Review Article
BioGecko
Vol 12 Issue 03 2023
ISSN NO: 2230-5807

Review of family Pyralidae Latreille, 1809 (Lepidoptera: Pyraloidea)

Ahmed J. Sabr[1] and Zainab K. Taha[2]
[1] Department of Biology, College of Education for Pure Sciens Ibn Al-Haitham, University of Baghdad, Iraq.
[2] Ministry of Education, First Resafa Education Directorate, Al-Qahera Secondary School for Girls, Baghdad, Iraq.
*Corresponding author email: ahmed.j.s@ihcoedu.uobaghdad.edu.iq
https://orcid.org/0000-0001-5853-7052

Abstract
This article included a review of the family Pyralidae Latreille, 1809. This family is a large and important group of the order Lepidoptera, placed in the superfamily Pyraloidea. The Pyralidae have 5921 species within 1055 genera. It involves five major subfamilies, namely Pyralinae, Phycitinae, Epipaschiinae, Galleriinae, and Chrysauginae. The snout moths can have very important ecological roles and include many important agricultural and crop pests because of their abundance and generally phytophagous habits. Monitoring indicated that the peak activity of the adult pyralid occurred during the fourth week of August and that of the larval pyralid during the second week of September.

Keywords: *Pyralidae, pyralid moths, Pyraloidea, Review.*

Introduction

The total number of Lepidoptera species in the world exceeds 150,000, of which about 18,000 are butterflies and more than 130,000 are moths (Kristensen et al., 2007). Pyraloidea, the third-largest superfamily of the Lepidoptera following Noctuoidea and Geometroidea, is comprised of two families: Pyralidae and Crambidae. The group includes about 16,000 species worldwide, with the greatest richness in the tropics. Morphologically, the superfamily is defined by a basally scaled proboscis and the presence of abdominal tympanic organs (Solis, 2007). Pyraloidea are typically small to medium-sized moths. Most larvae feed on living plants as concealed external folivores or as stem borers. However, pyraloids are exceptionally ecologically diverse and also include detritivores, coprophages, predators, and parasites, as well as aquatic herbivores (Mitter, 2016).

The family Pyralidae Latreille, 1809, is a large and important group of insects in the Lepidoptera order and belongs to the superfamily Pyraloidea, consisting of 1055 genera with 5921 described species of the family Pyralidae belonging to five major subfamilies, namely Pyralinae, Phycitinae, Epipaschiinae, Galleriinae, and Chrysauginae (Ahmed et al. 2017).

This family is more diverse in Asia and Africa than in the western hemisphere. Most Pyralidae larvae are phytophagous, but some larvae are considered pests of crops such as sugarcane, corn and rice; stored products such as stored food, flour, seeds, grains and fodder; different things such as household goods, clothing, paper and even plastics (Jin et al. 2020).

A few larval species feed on fungi, lichens, detritus, animal products, or other insects. Because of their abundance and generally phytophagous habits, Pyralids can have very important ecological roles and include many important agricultural and farm pests. In addition, their showiness and variable life histories have resulted in them being used more extensively in biodiversity and ecological studies. Alternatively, while traditional dichotomous keys can be helpful in giving a place to start, it is difficult to see many characters due to the covering of the scales. The reliable identification of specimens often requires careful examination of the genitalia or wing venation. There are a few user-friendly dichotomous keys; however, they do not have comprehensive coverage of pyralid subfamilies and tribes (Dombroskie, 2011).

Naming of Family Pyralidae

The naming of this family has gone through several series of changes or modifications. Linnaeus (1758) first of all named it Pyrales. Stephens (1829) named them variously as Pyralidae. Hampson (1898) named it Pyralidae, and he divided it into 12 subfamilies, namely Anerastiinae, Chrysauginae,

Crambinae, Endotrichinae, Epipaschinae, Galleriinae, Hydrocampinae, Phycitinae, Pyralinae, Pyraustinae, Schoenobiinae, and Scopariinae.

Imms (1925) combined the subfamilies Pyraustinae, Schoenobiinae, Hydrocampinae, and Scopariinae under Pyraustidae, Phycitinae and Anerastiinae under Phycitidae, and Pyralinae, Chrysauginae, Endotrichinae, and Epipaschiinae under the family Pyralidae. Comstock (1950) divided this family into six subfamilies, i.e., Crambinae, Galleriinae, Nymphulinae, Phycitinae, Pyralidinae, and Pyraustinae. After that, most entomologists like Shaffer *et al.* (1996), recognized 19 subfamilies under the family Pyralidae.

Taxonomy of Pyralid species

The early history of pyralid moths can be traced through the publications of workers like Linnaeus (1758), Huebner (1816–27), and Duponchel (1836). Klima (1939) prepared a world catalog of the subfamily Pyraustinae. Nazmi (1963) provided re-descriptions of the Pyraustinae of Egypt, which include a number of species with detailed descriptions of wing venation and male and female genitalia.

The first actual record of Iraqi Pyralidae was by Derwesh (1965), who made a detailed catalog of the pyralid fauna from different parts of Iraq, which included 207 species belonging to 117 genera. This work of Derwesh was published as a list of the pyralid species at the British Museum (Natural History).

Kapur (1967) did the taxonomic studies on rice stem borers, which included 6 genera and 11 species under Crambinae, 3 genera and 5 species under Schoenobiinae, and 2 genera and 2 species under Phycitinae. This contained a key to genera, several references on genera and species, their common names, distributions, host ranges, and remarks. He illustrated the male and female genetalia of *Chilo suppressalis* (Walker), *Tryporyza incertulas* (Walker), and *T. innotata* (Walker) in detail. Heinrich (1994) published a book entitled "Biology and Management of Rice Insects," where he provided and illustrated keys to identifying lepidopterous insects in addition to their general distributions, alternate host plants, biology and seasonal prevalence, nature of damage, and control strategies. Shaffer *et al.* (1996) prepared a checklist of Australian Pyralidae in which they proposed a number of new combinations and several new synonymies of genera and species.

Methaq (2021) made a taxonomic study of the pyralids of Iraq on six species placed in four genera: *Galleria mellonella* Linnaeus, 1758; *Achroia grisella* Fabricius, 1794; *Arenipses sabella* Hampson, 1901; *Ephestia elutella* Hübner, 1796; *Ephestia figulilella* Gregson, 1871; *Ephestia kuehniella* Hübner, 1796; This study included three new species for Iraq. All these records' species are isolated based on some important features: the head and its appendages (antenna, compound eyes, labial palpi, and galea); the thorax and its appendages (wings and legs); and the abdomen, which includes the male genitalia and female genitalia. All species belong to two subfamilies: Galleriinae and Phycitianae of the family Pyralidae. At the same time, Methaq and Ahmed (2022) published a description of the species *Ephestia ellutella* from Iraq.

Biology and ecology of Pyralid Species

- **Biology**

A single female can lay an average of 100–125 eggs after mating. The mating and laying of eggs occur about 3 days after adult emergence. The eggs can be laid singly or in clusters and are generally oviposited directly on the larval food source. The eggs hatch (incubation period) in 7 to 8 days at 20℃ and 3 to 4 days at 30 ℃, respectively. Upon hatching, the larvae begin to disperse and, within a few hours, can establish themselves as food sources. The larvae can complete their development (larval period) in 16–24 days at temperatures ranging from 18 to 35℃ for two periods. The number of larval instars varies from 5–6 (depending on the food source and the temperature). The pupal stage can last from 15 to 20 days at 20℃ and 7 to 8 days at 30 ℃, respectively. The total life cycle lasted for 30 to 44 days. (Godase and Dumbre, 1982; Oh et al., 2010)

- **Monitoring of Pyralids through light trip**

It is an established fact that visible light attracts a wide range of insects. It offers an efficient means of obtaining information regarding the distribution, seasonal flight periods, and peak of abundance, thereby helping in the suppression of pests through suitable plant protection measures at the appropriate time (Hienton, 1974). Most pyralids are known to be nocturnal, and the moths are attracted to artificial light in large numbers; the catch patterns could explain emergence and their buildup in the crop. They also observed a high incidence of borer activity in the vicinity of the trap. Srivastava and Mahur (1985)

reported a similar trend in the field population and light trap catches of *Nephotettix* sp. and suggested that light trap data could be used conveniently to estimate insect activity or field behavior.

Loevinsohan (1991) carried out an investigation to determine the abundance of major Pyralids through light traps and the influence of climatic factors. Cumulative rainfall influenced the catch of the insects significantly more than any other weather factor. In recent years, the use of light traps has been advocated for the purpose of insect monitoring in order to take up appropriate control measures in integrated pest management (Abbas et al. 2019).

The moth catches and field incidence began in the first week of August and showed a significant increasing trend in the month of September. The peak period of moths and field incidence was in the month of September, followed by October. The significant positive association between light trap catches and field incidence reflected the severity pattern of leaf folders in the field. The importance of light trap catches in monitoring pests and natural enemies over the crop season was studied. Monitoring indicated that the peak activity of adults occurred during the fourth week of August and that of larvae during the second week of September (Anonymous, 1999).

Pyralid Populations and field infestation

Pathak *et al.* (1968) observed that the high humidity and optimum temperature appeared to be important factors in increasing the population. The variation in peak incidence was due to changes in sowing dates or the growing season.

Dhaliwal *et al.* (1979) reported that the pyralid infestation increased with increasing nitrogen levels. It was reported that the infestation started in the first week of August and lasted until the first week of October.

Peak infestation occurred during the second week of September, when the crop was at the booting and panicle emergence stages. Studied the population dynamics in relation to the stage of the crop and weather factors, and the maximum infestation was found during August and September (Abdulrahman, 2013).

Conclusion

The family Pyralidae Latreille, 1809, is a large and important group of the order Lepidoptera; this family is divided into five major subfamilies, namely Pyralinae, Phycitinae, Epipaschiinae, Galleriinae, and Chrysauginae. Most Pyralidae larvae are phytophagous, but some larvae are considered pests of crops, stored products, and other things. A few larval species are considered predators and parasites. Pyralids can have very important ecological roles and include many important agricultural and farm pests; this is due to their abundance and generally phytophagous habits.

The total life cycle of Pyralidae lasted for 30 to 44 days. The larvae can complete their development (larval period) in 16–24 days at temperatures ranging from 18 to 35 ℃, respectively. The high humidity and optimum temperature appeared to be important factors in increasing the population. Studied the population dynamics in relation to the stage of the crop and weather factors, and the maximum infestation was found during August and September.

References

1. Kristensen, N.P., M.J. Scoble, & O. Karsholt, 2007. Lepidoptera phylogeny and systematics: The state of inventorying moth and butterfly diversity. Zootaxa, 1668: 699–747.
2. Solis M. A. 2007. Phylogenetic studies and modern classification of the Pyraloidea (Lepidoptera). Revista Colombiana de Entomología 33 (1): 1-9.
3. Mitter, C.H., D.R. Davis, & M.P. Cummings, 2016. Phylogeny and Evolution of Lepidoptera. *Annual Review of Entomology*. 62:265–283.
4. Ahmed, T., Z. Sarwar, M. Ijaz, M. Sajjad, & M. Binyameen, 2017. Biodiversity and Faunistic Studies of the Family Pyralidae (Lepidoptera) from Pothwar Region, Punjab, Pakistan. Pakistan Journal of Life and Social Sciences. 15 (2): 126-132.
5. Jin Roh, S., H. Park, SH. Kim, SY. Kim, YS. Choi, & S. JH, 2020. A new species of *Galleria* Fabricius (Lepidoptera, Pyralidae) from Korea based on molecular and morphological characters. ZooKeys 970: 51–61.
6. Dombroskie, J.J. 2011. A Matrix Key to Families, Subfamilies, and Tribes of Lepidoptera of Canada. Canadian Journal of Arthropod Identification. 17: 1-129.
7. Linnaeus, C. 1758. *Systema Naturae,* 10th ed., 2 vol. pp. 1-824, Stockholm.

8. Stephens, J.F. 1829. *A systematic catalogue of British Insects,* 388 pp.
9. Hampson, G.F. 1898. A revision of the subfamily Pyraustinae of family Pyralidae. *Proc. zool. Soc*. Lond., 590-782.
10. Imms, A.D. 1925. *A General Text Book of Entomology'*. 1354 pp. (Chapman and Hall, London).
11. Comstock, J.H. 1950. *An Introduction to Entomology*. Comstock Publishing Co. 9th Ed., 644 pp.
12. Shaffer, M., E.S. Nielsen, & M. Hork, 1996. *Checklist of the Lepidoptera of Australia*. Pyraloidea, Pyralidae. In: *Monographs on Australian Lepidoptera,* 4: xiv, 529pp. (CSIRO, Australia).
13. Huebner, J. 1816-1827. *Verzeichnis bekannter Schmetterlinge,* 431 pp. Ausburg.
14. Duponchel, P.A. 1836. *In* Godart. J.B., Histoire Naturella des Lepidopteres on *Papillons de France. Hist. Nat. Lep. Fr.,* 10 (7) : 1-387.
15. Klima, A. 1939. *Lepidopterorum Caulogus,* Part 94: 225-384. (S. Gravenhage).
16. Nazmi, N.H. 1963. A redescription of the Pyraustinae of Egypt (UAR). *Bull. Soc. Em. Egypte,* XLVII**:** 201-250.
17. Derwesh, A.I. 1965. A Preliminary List of Identified Insects and Some Arachnids of Iraq. Director General Agriculture Researh Projections Baghdad, Bulletin, 112:121-123. Pruthi, H.S. (1969) *Textbook on Agricuhural Entomology,* ix, 977 pp., New Delhi (ICAR).
18. Kapur, A.P. 1967. Taxonomy of the rice stem borer *In: The major insect pests of the rice plant.* Proceeding of a symposium at the International Rice Research Institute, September, 1964, pp.3-43.
19. Heinrich, E.A. 1994. *Biology and management of rice insects.* Wiley Eastern Limited, New Delhi pp. 779.
20. Methaq, A. 2021. Taxonomies Morphological Study of Some Species of the Moths (Pyralidae: Lepidoptera) in Some Region of Middle and South of Iraq. A Thesis Submitted to the College of Education for Pure Sciences Ibn Al- Haitham/ University of Baghdad, In Partial Fulfillment of the Requirement for the Degree of M.Sc.in Biology/ Zoology/ Insect.
21. Methaq, A. S. & J.S. Ahmed, 2022. Morpho-Taxonomic Study of *Ephestia elutella* Hübner, 1796 (Lepidoptera: Pyralidae). From Iraq. Indian Journal of Ecology; 49 Special Issues (19): 470-474.
22. Godase, S.K. & R.B. Dumbre, 1982. Laboratory studies on bionomics of rice leaf folder. *Pestology*, 6 (7): 13-16.
23. Oh, H.K., W.K. Kim, A.R. Kang, I.S. Kim, H.B. Lee, & I.K. Kim, 2010. Life Cycle of the Perilla Leaf Pyralid Moth, *Pyrausta panopealis* (Lepidoptera: Pyralidae) and Test of Larvicidal Effect of Some Commercial Natural Products. International Journal of Industrial Entomology. Vol. 21, No. 1, pp. 133-137.
24. Hienton, T.E. 1974. Summary of investigations of electric Insect traps. *Tech. Bull*. No. 1498, USDA, Washington, DC pp. 135.
25. Srivastava, S.K. & K.C. Mathur, 1985. Green leaf hopper relationship of field population and light trap catches. *Orzyae,* 22: 240-242.
26. Loevinsohn, L. 1991. Dispersal range of rice insect pest under natural conditions in the Philippines. *Intn. Rice. Res. NewsL,* 16 (3): 23-24. London.
27. Abbas, M., M. Ramzan, N. Hussain, A. Ghaffar, K. Hussain, S. Abbas, & A. Raza, 2019. Role of Light Traps in Attracting, Killing and Biodiversity Studies of Insect Pests in Thal. Pakistan Journal of Agricultural Research. Vol. 32 (4): Page 684-690.
28. Anonymous, A. 1999. Entomology and Pathology. *D.R.R. Annual Progress Report,* 2: 33-140.
29. Pathak, M.D. 1968. *Ecology of common insect pests of rice. A review of Entomology*. 13: 257-294.
30. Dhaliwal, G.S., H.N. Shahi, P.S. Gill, & M.S. Maskin, 1979. Field reaction of rice varieties of leaf folder at various nitrogen levels. *Intn. Rice Res. Newsl,* 47 (3): 7.
31. Abdulrahman, S. 2013. Effect of Covering Dates Fruit Bunches on *Ephestia cautella* Walker (Lepidoptera: Pyralidae) Infestation: Population Dynamics Studies in The Field. International Journal of Agriculture Applied Science. Vol. 5 (1): 98-100.