

Thrips species (Thysanoptera, Terebrantia) inhabiting irrigated rice and surrounding habitats in Cachoeirinha, state of Rio Grande do Sul, Brazil

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ABSTRACT. Thrips species (Thysanoptera, Terebrantia) inhabiting irrigated rice and surrounding habitats in Cachoeirinha, state of Rio Grande do Sul, Brazil. In Brazil, almost nothing is known about the thrips fauna associated with rice crops. This is especially true for Rio Grande do Sul State (RS), the major rice producer in Brazil, where no systematic surveys have been conducted. Thus, this work records preliminarily the species of suborder Terebrantia inhabiting irrigated rice (RC) and three nearby habitats: the area selected for rice, before cultivation (BR), grassland (GR) and forest border (FB) in Cachoeirinha, RS (50°58'21"W; 29°55'30"S). Eight field trips were carried out between October/2004 and February/2005 to Estação Experimental do Arroz in Cachoeirinha. Thrips specimens were collected with sweeping net and transported to laboratory for identification. A total of 623 adults terebrantians were recorded, belonging to two families and 18 species. *Frankliniella rodeos* (55.5%), *Neohydatothrips* cf. *paraensis* (30.3%) and *Frankliniella schultzei* (5.6%), were the most abundant, comprising more than 90% of the individuals. FB showed the highest species richness (S=15), followed by GR (S=10), RC (S=9) and BR (S=6). FB presented a low number of individuals (14.0%), contrasting with GR (44.8%) and BR (36.7%). In general, thrips abundance in RC was low at EEA (4.5%), and few species seems to effectively use rice as a host-plant. Two species previously considered of economic importance were found, *F. rodeos* and *F. schultzei*, the latter a new record for rice in Brazil. Five species are new records to RS.

KEYWORDS. Entomology; *Frankliniella*; inventories; *Oryza sativa*; phytophagous insects.

RESUMO. Espécies de tripses (Thysanoptera, Terebrantia) habitantes do arroz irrigado e habitats adjacentes em Cachoeirinha, Rio Grande do Sul, Brasil. No Brasil, pouco se sabe a respeito da fauna de tripses associada à cultura do arroz. Isto é especialmente válido para o Rio Grande do Sul (RS), o maior produtor de arroz do país, onde nenhum levantamento sistemático tem sido realizado. Visando suprir tal lacuna, este estudo registra preliminarmente as espécies da subordem Terebrantia habitantes do arroz irrigado (RC) e de três habitats vizinhos: área antes do plantio do arroz (BR), campo (GR) e borda de mata (FB) em Cachoeirinha, RS (50°58'21"W; 29°55'30"S). Foram realizadas oito saídas de campo entre outubro de 2004 e fevereiro de 2005 para a Estação Experimental do Arroz em Cachoeirinha. Os tripses foram coletados através de varredura e levados até o laboratório para identificação. Foram amostrados 623 Terebrantia adultos, pertencendo a duas famílias e 18 espécies. *Frankliniella rodeos* (55,5%), *Neohydatothrips* cf. *paraensis* (30,3%) e *Frankliniella schultzei* (5,6%), foram as espécies mais abundantes, perfazendo mais de 90% da amostra. FB apresentou a maior riqueza de espécies (S=15), seguida por GR (S=10), RC (S=9) e BR (S=6). FB apresentou um baixo número de indivíduos (14,0%), contrastando com GR (44,8%) e BR (36,7%). No geral, a abundância de tripses em RC na área de estudo foi baixa (4,5%), e provavelmente poucas espécies usam efetivamente o arroz como hospedeira. Foram coletadas duas espécies de importância econômica, *F. rodeos* e *F. schultzei*, sendo esta última um novo registro para o arroz no Brasil. Cinco espécies são novos registros para o RS.

PALAVRAS-CHAVE. Entomologia; *Frankliniella*; insetos fitófagos; inventários; *Oryza sativa*.

The members of the Order Thysanoptera, commonly named thrips, are tiny insects comprising about 5,800 species. About 1% of these have economic importance in several cultivated plants, almost all of them belonging to the suborder Terebrantia (Mound & Marullo 1996; Mound 2007). The damage produced by these insects is caused by direct injury to plant tissues (with their picking and sucking mouthparts) and also by indirect damage, through pathogen transmission (Mound & Kibby 1998).

However, in some agricultural systems little is known about the thrips fauna associated and their possible effects on the crops. This is especially true for rice, where some thrips species are considered pests, causing productivity losses. The most important is the Oriental rice thrips, *Stenchaetothrips biformis* (Bagnall, 1913), a worldwide species that damages leaves and induces curling and drying of the tips. In Palearctic

and Oriental regions, *Haplothrips aculeatus* (Fabricius, 1803) and *Haplothrips ganglebaueri* Schmutz, 1913, are also considered pests of rice, feeding on grain heads, causing a distorted development of the embryos (Grist & Lever 1969; Chander 1999).

Although Brazil is a large rice producer and consumer (Embrapa Arroz e Feijão 2008), almost nothing has been published on the associated thrips species in this crop. An exception is the work of Ferreira & Fernandes (1985), which recorded *Frankliniella rodeos* Moulton, 1933 damaging rice flowers in Goiás State, increasing the number of sterile spikelets. The lack of information is critical for Rio Grande do Sul State (RS), the main rice producer in Brazil (Embrapa Arroz e Feijão 2008), where no systematic inventories have been conducted so far. Particularly, the rice crops cultivated under irrigated conditions urgently need studies on surveys

and characterization of potential insect pests and their natural enemies, aiming to obtain a correct identification of species and establish appropriated control methods (Costa 2007).

Thus, this work preliminarily records the thrips species of suborder Terebrantia inhabiting irrigated rice and three nearby habitats: preceding area where rice is cultivated, grassland and forest border in Cachoeirinha (RS).

MATERIAL AND METHODS

Study site. Field trips were carried out to Estação Experimental do Arroz (EEA) in Cachoeirinha, RS (50°58'21"W; 29°55'30"S). The climate is humid subtropical (Cfa according to Köppen) and the temperature along the sample period ranged from 15°C to 29°C. In EEA, the rice crop is delimited by riparian forest and grassland, and several herbaceous plants are associated with it: *Aeschynomene denticulata* Rudd (Fabaceae), *Brachiaria plantaginea* (Link) Hitchc. (Poaceae), *Cyperus difformis* L. (Cyperaceae), *Echinochloa colonum* (L.) Link (Poaceae), *Heteranthera reniformis* Ruiz & Pavon (Pontedericaceae), *Hymenachne amplexicaulis* (Rudge) Nees (Poaceae), *Panicum dichotomiflorum* Michx (Poaceae), *Thalia geniculata* L. (Maranthaceae) (IRGA 2001).

Rice cropping. *Oryza sativa* L. (Poaceae) is originated from Asia and is widely cultivated in tropical and temperate climate countries. There are thousands of varieties of rice, which enable the plant to be grown successfully in different regions. It is cultivated in two main systems: the "upland" or "dry" one and the "irrigated" or "wet" one (Grist & Lever 1969). In this study, the rice (variety BR IRGA 410) grown under irrigated conditions and was sowed in the middle of December/2004.

Sampling and analysis. Between October/2004 and February/2005 eight field trips were conducted to EEA. Thrips were collected by sweeping in four different habitats: (i) the area selected for rice, before cultivation (BR); (ii) the same area after rice sowing (RC); (iii) riparian forest border (FB) (80 m far from RC) and (iv) grassland (GR) (10 m away from RC). FB and GR were sampled eight times, while BR and RC were sampled three and five times, respectively. The thrips were kept in 60% ethanol and transported to the laboratory for identification using microscopy magnification. Slide preparation is the same as in Mound & Kibby (1998) and nomenclature follows Mound (2007). The specimens are deposited in the zoological collection of Laboratório de Ecologia de Insetos, Departamento de Zoologia, UFRGS, Porto Alegre (Brazil). An individual-based rarefaction test was calculated using PAST software (Hammer *et al.* 2001).

RESULTS

A total of 623 adult terebrantians were recorded (440 females, 70.6% and 183 males, 29.4%), belonging to two families and 18 species (Table I). *F. rodeos* (N=346, 55.5%), *Neohydathrips cf. paraensis* (Hood, 1954) (N=189, 30.3%)

and *Frankliniella schultzei* (Trybom, 1910) (N=35, 5.6%), were the most abundant species, comprising more than 90% of the number of individuals. In addition, these three species were the only ones present in all four habitats analyzed. *F. rodeos* was the dominant species for all habitats, including RC, even at a low number (N=12, 1.9%). Although abundant in the majority of habitats, *N. cf. paraensis*, was almost absent in RC (N=1, 0.2%).

With the exception of *Stomatothrips rotundus* Hood, 1949 (N=1, 0.2%), known to exhibit a predatory habit, all other Terebrantia collected are phytophagous. Larvae and pupae were also recorded in all habitats, and the majority probably belongs to genus *Frankliniella*.

The number of females comprised about 70% of the total abundance. In three species, all singletons or doubletons, the males were not recorded. No females of *Arorathrips fulvus* (Moulton, 1936) and *S. rotundus* were recorded; however, these were singleton species.

FB showed the highest species richness (S=15), followed by GR (S=10), RC (S=9) and BR (S=6). However, using an individual rarefaction test, species richness in RC was shown to be significantly higher than all the other habitats (Fig. 1). In FB the number of species was also significantly higher than BR and GR. RC (N=28) and FB (N=87) actually had a low number of individuals, indicating a high diversity, contrasting with BR (N=229) and GR (N=279), in which dominance by a few successful species is clear. Five species were habitat-exclusive, but these were also singletons (Table I). Their number along with doubletons comprised about 45% of the recorded species.

DISCUSSION

Because of the lack of standardised thrips surveys on rice in Brazil, the species richness recorded in RC (S=9) can not be contrasted with those from other regions of the country. The use of different collecting techniques and sampling effort probably strongly influences the number of species collected, hampering comparisons unless a standard method of survey is agreed upon. In the Philippines, using dissection of plant parts and yellow pan traps, Reves & Rillon (1994) recorded 18 phytophagous terebrantians in irrigated rice. However, this difference in number of species is probably partially derived from the different climates of the two study areas. In tropical areas, species richness is higher, although the number of mycophagous thrips also increases in wet and warm countries (Marullo 1997; Mound 2002).

In general, thrips abundance in RC was low at EEA, and certainly few species effectively use the rice as a host plant. Although the species richness between BR (S=6) and RC (S=9) were not remarkably different, the number of individuals recorded was more than eight times higher in the first habitat (Table I). The high species richness estimated in RC (Fig. 1) is only a reflection of the low number of thrips in proportion of number of species observed. Nevertheless, at this moment there is no way to know if these species are occasional or they are all using the rice as feeding and reproductive site.

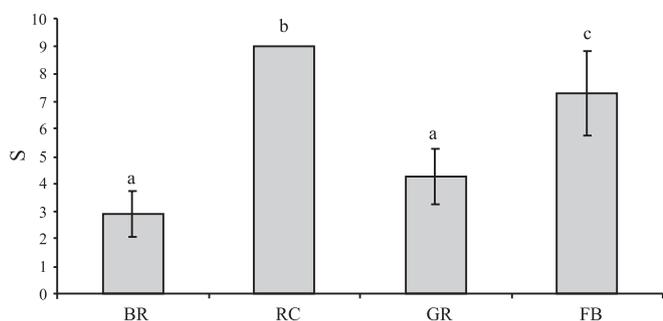


Fig. 1. Species richness (S) of thrips (Terebrantia) in different habitats in EEA (Cachoeirinha, RS, Brazil) using an individual-based rarefaction test. BR: Before rice; RC: Rice; GR: Grassland; FB: Forest border. Different letters express significant differences in richness; error bars are 95% confidence intervals.

FB seems to support a high number of thrips species. This could be explained by higher vegetation diversity in FB, contrasting with the homogeneity of the others habitats. However, thrips abundance in this habitat is low, including the dominant species. For example, only 14% and 2% of individuals of *F. rodeos* and *F. schultzei* were collected in FB, respectively. In addition, more than 65% of the species recorded in FB was comprised by singletons. Thus, this habitat apparently does not constitute a source for thrips to other habitats and the maintenance of vegetation of FB near rice crops in EEA seems to offer little or no effects on presence of pest thrips.

GR showed the highest number of thrips but the species richness is similar to RC (Table I). This result is derived from the high abundance of *F. rodeos* in GR (N=157), which

probably uses the numerous plant species of the herbaceous vegetation as host in this area. Analyzing those species with five or more individuals, all of them were collected in three or all four habitats. This can possibly indicate a high vagility by the thrips species recorded.

The absence of males in some species probably reflects the low abundance recorded on these. However, the number of females was higher than males in 77.7% species recorded. In addition, some of them showed a high relative frequency of females (e.g. *F. schultzei*, *Arorathrips mexicanus* (Crawford, 1909) and *Bregmatothrips venustus* Hood, 1912. According to Lewis (1973), female-biased sex-ratio populations in Thysanoptera are common in several thrips species. In some of them, the males are rare or remain unknown, suggesting parthenogenetic reproduction, sometimes induced by *Wolbachia* (Arakaki *et al.* 2001; Kumm & Moritz 2008). Besides this, sex ratio in thrips also varies according to temperature, colonization patterns and geographical region (Lewis 1973).

The high abundance of *F. rodeos* in this study is not surprising. Cavalleri *et al.* (2006) also registered a large number of individuals of this species in several wild plants in a Conservation Unit placed about 45 km of EEA. Based on the studies of Pinent *et al.* (2006) and Cavalleri *et al.* (2006), together with personal observations, the genus *Frankliniella* certainly is the richest and most abundant group amongst Terebrantia in the state of Rio Grande do Sul.

It is also worth mentioning the high number of *Arorathrips* species recorded here (S=4), representing 80% of the species referred for Brazil. This genus comprises flower grass feeding species that are common in cultivated pastures (Mound & Kibby 1998). In addition, Mound & Palmer (1972) states

Table I. Terebrantian species (Insecta: Thysanoptera) collected in four different habitats at Estação Experimental do Arroz in Cachoeirinha, State of Rio Grande do Sul, between October/2004 and February/2005. BR: Before rice; RC: Rice; GR: Grassland; FB: Forest border.

Thrips species	BR (S=6)	RC (S=9)	GR (S=10)	FB (S=15)	Total	Sex ratio (F:M)
Family Thripidae						
<i>Frankliniella rodeos</i> Moulton	129	12	157	48	346	1.52:1
<i>Neohydatothrips cf. paraensis</i> (Hood)	92	1	81	15	189	4.72:1
<i>Frankliniella schultzei</i> (Trybom)	2	5	27	1	35	10.7:1
<i>Leucothrips</i> sp.	0	3	4	10	17	3.25:1
<i>Arorathrips mexicanus</i> (Crawford)*	0	1	2	2	5	5:0
<i>Bregmatothrips venustus</i> Hood	0	1	2	2	5	5:0
<i>Frankliniella serrata</i> Moulton	3	0	0	1	4	4:0
<i>Arorathrips fulvus</i> (Moulton)	0	3	1	0	5	3:1
<i>Thrips australis</i> (Bagnall)	0	0	3	1	4	4:0
<i>Arorathrips xanthius</i> (Hood)*	2	0	0	1	3	1:2
<i>Arorathrips nigriceps</i> (Hood)*	1	0	0	1	2	2:0
<i>Frankliniella trinidadensis</i> Hood	0	1	0	1	2	2:0
<i>Plesiothrips</i> sp.	0	0	1	1	2	0:2
<i>Caliothrips phaseoli</i> (Hood)	0	0	0	1	1	1:0
<i>Chirothrips texanus</i> Andre*	0	0	1	0	1	1:0
<i>Chirothrips</i> sp.	0	0	0	1	1	1:0
<i>Frankliniella gemina</i> Bagnall	0	1	0	0	1	1:0
Family Aeolothripidae						
<i>Stomatothrips rotundus</i> Moulton*	0	0	0	1	1	0:1
Total	229	28	279	87	623	-

* New records for the State of Rio Grande do Sul

that these thrips may be important in limiting production of grasses when they are grown for seed.

Of the thrips collected in RC, two of them are previously considered of economic importance, *F. rodeos* and *F. schultzei*, the latter a new record for rice in Brazil. As mentioned above, Ferreira & Fernandes (1985) recorded *F. rodeos* in rice flowers in Goiás State, causing damage to the spikelets. *F. schultzei* is a native polyphagous thrips that attacks several plants species around the world and is considered a major pest amongst Thysanoptera (Monteiro *et al.* 1999). Although both species had low abundance in RC, a monitoring of these populations is suggested, given their potential as pests. One of the few species recorded to Rio Grande do Sul State on rice (Costa Lima 1936), *S. bififormis*, was not recorded in this study. This record could be a misidentification and unfortunately there is no indication where this material is deposited. If present, this thrips, characteristic of Tropical regions, is certainly not abundant in EEA.

A compilation of the scarce preexisting published data about Brazilian thrips fauna on rice (Silva *et al.* 1968; Rosseto *et al.* 1972; R. C. Monteiro, pers. comm.) indicated that only six terebrantian species were previously recorded for this crop. Of these, only *F. rodeos* was recorded in the present study. Consequently, 17 Terebrantia species are now referred for rice in Brazil. In addition, a total of five species are new records to State of Rio Grande do Sul (Table I). A list of species recorded in this crop in Brazil is being prepared, including recent data, species diagnosis and identification keys.

As pointed out by Cavalleri & Kaminski (2007), the lack of inventories on the Brazilian thysanopterofauna is enormous, both in natural and agricultural systems. The present study is the first systematized thrips survey conducted in rice in Brazil, being remarkable in the amount of new records and data obtained. Considering the importance of rice crops in the country, these surveys are the first step to recognize this fauna and its interactions, facilitating studies on the spatial distribution of prejudicial thrips and their monitoring.

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