperature had a significant influence on the abundance of adults. If we consider that during those months the maximum temperature reached an average of 28°C, the observed result may be reflecting a higher activity and mobility and therefore more adults captured in yellow sticky traps.

Table 3 Spearman correlation test between nymphs and adults on *Eucalyptus* branches and yellow sticky traps in the *Eucalyptus* species.

Stage	Host	*r*	*P*
Nymph	*E. camaldulensis*	0.36	< 0.01
	E. dunnii	0.31	< 0.01
	E. tereticornis	0.56	< 0.01
	E. viminalis	0.59	< 0.01
Adult	*E. camaldulensis*	0.58	< 0.01
	E. dunnii	0.53	< 0.01
	E. tereticornis	0.50	< 0.01
	E. viminalis	0.56	< 0.01

r Spearman correlation coefficient, $P < 0.05$.

One of the reasons of the global distribution and the importance of *T. peregrinus* as one of the big five *Eucalyptus* pests around the world (Lawson *et al.* 2013) is its extensive host range within this genus. However, *T. peregrinus* prefers some species more than others. Numerous studies focused in comparing the performance and preference of the bronze bug in different eucalyptus species among which *E. camaldulensis*, *E. tereticornis*, *E. viminalis*, and *E. dunnii* were selected over other species with which they were compared. In laboratory assays, Schmatz *et al* (2011) observed that the bronze bug fed significantly more on *E. camaldulensis* than on any of the other tested species. *Eucalyptus dunnii* and, to a lesser extent, *E. viminalis* were highlighted by Smaniotto *et al* (2017) for favoring the oviposition period, egg viability, and longevity of adults. On the other hand, Martinez *et al* (2017) observed that *E. tereticornis* was the host plant selected by females for oviposition and in the same time favored a good performance for the development of nymphs. In a more comparative study, Santadino *et al* (2017b) calculated a ranking of feeding preference in which *E. viminalis* was the most preferred species for the bronze bug followed by *E. tereticornis* and *E. dunnii.* This order of preference is somehow supported by our results; when observing the abundance of nymphs of the bronze bug in the same eucalyptus species, *E. viminalis* presents the highest number of individuals per branch followed by *E. tereticornis* and *E. dunnii*. Santadino *et al* (2017b) correlated this preference with the concentration of two components of *Eucalyptus* essential oils, a high content of ρ-cymene, which exhibits an attractant and phagostimulant properties (Lugemwa *et al* 1989, Kordan *et al* 2013), and a low content of 1-8 cineole, a natural bioactive repellent of different insects (Batish *et al* 2008, Alzogaray *et al* 2011, Juan *et al* 2011). These two components had also been cited as the mayor constituents of *E. camaldulensis* essential oils (Farah *et al* 2002, Cheng *et al* 2009) and although *E. camaldulensis* chemical composition is very variable (Oyedeji *et al* 2000, Chalchat *et al* 2001), several components are shared with *E. tereticornis* (Lucia *et al* 2016). These chemical similarities together with the comparable abundance of nymphs and adults observed in the present study in both *Eucalyptus* species, during the same sampling period (i.e., May 2013 to May 2014), suggest that *T. peregrinus* preference for *E. camaldulensis* could be very much alike to that observed for *E. tereticornis*.

The *Eucalyptus* species we studied belong to the subgenus *Symphyomyrtus*, whose species have been characterized for carrying a high diversity of herbivore assemblage and for having a tendency to suffer elevated levels of damage by insect pests (Noble 1989, Stone *et al* 1998). Moreover, because most of the *Eucalyptus* species reported as hosts for *T. peregrinus* are within *Symphyomyrtus*, Saavedra *et al* (2015b) suggested this subgenus comprises the most palatable and susceptible host species to this pest. In these respect, *E. camaldulensis*, *E. tereticornis*, and *E. viminalis* have been identified by several authors as highly susceptible species (Jacobs & Neser 2005, Martínez *et al* 2009, FAO 2012, García *et al* 2013, Hodel *et al* 2016, BICEP 2017), whereas *E. dunnii* was characterized as moderately susceptible (Martinez *et al* 2009b).

During the fall and winter seasons, in branch samples of all the *Eucalyptus* species, a considerable number of nymphs and adults of the bronze bug were found dead covered with mycelium belonging to a entomopathogenic fungus of the genus *Zoophtora* s.. Fungal pathogens infecting *T. peregrinus* are not uncommon and have been previously observed by other authors. Simeto *et al* (2014) reported epizootic events in *Eucalyptus* plantations in Uruguay during fall and beginning of winter and identified several strains of entomopathogenic fungi among which recognized the genera *Beauveria*, *Paecilomyces*, *Verticillium*, and *Lecanicillium*. In Brazil, *Zoophthora radicans* (Entomophthorales: Entomophthoraceae) was described occurring naturally on field populations of the bronze bug (Mascarin *et al* 2012). This result represents the first report of an entomopathogenic fungus attacking nymphs and adults of the bronze bug in Argentina. A proper identification as well as a more profound evaluation is necessary in order to determine the potential of this pathogen as a control agent of this exotic pest.

There was no consistent relationship between the meteorological variables and the abundance of nymphs and adults of the bronze bug. Contrary to these observations, Garlet *et al* (2012) found a positive correlation between the number of *T. peregrinus* and temperature in Brazil, and concluded that high temperatures together with low relative humidity are the optimal conditions for the bronze bug development. In South Africa, no relationship was observed between the presence of *T. peregrinus* and temperature, relative humidity, and rainfall (Nadel *et al* 2014). However, a synchronicity among sites in similar regions allowed the authors to hypothesize that there are factors acting on a broader spatial scale (i.e., weather and trophic interaction) that drive *T. peregrinus* seasonality more strongly than a direct effect of temperature. In the present study, although the monitoring sites have different average values of temperature, humidity, and rainfall, they are located in the same climatic region (Koppen classification, Cfa Subtropical without a dry season and with a warm summer). Then, it is plausible to think that large-scale factors are responsible for the changes in *T. peregrinus* populations.

In pest management, it is necessary to know the abundance of the pest population in order to determine the need of management strategies (Binns & Nyrop 1992). In this sense, monitoring through the collection of samples in the field provides the information about the abundance of problem species. The way to gather this information and therefore its reliability is highly important, because it will be used as a basis for decision making (Petrovskaya *et al* 2012). In order to reduce the time employed in monitoring, facilitation tools were developed, such as colored sticky traps. Some of the features that make sticky traps advantageous for monitoring are the effectiveness in the detection of first pest occurrence (Natwick *et al* 2007), lower handling time (Pizzol *et al* 2010), cost-efficiency, and easiness of use (Böckmann & Meyhöfer 2017). The use of yellow sticky traps for the bronze bug monitoring is widely distributed in several countries (TPCP 2007, Martínez *et al* 2010, Ide *et al* 2011, Barbosa *et al* 2014, Botto 2015); for instance, Nadel *et al* (2014) assessed the population dynamic of *T. peregrinus* in South Africa using yellow sticky traps placed at the mid canopy of *Eucalyptus* trees. In Uruguay, a monitoring plan at a national level, based on sticky traps hung from the canopy at 1.8 m high, was designed to determine the geographic distribution and the population level of the bronze bug. Martínez *et al* (2009a) studied the vertical distribution of *T. peregrinus* using yellow sticky traps at different heights in the tree canopy and found that the abundance of the bronze bug increased at higher altitudes; however, the covariance in the abundance among the different tree strata, together with the logistics convenience, justified the use of traps at 1.8 m. Despite these findings, there still was the question if traps gave reliable information about *T. peregrinus* real abundance in the tree.

In the course of this work, we were able to observe some aspects of the bronze bug behavior in the field. Adults of *T. peregrinus* are not characterized by their ability to fly, but by their great mobility, like the nymphs, moving quickly through the leaves, especially when they are disturbed. These observations are consistent with those made by Noack & Rose (2007) during laboratory trials. This aspect of their behavior, it is important when analyzing the captures in yellow sticky traps. The position of the traps in contact with the branch allowed that both nymphs and adults that were walking on the branch, and were attracted to the trap, were captured. Our results showed that the relative composition of nymphs and adults of the bronze bug were similar between sampling methods, meaning that when nymphs were more abundant in the branches, they were also more captured in the sticky traps. We also found that the relationship between the number of nymphs in branches and the number of nymphs in traps was significant and the same result was observed for adults. Both results evidence that the yellow sticky traps placed in contact with branches at a relatively low high (1.8 m) gives reliable information about the abundance of nymphs and adults of *T. peregrinus* in the field.

The present study not only contributes to expand the knowledge about the population development of the bronze bug in one of the neotropical regions recently invaded but also to identified the influence that biotic factors, such as entomopathogenic fungus, and abiotic factors, such as the meteorological variables, have on the population levels of this pest. In addition, the analysis made on the use of traps supports the use of this tool as a method for monitoring *T. peregrinus* population.

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