

Life history of Tenthredinidae Family (Insecta: Hymenoptera)

Carlos Henrique Marchiori *

Instituto Federal Goiano, Biology, Parasitology, Goiânia, Goiás, Brazil.

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Abstract

Tenthredinidae (sometimes called sawfly or sawhorse wasps), Tenthredinidae, are a family of Hymenoptera of the suborder Symphyta. It is the largest family of the Tenthredinoidea superfamily with more than 7,500 species in 600 genera. Some species are leaf miners, stem borers, or gall formers. The larvae that feed on the outside of plants resemble Lepidopteran caterpillars. The aim of this manuscript was to carry out an inventory of the Tenthredinidae Family (Insecta: Hymenoptera) related to its conceptual aspects such as biogeography, ecology, habitat, geographic distribution, life cycle, phenology and also taxonomic aspects. To this end, a bibliographic survey of Ichneumonidae was carried out in the years 1937 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: Herbivorous; Larvae; Gall formers; Lepidopteran; Feed

1 Introduction

1.1. Description

Tenthredinidae (sometimes called sawfly or sawhorse wasps), Tenthredinidae, are a family of Hymenoptera of the suborder Symphyta. It is the largest family of the Tenthredinoidea superfamily with more than 7,500 species in 600 genera (Figures 1A, 1B and 2) [1].



Figure 1A Specimens of Tenthredinidae; (Source: [https://commons.wikimedia.org/wiki/File:Selandria_serva_\(Tenthredinidae\)_\(imago\),_Nijmegen,_the_Netherlands.jpg](https://commons.wikimedia.org/wiki/File:Selandria_serva_(Tenthredinidae)_(imago),_Nijmegen,_the_Netherlands.jpg))

* Corresponding author: Carlos Henrique Marchiori
Instituto Federal Goiano, Biology, Parasitology, Goiânia, Goiás, Brazil.



Figure 1B Specimens of Tenthredinidae Family; (Source; <https://www.sciencedirect.com/science/article/abs/pii/S1226861518306010>)

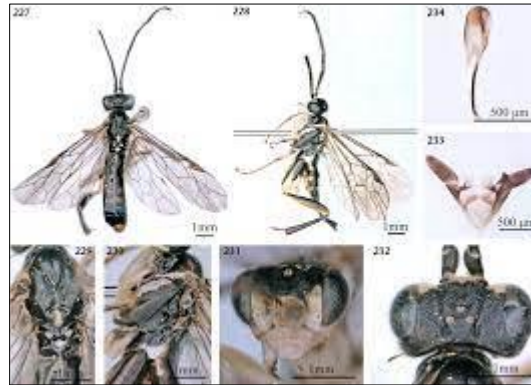


Figure 2 Male: (227) dorsal view; (228) side view; (229) mesonotum and metanotum, dorsal view; (230) mesopleuron and metapleuron, lateral view; (231) head, front view; (232) head, dorsal view; (233) harpe and parapsis; (234) penis valve; (Source: Zhong Y, Li Z, Wei M. Review of the *Pachyprotasis flavipes* group (Hymenoptera: Tenthredinidae) from China with descriptions of two new species. Zoologia. 2021; 38: 1-50)

The vast majority of larvae are herbivorous; They feed mainly on the foliage of trees and shrubs. Some species are leaf miners, stem borers, or gall formers. The larvae that feed on the outside of plants resemble lepidopteran caterpillars with several pairs of false legs on the abdomen, while those that live inside lack such legs. They generally overwinter in the pupal stage, hidden in the ground. Adults need very little food (Figure 3) [1].

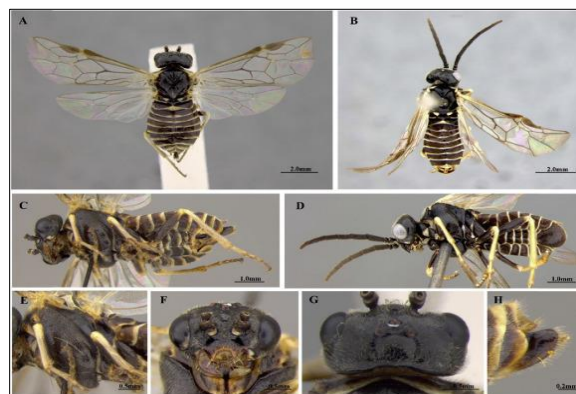


Figure 3 *Dinax ermak* (Zhelochovtsev, 1968). (A, C, E–H) female; (B, D) male: A–B, habitus in dorsal view; C–D, habitus in lateral view; E, thorax in lateral view; F, head in frontal view; G, head in dorsal view; H, ovipositor sheath; (Source: Zhong Y, Li Z, Wei M. Review of the *Pachyprotasis flavipes* Hartig, 1837, group (Hymenoptera: Tenthredinidae) from China with descriptions of two new species. Zoologia. 2021; 38: 1-50)

The diagnostic characters of the family are difficult to describe. For its identification one depends on the combination of the following features: 5 to 9 antennal segments or artifacts (flagellomeres) plus a well-defined separation between the terga of the first abdominal segment and the metapleura. Tenthredinidae are often black or brown, sometimes brightly colored, between 3 and 20 mm long. Like other members of Symphyta they lack the narrowing or petiole (wasp waist)

between the thorax and the abdomen, which differentiates them from wasps, ants and bees, members of Apocrita. The two sexes often differ markedly in color (Figures 4 and 5) [1,2].

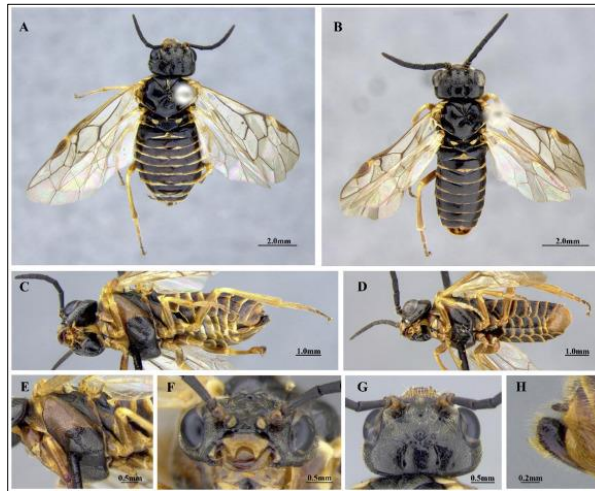


Figure 4 *Dinax jakowleffi* Konow, 1987. (A, C, E–H) female; (B, D) male: A–B, habitus in dorsal view; C–D, habitus in lateral view; E, thorax in lateral view; F, head in frontal view; G, head in dorsal view; H, ovipositor sheath; (Source: Park B et al. Discovery of the genus *Dinax* Konow (Hymenoptera: Symphyta: Tenthredinidae: Allantinae) in Japan and South Korea. Journal of Asia-Pacific Biodiversity; 2018; 11: 595e599596)

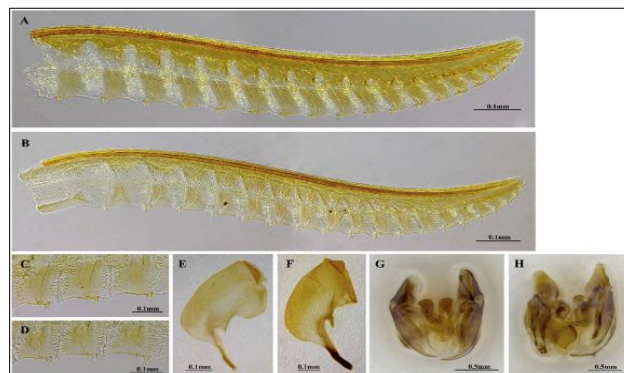


Figure 5 Genitalia of *Dinax* spp. (A, C, E, G) *Dinax ermak* (Zhelochovtsev, 1968); (B, D, F, H) *Dinax jakowleffi* Konow, 1987: A–B, lanceet; C–D, serrulae 2–4 of lanceet; E–F, penis valve; G–H, genital capsule (without penis valves); (Source: Park B et al. Discovery of the genus *Dinax* Konow (Hymenoptera: Symphyta: Tenthredinidae: Allantinae) in Japan and South Korea. Journal of Asia-Pacific Biodiversity; 2018; 11: 595e599596)



Figure 6 Larva of Hymenoptera from Tenthredinidae family called sawflies on cereals; (Source: <https://www.shutterstock.com/pt/image-photo/larva-hymenoptera-tenthredinidae-family-called-sawflies-1046096017>)

Females use their saw-shaped ovipositor to pierce the bark of stems and to deposit their eggs. This damages the trees. They are common in meadows and open spaces in forests and near fast-flowing streams (Figure 6) [3,4].

1.2. Diet

They are common in meadows and in forest clearings near rapid streams. The adults eat little, while the larvae feed on the foliage of riverside trees and shrubs, especially willows. Several species and genera have been described from the fossil record, such as *Eriocampa tulameenensis* Rice 1968 and *Pseudosiobla campbelli* Rice, 1968 from British Columbia. Many of the nearartic species of Symphyta. Females use their saw-like ovipositors to cut slits in the bark of branches into which the translucent eggs are embedded, which damages the trees. They are common in meadows and in forest clearings near rapid streams. The adults eat little, while the larvae feed on the foliage of riverside trees and shrubs, especially willows (Figure 7) [4,5].



Figure 7 Tenthredinidae diet and damage; (Source: <https://www.englishseekho.org/word/meaning-of-Tenthredinidae-in-hindi>)

1.3. Life cycle

The female ingests her eggs on the leaves in May, and the larva obviously hatch now. After eating for a matter of two to three weeks, the larva falls to the ground to form a pupa from which it emerges in the spring of the following year. There is only one generation per year (Figures 8, 9, 10 and 11) [5,6].



Figure 8 *Cladius difformis* (Panzer, 1799) Life cycle: larva, pupa, dorsal view, pupa, ventral view, female and male; (Source: <https://stringfixer.com/pt/Tenthredinidae>)



Figure 9 24 habitat where host plants occur (circles) 25 three freshly laid purple eggs on abaxial of mature old frond 26 freshly laid yellow eggs on abaxial of young frond of soft primary vein (note: frond was flipped upside-down for photography) abaxial of showing pierced holes of oviposition (arrows), ca. 0.2 mm 28 middle stage (3-day old) purple orange and yellow eggs 29 clustered mature yellow eggs showing developing larva in each (note: mandibles stemmata, and thoracic legs are seen in reddish brown 30 just hatched first instar larvae (2.6–2.7) mm long, n=30), an egg with developed larva inside (black stemmata), and remaining shrunk egg shells; (Source: Smith DR, Nishida K. A new genus and three new species of Neotropical sawflies (Hymenoptera, Tenthredinidae) from Costa Rica, with host plants and life history notes. *Journal of Hymenoptera Research*. 2019; 72: 45-75)



Figure 10 31 early stage first instar larvae on abaxial blade and feeding scar as hole(s) on young frond (note green internal color of larva) 32 early stage first instar larvae scrape-feeding on abaxial blade of mature frond 33 middle instar larvae feeding on sorus on mature tough frond (note brown internal color of larva) 34 last feeding instar larvae, lateral view 35 last feeding instar larvae, dorsal view 36 cocoon (ca. 12 mm long) spun on surface of dry, mossy branch (enclosed in oval circle) 37 pupa in situ (cocoon is cut to show pupa); (Source: Smith DR, Nishida K. A new genus and three new species of Neotropical sawflies (Hymenoptera, Tenthredinidae) from Costa Rica, with host plants and life history notes. *Journal of Hymenoptera Research*. 2019; 72: 45-75)

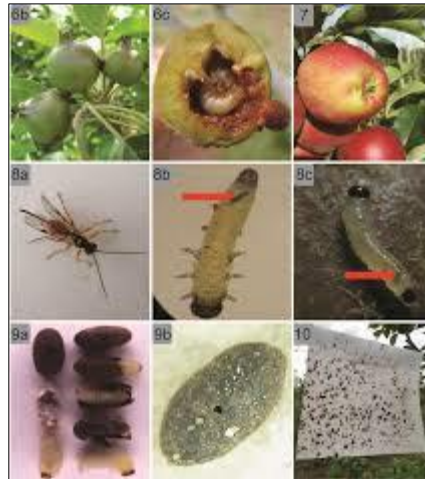


Figure 11 Female ASF ovipositing in an apple flower; (2) ASF caught on sticky trap, (2a) ventral view of male and (2b) female; (3a) External appearance of fresh oviposition scar shown by red arrow, (3b) tissues of fruitlet receptacle under egg deposition, (3c) as revealed by dissection, (3d) ASF egg in receptacle as revealed by dissection, (3e) ASF egg development (after Kuenen and van de Vrie 1951; see also Trapman, 2016b); (4) ASF mature larva; (5a) ASF primary damage early season, (5b) late season; (6a) Migrating ASF larva and secondary damage showing frass near entry and exit holes, (6b) one ASF larva can damage several nearby fruitlets, (6c) fruitlet; (Source: <http://www.bulletinofinsectology.org/pdfarticles/vol72-2019-035-054vincent.pdf>)

1.4. Management

From a pest management standpoint on the Central Coast, the slight damage we see on the leaf is usually not detrimental to the plant and is limited to two to three weeks anyway. However, growers who are concerned about contamination of harvested fruit from a heavy infestation of this wasp may want to treat with an insecticide (Figure 12) [5,6].

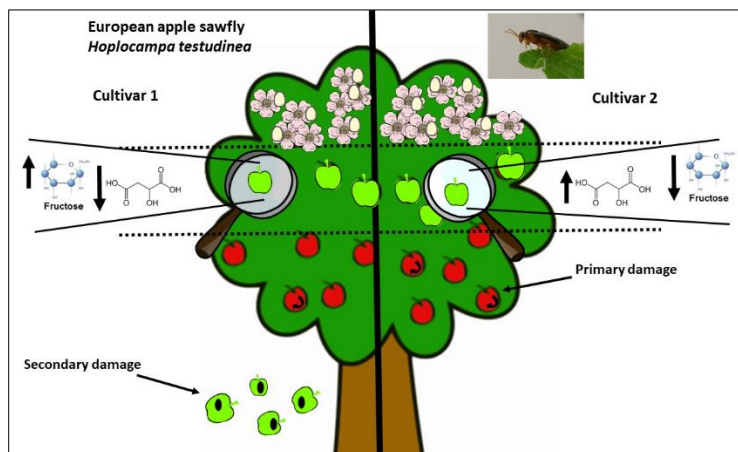


Figure 12 Many insect species show a preference for specific varieties or cultivars within a host plant type, e.g., apple. The European apple sawfly, *Hoplocampa testudinea* (Klug, 1816) was found to show preference for apple cultivars in Nova Scotia in 2013 and 2014. We hypothesized that this preference could result from either the female selecting specific cultivars for egg deposition or differential survival of the larvae on these cultivars; (Source: Blatt S, Hiltz K. A New Look at Cultivar Preference in *Hoplocampa testudinea* (Klug, 1816) (Hymenoptera: Tenthredinidae) on Apple in the Annapolis Valley of Nova Scotia. Canada Insects. 2021; 12(769): 1-18)

1.5. Taxonomy

Tenthredinidae is divided into seven subfamilies. Of the 430 genera, nine contain more than 50 species. Subfamilies: Allantinae, Blennocampinae, Heterarthrinae, Nematinae, Selandriinae - (includes Dolerinae), Susaninae and Tenthredininae (Figure 13A) [7,8,9].

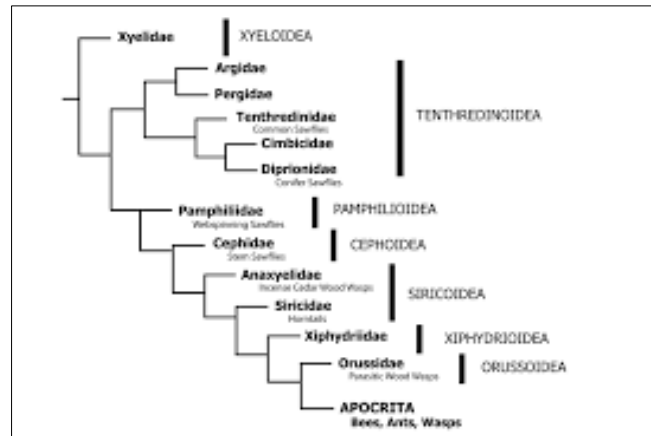


Figure 13A Sawfly: Tenthredinidae classification; (Source: https://idtools.org/id/sawfly/sawflies_classification.php)

1.6. Phylogeny

Of these subfamilies, Tenthredininae and Allantinae are sister groups and in turn form a sister group to Nematinae (Figure 13B) [9,10].

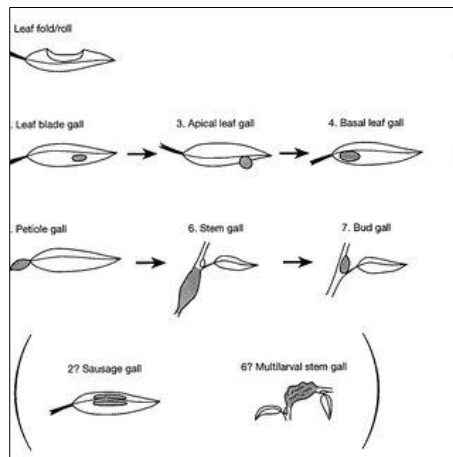


Figure 13B The different gall types induced by nematine sawflies on willows. Arrows indicate the Price-Roininen hypothesis of how the gall types have evolved. The three genera of nematines are indicated to the left of the gall type figures; (Source: Price 1992; see also Roininen 1991a, Price & Roininen 1993)

1.7. Some species

Among the best-known wasps or sawfly is the rose slug *Cladius difformis* (Panzer, 1799), which feeds on rose leaves. The larvae distinguish the types of bushes. The larch sawfly *Pristiphora erichsonii* (Hartig, 1837) lays its eggs on these trees, which the larvae leave without leaves (Figures 14 and 15) [11,12].



Figure 14 *Cladius difformis* (Panzer, 1799); (Source: <https://www.marylandbiodiversity.com/view/11776>)



Figure 15 *Pristiphora erichsonii* (Hartig, 1837); (Source: https://www.dkbdigitaldesigns.com/clm/species/pristiphora_erichsonii)

Objective

The aim of this manuscript was to carry out an inventory of the Tenthredinidae Family (Insecta: Hymenoptera) related to its conceptual aspects such as biogeography, ecology, habitat, geographic distribution, life cycle, phenology and also taxonomic aspects.

2 Methods

The method used to prepare this mini review was Marchiori 2021 methodology [13].

3 Studies conducted and selected

3.1. Study 1

3.1.1 Family Representative

Nematus oligospilus Förster, 1854 (Figures 16 and 17) [13].

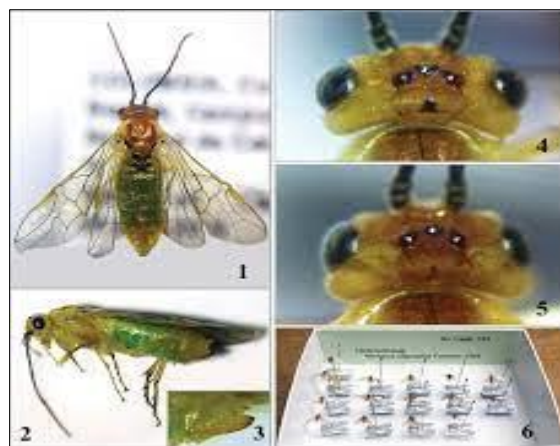


Figure 16 *Nematus oligospilus* Förster, 1854, ♀, reared from immatures collected on *Salix humboldtiana* (Salicaceae) in Bogotá, Colombia. 1. Dorsal view 2 Lateral view 3 Ovipositor sheath, lateral view 4 Vertex with a conspicuous black spot 5 Vertex with a reduced black spot 6 Housed specimens at the Entomological Museum UNAB (Catal. Number 733); (Source: Malagón-Aldana LA, Francisco S, Smith DR. On the natural history of the willow sawfly *Nematus oligospilus* (Hymenoptera, Tenthredinidae) inhabiting *Salix humboldtiana*, in Colombia. Journal of Hymenoptera Research. 2017; 55: 189-199.)

Family Tenthredinidae It is a very numerous group, of medium or small size, rarely more than 20 mm in length. The larvae are eruciformes and the majority feed on the superficial portion of the leaves. In general, there is one generation per year and the winter is spent inside a cocoon in the ground or in a sheltered place. Females have a serrated ovipositor used to Pierce branches and lay eggs.



Figure 17 Larva of willow sawfly, *Nematus oligospilus* Forster, 1854 (Hymenoptera: Tenthredinidae) feeding (damage) on leaf of weeping willow, *Salix babylonica* (Salicaceae); (Source: Image: Tim Holmes © Plant & Food Research)

They are found feeding on the leaves of trees and shrubs. They can be recognized by the habit of bending the abdomen over the body or under the margin of the mouth when feeding leaf.

3.2. How to recognize the Family?

Larva features: eruciform larva (with distinct head, three pairs of thoracic legs and more than five pairs of false legs).

Adult feature: sessile abdomen; anterior tibiae with two spurs; from five to nine antennal segments; measure from mm to 20 mm in length; generally black or brown in color [14].

3.3. Study 2



Figure 18 Male; (Source: https://artigos.wiki/blog/en/Cladius_difformis)



Figure 19 Female; (Source: https://artigos.wiki/blog/en/Cladius_difformis)

Cladius difformis (Panzer, 1799), the bristly pink slug, is a species of common fly in the family Tenthredinidae. They pass through several generations a year. May cause damage to roses, raspberries and strawberries. Native to the Palearctic, probably accidentally introduced into the Nearctic (Figures 18, 19, 20 and 21) [15].



Figure 20 Pupa; (Source: https://artigos.wiki/blog/en/Cladius_difformis)



Figure 21 Larva; (Source: https://artigos.wiki/blog/en/Cladius_difformis)

3.4. Study 3

The objective of this study was to identify the Tenthredinoidea collected in a Cerrado fragment, evaluate their population fluctuation and the collection methodologies used.

Sampling of Tenthredinoidea was carried out between Malaise traps, active in the field all the time, and 20 Moericke traps and 24 soil traps (pitfall type), active for one week per month (Figures 22, 23 and 24) [16].



Figure 22 Malaise trap; (Source: <https://marizetedobrasil.loja2.com.br/1463374-Armadilha-de-Malaise-teto-preto-com-detalhe->)

Fifty-four specimens of Tenthredinoidea were collected from two families: Pergidae (53 specimens/ 98.1% of the total) and Tenthredinidae (one/1.9%). The only copy of Tenthredinidae was identified as *Adiaclema* Enderlein (Selandriinae); the low frequency of that family corroborates reports that its species diversity is small in the neotropical region. The objective of this study was to identify the Tenthredinoidea collected in a Cerrado fragment, evaluate their population fluctuation and the collection methodologies used [16].

From Pergidae, four genera of Acordulecerinae were identified: *Acordulecera* Say (five specimens / 9.3% of the total), *Acorduloceridea* Rohwer (four / 7.4%), *Tequus* Smith (three / 5.6%) and *Sutwanus* Smith (two / 3.7%) and two from Perreyiinae: *Perreyia* Brullé (38 specimens / 70.4% of the total) and *Perreyiella* Conde (one / 1.9%) [16].



Figure 23 Moericke trap; (Source: <https://repositorio.ufscar.br/bitstream/handle/ufscar/9444/DissDFS.pdf?sequence=1&isAllowed=y>)



Figure 24 Pitfall trap; (Source: http://www.biologico.sp.gov.br/uploads/docs/bio/v78_1/marchiori.pdf)

3.5. Some Species (Morphology))



Figure 25 *Allantus togatus* (Panzer, 180)



Figure 26 *Athalia cordata* Serville, 1823



Figure 27 *Athalia cornubiae* Benson, 1931



Figure 28 *Cladius brullei* (Dahlbom 1835)



Figure 29 *Craesus septentrionalis* (Linnaeus, 1758)



Figure 30 *Macrophya punctumalbum* (Linnaeus, 1767)



Figure 31 *Rhogogaster viridis* (Linnaeus, 1758)



Figure 32 *Selandria serva* (Fabricius, 1793)

4 Conclusion

The vast majority of larvae are herbivorous; They feed mainly on the foliage of trees and shrubs. Some species are leaf miners, stem borers, or gall formers. The larvae that feed on the outside of plants resemble Lepidopteran caterpillars with several pairs of false legs on the abdomen, while those that live inside lack such legs. They generally overwinter in the pupal stage, hidden in the ground. Adults need very little food.

References

- [1] Davis RB, Baldauf SL, Mayhew PJ. The origins of species richness in the Hymenoptera: insights from a family-level supertree. *BMC Evolutionary Biology*. 2010; 10(1): 109.
- [2] Rice HMA. Two tertiary sawflies, (Hymenoptera – Tenthredinidae), from British Columbia. *Geological Survey of Canada*. 1968; 67(59): 1-21.
- [3] Borror DJ, DeLong DM, Triplehorn CA. An introduction to the study of insects. Holt, Rinehart and Winston. 4th ed. New York: Holt, Rinehart and Winston. 1976.
- [4] Bolda M. Wasps of the family Tenthredinidae in the *Mora* (Raspberry) of the Central Coast. Berkely: University of California. 2012.
- [5] Müller C, Agerbirk N, Olsen CE, Boevé JL, Schaffner U. Brakefield Sequestration of host plant glucosinolates in the defensive hemolymph of the sawfly *Athalia rosae*. *Journal of Chemical Ecology*. 2001; 27(12): 2505–2516.
- [6] Müller C, Boevé JL, Brakefield PM. Host plant derived feeding deterrence towards ants in the turnip sawfly *Athalia rosae*. In: Nielsen JK, Kjær C, Schoonhoven L.M. Proceedings of the 11th International Symposium on Insect-Plant Relationships. Series Entomologica. 2002; 57.
- [7] Naito T, Suzuki H. Sex determination in the sawfly, *Athalia rosae ruficornis* (Hymenoptera): occurrence of triploid males. *Journal of Heredity*. 1991; 82(2): 101–104.
- [8] Oishi K, Sawa M, Hatakeyama M, Kageyama Y. Genetics and biology of the sawfly, *Athalia rosae* (Hymenoptera). *Genetica*. 1993; 88(2–3): 119–127.
- [9] Zhong Y, Li Z, Wei M. Review of the *Pachyprotasis flavipes* group (Hymenoptera: Tenthredinidae) from China with descriptions of two new species. *Zoologia*. 2021; 38: 1-50.
- [10] Park B, et al. Discovery of the genus *Dinax* Konow (Hymenoptera: Symphyta: Tenthredinidae: Allantinae) in Japan and South Korea. *Journal of Asia-Pacific Biodiversity*. 2018; 11: 595e599596.
- [11] Smith DR, Nishida K. A new genus and three new species of Neotropical sawflies (Hymenoptera, Tenthredinidae) from Costa Rica, with host plants and life history notes. *Journal of Hymenoptera Research*. 2019; 72: 45-75.
- [12] Penteado SRC, Barbosa LR, Iede ET, Reis Filho W, Strapasson P, Linzmeier AM, Thomazini MJ. Reconhecimento e identificação das principais famílias de insetos de importância quarentenária associados a materiais de propagação e/ou madeira. 1th, ed. Colombo: Embrapa Florestas. 2009.
- [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] Malagón-Aldana LA, Francisco S, Smith DR. On the natural history of the willow sawfly *Nematus oligospilus* (Hymenoptera, Tenthredinidae) inhabiting *Salix humboldtiana*, in Colombia. *Journal of Hymenoptera Research*. 2017; 55: 189-199.
- [15] Valderrey MJL. Tenthredinidae (Arthropoda) [Internet]. Rio de Janeiro: Terraquea Nature; © 2019.
- [16] *Cladius difformis* Report [Internet]. New York: Integrated Taxonomic Information System; © 2018.