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Original Article

Characterization of the insect assemblage associated with two weed species in a rice-growing area

Caracterização da comunidade de insetos associada a duas espécies de plantas daninhas em uma área de cultivo de arroz

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Abstract

Rice is essential to global food security, and its crops are challenged by the presence of *Aeschynomene* Fabaceae (jointvetch), whose control by herbicides generates environmental, health and resistance risks. Thus, this study aims to characterizing the assemblage of phytophagous insects associated with *A. denticulata* and *A. indica* during two rice harvests, and cooperates in identifying possible biocontrol agents and understanding the role these plants play as alternative hosts of insects that have agricultural pest *status*. A total of 300 plants were inspected where phytophagous entomofauna was collected. Faunal analysis was performed, including its abundance, constancy, dominance, frequency, richness, diversity, equitability, rarefaction and principal component analysis (PCA). *Acanthoscelides atrocephalus*, Morphospecie 6, *Ceresa* sp., Morphospecie 2 and *Euschistus heros* were predominant when collecting the two plants. For the first time, 15 species of insects associated with *A. denticulata* and 16 with *A. indica* were recorded. Among the insects found, species such as *A. atrocephalus* present in the seeds and *Tyloderma* sp. (observed in the roots) showed potential for future research in Integrated Weed Management as bioagents. The observed association between jointvetch and economic interest insects, such as *E. heros*, suggests that these weeds may favor the maintenance of these populations in the rice-growing area. These results contribute to the development of sustainable strategies in weed management for rice cultivation, and expand knowledge about ecological interactions of these species.

Keywords: biological control, insect-plant interaction, weeds.

Resumo

O arroz, fundamental à segurança alimentar global, enfrenta desafios causados por *Aeschynomene* Fabaceae (angiquinho), cujo controle por herbicidas gera riscos ambientais, à saúde e resistência. Assim, este estudo objetivou caracterizar a assembleia de insetos fitófagos associados a *A. denticulata* e *A. indica* durante duas safras de arroz, e colaborou na identificação de potenciais bioagentes de controle e a compreender o papel dessas plantas como hospedeiras alternativas de insetos com *status* de pragas agrícolas. Foi inspecionado um total de 300 plantas, nas quais coletou-se a entomofauna fitófaga presente. Realizou-se análise faunística incluindo os índices de abundância, constância, dominância, frequência, riqueza, diversidade, equitabilidade, rarefação e análise de componentes principais (PCA). As espécies *Acanthoscelides atrocephalus*, Morphospecie 6, *Ceresa* sp., Morphospecie 2 e *Euschistus heros* foram predominantes nas coletas das duas plantas. Registrou-se pela primeira vez, 15 espécies de insetos associadas a *A. denticulata* e 16 a *A. indica*. Dentre os insetos encontrados, espécies como *A. atrocephalus* presente nas sementes e *Tyloderma* sp., observados nas raízes, demonstraram potencial para futuras pesquisas em Manejo Integrado de Plantas Daninhas como bioagentes. E a associação observada entre o angiquinho e insetos de interesse econômico como *E. heros*, sugere que essas plantas daninhas podem favorecer a manutenção dessas populações na área orizícola. Esses resultados contribuem para o desenvolvimento de estratégias sustentáveis no manejo de plantas daninhas no cultivo do arroz e ampliam o conhecimento sobre as interações ecológicas dessas espécies.

Palavras-chave: controle biológico, interação inseto-planta, plantas daninhas.

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1. Introduction

Irrigated rice, *Oryza sativa* L. (Poaceae), plays a key role in both human nutrition and global food security. In Brazil, this culture is greatly prominent, especially in the state of Rio Grande do Sul, due to availability of adequate areas, usage of modern technologies, and efficient management (Moura and Landau, 2020). Despite technological advances that increase productivity, weeds are still an obstacle, competing with rice for resources and reducing crop yields (Silva et al., 2022).

In flooded areas of irrigated rice cultivation, species of Fabaceae, such as *Aeschynomene denticulata* Rudd and *A. indica* L., which have adapted to humid environments, colonize and quickly become common in crops, in southern part of Brazil (Martins et al., 2021). Such species, in addition to impairing rice development, hinder management, reduce harvest quality, and can cause more than 50% losses, when lacking adequate control (Agostinetto et al., 2004). Herbicide control is the most used method for weed management, but its continuous use favors resistance, thus requiring more sustainable strategies (Correia and Streck, 2023).

In this context, biological control stands out as a promising alternative for Integrated Weed Management (IWM). The use of phytophagous insects as bioagents has been studied, since it has advantages such as selectivity, lower environmental impact and long-term control (Souza et al., 2019). For effectiveness, it is necessary to know the insect species naturally associated with weeds (Menezes and Soares, 2016). Also, such plants can act as alternative hosts, ecologically influencing the agro-ecosystem — since insects can act as pests or biological control agents. Understanding these kinds of interactions is essential to assess possible control and to prevent ecological risks, such as transference to cash crops or effects on non-target organisms (Herrick and Kok, 2011). Thus, detailed faunal studies, considering species richness, abundance and function, are indispensable to plan and apply biological control safely in different agroecosystems (Lovatto et al., 2012).

In such context, this study aims to characterizing the assemblage of phytophagous insects associated with *A. denticulata* and *A. indica* during 2022/2023 and 2023/2024 rice harvests, in order to indicate species that can potentially become biological weed control agents, as well as their economic barrier with insect species in pest status that use them as alternative hosts in irrigated rice areas.

2. Materials and Methods

2.1. Collection and identification of phytophagous insects

The study was conducted in a 20 x 40 m area of spontaneous growth of *A. denticulata* and *A. indica*, located at the Herbology Center/cap/UFPel, Capão do Leão, RS (lat: -31.8066940, lon: -52.4824340). The area, previously used for irrigated rice, was prepared with narrow leaf herbicide (187.5 Clinger/125 Veget) to reduce competition, without application of insecticides or herbicides for broad leaves. The collection of phytophagous insects occurred every fifteen days, from February to April 2023 and 2024, thus covering two harvests (2022/2023 and 2023/2024).

Fifteen plants of each species were collected by date, with a total of 150 samples per plant. Plants were first bagged to capture the insects, uprooted and transported to the Insect Ecology Laboratory (LABEI/UFPel) for scanning analysis. Collected insects were preserved in 70% alcohol, then identified with a dichotomous key, and counted (Fujihara et al., 2016; Rafael et al., 2024). Additional methods included observing the emergence grain-feeding insects in air-conditioned chambers (24°C ± 2°C, 70% ± 10% RH, 12h photoperiod) from fruit separation and periodic observation of emergencies for two months, as well as the inspection of stems and roots for drills, with transplantation of larvae found to new plants in a greenhouse.

2.2. Faunal analysis and ecological indices

A faunal analysis of the phytophagous insects collected in, *A. denticulata* and *A. indica* was performed. The Abundance (A) (Garcia and Corseuil 1998), Constancy (C) (Silveira-Neto et al., 1976), Dominance (D) (Silva, 1993) and Frequency (F) (Thomazini and Thomazini, 2002) indices were applied, according to Silveira-Neto et al. (1976), using Anafau® software. The species that reached maximum category in all indexes analyzed were considered dominant.

Similarity between plants was assessed by the similarity quotient (SQ) (Silveira-Neto et al., 1995). The Shannon-Wiener diversity index (H') and the Pielou equitability index (J') were also calculated, considering species richness and distribution (Magurran, 1988).

Species richness of the entomofauna found in each assemblage was compared, through rarefaction analyses based on occurrence number (Gotelli and Colwell, 2001). To evaluate the relationship between recorded richness and each sampling event (according to the weed species), Principal Component Analysis (PCA) was used. Data on abundance were previously transformed into Log(x+1) to avoid the effect of very abundant species (outliers). For this analysis, PAST statistical software version 4.17 (Hammer et al., 2001) was used.

3. Results

For the first time, 15 species of insects associated with *A. denticulata*, and 16 to *A. indica*, were registered (Table 1).

Based on the data obtained, the entomofauna associated with the plants showed a similarity of 45.2%, considering both harvests. When analyzed separately by plant, similarity between annual crops was of 47.6% for *A. denticulata*, and 66.7% for *A. indica*.

3.1. Insect composition and richness in A. denticulata and A. indica

Low diversity of phytophagous insects was observed in both weed species. Hemiptera and Coleoptera were the most abundant in both collection periods. The *A. denticulata* plant recorded 702 individuals of Hemiptera (mainly aphids and bedbugs), and 687 in Coleoptera. In *A. indica*,

Table 1. Phytophagous insects, collected in *Aeschynomene denticualata* and *Aeschynomene indica* during 2022/2023 and 2023/2024 harvests of rice cultivation, in experimental areas of the Herbology Center Capão do Leão/RS.

Taxa	Weeds	
	A. denticulata	***A. indica***
COLEOPTERA		
Buprestidae		
Morphospecie 1	-	01
Chrysomelidae		
Acanthoscelides atrocephalus (Pic, 1938)	570	181
Curculionidae		
Morphospecie 2*	108	74
Morphospecie 3	04	-
Tyloderma sp1.	05	10
Tyloderma sp2.	-	01
Eubulus sp.	-	04
Eucnemidae		
Morphospecie 4	-	01
HEMIPTERA		
Alydidae (Tribo Micrelytrini)		
Morphospecie 5	01	-
HEMIPTERA		
Aphididae		
Morphospecie 6	603	122
Cercopidae		
Deois flexuosa (Walker, 1851)	01	-
Membracidae		
Ceresa sp.	26	09
Pentatomidae		
Diceraeus sp.	01	-
Edessa sp.	-	02
Euschistus heros (F., 1798)	70	34
Oebalus ypsilongriseus (De Geer, 1773)	-	01
Morphospecie 7	-	01
Piezodorus guildinii (West., 1837)	-	01
LEPIDOPTERA		
Erebidae		
Morphospecie 8	04	-
Selenisa sueroides (Guenée, 1852)	04	-
Noctuidae		
Helicoverpa gelotopoeon (Dyar, 1921)	03	-
Spodoptera cosmioides (Walker, 1858)	-	01
Spodoptera ornithogalli (Guenée, 1852)	01	01
ORTHOPTERA		
Tettigoniidae		
Morphospecie 9	01	-

Coleoptera was most abundant, with 272 individuals, followed by Hemiptera with 170 individuals, due to the significant amount of beetles collected in seeds and roots.

However, *A. indica* presented greater Richness (S=16), proven by Margalef's Richness (3.15). In comparison, *A. denticulata* showed greater diversity of species recorded (Table 2).

The equitability of Pielou (J') demonstrated that phytophagous insects in *A. denticulata* showed greater uniformity in distribution of individuals between species (J'=0.91), thus indicating a more balanced community. In *A. indica*, equitability was lower (J'=0.80), suggesting the effect of predominant species and lower uniformity, despite the greater richness observed.

The results of species accumulation obtained through rarefaction curves (Figure 1), based on observed species richness, allowed the comparison of richness between the two jointvetch species under standardized sampling effort. From the perspective of estimated richness, using the first-order Jackknife estimator, *A indica* showed a higher number of species compared to *A. denticulata*. As the rarefaction curves did not reach an asymptote, the results suggest that additional species may still be associated with both jointvetch species.

Principal Component Analysis (PCA) in areas with *A. denticulata* (Figure 2A) and *A. indica* (Figure 2B) reveals that the structure of the phytophagous insect community is dominated by a common primary gradient (PC1), which is strongly determined by high occurrence of *A. atrocephalus* (Aca) and Morphospecie 2* (Cusp), suggesting that their abundance is the most important factor in differentiating sampling contexts, regardless of *Aeschynomene*. However, plants exert a distinct selective effect on secondary variation (PC2): in *A. denticulata*, PC2 is driven by the spittlebug *Ceresa* sp. (Cesp), whereas in *A. indica*, PC2 is determined by aphids (Morphospecie 6), indicating that each host plant favors a different pattern of co-occurrence for the most abundant species.

It is also remarkable in the group of species with low projection (left side of the graphs); by presenting ecological characteristics similar to each other, they are distinguished from the dominant species. This group composition differs between the two plants (Figure 2A and B). The occurrence

Table 2. Richness and diversity indices of phytophagous insects assemblage in the 2022/2023 and 2023/2024 harvests, in rice cultivation of experimental areas of the Herbology Center, Capão do Leão/RS.

Species	Abundance	Richness (ies)	Diversity (H')	Margalef	Equitability (J')
A. denticulata	1.402	15	2.10	2.80	0.91
A. indica	444	16	1.99	3.15	0.80

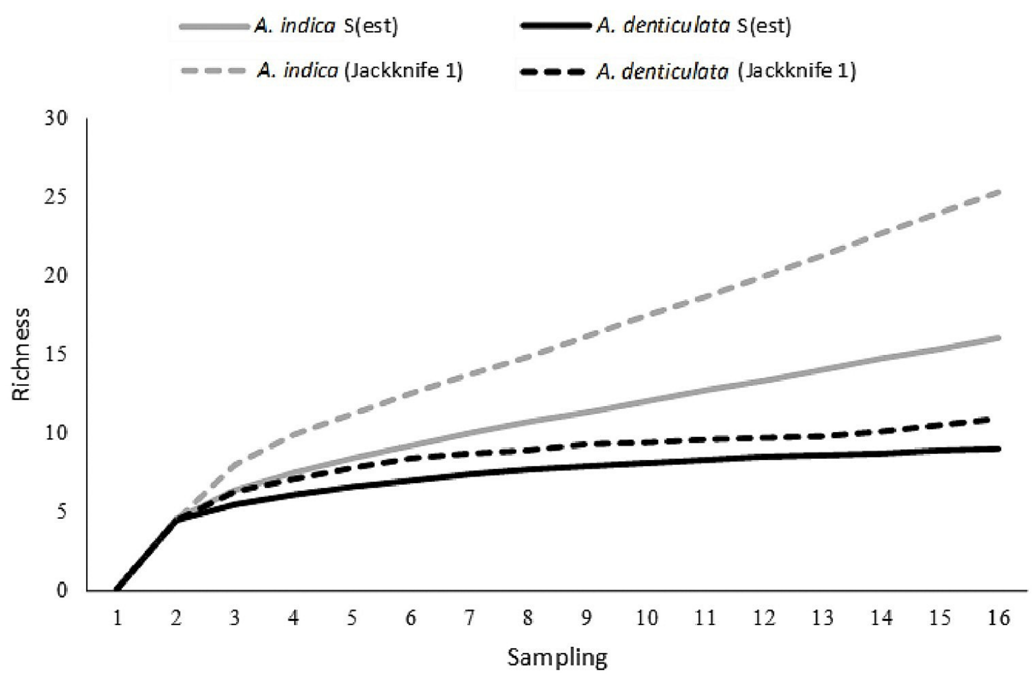

Figure 1. Rarefaction curve of two species of jointvetch, *Aeschynomene denticulata* and *Aeschynomene indica*, in rice cultivation, in experimental areas, Capão do Leão, RS, Brazil. Estimated number of species *A. denticulata* S(est): Continuous black line; *A. indica* S(est): Continuous grey line); First order Jackknife richness estimator *A. denticulata* (Jackknife 1): Dashed black line; *A. indica*: Dashed grey line).

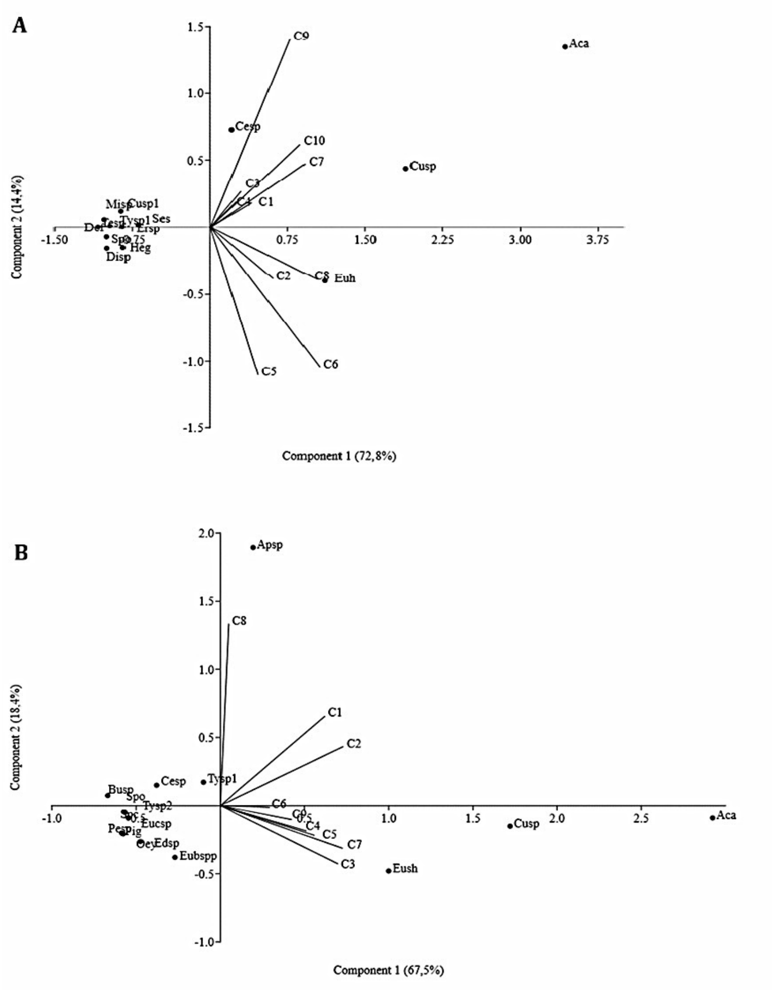

Figure 2. A. Principal component analysis of phytophagous insect species recorded in *A. denticulata*; **B.** in *A. indica*. Aca = *A. atrocephalus*; Apsp = Morphospecie 6; Busp = Morphospecie 1; Cesp = *Ceresa* sp.; Cusp = Morphospecie 2*; Cusp1 = Curculionidae sp.1; Def = *D. flexuosa*; Disp = *Diceraeus* sp.; Ersp = Morphospecie 8; Edsp = *Edessa* sp.; Eubspp = *Eubulus* sp.; Eucsp = Morphospecie 4; Euh = *E. heros*; Heg = *H. gelotopoeon*; Misp = Morphospecie 5; Oey = *O. yspsilongriseus*; Pesp = Morphospecie 7; Pig = *Piezodorus guildinii*; Spc = *S. cosmioides*; Spo = *S. ornithogalli*; Ses = *S. sueroides*; Spo = *S. ornithogalli*; Tesp = Tettigoniidae sp.; Tysp1 = *Tyloderma* sp.1; Tysp2 = *Tyloderma* sp.2.

of unique species in each scenario reinforces the conclusion that the two *Aeschynomene* species act as distinct environmental filters, thus shaping the phytophagous community for both dominant species that define PC2, and those of lower occurrence.

3.2. Faunal analysis

Insects belonging to four Orders were found: Coleoptera, Hemiptera, Lepidoptera, and Orthoptera (Table 3).

It was possible to observe that *Acanthoscelides atrocephalus* (Chrysomelidae), Morphospecie 6* (Aphididae), *Ceresa* sp. (Membracidae), Morphospecie 2* (Curculionidae) and *Euschistus heros* (Pentatomidae) were predominant in *A. denticulate* collections, reaching maximum category in all indexes analyzed (very abundant, constant, dominant and very frequent). For *A. indica*, in addition to these species, *Tyloderma* sp.1 was also predominant.

Adults of *A. atrocephalus* (Coleoptera: Chrysomelidae) and larvae of an unidentified rhizophagous curculionid were predominant in both plant species. On the other hand, adults of *Eubulus* sp. were collected only in roots of *A. indica,* being common, constant, non-dominant and frequent. Also in the roots, two species of *Tyloderma* were *observed*: *Tyloderma* sp. 1 was observed in the two species of *Aeschynomene*, and manifested as very abundant, constant, non-dominant and very frequent in *A. denticulata*; in *A. indica*, it differed only in the dominance index. *Tyloderma* sp. 2 was observed in *A. indica* only in the first collection period, as common, constant, non-dominant and frequent. Approximately 90% of the bore specimens collected from the roots were in larval phase, thus preventing precise species identification.

Pentatomidae presented the highest richness, with six species collected. *Euschistus heros* was collected in both several nymphal instars and adulthood, and was classified as

Table 3. Faunistic analysis of phytophagous insects collected in *Aeschynomene denticulata* and *A. indica* during the 2022/2023 and 2023/2024 harvests for rice cultivation, in experimental areas of the Herbology Center, Capão do Leão/RS.

	Abundance		Constancy		Dominance		Frequency	
	Ad	***Ai***	***Ad***	*Ai*	***Ad***	***Ai***	***Ad***	***Ai***
COLEOPTERA								
Acanthoscelides atrocephalus[**1,2]	va	va	W	W	D	D	VF	VF
Morphospecie 1[**]	-	C	-	W	-	ND	-	F
Morphospecie 2[*1,2]	va	va	W	W	D		VF	VF
Morphospecie 3[**]	va	-	W	-	ND		VF	-
Eubulus sp.[**]	-	C	-	W	-		-	F
Morphospecie 4[**]	-	C	-	W	-		-	F
Tyloderma sp. 1[**2]	va	va	W	W	ND		VF	VF
Tyloderma sp. 2[**]	-	C	-	W	-		-	F
HEMIPTERA								
Morphospecie 6[1,2]	va	va	W	W	D		VF	VF
Ceresa sp.[1,2]	va	va	W	W	D		VF	VF
Deois flexuosa[**]	R	-	W	-	ND		PF	-
Diceraeus sp.[*]	R	-	W	-	ND		PF	-
Edessa sp.[*]	-	C	-	W	-		-	F
Euschistus heros[1,2]	va	va	W	W	D		VF	VF
Morphospecie 5[*]	R	-	W	-	ND		PF	-
Oebalus ypsilongriseus[**]	-	C	-	W	-		-	F
Morphospecie 7[*]	-	C	-	W	-		-	F
Piezodorus guildinii[**]	-	C	-	W	-		-	F
LEPIDOPTERA								
Morphospecie 8[*]	va	-	W	-	ND		VF	-
Helicoverpa gelotopoeon[*]	C	-	W	-	ND		F	-
Selenisa sueroides[*]	va	-	W	-	ND		VF	-

Ad – Aeschynomene denticulata; Ai = Aeschynomene indica. **A** = abundance: r = rare; d = dispersed; c = common; a = abundant; va = very abundant. **C** = constancy: W = constant; Y = accessory; Z = accidental. **D** = dominance: D = dominant; ND = non-dominant. **F** = frequency: F = frequent; VF = very frequent; UF = unfrequent. *Only for individuals collected at a young stage (larval or nymphal); ** Only for individuals collected at an adult stage. In the absence of (*) both phases were collected (young and adult); [1]Predominant in *A. denticulata*; [2]Predominant in *A. indica.*

Table 3. Continued...

	------------Abundance------------		------------Constancy------------		------------Dominance------------		------------Frequency------------	
	Ad	***Ai***	***Ad***	*Ai*	***Ad***	***Ai***	***Ad***	***Ai***
*Spodoptera cosmioides**	-	C	-	W	-		-	F
*Spodoptera ornithogalli**	r	C	W	W	ND		PF	F
ORTHOPTERA								
Morphospecie 9*	r	-	W	-	ND		PF	-

Ad – Aeschynomene denticulata; Ai = Aeschynomene indica. **A** = abundance: r = rare; d = dispersed; c = common; a = abundant; va = very abundant. **C** = constancy: W = constant; Y = accessory; Z = accidental. **D** = dominance: D = dominant; ND = non-dominant. **F** = frequency: F = frequent; VF = very frequent; UF = unfrequent. *Only for individuals collected at a young stage (larval or nymphal); ** Only for individuals collected at an adult stage. In the absence of (*) both phases were collected (young and adult); [1]Predominant in *A. denticulata*; [2]Predominant in *A. indica.*

predominant in both weeds. *Ceresa* sp. (Membracidae) has been set as predominant in both *A. denticulata* and *A. indica*.

Five species of caterpillars (Lepidoptera) were recorded, with emphasis on *S. ornithogalli*, which was the only one detected in both weeds. All caterpillar species belong to the families Noctuidae (*H. gelotopoeon*, *S. ornithogalli* and *S. cosmioides*) and Erebidae (*S. sueroides* and Morphospecie 8) were common, constant and non-dominant, differing only in abundance and frequency.

3.3. Importance of phytophagous entomofauna in A. denticulata and A. indica

Among the phytophagous insects collected, *Acanthoscelides atrocephalus and Euschistus heros* were predominant. *A. atrocephalus* emerged directly from seeds of *A. denticulata* and *A. indica*, visibly damaging the inside. This occurrence reinforces it as a potential biological control agent, since its feeding can make seed germination unfeasible. Another case of potential agent of biological control is indicated by the presence of borer larvae of genera *Tyloderma* and *Eubulus*, which were found in the roots of both weed species, with greater diversity in *A. indica*. Root damage (galleries) caused by these larvae compromises plant development.

Euschistus heros is considered as a pest of soybeans, corn and rice. Nymphs and adults occurred in both weeds. The use of *A. denticulata* and *A. indicates* as alternative hosts reinforces the importance of managing these species, since they can act as reservoirs for insects with pest status.

Finally, other associations of insects that have pest *status* in crops of economic importance were observed (Figure 3). *A. denticulata* was registered as an alternative host for Morphospecie 6 (Aphididae), *D. flexuosa* (Cercopidae), *H. gelotopoeon* and *S. ornithogalli* (Noctuidae). *A. indica*, on the other hand, was associated to Morphospecie 6 (Aphididae), *O. ypsilongriseus* and *P. guildinii* (Pentatomidae), *S. cosmioides* and *S. ornithogalli* (Noctuidae). These species are known for their economic importance, which reinforces the role of weeds in population dynamics of agricultural insects.

4. Discussion

The first records of phytophagous insects associated with *Aeschynomene denticulata* and *A. indica* highlight the relevance of these weed species as components of local trophic networks, providing insights into ecological interactions and their potential implications for biological control and sustainable weed management (Vargas and Mundaca, 2014).

Several authors have recorded insects associated with *Aeschynomene* species, such as *Euschistus heros* in *A. rudis* in Rio Grande do Sul (Link, 1979), *Selenisa* sueroides in *A. americana* in Florida (Bushwein et al., 1989) and *Aphis craccivora* in India (Singh et al., 2016). In different regions of Africa and Asia, Bruchidae associated with fruits of several species of the genus *Aeschynomene* have been recorded; *Acanthoscelides modestus,* for instance, has been associated with *A. ciliata* Vogel, *A. rudis* Benth., *A. scabra* G. Don, and *A. sensitiva* Sw (Romero and Johnson, 2002; Delobel and Le Rü, 2008). More recently, *A. atrocephalus* has been associated with *A. denticulata* and *A. indica* (Greco et al., 2025), thus reinforcing the potential of bruchids as biological control agents, given their seed-feeding habit, host specificity, and capacity to reduce seed viability (Greco et al., 2025).

Figure 3. Field records. a. *Euschistus heros* (Hemiptera: Pentatomidae); b. *Deois flexuosa* (Hemiptera: Cercopidae); c. *Helicoverpa gelotopoeon* (Lepidoptera: Noctuidae); d. *Selenisa sueroides* (Lepidoptera: Erebidae, Erebinae).
Source: Greco, M.G.C.E.

The insect assemblages observed on weeds in the present study emphasize the relevance of faunal surveys for understanding patterns of insect diversity and their implications for agricultural systems (Diagne et al., 2021; Ahmed et al., 2022; Winston et al., 2024). In particular, the presence of phytophagous insects associated with *A. denticulata* and *A. indica* that, according to previous studies, may present potential for their biological control (Paterson et al., 2021; Canavan et al., 2021; Day and Callander, 2024).

At the same time, the association of insects with alternative hosts such as *A. denticulata* and *A. indica* is especially relevant from an integrated pest management perspective, as these plants can act as refuge and food resources during off-season periods, favoring insect survival and persistence, as reported in the literature (Eliyatiningsih et al., 2020; Kumar et al., 2021; Lagôa et al., 2021; Pal et al., 2023). In this sense, recognizing these ecological relationships supports a better understanding of population dynamics, contributing to the definition of preventive control strategies and to the reduction of insecticide dependence, in line with more sustainable management approaches (Eliyatiningsih et al., 2020; Kumar et al., 2021; Lagôa et al., 2021).

Records in this study show the association of insects of economic importance with weeds, such as *E. heros*, an insect that causes significant productivity losses in both soybeans and rice (Oliveira et al., 2016); *S. cosmioides*, which causes losses in soybeans, cotton and corn (Santos et al., 2010; Silva et al., 2011) and *O. ypsilongriseus*, rice pest (Cherry et al., 1998). Species with lower agricultural impact were also observed, such as Morphospecie 1 (Buprestidae), *Ceresa* sp. (Membracidae) and *Eubulus* sp. (Curculionidae), but their presence is important for monitoring biodiversity and prevention of new pests (Capinera, 2005). This information favors practices such as biological control and agricultural landscape management, thus reducing the impacts of pests on productivity and the economy (Eliyatiningsih et al., 2020; Kumar et al., 2021). For example, insects that consume seeds and roots, such as Curculionidae beetles, act as a natural controlling factor of weeds, by destroying seeds before germination or attacking the root system (Herrick and Kok, 2011). This process helps restore ecosystems and reduces the use of herbicides (Cullen et al., 2023), promoting more balanced and sustainable agricultural systems (Oliveira et al., 2021).

Furthermore, faunal analyses are essential to characterize a region's biodiversity, and are widely used as indicators of ecosystem health (Yasinzai et al., 2019). Differences in abundance among insects collected during the collection period, may be related to temperature and humidity, which directly influence organism behavior and distribution, and thus interfere with population dynamics (Coelho et al., 2021). Rice fields, which constitute the sampling environment of the present survey, are temporary humid agroecosystems that support a high diversity of arthropods and tend to harbor greater biodiversity than other cropping systems (Acosta et al., 2017). A study on organic rice fields showed that the most numerous phytophagous families were Pentatomidae**,** Chrysomelidae and Curculionidae (Acosta et al., 2017), thus reinforcing the relevance of both the area studied and the interaction between irrigated rice and weeds. Understanding these communities is vital for ecosystem conservation and management (Duffus et al., 2023; Köthe et al., 2023).

The fact that weeds as *A. denticulata* and *A. indica* host phytophagous pest insects associated or not with irrigated rice indicates that they can maintain populations of these insects and their natural enemies beyond the growing seasons, contributing to the conservative management in the agrosystem (Cortez-Madrigal and Gutiérrez-Cárdenas 2023). Finally, faunal studies of phytophagous insects in weeds are essential for new management strategies. Research with other weed species has been carried out with hairy fleabane in soybeans, such as in the state of Goiás, Brazil, that confirms its potential as an alternative host and indicates possible biological control agents, corroborating this present study (Dalazen et al., 2017).

5. Conclusions

In this study, individuals of *A. atrocephalus*, Morphospecie 6 (Aphididae), *Ceresa* sp. (Membracidae), Morphospecie 2 (Curculionidae) and *Euschistus heros* (Pentatomidae) were predominant in collections that took place in both plants. In addition to these species, *Tyloderma* sp.1 was *also* predominant on *A. indica*.

Species *A. indica* and *A. denticulata* are also recorded as alternative hosts for species of agricultural importance such as *E. heros*, emphasizing the importance of controlling these weed species in agricultural fields. In addition, *A. atrocephalus*, larvae of Curculionidae (Morphospecie 2 and *Tyloderma* sp.) are the main insects for potentially becoming biological control agents, due to the damage they cause to seeds and roots of *Aeschynomene*.

Finally, 15 species of insects associated with *A. denticulata* and 16 with *A. indica* were recorded for the first time. These results contribute to the development of sustainable strategies in weed management regarding irrigated rice cultivation, and expand knowledge about ecological interactions of *A. denticulata* and *A. indica* with the recorded entomofauna.

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Data Availability Statement

All the data supporting the results of this study were published in the article itself.

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