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(Review Article)

Assessment of conceptual and taxonomic aspects of the Scelionidae Family (Hymenoptera: Scelionidae)

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Abstract

Biology of Scelionidae Scelionid wasps are idiobiont endoparasitoids of spider eggs, mainly araneids and teridids, and of insects odonates, orthopterans, mantles, embypterans, hemipterans, neuropterans, coleopterans, dipterans and lepidopterans. Its females have an ovipositor that acts as a hypodermic needle, allowing it to pierce the chorion of the host's egg and lay eggs. The parasitoid larvae consume the host's tissues and thrusts within it, with one adult emerging in solitary species or several adults in gregarious species. The objective of this mini review is to understand the biology, ecology, habitat, geographical distribution, taxonomy, life cycle and phenology of the Scelionidae Family. In this study, quantitative and conceptual aspects were used. To this end, a bibliographic survey of Scelionidae was carried out in the years 1982 to 2021. Only complete articles published in scientific journals and expanded abstracts presented at national and international scientific events, Doctoral Thesis and Master's Dissertation were considered. Data were also obtained from platforms such as: Academia.edu, Frontiers, Qeios, Pubmed, Biological Abstract, Publons, Dialnet, World, Wide Science, Springer, RefSeek, Microsoft Academic, Science and ERIC.

Keywords: Biology; Order; Species; Genera; Phenology; Brazil

1. Introduction

The Scelionidae family has a cosmopolitan distribution except for the polar regions. It is particularly diverse in the rainforests of the tropics and subtropics. Around 244 genera and 3,308 species have been recorded worldwide. In the Neotropical Region, 56 genera and 334 species have been recorded, traditionally distributed in three subfamilies as follows: Scelioninae, 44 genera and 227 species; *Teleasinae*, six genera and 16 species; and Telenominae, six genera and 91 species. For Argentina, 56 species assigned to 19 genera have been cited, representing 2% worldwide and 17% at the neotropical level (Figures 1 and 2) [1,2,3].

Main morphological characteristics numerous external morphological characters used for their identification are reduced or vestigial in parasitoid microhymenoptera, particularly in Platygastroidea, which are groups with more simplified characters. For example, many platigastroids have little wing nerve, the cells are not closed, the tegumentary surface is smooth and not sculptured, the antennas are reduced to at least 10 arteries (up to six) and the meso and metasomal sclerites are particularly fused the apter forms of the genus *Baeus*, which inhabit the south, and the hojarasca and associate with spider (Figure 3) [4,5,6].

The length of the body varies between 0.5 to 10 mm in length, usually from 1 to 2.5 mm; in a very variable way, the ovipositors of the scelionidos are generally gracile, of reduced diameter, they have evolved in such a way as to minimize the possible damages that they could cause in the hosts from where their inmature states unfold (Figure 4) [7,8].

They are also completely internal, as if they remained exposed they could become damaged when not used. They are distinguished from the basic types of ovipositor: 1) the muscular one (shared with platigastridia) is extended and

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retracted by antagonistic protractor and retractor muscles, 2) the hydrostatic one is activated by changes in the hydrostatic pressure inside the abdomen. The type of ovipositor of the esceliónidos correlates with the oviposition site and with the characteristics of the corion of the hosts of the hosts, especially its grosor. Based on this characteristic, inferences can be made about possible hosts or environments to be colonized by these insects, the hydrostatic ovipositor allows its species to reach the underground postures of the host orthoptera, which can extend more than three times the length of the metasoma (Figure 5) [9,10].

Figure 1 Hymenoptera-Scelionidae-Parasitoid Apocrita female; (Source: Salvador Vitanza)

Figure 2 Hymenoptera-Scelionidae-Parasitoid Apocrita male; (Source: https://ru.wikipedia.org/wiki/Trissolcus)

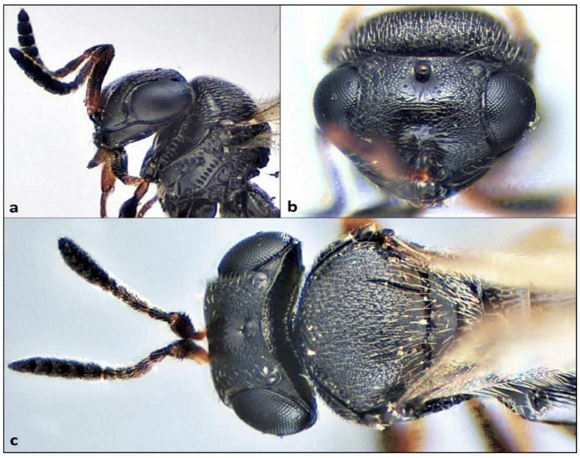

Figure 3 Morphological characteristics: (a) head, mesosoma, lateral view; (b) head, frontal view; (c) head, mesosoma, dorsal view; (Source: https://www.researchgate.net/figure/Morphological-characteristics-of-Trissolcus-japonicus-female-a-head-mesosoma-lateral_fig1_351334417)

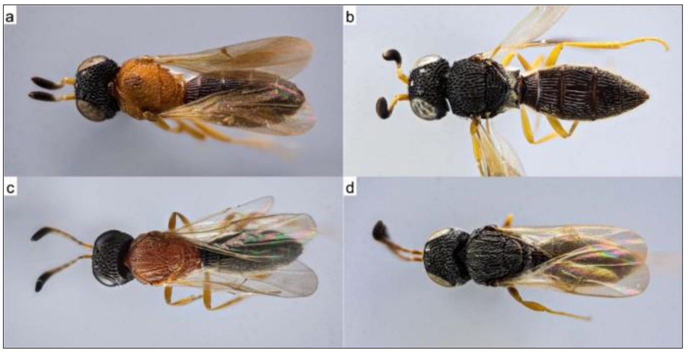

Figure 4 Macrophotography of dorsal color patterns of two scelionid genera. Macrophotography of dorsal color patterns of two scelionid genera obtained with a Reflex Camera 850, 20X microscope lenses and results of focus stacking of 180 captures. Genus *Scelio* (a) orange morph (SO), (b) black morph (SB) and genus *Baryconus* (c) orange morph (BO), (d) black morph (BB); (Source: https://www.nature.com/articles/s41598-020-58301 2?proof=thttps%3A%2F%2Fwww.nature.com%2Farticles%2Fsj.bdj.2014.353%3Fproof%3Dt)

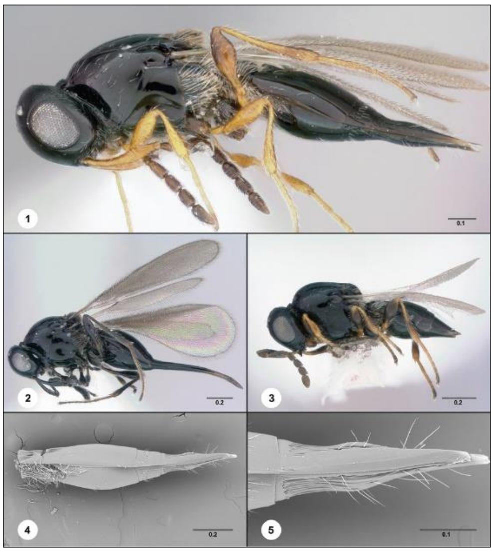

Figure 5 *Metanopedias* 1 female (OSUC 404924), habitus, lateral view 2 female (OSUC 265251), habitus, lateral view 3 female (OSUC 266113), habitus, lateral 4 female (USNMENT00989611_2), metasoma, lateral view 5 female (USNMENT00989611_2), T5, S5, lateral view. Scale bars in millimeters. Convergence in the ovipositor system of platygastroid wasps (Hymenoptera); (Source: https://jhr.pensoft.net/articles.php?id=12300)

With respect to the thickness of the huevos corion, the most robust species (eg those of the genera *Gryon*, *Trissolcus, Psix, Paratelenomus*, and the *Telenomus podisi* Ashmead 1893 species group), poses a robust ovipositor, adapted to the penetration of a corion of great thickness, like the ones of the colored heteropters, from 50 to 60 µ of thickness, and escuteléridos, with a 40 µ corion. The most gracile species (e.g. the remaining species groups of *Telenomus*, *Nirupama* and *Eumicrosoma*) pose a delicate ovipositor, adapted to the penetration of huevos with thin corion. For example, in the *Baeini* sp. the ovipositor is very gracile, a characteristic that correlates with the smooth texture of the huevos de las spiders that parasitoidizan. Something similar occurs with the species that attack reddish and riparochromic hemipteran huevos, heteroptera whose huevos have a 8 µ and 4.5 µ tan solo corion, respectively (Figures 6, 7, 8 and 9) [11,12].

Biology of Scelionidae Scelionid wasps are idiobiont endoparasitoids of spider eggs, mainly araneids and teridids, and of insects odonates, orthopterans, mantles, embypterans, hemipterans, neuropterans, coleopterans, dipterans and lepidopterans. Its females have an ovipositor that acts as a hypodermic needle, allowing it to pierce the chorion of the host's egg and lay eggs. The parasitoid larvae consume the host's tissues and thrusts within it, with one adult emerging in solitary species or several adults (five to 10 parasitoids per egg) in gregarious species (Figure 10) [11,12].

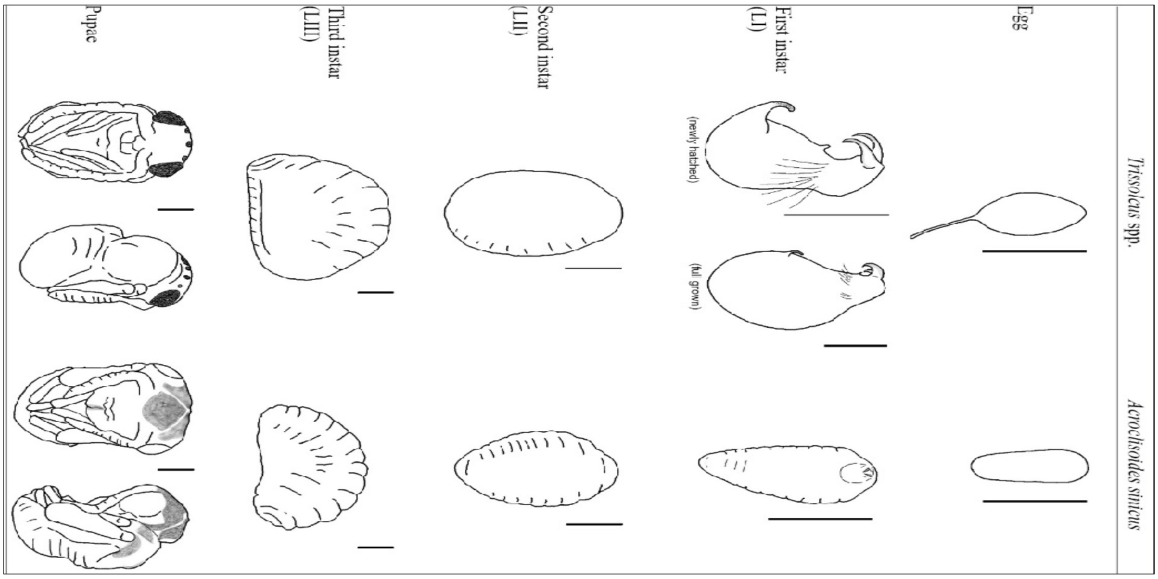

Figure 6 Schematic representation of juvenile developing stages of *Trissolcus* spp. *Trissolcus japonicus* (Ashmead, 1904) and *Trissolcus mitsukurii* (Ashmead, 1904) (Hymenoptera, Scelionidae) and *Acroclisoides sinicus* (Huang and Liao, 1988) (Hymenoptera: Pteromalidae). Bars correspond to 200 µm; drawings based on eggs and early larval stages mounted on microslides; (Source: https://www.researchgate.net/figure/Schematic-representation-of-juvenile-developing-stages-of-Trissolcus-spp-T-japonicus_fig1_350119106)

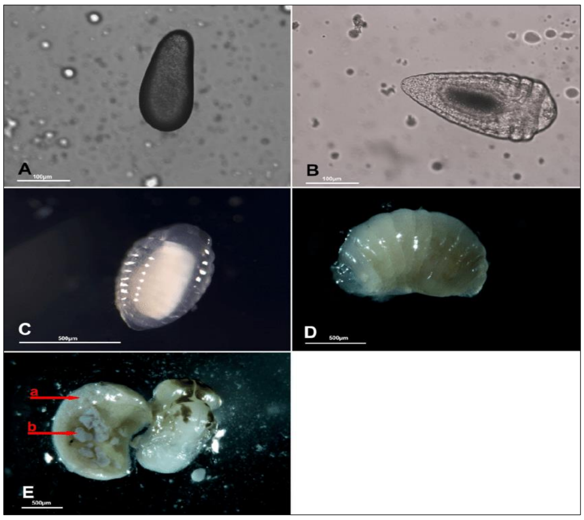

Figure 7 *Acroclisoides sinicus* (Huang and Liao, 1988) (Hymenoptera: Pteromalidae): (A) egg and (B) first-instar larva (LI); (C) second-instar larva (LI), (D) third-instar larva (LIII) and (E) pupa; arrow a = large, semicircular meconium of the host species (*Trissolcus* sp.) (Hymenptera: Scelionidae), arrow b = meconium of *A. sinicus* appear as dark-gray grains above the creamy-white meconium of its host; (Source: https://www.researchgate.net/figure/Acroclisoides-sinicus-dissected-from-Halyomorpha-halys-eggs-eggs-dissected-and-chorion_fig4_350119106)

Insects considered agricultural pests and spiders have natural enemies (predators, pathogens and parasitoids) that regulate their populations, acting as biological controllers. In the case of parasitoids, the adults are free-living and the immature stages develop in the eggs, larvae, pupae or adults of their hosts, causing their death. Among the groups of insects that behave as parasitoids of pest insects are the Diptera and the microhymenoptera (Figure 11) [12].

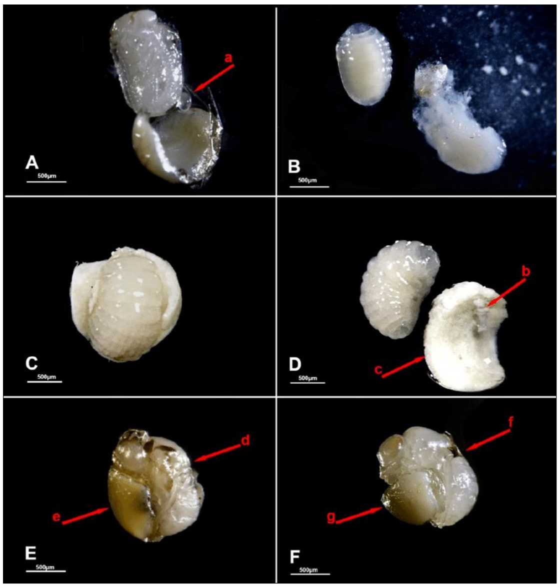

Figure 8 *Acroclisoides sinicus* (Huang and Liao, 1988) (Hymenoptera: Pteromalidae) dissected from *Halyomorpha halys* (Stal, 1855) (Hemiptera: Pentatomidae) eggs (eggs dissected and chorion removed): (A) first-instar larva (LI, arrow a) adhering externally to its host, the pupa of *Trissolcus japonicus* (Ashmead, 1904) and its meconium (partially separated for viewing); (B) third-instar larva (LIII) and residues of its host after complete feeding; (C) third-instar larva (LIII) adhering to meconium of its host *Trissolcus mitsukurii* (Ashmead, 1904) (Hymenoptera, Scelionidae) ; (D) meconium of the host (arrow c) and first traces of *A. sinicus* meconium (arrow b) (partially separated for viewing); (E) pupa of A. sinicus (arrow d) adhering to the meconium of its host (arrow e) and displacing its volume within the H. halys egg; (F) *T. mitsukurii* pupa (arrow f) and its meconium (arrow g) when not parasitized by *A. sinicus*; (Source: https://www.researchgate.net/figure/Acroclisoides-sinicus-dissected-from-Halyomorpha-halys-eggs-eggs-dissected-and-chorion_fig4_350119106)

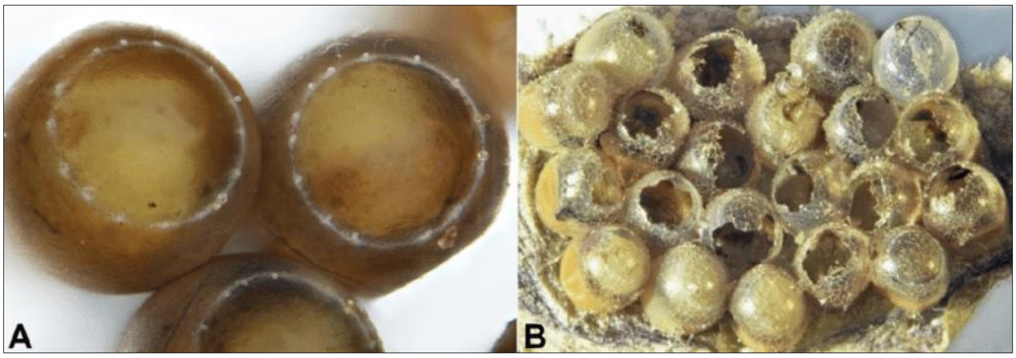

Figure 9 Acrolisoides sinicus Huang and Liao, 1988) (Hymenoptera: Pteromalidae): (A) pupae inside the eggs of *Acrosternum heegeri* Fieber, 1861 (Hemiptera: Heteropera: Pentatomidae: Pentatominae: Pentatomini), previously parasitized by *Telenomus* sp., and (B) *A. sinicus* adult emergence holes from the eggs of *Dolycoris baccarum* (Linnaeus, 1758) bug. Animalia > Arthropoda > Insecta > Hemiptera > Pentatomidae) primary-parasitized by *Trissolcus mitsukurii* (Ashmead, 1904) (Hymenoptera, Scelionidae)

Classification and geographical distribution Traditionally, Scelionidae included the subfamilies Scelioninae, Teleasinae and Telenominae; and Platygastridae to Platygastrinae and Sceliotrachelinae; all belonging to the Platygastroidea superfamily. The three subfamilies of Scelionidae in Platygastridae, maintaining the internal organization of each of them. The hosts of the Scelionidae tribes in the traditional sense are provided in the. Of the 20 tribes traditionally assigned to this family of microhymenopterans, 16 are associated with heterometaboli, four with holometaboli (mainly Orthoptera, Coleoptera, but Chalcidoidae) [13].

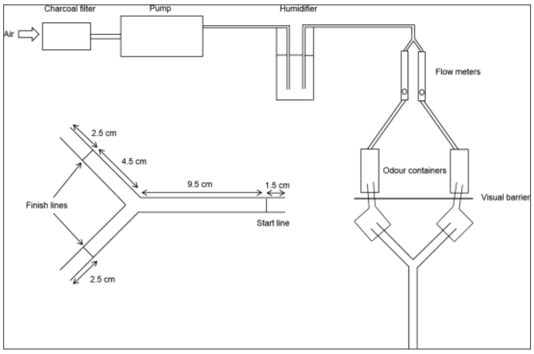

Figure 10 Selective flowers to attract and enhance *Telenomus laeviceps* (Förster, 1861) (Hymenoptera: Scelionidae): a released biocontrol agent of *Mamestra brassicae* (Linnaeus, 1758) (Lepidoptera: Noctuidae); (Source:https://www.cambridge.org/core/journals/bulletin-of-entomological-research/article/abs/selective-flowers-to-attract-and-enhance-telenomus-laeviceps-hymenoptera-scelionidae-a-released-biocontrol-agent-of-)

Figure 11 *Telenomus* sp. (Hymenoptera) are solitary wasps and do not form a colony. A wasp lays a larva in an egg of one of its victim species, generally bugs from the genus *Triatoma*, using an ovipositor. This stops the development of the host egg. The larvae develop for around 30 days before finally hatching from its host egg. The adult *Telenomus* would have a variable life span in less than 3 days but with the potential of up to 40 days; (https://en.wikipedia.org/wiki/File:Telenomus_sp_(1).jpg)

Objective

The objective of this work is to investigate the biology, ecology, habitat, geographic distribution, Taxonomy, life cycle, Phenology, biological control, and work carried out on the Evaniidae Family (Insecta: Hymenoptera).

2. Methods

The method used to prepare this mini review was Marchiori 2021 methodology [14].

3. Studies conducted and selected

3.1. Study 1

The aim of this study was to know the families of parasitoid Hymenoptera and their frequency in a reforestation of *Eucalyptus grandis,* on the edge (transition between eucalyptus and native forest) and in a fragment of native forest adjacent to it.

Twenty-seven collections were carried out from March 1997 to March 1998, with the capture of 2,099 parasitoid hymenoptera, from nine superfamilies (Ceraphronoidea, Chalcidoidea, Chrysidoidea, Cynipoidea, Evanioidea, Ichneumonoidea, Platygastroidea, Proctotrupoidea) and 26 families. The most abundant superfamilies were Ichneumonoidea and Chalcidoidea, with 1,029 and 507 individuals, which represented 49.02 and 24.15% of the total collected, respectively. The families Ichneumonidae and Braconidae had higher numbers of individuals (577 and 452), representing 27.49 and 21.53% of the collected parasitoids respectively.

Although the Ichneumonidae family had the largest number of individuals, Braconidae had the largest number of morphospecies and representatives of these two families were collected at all sampling points. The superfamily Chalcidoidea had individuals from 12 families (Chalcididae, Encyrtidae, Eucharitidae, Eulophidae, Eupelmidae, Eurytomidae, Mymaridae, Perilampidae, Pteromalidae, Signiphoridae, Torymidae and Trichogrammatidae), with Eulophidae (18815), with higher numbers than 81% of individuals. On the other hand, the Signiphoridae and Trichogrammatidae families had only one individual collected for each of them (Figure 12).

Figure 12 Trap used in the experiment: Malaise trap; (Source: https://www.nhbs.com/malaise-trap)

Scelionidae, from the superfamily Platygastroidea, had 1 7.82% of the individuals captured, with 374 individuals, while the Platygasteridae family had only 0.62%, with 13 individuals. The Dryinidae family had the largest number of individuals of the superfamily Chrysidoidea, with 1.05% of the individuals collected, while Bethylidae and Chrysididae had three and 11 individuals respectively. The individuals from the superfamily Cynipoidea belong to the families Eucoilidae (37) and Figitidae (1). The superfamilies with smaller numbers of individuals were Ceraphronoidea, Evanioidea, Proctotrupoidea and Vespoidea.

The parasitoid Hymenoptera were collected throughout the year, with most of them in April, August and September with 299, 390 and 276 individuals respectively. The number of individuals from parasitoid Hymenoptera was higher on the edge, followed by eucalyptus and native forest with 267.00, 186.00 and 149.67 respectively. The families Ichneumonidae, Braconidae, Eulophidae, Chalcididae and Pteromalidae had greater abundance at the edge with 70.00; 77.50; 20.50; 14.50 and 10.00 individuals respectively, while the Scelionidae Family was more abundant in eucalyptus with 41.17 individuals [14].

3.2. Study 2

3.2.1. Study of Biology of Scelionidae

Scelionidae's main characteristic is its development inside the host's egg, that is, before causing any harm to the plants. In addition, these parasitoids can reach the pest in all regions of the plant, unlike insecticides, which are often not efficient because they do not reach the pests protected in the lower canopy of the plants, where they are protected between the leaves (Figures 13, 14 and 15).

These factors highlight the economic importance of these parasitoids in the biological control of pest insects. In this family, insects have parasite specificity, that is, each species attacks only one host family. It has the ability to search for hosts and a parasitoid per egg emerges, however, if superparasitism occurs, the first instar larvae will compete with each other and only one will complete its cycle per egg, however, if superparasitism occurs, the first instar larvae will compete with each other and only one will complete its cycle [15, 16].

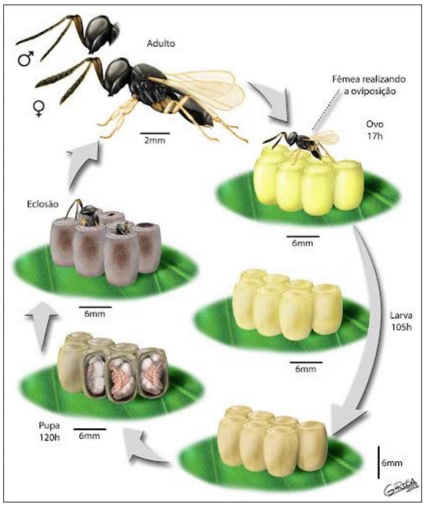

Figure 13 *Telonomus podisi* (Ashmead, 1893) development cycle in *Euschistus heros* (Fabricius, 1798) (Hemiptera, Pentatomidae) eggs; (Source G. Rosa, 2012)

Figure 14 Bedbug control with Scelionidae in soybean; (Source: https://gebio.com.br/campo/controle-de-percevejos-com-telenomus-podisi-em-soja/)

Figure 15 The egg parasitoid Scelionidae; (Source: https://www.researchgate.net/figure/O-parasitoide-de-ovos-Telenomus-podisi_fig2_239543766)

3.3. Study 3

Study of the Bioecology of *Telonomus podisi* (Ashmead, 1893) (Figure 16).

Figure 16 Important natural enemies, wasps parasitize eggs that would give rise to caterpillars; (Source: Photo: RR Rufino)

The egg parasitoid *T. podisi* is a free-living microhymenoptera that feeds on nectar or honey. It is approximately 1 mm long, black in color, its sexual dimorphism is through the antennae, females have a nailed antenna and threadlike male and, develops inside the egg of different hosts of the Pentatomidae, Scutelleridae and Coreidae family showing its adaptation to different hosts and climatic condition [17,18].

They are present throughout the year, due to the availability of alternative hosts, and in abundance in soybean crops, due to the *E. heros* population, which has always been considered the preferred host. The biological cycle of this parasitoid lasts around 10 to 13 days when they are subjected to temperatures between 25 and 32°C, passing through the egg, larva and pupae stages inside the host eg (Figure 17) [18,19].

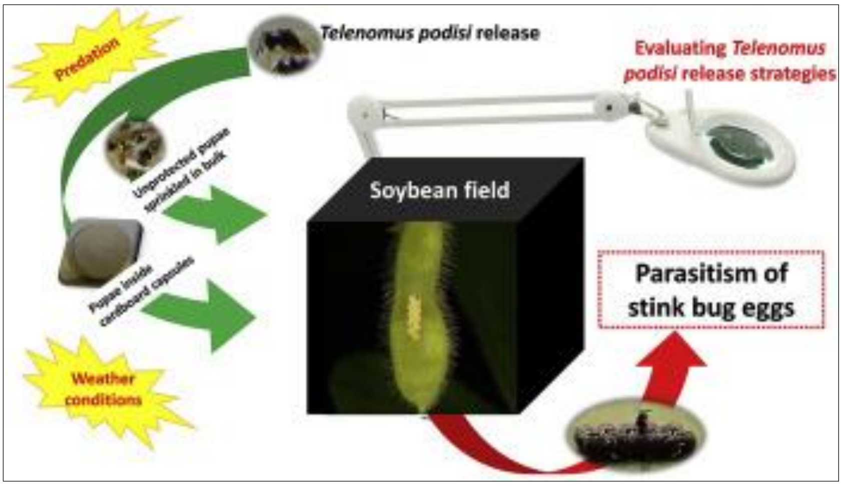

Figure 17 Release of the egg parasitoid *Telonomus podisi* (Ashmead, 1893) to manage the Neotropical Brown stink bug, *Euschistus heros* (Fabricius, 1798), in soybean production; (Source: https://www.sciencedirect.com/science/article/abs/pii/S026121942030243X)

When females find a mass of eggs, they bring the antenna closer to their host, examine and insert their ovipositor into the base of the egg. Then, make the marking, passing the ovipositor over the chorion, to avoid superparasitism. The process takes about 5 to 8 minutes (Figures 18 and 19).

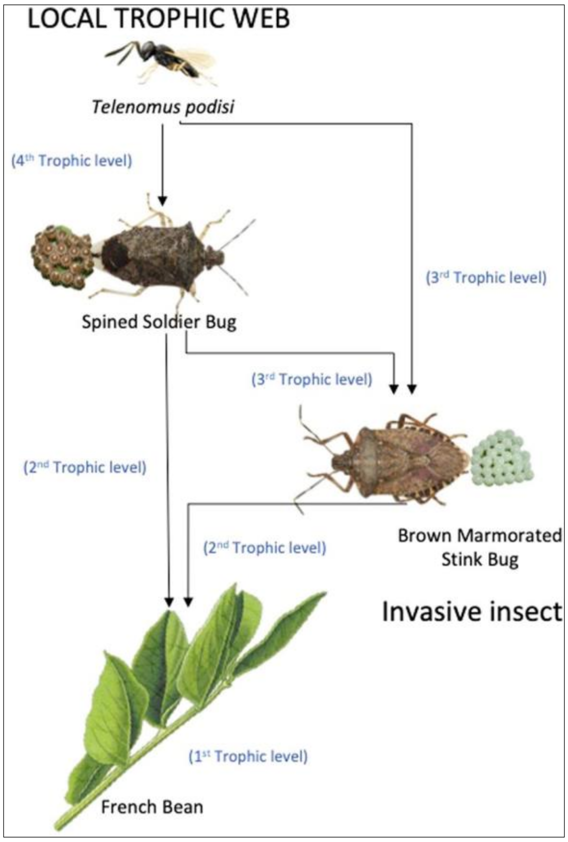

Figure 18 Schematic diagram of the studied multitrophic system. The arrows refer how species relate to each other; (Source: https://www.researchgate.net/figure/Schematic-diagram-of-the-studied-multitrophic-system-The-arrows-refer-how-species-relate_fig1_337920820)

Figure 19 We reared a *Telenomus* species from eggs of *Bombyx mandarina* (Moore, 1872) (Lepidoptera: Bombycidae) and *Bombyx mori* (Linnaeus, 1758) (Lepidoptera: Bombycidae) in Japan, and from eggs of *B. mandarina* in Taiwan; (Source: https://europepmc.org/article/pmc/pmc6080068#similar-articles)

The development is noticeable due to the change in the color of the host's eggs, as in the eggs of *Dichelops melacanthus* (Dallas, 1851) (Hemiptera: Pentatomidae) (green color), which when they are parasitized change to gray and then to black, which is the same color as the adult parasitoids. Males are the first to emerge, one to two days earlier than females, and are attracted to copulation as soon as they begin chewing the chorion. *T. podisi* females have an average fecundity of 104 eggs, deposited mainly in the first days of life, in *Euschistus heros* (Fabricius, 1798) (Hemiptera, Pentatomidae) eggs [20,21,22].

Females of *T. podisi* have an average fecundity of 104 eggs, deposited mainly in the first days of life, in eggs of *E. heros*. The maximum period of oviposition is 18 days and the production of more offspring is in the first 24 hours of life, however, they found that on the second day the production of offspring was greater. In eggs produced in the first days it is possible to observe a higher proportion of females than males, but as the female age increases, there is an inversion in this proportion. *T. podisi* presents a preference for the brown stink bug *E. heros.* The natural incidence of these parasitoids in soybean crops is directly associated with the management practices adopted in the culture, since they are sensitive insects to the use of non-selective chemical products (Figure 20).

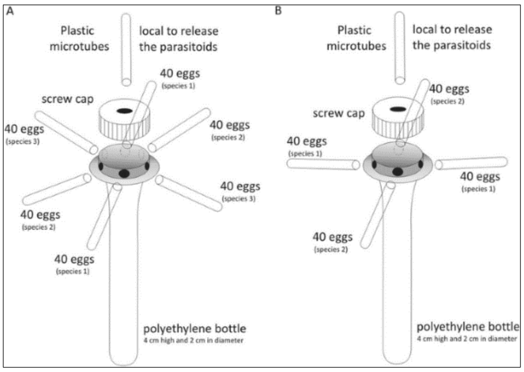

Figure 20 Host preferences of *Telenomus podisi* Ashmead, 1893 (Hymenoptera: Scelionidae): Parasitism on eggs of *Dichelops melacanthus* (Dallas, 1851) (Hemiptera), *Euschistus heros* (Fabricius, 1798) (Hemiptera, Pentatomidae), and *Podisus nigrispinus* (Dallas, 1851) (Hemiptera: Pentatomidae); (Source: https://link.springer.com/article/10.1007/s13744-017-0564-5)

This parasitoid is a solitary parasitoid that develops in eggs of gregarious hosts (bed bugs) in the field, including herbivorous and predatory species found *T. podisi* in eggs of *Podisus nigrispinus* (Dallas, 1851) (Hemiptera: Pentatomidae) in *Eucalyptus* plantation, found the parasitoid in eggs of *E. heros*, *Piezodorus guildinii* (Westwood, 1837) and *P. nigrispinus* in soybean. But their preference for certain hosts may be due to the predominance of a certain host species with greater abundance, for example, in soybeans, *T. podisi* has a preference for the brown stink bug *E. heros* [23,24,25].

4. Conclusion

Biology of Scelionidae Scelionid wasps are idiobiont endoparasitoids of spider eggs, mainly araneids and teridids, and of insects odonates, orthopterans, mantles, embypterans, hemipterans, neuropterans, coleopterans, dipterans and lepidopterans. Its females have an ovipositor that acts as a hypodermic needle, allowing it to pierce the chorion of the host's egg and lay eggs. The parasitoid larvae consume the host's tissues and thrusts within it, with one adult emerging in solitary species or several adults (five to 10 parasitoids per egg) in gregarious species.

References

[1] Bianco S, Gaiad JL, Oliveira G. Cultura do fumo: manejo integrado de pragas e doenças. 1th ed. Santa Cruz do Sul: Souza Cruz. 1998.

[2] Masner L. Revisionary notes and keys New World genera of Scelionidae (Hymenoptera: Proctotrupoidea). Memoirs of the Entomological Society of Canada. 1976; 97: 1- 87.

[3] Masner L. Superfamily Platygastroidea. Hymenoptera of the World: An identification guide to families. 1th ed. Ottawa: Agriculture Canada Publications. 1993.

[4] Austin AD. Morphology and mechanics of the ovipositor system of *Ceratobaeus* Ashmead (Hymenoptera: Scelionidae) and related genera. International Journal of Insect Morphology and Embryology. 1983; 2(2- 3): 139-155.

[5] Masner L. Pleural morphology in scelionid wasps (Hymenoptera: Scelionidae) an aid to higher classification. The Canadian Entomologist. 1979; 111: 1079- 1087.

[6] Masner L. Key to genera of Scelionidae of the Holarctic region, with descriptions of new genera and species (Hymenoptera: Proctotrupidea). Memoirs of the Entomological Society of Canada. 1980; 113: 1- 54.

[7] Austin AD, Field AD. The ovipositor system of scelionid and platygastrid wasps (Hymenoptera: Platygastroidea): comparative morphology and phylogenetic implications. Invertebrate Taxonomy. 1997; 11: 1- 87.

[8] Austin AD, Johnson NF, Dowton M. Systematics, evolution, and biology of scelionid and platygastrid wasps. Annual Review of Entomology. 2005; 50: 553- 583.

[9] Fernando-Fernández C. Ibero-American project of Biogeography and Systematic Entomology: PRIBES, Works of the 1st ed. Ibero-American Workshop of Systematic Entomology. Zaragoza: Aragonese Entomological Society. 2000.

[10] Sivinski J, Aluja M. The evolution of ovipositor length in the parasitic Hymenoptera and the search for predictability in biological control. The Florida Entomologist. 2003; 86(2): 143- 150.

[11] DallOglio TO, Zanuncio CJ, Freitas A, Fernando PR. Parasitoid hymenoptera collected in a *Eucalyptus grandis* stand and native forest in Ipaba, Minas Gerais state. Forest Science. 2003; 13(1): 123-129.

[12] Bueno AF, Sosa-Gomez DR, Côrrea-Ferreira BS, Moscardi F, Bueno RCOF. Inimigos naturais das pragas da soja. Brasília: Embrapa. 2012.

[13] Marchiori CH. Biology and feeding behavior of ceratopogonid adult (Diptera: Ceratopogonidae). International Journal of Frontiers in Science and Technology Research. 2021; 1(2): 007–024.

[14] Nakama PA, Foerster LA. Effect of Temperature alternation on the development and emergence of *Trissolcus basalis* (Wollaston) and *Telenomus podisi* Ashmead (Hymenoptera: Scelionidae). Neotropical Entomology. 2001; 30: 269-275.

[15] Johnson NF. Systematics of Nearctic *Telenomus*: classification and revisions of the podisi and pbymatae species groups (Hymenoptera: Scelionidae). Bulletin of the Ohio Biological Survey. 1984; 6: 113.

[16] Margaría CB, Loiácono MS, Lanteri AA. New geographic and host records for scelionid wasps (Hymenoptera: Scelionidae) parasitoids of insect pests in South America. Zootaxa. 2009; 2314: 41-49.

[17] Colazza S, Rosi MC, Sebastiani P, Ursini M. Host acceptance behavior in the egg parasitoid *Trissolcus basalis* (Hymenoptera: Scelionidae). Acta Oecol. 1996; 17(2): 109-125.

[18] Quicke DLJ. Parasitic wasps. 1th ed. London: Chapmann & Hall. 1997.

[19] Godfray HCJ. Parasitoids behavioral and evolutionary ecology. Princeton: University Press. 1994.

[20] Medeiros MA, Schimidt FVG, Loiácomo MS, Carvalho VFBM. Parasitismo e predação em ovos de *Euschistus heros* (Fab.) (Heteroptera: Pentatomidae) no Distrito Federal, Brasil. Anais da Sociedade Entomologica do Brasil. 2007; 26(2): 397-401.

[21] Correa-Ferreira BS. Natural occurrence of the parasitoid complex from soybean stink bug eggs in Paraná. Annals of the Entomological Society of Brazil. 1986; 15: 189-199.

[22] Pacheco DJP, Corrêa-Ferreira BS. Reproductive potential and longevity of the parasitoid *Telenomus podisi* Ashmead, in eggs of different bedbug species. Annals of the Entomological Society of Brazil. 1998; 27: 585-591.

[23] Pacheco DJP, Corrêa-Ferreira BS. Parasitism of *Telenomus podisi* Ashmead (Hymenoptera: Scelionidae) in populations of soybean pests. Annals of the Entomological Society of Brazil. 2000; 29: 295-302.

[24] Peres WAA, Corrêa-Ferreira BS. Methodology of mass multiplication of *Telenomus podisi* Ashmead and *Trissolcus basalis* (Hymenoptera: Scelionidae) on eggs. Neotropical Entomology. 2004; 33: 457-462.

[25] Yeargan KV. Reproductive capability and logenvity of the parasitic wasps *Telenomus podisi* and *Trissolcus euschisti*. Annals of the Entomological Society of America. 1982; 75:181-183.