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# Miridae (Hemiptera: Heteroptera) associated with canola (*Brassica napus* L. var. *oleifera*) in southern Brazil

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# Miridae (Hemiptera: Heteroptera) asociados con la canola (*Brassica napus* L. var. *oleifera*) en el sur de Brasil

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## ABSTRACT

The objective of this study was to conduct a survey of Miridae species associated with canola in southern Brazil. Collections were carried out with an entomological net in an experimental area of Embrapa Trigo, in Passo Fundo, Rio Grande do Sul state, cultivated with canola during 2019. Thirteen species of Miridae were collected, the most abundant being *Horciasoides nobilellus* (Berg, 1883) and

*Moissonia cuneata* (Stål, 1860). All species are being associated with canola for the first time, and five of them have been recorded for the first time in Rio Grande do Sul. The study also presents taxonomic information, host plants, and geographic distribution of the species collected. *Notholopus pachycerus* (Reuter, 1907), one of the most collected species, was found feeding on canola silique, indicating that the species may be causing damage to the crop. Therefore, further studies are needed to assess the damage that these species can cause to canola flower buds and seeds.

**Keywords:** Associated Plants. Damage. Geographical Distribution. Neotropical. Pests.

## RESUMO

O objetivo deste estudo foi realizar um levantamento das espécies de Miridae associadas à canola no sul do Brasil. As coletas foram realizadas com rede entomológica em uma área experimental da Embrapa Trigo, em Passo Fundo, Rio Grande do Sul, cultivada com canola durante o ano de 2019. Treze espécies de Miridae foram coletadas, sendo as mais abundantes *Horciasoides nobilellus* (Berg, 1883) e *Moissonia cuneata* (Stål, 1860). Todas as espécies estão sendo associadas à canola pela primeira vez, e cinco delas foram registradas pela primeira vez no Rio Grande do Sul. O estudo também apresenta informações taxonômicas, plantas hospedeiras e distribuição geográfica das espécies coletadas. *Notholopus pachycerus* (Reuter, 1907), uma das espécies mais coletadas, foi encontrada alimentando-se de síliqua de canola, indicando que a espécie pode estar causando danos à cultura. Portanto, mais estudos são necessários para avaliar os danos que essas espécies podem causar aos botões florais e sementes de canola.

**Palavras-chave:** Plantas Associadas. Danos. Distribuição Geográfica. Neotropical. Pragas.

## RESUMEN

El objetivo de este estudio fue realizar un censo de especies de Miridae asociadas a la canola en el sur de Brasil. Las recolecciones se realizaron con una red entomológica en un área experimental de Embrapa Trigo, en Passo Fundo, Rio Grande do Sul, cultivada con canola durante el año 2019. Se recolectaron trece especies de Miridae, siendo las más abundantes *Horciasoides nobilellus* (Berg, 1883) y *Moissonia cuneata* (Stål, 1860). Todas las especies están siendo asociadas a la canola por primera vez, y cinco de ellas fueron registradas por primera vez en Rio Grande do Sul. El estudio también presenta información taxonómica, plantas hospedantes y distribución geográfica de las especies colectadas. *Notholopus pachycerus* (Reuter, 1907), una de las especies más recolectadas, fue encontrada alimentándose de silicua de canola, lo que indica que la especie puede estar causando daños al cultivo. Por lo tanto, se necesitan más estudios para evaluar el daño que estas especies pueden causar a los brotes y semillas de las flores de canola.

**Palabras clave:** Plantas Asociadas. Daños. Distribución Geográfica. Neotropical. Plagas.

## 1 INTRODUCTION

Miridae family represents 25% of suborder Heteroptera (Henry, 2009), with 11,139 described species (Schuh, 2002-2013). New catalog surveys and species lists are required to update the number of species based on Schuh's online catalog (2002-2013). Ferreira *et al*. (2024a) reported 1,108 species of Miridae in Brazil. Current knowledge of Miridae biology is based mostly on studies of economically important species in temperate zones. Although Brazil is regarded as the country with the most biodiversity, there is a lack of understanding about the biology and taxonomy of Miridae, particularly in northeast and Amazon areas (Ferreira *et al*., 2024b; Grazia *et al*., 2024).

Canola (*Brassica napus* L. var. *oleifera* - Brassicaceae) grains contain 36% to 42% oil, whereas flour has 36% to 39% protein (Canola Council of Canada, 2024). In Brazil, it is utilized for human consumption and industrial purposes, as well as a component of biofuel and animal feed (De Mori *et al*., 2014).

Brazilian canola production is concentrated in the southern region of the country, in the states of Rio Grande do Sul and Paraná, which account for 98.9% and 1.1% of the total grain produced in the period 2021 to 2024, respectively. Canola cultivation has increased, notably in the state of Rio Grande do Sul, which recorded 74,100 hectares in 2021 and 137,100 hectares in 2024. Thus, the national canola crop for 2024 was 203,300 tons of grain (CONAB, 2024).

In Brazil, phytophagous insects associated with canola crops are most commonly found into Lepidoptera immature, Formicidae, Aphididae, Coleoptera, and Heteroptera. (Marsaro Júnior *et al*., 2017, 2020, 2021, 2023; Bianchi *et al*., 2019; Marsaro Júnior and Pereira, 2021). Among Heteroptera, the most abundant family is Pentatomidae, with 27 species, including *Nezara viridula* (Linnaeus, 1758), *Euschistus heros* (Fabricius, 1798), and *Diceraeus furcatus* (Fabricius, 1775) (Bianchi *et al*., 2019). These three species cause damage to

the silique walls (rosetting), lowering the plant's photosynthetic area, as well as damaging to the seeds, affecting their viability, structure (deformation), and content (rotting) (Oliveira *et al*., 2023). Only nymphs of *D. furcatus* and *N. viridula* were found on canola fields (Bianchi *et al*., 2019), suggesting that canola is a host plant for the two species.

*Lygus* spp. (Miridae) are responsible for canola damage in Canada, a traditional canola-growing region. These species are native and frequently found in canola fields. Insecticide treatment to control *Lygus* spp. first occurred in 1996. Approximately 4,000 hectares were sprayed in the Vulcan, Alberta area. In 1997, insecticides were applied to 162,000 hectares in the Foothills, Newell, Vulcan, Willow Creek, Bonnyville, and Peace River regions of Alberta and the Meadow Lake area of Saskatchewan. Crop damage was estimated at more than $10 million. In 1998, over 350,000 hectares were sprayed in Alberta. In western Canada, four species of the genus *Lygus* were observed destroying flower buds and canola seeds*: L. keltoni* Schwartz and Foottit, *L. lineolaris* (Palisot de Beauvois), *L. elisus* Van Duzee, and *L. borealis* (Kelton) (Canola Council of Canada, 2024).

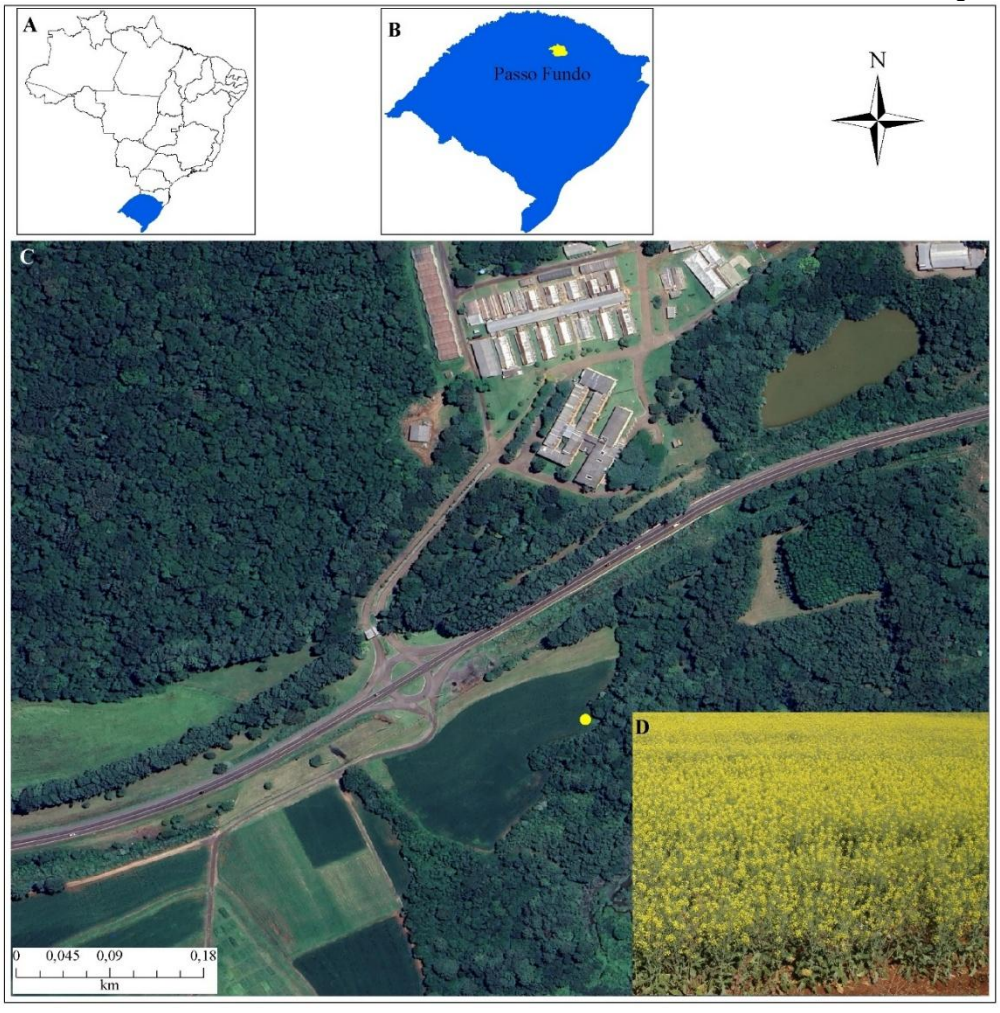
Despite the fact that Nogueira *et al*. (2019) recorded 168 species of Miridae associated with crop plants in Brazil (Poaceae, Asteraceae, Fabaceae, and Solanaceae being the most representative families), only fifteen species of Miridae are associated with Brassicaceae, not including canola. This is the first Miridae study in Brazil associated with canola crop. It aims to better understand the diversity of Miridae species on canola by examining their diagnosis, geographic distribution, and other associated plants.

## 2 METHODOLOGY

The research was conducted at the Embrapa Trigo experimental station, in Passo Fundo, Rio Grande do Sul state (28°14'S; 52°24'W) (Figure 1A-D). An area of 800 $m^2$ was sown with canola, *Brassica napus* L. var. *oleifera*, hybrid ALHT B4, in July 2019. Using entomological nets, 13 samples of insects (sampling effort of 13 hours) were done in the area when the plants were

blooming and developing siliques (Figure 1C-D), from September 27th to November 12th. No pesticides were applied in this experimental area during of study. The collected material was taken to the laboratory for sorting, double mounting, labeling, and storage. PSF Ferreira identified the species with a Leica Mz 95 stereo microscope and taxonomic literature. The total number of specimens examined for each species is shown in Table 1. The photos of species were taken using a 10.5 MP Full HD digital camera connected to a Leica Mz 95 stereo microscope. The Miridae specimens collected are deposited in nationally recognized entomological collection under the responsibility of PSF Ferreira.

Figure 1 Sampling site of Miridae in canola cultivation area. A. Map of Brazil, state of Rio Grande do Sul highlighted in blue. B. Map of state of Rio Grande do Sul with Passo Fundo municipality highlighted in yellow. C. Embrapa Trigo experimental area, yellow circle marks the place where the collections were carried out. D. Detail of canola cultivation in flowering stage.




Fonte: Prepared by the authors

## 3 RESULTS

A total of 550 Miridae specimens were collected from 13 species identified as follows: *Sysinas pallidipes* (Stal, 1860) (Bryocorinae, Eccritotarsini); *Hyaliodocoris insignis* (Stal, 1860) (Deraeocorinae, Hyaliodini); *Creontiades rubrinervis* (Stal, 1862), *Garganus gracilentus* (Stal, 1860), *Horciasoides nobilellus* (Berg, 1883), *Notholopus pachycerus* (Reuter, 1907), *Phytocoris effictus* Stal, 1860, *Polymerus minutus* Ferreira, 1980, *Proba fraudulenta* (Stal, 1860), *Taylorilygus apicalis* Fieber, 1861 and *Tropidosteptes hirsutus* (Distant, 1884) (Mirinae, Mirini); *Collaria scenica* (Stål, 1859) (Mirinae, Stenodemini) and *Moissonia cuneata* (Stal, 1860) (Phylinae, Phylini) (Table 1). The most abundant species were: *Horciasoides nobilellus* (28.18%) and *Moissonia cuneata* (26.36%). The least abundant species were: *Hyaliodocoris insignis, Polymerus minutus, Sysinas pallidipes*, and *Tropidosteptes hirsutus*, with a total of (0.18%) for each one (Table 1). Taxonomic information and comments on each species are presented as follows.

Table 1. Species of Miridae collected in 2019 in a canola experimental crop in Passo Fundo, Rio Grande do Sul, Brazil.

| **Subfamily** | **Tribe** | **Specie** | **Abundance** | **Relative abundance (%)** |
|---|---|---|---|---|
| Bryocorinae | Eccritotarsini | *Sysinas pallidipes* (Stal, 1860) | 1 | 0,18 |
| Deraeocorinae | Hyaliodini | *Hyaliodocoris insignis* (Stal, 1860) | 1 | 0,18 |
| Mirinae | Mirini | *Creontiades rubrinervis* (Stal, 1862) | 4 | 0,73 |
| | | *Garganus gracilentus* (Stal, 1860) | 17 | 3,09 |
| | | *Horciasoides nobilellus* (Berg, 1883) | 155 | 28,18 |
| | | *Notholopus pachycerus* (Reuter, 1907) | 87 | 15,82 |
| | | *Phytocoris effictus* Stal, 1860 | 2 | 0,36 |
| | | *Polymerus minutus* Ferreira, 1980 | 1 | 0,18 |
| | | *Proba fraudulenta* (Stal, 1860) | 51 | 9,27 |
| | | *Taylorilygus apicalis* Fieber, 1861 | 82 | 14,91 |
| | | *Tropidosteptes hirsutus* (Distant, 1884) | 1 | 0,18 |
| | Stenodemini | *Collaria scenica* (Stal, 1859) | 3 | 0,55 |
| Phylinae | Phylini | *Moissonia cuneata* (Stal, 1860) | 145 | 26,36 |
| **Total** | | | **550** | **100,00** |

Fonte: Prepared by the authors

**Bryocorinae**

**Eccritotarsini**

***Sysinas pallidipes* (Stal, 1860) (Figure 2A)**

**Diagnosis**: General colour black. Length ranging from 4.5 to 6.0 mm. Head, scutellum, and hemelytra fully black; pronotum reddish except for black calli; membrane fuscous, with a transparent or clear apex. Legs mostly yellow, with fuscous to black tibiae save at the bases (Ferreira and Henry, 2011). Male genitalia diagnosis and illustrations in Ferreira *et al*. (2024b: 242).

**Distribution**: Brazil (Rio de Janeiro, Minas Gerais, Espírito Santo, Rio Grande do Sul), Colombia, Peru, Paraguay (Alvarez-Zapata *et al*., 2022, Ferreira *et al*., 2024b).

**Plant Association**: *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record), *Sapium* sp. (Nogueira *et al*., 2019).

**Deraeocorinae**

**Hyaliodini**

***Hyaliodocoris insignis* (Stal, 1860) (Figure 2B)**

**Diagnosis:** Two dark spots on the pronotum narrowing and curving to the lateral margins. Hemelytra with a short transverse dark fascia near the claval apex, not reaching the embolium (Ferreira *et al*., 2024b). Male genitalia diagnosis and illustrations in Ferreira *et al*. (2024b: 243).

**Distribution:** Brazil (Espírito Santo, Minas Gerais, Rio de Janeiro, Paraná, Rio Grande do Sul, Santa Catarina), Argentina, Paraguay, Peru (Carvalho and Afonso, 1977; Schuh, 2002–2013; Ferreira *et al*., 2024a).

**Plant Association:** *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record), *Calyptocarpus biaristatus* (DC.) H. Rob., *Conyza* spp., *Fragaria x ananassa* Duch., *Gamochaeta falcata* (Lam.) Cabrera, *Glycine max* var. *bilox* (L.) Merr, *Phaseolus vulgaris* L., *Solanum granuloso-leprosum* Dunal, *Solanum lycopersicum* L. (Ferreira *et al*., 2024a).

**Mirinae**

**Mirini**

***Creontiades rubrinervis* (Stal, 1862) (Figure 2C)**

**Diagnosis:** Body length varies from 6.0 to 7.0 mm. Body smooth or shagreened dorsally and hairy; general color yellowish-green on upper surface and legs tinged or marked with red; membrane veins red; hind femur not flattened of equal thickness throughout; antennal segment I tinged red and II and III apically red (Hernandez and Henry, 2010). Male genitalia diagnosis and illustrations in Hernandez and Henry (2010: 183).

**Distribution:** Brazil (Bahia, Ceará, Pernambuco, Piauí, Minas Gerais, São Paulo, Rio Grande do Sul (new state record)), Argentina, Colombia, Cuba, Ecuador, French Guiana, Honduras, Mexico, Nicaragua, Peru, Paraguay, El Salvador, United States (Carpintero, 2004; Hernandez and Henry, 2010; Chérot and Carpintero, 2016; Ferreira *et al*., 2024a).

**Plant Association:** *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record), *Canavalia rosea* (Sw.) DC., *Canavalia maritima* Thouars, *Canavalia* sp., *Cicer arietinum* L., *Citrullus lanatus* (Thunb.) Matsumura & Nakai, *Cucumis* sp., *Glycine max* (L.) Merr., *Gossypium herbaceum* L., *Gossypium hirsutum* L., *Ipomoea pescaprae* (L.) R.Br., *Ipomoea* sp., *Phaseolus lunatus* L., *Phaseolus* sp., *Phaseolus vulgaris* L., *Sesamum indicum* L., *Solanum* sp., *Sorghum bicolor* (L.) Moench, *Vigna* sp., *Vigna unguiculata* (L.) Walp., *Vigna sinensis* Endl. ex Hassk, *Zea mays* L. (Hernandez and Henry, 2010; Nogueira *et al*., 2019; Ferreira *et al*., 2024a).

***Garganus gracilentus* (Stal, 1860) (Figure 2D)**

**Diagnosis:** Body length 4.5 to 6 mm. General color dark brown, embolium and cuneus laterally pale yellowish; sooty membrane. Abdomen dark brown. Legs flavotestaceous, hind femora fuscous at the apex, tibiae with two yellowish rings. Antennae with segment I flavotestaceous, II black strongly thickened towards the apex; III dark brown with a whitish base, IV dark brown. Pronotum black with thin whitish basal margin border; pronotum collar with lateral and inferior region, margin of the propleura and ostiolar peritrema, white. Scutellum

dark brown (Carvalho, 1945). Male genitalia diagnosis and illustrations in Carvalho (1945: 15).

**Distribution:** Brazil (Mato Grosso, Espirito Santo, Minas Gerais, Rio de Janeiro, Rio Grande do Sul, Santa Catarina), Colombia, Ecuador, Venezuela, Mexico (Schuh, 2002-2013; Cazorla, 2021).

**Plant** Association**:** *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record), *Abelmoschus esculentus* (L.) Moench, *Beta vulgaris* L., *Bidens pilosa* L., *Bidens rubicundula* f. alba T.G.J. Rayner, *Brachiaria brizantha* (A. Rich.) Stapf, *Brachiaria ruziziensis* R. Germ. & C.M. Evrard, *Brassica* sp., *Broussonetia papyrifera* (L.) L'Hér. ex Vent., *Cajanus cajan* (L.) Millsp., *Calendula officinalis* L., *Coffea arabica* L., *Cucurbita moschata* Dusch, *Daucus carota* L., *Eleusine coracana* (L.) Gaertn., *Glycine max* (L.) Merr., *Gossypium herbaceum* L., *Gossypium hirsutum* L., *Ilex paraguariensis* A. St.-Hil*., Ipomoea potatoes* (L.) Lam., *Ipomoea* sp., *Oryza sativa* L., *Panicum maximum* Jacq., *Phaseolus vulgaris* L., *Raphanus raphanistrum* L., *Sida* sp., *Solanum tuberosum* L., *Sorghum bicolor* (L.) Moench, *Sorghum vulgare* Pers., *Triticum* sp. (Nogueira *et al*., 2019; Carpintero *et al*., 2021; Cazorla, 2021; Ferreira *et al*., 2024a).

***Horciasoides nobilellus* (Berg, 1883) (Figure 2E)**

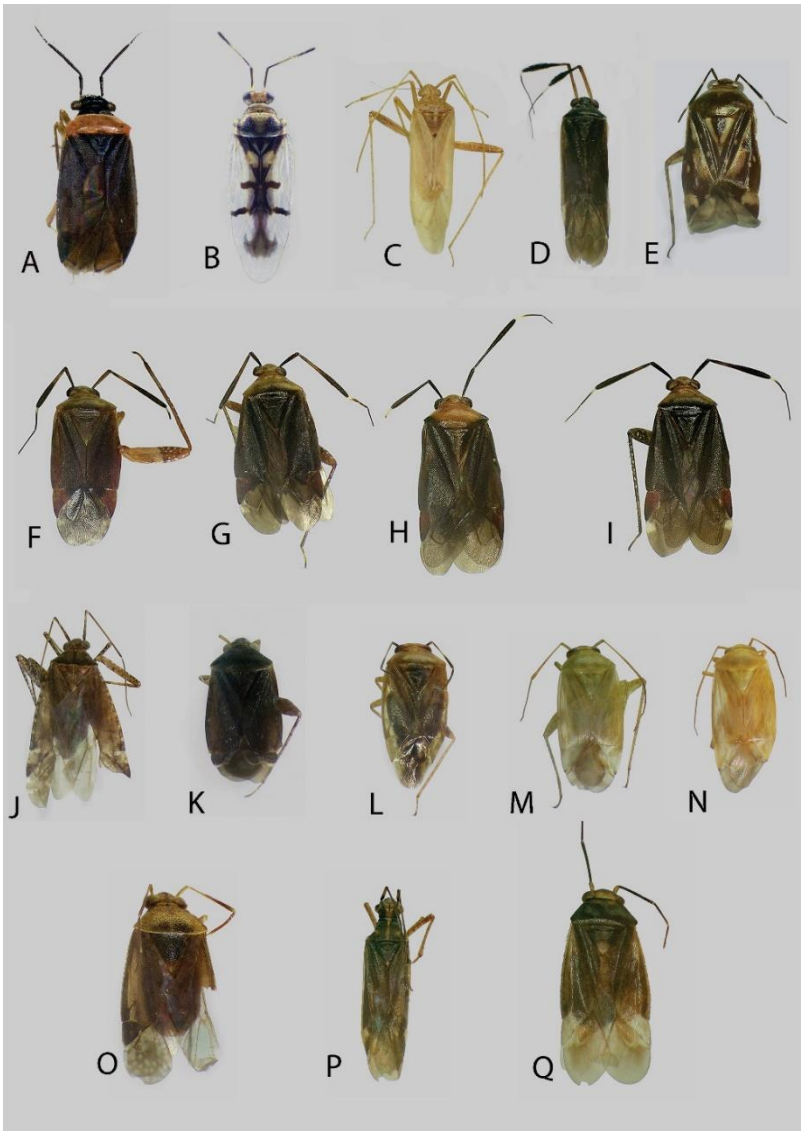
**Diagnosis:** Body length 4.5 to 6 mm. General color dark brown; yellowish scutellum with dark longitudinal triangular band; hemelytra with pale or pale yellowish bands, spots, or dots; a wide pale spot at the base of the cuneus; corium with a wide pale yellowish band bordering the claval suture; segment II black with a pale ring in the basal third and thickening towards the apex (Berg, 1883; Carvalho, 1976). Male genitalia diagnosis and illustrations in Carvalho (1976: 461).

**Distribution:** Brazil (Amazonas, Pará, Rondônia, Ceará, Mato Grosso, Goiás, Rio de Janeiro, São Paulo, Minas Gerais, Espírito Santo, Rio Grande do Sul, Paraná), Argentina, Bolivia, Peru, Paraguay, Suriname, Uruguay, Venezuela (Ferreira *et al*., 2024a).

**Plant Association:** *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record), *Abelmoschus esculentus* (L.) Moench, *Amaranthus*

*spinosus* L., *Amaranthus viridis* L., *Austroeupatorium inulifolium* (= *Eupatorium inulaefolium* Kunth) (Kunth) R.M.King & H.Rob., *Baccharis dracunculifolia* DC., *Baccharis punctulate* DC., *Bidens pilosa* L., *Bidens rubicundula* f. alba T.G.J. Rayner, *Condea fastigiata* (= *Hyptis fasciculata* Benth.) (Benth.) Harley & J.F.B. Pastore, *Condea undulata* (Schrank) Harley & J.F.B. Pastore, *Eupatorium inulaefolium* Kunt., *Flaveria bidentis* (L.) O. Kuntze, *Glycine max* L., *Gossypium barbadense* L., *Gossypium herbaceum* (L.), *Gossypium hirsutum* L., *Hibiscus esculentus* L., *Hypericum* sp., *Ludwigia peploides* (Humb., Bonpl. & Kunth) P.H. Raven 1963, *Malus pumila* Mill., *Malvastrum coromandelianum* (L.) Garcke, *Mikania cordifolia* (L. Fil.) Willd., *Physalis angulata* L., *Pleroma trichopodum* DC., *Pterolepis glomerata* (Rottb.) Miq., *Sida cordifolia* L., *Sida rhombifolia* L., *Sida* sp., *Solanum* sp., *Solidago chilensis* Meyen, *Sorghum bicolor* (L.) Moench, *Sorgum* sp., *Sphaeralcea bonariensis* (Cav.) Griseb., *Tibouchina trichopoda* (= *Pleroma trichopodum* DC.) (DC.) Baill., *Triumfetta semitriloba* Jacq. (Carvalho *et al*., 2000; Ferreira *et al*., 2024a).

Figure 2. Miridae species associated with canola crops in dorsal view, collected in 2019 in Passo Fundo, Rio Grande do Sul, Brazil. (A) *Sysinas pallidipes* (Stal, 1860); (B) *Hyaliodocoris insignis* (Stal, 1860); (C) *Creontiades rubrinervis* (Stal, 1862); (D) *Garganus gracilentus* (Stal, 1860); (E) *Horciasoides nobilellus* (Berg, 1883); (F-I) *Notholopus pachycerus* (Reuter, 1907); (J) *Phytocoris effictus* Stal, 1860; (K) *Polymerus minutus* Ferreira, 1980; (L) *Proba fraudulenta* (Stal, 1860); (M- N) *Taylorilygus apicalis* Fieber, 1861; (O) *Tropidosteptes hirsutus* (Distant, 1884); (P) *Collaria scenica* (Stal, 1859); (Q) *Moissonia cuneata* (Stal, 1860). Photographs: L. S. F. Ferreira.




Fonte: Prepared by the authors

***Notholopus pachycerus* (Reuter, 1907) (Figure 2F-I)**

**Diagnosis:** Body length varies from 5.7 to 8.1 mm. The general color ranges mostly from black to dark brown. The pronotum tilted towards the apex, with the anterior part being sulfurous to light yellowish. Tibiae with sulfurous rings; hind femora broadened with little white spots; antennal segment II enlarged significantly towards apex. The species varies in color. Sooty hemelytra;

scutellum apex, claval-corial commissure, outer border of the corium toward the apex flavus testaceo; cuneus reddish with a blackish apex (Carvalho, 1975). Male genitalia diagnosis and illustrations in Carvalho and Ferreira (1971: 171)

**Distribution:** Brazil (Rio Grande do Sul, Alagoas, Mato Grosso, Minas Gerais, Rio de Janeiro, Santa Catarina, Pernambuco, Paraná, Pará, Goiás, Paraíba), Colombia, Paraguay and Mexico (Ferreira *et al*., 2024a).

**Plant Association**: *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record).

***Phytocoris effictus* Stal, 1860 (Figure 2J)**

**Diagnosis:** Length ranging from 5.0 to 6.3 mm. General coloration brown and pale yellowish. Antennae pale yellowish, with segment I bearing three to four dark brown dots. Pronotum brown with three lighter bands around collar and calli. Posterior border of pronotum with four black longitudinal stripes (which may or may not be evident) and an extremely yellowish posterior margin. Scutellum brown with little pale yellowish patches, yellowish apex, and two lateral black dots. Hemelytra pale yellowish marbled, darker on clavus; embolium with pale and black spots interspersed; extreme apex of the corium and apical region of cuneus, dark; inner region of cuneus light with dark spots. Membrane and veins light yellowish and brown (Carvalho and Gomes, 1970). Male genitalia diagnosis and illustrations in Carvalho and Gomes (1970: 126-127).

**Distribution:** Brazil (Minas Gerais, Santa Catarina, Rio de Janeiro, Rio Grande do Sul, Mato Grosso, Paraná), Argentina, Peru, Paraguay (Carvalho and Gomes, 1970; Schuh, 2002-2013).

**Plant Association**: *Brassica napus* L. var. oleifera, hybrid ALHT B4 (new plant association record), *Condea undulata* (Schrank) Harley & J.F.B. Pastore, *Parthenium hysterophorus* L., *Phaseolus vulgaris* L., *Phytolacca dioica* L., *Setaria poiretiana* (Schult.) Kunth (Carpintero, 2004; Nogueira *et al*., 2019; Carpintero *et al*., 2021).

***Polymerus minutus* Ferreira, 1980 (Figure 2K)**

**Diagnosis:** Small size, body length not exceeding 4.5 mm. Pronotum, scutellum, and hemelytron are uniformly black (except for the cuneus area). Pronotum punctate. Antennal segments predominantly black with a pale median region (Ferreira, 1980). Male genitalia diagnosis and illustrations in Ferreira (1980: 378).

**Distribuition:** Brazil (Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul (new state record)) (Ferreira, 1980; Ferreira *et al*., 2024a).

**Plant Association:** *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record).

***Proba fraudulenta* (Stal, 1860) (Figure 2L)**

**Diagnosis:** Body length from 4.0 to 6.0 mm. General brown color, with pale and translucent areas. Head (except clypeus), collar, and callus region lighter. Scutellum pale with a wide brown longitudinal stripe. Hemielytron translucent brown with a pale cuneus and a pale membrane with a darker longitudinal median area. Tip of cuneus dark. Femora brown with two black subapical rings and pale tibiae. Antenna brown to dark brown with median portion of segment II light (Osako *et al*., 2024). Male genitalia diagnosis and illustrations in Osako *et al*. (2024: 3).

**Distribution:** Brazil (São Paulo, Rio de Janeiro, Paraná, Santa Catarina, Rio Grande do Sul (new state record)), Argentina, Bolivia, Colombia, Paraguay, Peru (Carpintero, 2004; Ferreira *et al*., 2024a).

**Plant Association**: *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record), *Baccharis salicifolia* (Ruiz & Pavi.) Pers., *Cynara cardunculus* (L.) Fiori, *Helianthus annuus* L., *Salvia officinalis* L., *Solanum tuberosum* L. (Carpintero, 2004; Chérot and Carpintero, 2017).

***Taylorilygus apicalis* Fieber, 1861 (Figure 2M-N)**

**Diagnosis:** Body length ranging from 4 to 5 mm. General color uniformly yellowish or yellowish-green. Appendages yellowish-green or straw; clavus with

slightly brownish area near the apex of the corium. Membrane somewhat sooty, darker at the apex of both cells and near the cuneus; cell veins pale. Body with fine yellow adpressed pilosity. Hemelytra and pronotum not punctate; cuneus approximately twice as long as wide (Hernandez and Henry, 2010). Male genitalia diagnosis and illustrations in Hernandez and Henry (2010: 187).

**Distribution:** Brazil (Mato Grosso, Minas Gerais, Espirito Santo, Rio de Janeiro, Rio Grande do Sul), Argentina, Australia, Bosnia and Herzegovina, Switzerland, Chile, Cameroon, Colombia, Cuba, Cape Verde, Algeria, Ecuador, Egypt, Spain, France, Guatemala, Israel, Italy, Sri Lanka, Libya, Madagascar, Mexico, Nicaragua, New Zealand, Peru, Puerto Rico, Paraguay, Saudi Arabia, Sudan, Suriname, El Salvador, Turkey, United States, Uruguay, Yemen, and South Africa (Carvalho, 1959; Henry, 1985; Ferreira *et al*., 2024a).

**Plant Association:** *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record), *Parthenium hysterophorus* L. (Hernandez and Henry, 2010).

***Tropidosteptes hirsutus* (Distant, 1884) (Figure 2O)**

**Diagnosis:** Body length from 4.0 to 5.0 mm. General dark brown color. Body densely hairy. Pronotum strongly punctate; defined calluses; pronotum disc with one or two posterior black spots; membrane with numerous pale round spots. Scutellum punctate, unicolor without median longitudinal pale line. Hemelytra punctate without pale spots (Carvalho, 1986). Male genitalia diagnosis and illustrations in Carvalho (1986: 407).

**Distribution:** Brazil (Pará, Bahia, Mato Grosso, Paraná, Santa Catarina, Rio de Janeiro, Minas Gerais, Rio Grande do Sul (new state record)), Argentina, Bolivia, Peru, Costa Rica, El Salvador, Mexico (Carvalho, 1986; Schuh, 2002-2013).

**Plant Association**: *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record).

**Stenodemini**

***Collaria scenica* (Stal, 1859) (Figure 2P)**

**Diagnosis:** Body ranging from 4.5 to 6.5 mm, elongated, apparently glabrous above, with long and slender antennae and legs. Fusco-testaceous in color, with black and white patches. Head as long as wide, grooved at vertex and extended posteriorly into a neck shape; black head, posterior region at the level of posterior margin of the eyes with a pale “v”-shaped spot; two pale spots on forehead (one on each side) reaching the anterior margin of the eyes and another in the center of forehead. Eyes located in the middle of the head, away from the anterior margin of the pronotum; neck with an upper median spot and two pale spots behind the eyes (one on each side). Black antenna with pale segments I and II in the basal area. Pronotum sharply punctuated and constricted behind the calli (Carvalho and Fontes, 1981; Schwartz, 2008; Morales *et al*., 2016). Male genitalia diagnosis and illustrations in Carvalho and Fontes (1981: 45).

**Distribution:** Brazil (Bahia, Mato Grosso, Goiás, São Paulo, Minas Gerais, Distrito Federal, Rio Grande do Sul, Santa Catarina, Paraná), Argentina, Colombia, Uruguay (Carvalho and Fontes, 1981; Carpintero, 2004; Morales *et al*., 2016).

**Plant Association:** *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record), *Avena sativa* L., *Avena strigose* Schreb., *Brachiaria mutica* (Forssk.) Stapf, *Cenchrus clandestinus* (Hochst. Ex Chiov.) Morrone, *Cynodon dactylon* (L.) Pers., *Digitaria sanguinalis* (L.) Scop., *Echinochloa colona* (L.) Link, *Eleusine indica* (L.), *Festuca arundinacea* Schreb, *Oryza sativa* L., *Panicum maximum* Jacq., *Panicum miliaceum* L., *Phalaris aquática* L., *Stenotaphrum secundatum* (Walter) Kuntze, *Triticum aestivum* L., *Triticum* sp., *Zea mays* L. (Carvalho and Fontes, 1981; Carpintero, 2004; Barreto-Triana *et al*., 2018; Castaño-Quintana *et al*., 2019; Nogueira *et al*., 2019; Ferreira *et al*. 2024a).

**Phylinae**

**Phylini**

***Moissonia cuneata* (Stal, 1860) (Figure 2Q)**

**Diagnosis:** Body length 3 to 4 mm. General dark brown color. Head, antennal segment I, apex of the scutellum, lateral spots of the mesoscutum, thin band at the corium commissure following the apex of the clavus, cuneus (total or

mostly), spot on the membrane next to the cuneus, pale yellowish. Sooty membrane. Abdomen black with pale yellowish coxae, femora, and median region. Fore and middle femora with black apical spots. Hind femora with black apical half; tibiae with spines and black spots (Carvalho, 1990; Schuh, 2002-2013). Male genitalia diagnosis and illustrations in Carvalho (1990: 172).

**Distribution:** Brazil (Rio de Janeiro, São Paulo, Minas Gerais, Santa Catarina, Rio Grande do Sul (new state record)), Argentina, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Nicaragua, Panama, Peru, El Salvador (Carvalho and Afonso, 1977; Ferreira *et al*., 2024a).

**Plant Association:** *Brassica napus* L. var. *oleifera*, hybrid ALHT B4 (new plant association record), *Crotalaria* sp., *Daphne* sp., *Eleusine* sp., *Ipomoea batatas* (L.) Lam., *Setaria* sp., *Sorghum bicolor* (L.) Moench (Ferreira *et al*., 2024a).

## 4 DISCUSSION

We observed that canola showed a great diversity of Miridae species, a fact also observed by Bianchi *et al*. (2019) who found the occurrence of several species of *phytophagous stink bugs (Pentatomidae)* on the crop, some of which are considered pests of importance for several crops in Brazil, including canola.

*Sysinas pallidipes* has already been associated with plants from the Euphorbiaceae family (Nogueira *et al*., 2019). It is being related to canola for the first time in this study. Only one specimen of *S. pallidipes* was collected during research (Table 1). The specimen must be associated with weeds present in the canola-growing area. The presence of *S. pallidipes* should not be relevant to canola as a pest.

*Hyaliodocoris insignis* is a predatory species associated with plants from the following families: Asteraceae, Fabaceae, Rosaceae, and Solanaceae (Ferreira *et al*., 2024a). *H. insignis* is associated with canola for the first time. Adults and nymphs were seen feeding on eggs of *Duponchelia fovealis* Zeller, 1847 (Lepidoptera: Crambidae) (Zawadneak *et al*., 2016). According to Marsaro Júnior *et al*. (2020), in Brazil canola hosts several Lepidoptera species. Although

no observation of *H. insignis* activity was seen in the canola field, it is likely that this predator was looking for Lepidoptera eggs, a potentially useful species for biological control.

*Creontiades rubrinervis* is associated with plants in the families Convolvulaceae, Cucurbitaceae, Fabaceae, Malvaceae, Pedaliaceae, Poaceae, and Solanaceae (Hernandez and Henry, 2010; Nogueira *et al*., 2019; Ferreira *et al*., 2024a). This species was discovered for the first time in canola crop and in the state of Rio Grande do Sul. Four specimens were collected (Table 1) from the canola field. Because of its limited population, *C. rubrinervis* is not regarded as a potential pest in canola. However, additional samples and onsite observations must be taken.

*Garganus gracilentus* is associated with the following plant families: Amaranthaceae, Apiaceae, Aquifoliaceae, Asteraceae, Brassicaceae, Convolvulaceae, Fabaceae, Malvaceae, and Poaceae (Nogueira *et al*., 2019; Carpintero *et al*., 2021; Cazorla, 2021; Ferreira *et al*., 2024a). *G. gracilentus* was found in *Brassica* sp. of the same genus as canola (Maes and Carvalho, 1989). It is also related to *Raphanus raphanistrum* L. (Ferreira and Rossi, 1979) in the same botanical family. This study sets a new record for relationship with canola, *Brassica napus* L. var. *oleifera*. Considering that this species has already been associated with plants from the Brassicaceae family (specifically the *Brassica* genus) and that 17 specimens were collected in this study (Table 1), it is likely that *G. gracilentus* feeds on this oilseed plant and be a potential pest.

*Horciasoides nobilellus* relates to the following plant families: Amaranthaceae, Asteraceae, Hypericaceae, Lamiaceae, Malvaceae, Melastomataceae, and Rosaceae (Carvalho *et al*., 2000; Ferreira *et al*., 2024a). *H. nobilellus* is reported here as the first record for canola. In Brazil, *H. nobilellus* is regarded as one of the most serious cotton crops. Adults and nymphs feed on the young parts of the plants. They inoculate toxins into the sap, causing flower buds, blooms, and new bolls to fall off. As a result, it reduces the number of bolls and decreases plant production. When the attacked bolls do not fall, they become deformed, preventing full opening. The sucked regions exhibit little necrotic patches on the exterior, calluses on the inside, and yellowing of the fibers or rot

(Silvie *et al*., 2001). *H. nobilellus* is the most abundant species in the sampled canola area (Table 1). Further observations in the canola crop are required to identify *H. nobilellus* as a potencial pest.

*Notholopus pachycerus*, according to this study, has canola as the first plant associated, and until this record this Miridae had not yet been associated whith any other plant. It is the third most collected species (87 specimens) (Table 1). *N. pachycerus* was found and photographed feeding on canola siliqua (Figure 3). The species should be considered a potential pest. Therefore, it is important that future studies investigate the damage that feeding this Miridae causes to canola seeds. The species has been found in Rio Grande do Sul since the beginning of the twentieth century. A female of *Paracalocoris pachycerus* Reuter, 1907 (junior synonym for *Notholopus pachycerus*) was collected in the state of Rio Grande do Sul and housed in the Zoological Museum of Helsinki, Finland (Carvalho and Ferreira, 1971).

Figure 3. Specimen of *Notholopus pachycerus* feeding on canola silique, in 2019 in an experimental area cultivated in Passo Fundo, Rio Grande do Sul, Brazil. Photography: A. L. Marsaro Júnior.

Fonte: Prepared by the authors

*Phytocoris effictus* is associated with plant families such as Asteraceae, Fabaceae, Lamiaceae, Phytolaccaceae, and Poaceae (Carpintero, 2004; Nogueira *et al*., 2019; Carpintero *et al*., 2021). It is associated with canola for the first time. Only two specimens of this species were collected during research

(Table 1). It is possible that specimens may be associated with weeds present in the canola-growing area. The presence of *P. effictus* should not be relevant to canola.

*Polymerus minutus* has its possible first associated plant (canola), considering that only one specimen was collected (Table 1). Its distribution is here recorded in the state of Rio Grande do Sul for the first time. More samples and onsite observations are necessary to determine whether the species has any relationship to canola crops.

*Proba fraudulenta* has been linked to family plants such as the Asteraceae, Lamiaceae, and Solanaceae (Carpintero, 2004; Chérot and Carpintero, 2017). It is first related to canola and recorded for the state of Rio Grande do Sul. In São Paulo state, *P. fraudulenta* nymphs and adults were found damaging artichoke leaves and inflorescences (*Cynara cardunculus* var. *scolymus* (L.) Fiori) (Asterales: Asteraceae) (Osako *et al*., 2024). These latter authors reported that *P. fraudulenta* feeding on artichokes resulted in yellowing and drying of the leaves, a reduction in plant vigor, size, and quality of the inflorescence, and plant mortality, all of which had a direct impact on production. Since *P. fraudulenta* has not yet been associated with Brassicaceae plants, it may have been collected from weeds found in the canola-growing area. The number of specimens collected (51) (Table 1) shows that further samples and onsite observations are needed to learn more about the connection with canola plants.

*Taylorilygus apicalis* is associated with the Asteraceae (Hernandez and Henry, 2010). It is noteworthy that *Taylorilygus apicalis* is mentioned in the vast majority of literature by the junior synonym *Taylorilygus pallidulus* (Blanchard, 1852). *T. apicalis* is a common and widespread species that feeds on various species of weeds and can be found all over the world. Snodgrass *et al*. (1984), Henry (1985), and Ferreira *et al*. (2024b) provided detailed lists of plants linked with *T. apicalis* - belonging to the families Amaranthaceae, Apiaceae, Asteraceae, Brassicaceae, Calyraceae, Convolvulaceae, Euphorbiaceae, Fabaceae, Geraniaceae, Lamiaceae, Lythraceae, Onagraceae, Poaceae, Polygonaceae, Ranunculaceae, Salicaceae, Solanaceae, and Verbenaceae. Canola as an associated plant is a new record for *T. apicalis*. Given that this

species has been associated with the Brassicaceae family and that 82 specimens were collected in research (Table 1), it is likely that *T. apicalis* feeds on canola plants.

*Tropidosteptes hirsutus* had not yet been associated with any plant. It is recorded for the first time in this study with canola and, at the same time, in the state of Rio Grande do Sul. Considering that only one specimen was collected (Table 1), it is likely that this species is associated with some weed present in the experimental area and is therefore not relevant to the canola crop.

*Collaria scenica*, a pest of economic importance in Colombia, causes damage to prairie grasses used as pasture for dairy cattle. Its damage results in a 25% drop in dry matter, a 10% decrease in digestibility, a reduction in milk production of up to 5 liters per cow per day and an estimated economic loss of 20% (Barreto-Triana *et al*., 2018). In Brazil, the nymphs and adults of *C. scenica* cause damage showing satisfactory development and reproduction in several cultivated grasses, including wheat, oats, ryegrass and barley (Carlessi *et al*., 1999; Barboza, 2009; Rech, 2018, Panizzi *et al*., 2021). *C. scenica* is a specialist in the Poaceae plant family. Three specimens were collected from canola (Table 1), indicating that specimens were linked with the grasses growing in the crop. Therefore, the presence of *C. scenica* is not important from a phytosanitary point of view for canola crops.

*Moissonia cuneata* has *Ellenia cuneata* as a nomenclatural variant (Schuh, 2002-2013; Carvalho, 1990). It is associated with the following plant families: Arecaceae, Convolvulaceae, Fabaceae, Poaceae, and Thymelaeaceae (Ferreira *et al*., 2024a). This species is associated for the first time with canola and its occurrence in the state of Rio Grande do Sul. *M. cuneata* is the second most abundant species (145 specimens) (Table 1). Further studies should be done to evaluate its associations with canola.

The Miridae species observed on canola - compared to the Pentatomidae that also occur on this crop in Brazil - have a smaller body size, which is why they may be neglected and go unnoticed by farmers. However, as observed in this study, the diversity and abundance of Miridae in the crop is relevant and, for this

reason, further studies are needed in order to verify the impacts that these species can have on the canola crop.

Canola is a plant with very small seeds (about 2 mm in diameter) and, as a consequence, the impact of Miridae feeding on the seeds, as well as on the flower buds, can cause qualitative and quantitative damage, which can affect the productive potential of the plant, as well as germination, vigor and lipid and protein content of the seeds, among other components. This damage has already been observed by phytophagous stink bugs (Pentatomidae) when they feed on canola or soybean (Panizzi *et al*., 1979, Vergara *et al*., 2019, Oliveira *et al*., 2023). In Canada, *Lygus* species (Miridae) are important pests of canola, causing severe damage to flower buds and seeds of this crop, sometimes requiring chemical control measures, with applications of insecticides (Canola Council of Canada, 2024). In this study, species of Miridae were observed feeding on canola siliques (e.g. *Notholopus pachycerus*) (Figure 3). This strengthens the association of some Miridae species with canola. However, further studies would be necessary to verify whether this crop could be characterized as a host plant. According to Bernays and Chapman (1994), host plants are those where the insect can feed, reproduce and shelter. In contrast, associated plants are those that only provide water or some nutrients for maintenance, especially for adults, when the preferred food source is not available. In this case, these plants do not provide sufficient nutritional quality to allow the nymphs to develop and/or the adults to reproduce. Associated plants can also provide shelter from abiotic (rain, sunlight) or biotic (parasitoids/predators) factors (Smaniotto and Panizzi, 2015; Panizzi and Lucini, 2017).

A study by Panizzi and Lucini (2022), on the subject of host plants and associated plants, showed that the presence of weeds in agricultural crops without soil preparation (no-till) and pastures contributes to the occurrence and bioecology of phytophagous pest stink bugs (Pentatomidae) that affect large commodities in the Neotropics. Similarly, some species of Miridae found on canola in this study may be using this crop as an associated plant, a kind of green bridge, to later migrate to a host plant grown after the canola. Furthermore, for some species of Miridae, canola may be a host plant.

The area cultivated with canola in Brazil is increasing, mainly in the state of Rio Grande do Sul (south of the country, a traditional region for growing the crop, which has mild temperatures and more rainfall distributed throughout the year), but research is being carried out to adapt canola to tropical areas (warmer and less rainy, like the Cerrado Biome), which in the future could contribute to an even greater expansion of the area occupied by the crop in the country.

The increase in food supply, the expansion of the cultivated area, soil management, climate change and higher crop productivity are closely related to changes in agricultural practices and the subsequent increase in mirid populations.

The introduction of exotic plants in Brazil (such as canola) has resulted in the appearance of new host plants, and new associations of plants and species of mirids. Mirids have enormous potential as bioindicators of ecological change, particularly for conservation initiatives, preservation measures and environmental management programs. This is due to the wide range of dietary needs of the species, their high sensitivity to pesticides and habitat changes, and their role in damaging domesticated plant species.

Thus, with the prospect of expanding the area under canola cultivation in Brazil, the diversity, abundance and importance of Miridae for the crop may increase and these insects may become relevant, even to the point of causing damage to this oilseed. For this reason, surveys/monitoring of Miridae in canola should be continued and expanded to productive areas of the crop, as well as studies aimed at assessing the biology and damage of these insects to canola.

## 5 CONCLUSION

The field surveys carried out in this study indicated a great diversity of Miridae associated with canola crops in the state of Rio Grande do Sul, with 13 species identified.

The observation of Miridae feeding on canola silique indicates that the species found can cause damage to the grains.

The results presented on the collected Miridae (diagnosis of the species - with the morphological characteristics for identification, their associated plants and their geographic distribution) are relevant for the academy since they expand the knowledge of information on the Miridae species in the Neotropical region, and for society, mainly for farmers, since this information can help in the planning of future integrated pest management programs for canola crops.

Despite the relevance of the results and due to the limitations of the study (low sampling effort - low number of samples collected, short data collection period - only one year of collection and geographic limitation), we believe that the efforts efforts do not allown to fully understand the wide diversity of Miridae species associated with canola, as well as their relationships with the crop. To fill these gaps, additional field surveys are needed, as well as studies on the biology and the impact that Miridae species have on canola.

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