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The External Genitalia of Male and Female of Family Lygaeidae

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Abstract: The Hemiptera (true bugs) includes the Lygaeidae.The family is more frequently known as ground bugs or milkweed bugs than as seed bugs. Genitals play a major role in differentiating the insects, as genital parts are different in every species of insect. In, this paper, we are going to study the external genitals of male and female, by which we can observe the variations and difference among them.

Key Words – Lygaeidae, Genitals, Anatomy, Morphology

Introduction

Insectsof Lygaeidae family known by many names as seed bugs, ground bugs, or milkweed bugs (Burdfield et al., 2014) (Chandra and kushwaha 2014) (Chattopadhyay,2022) (Hamed et al., 2023) (Magsi et al., 2018).

Members of the Lygaeidae family are classified as members of the Hemiptera order and the Heteroptera suborder (Magsi et al., 2018) (Burdfield et al., 2014) (Hamed et al., 2023).

The sizes for Lygaeidae may vary from 1 to 12 millimeters (Magsi et al., 2018).From tiny to medium, oval - elongated to even cylindrical. A few subfamilies contain unusually shaped seeds that are often brown, dark brown, or black in color, but can also occasionally be red or reddish-brown (Magsi et al., 2018) (Saha et al., 2020) Most recognizable features of the Lygaeidae family include the presence ofa Y-shaped pattern on the scutellum and the impressed, frequently glossy transverse line across the calli (Henry etal., 2015) (Chattopadhyay, 2022).

Their four segments on the antennae and four segments on the beak identify them (Henry et al., 2015). (Hamed and Mawlood, 2023).

The external genitalia are crucial for identifying the species, the essential structures in the male genitalia are the pygophore, paramere, and aedeagus, and in the female genitalia, essential structures are the spermatheca and genital plate (Gupta et al., 2015) Ovipositorplays crucial role in female during copulation(Rodriguez and lucas 1998).

Male and Female Genitatia of Lygaeidae Family

To recognize and distinguish amongst insects, external genitalia play a crucial role. (Ashlock,1957) (Drake and Davis, 1959) (Scudder, 1959) (Gupta et al., 2015).

Among the male genitalia, the pygophore, aedeagus, phallus and paramere are crucial structures (Gupta et al., 2015) (Cagatay, 1995). Among the female genitalia, ovipositor,spermatheca and genital plate plays a crucial role (gupta et al., 2015) (Drake and Davis, 1959).

In male - When the insect is not in copulation, abdominal segments eight through eleven usually get retracted within the seventh segment. These segments are all connected to or comprise the male genitalia (Ashlock, 1957). Only the ventral region of the male's eighth segment is sclerotized, and it has been significantly decreased. Normally, the ninth segment, or pygophore, and this segment retracts compactly into the seventh segment. The proctager, which sits on top of the pygophore, incorporates the tenth and eleventh segments, which are greatly shortened (Drake and Davis, 1959).

During mating, sperm are transferred by the male intromittent organ of the seed bug, which ends in a lengthy, sclerotized structure (Dougherty and Shuker, 2015)

In female - The seventh segment typically covers the base of the ovipositor and is extremely severely cleft mid-ventrally. The ninth and eighth tergites are in an almost ventricle plane due to ventral compression and the tenth segment disappears to become a little tubular sclerite that emerges from under the ninth tergum (Drake and Davis, 1959).

Table 1: showing the information about theexternal genitalia of male

External Genitalia	Characteristics	References
Pygophore	The pygophore, also known as the genital capsule, is derived from the ninth abdominal segment and includes the remaining segments, the phallus, and the parameres. It has a cup-shaped opening, and in the Lygaeidae, its anterior boundary is always complete dorsally, though it is often reduced to a narrow bridge. The posterior margin is either ridged or rounded horizontally, but it is never prolonged into processes like those seen in many other families of Heteroptera. Normal coverage of the pygophore's dorsal aperture is	(Ashlock, 1957)

	provided by the proctiger, which is comprised of the anus and leftover abdominal segments. The dorsally positioned tergum, a small tergite next to the pygophore, appears to be unique to the Lygaeinae family; in other members of the family, it is either lost completely or united with the pygophore. The anus is surrounded by segments ten and eleven. additionally, could be separated into sternal and tergal sections, or whole rings. When the phallus is erect, the proctiger folds down into the vaginal atrium.	
Parameres	The parameres of the Lygaeidae are symmetrical structures that are paired and arise on the membrane between the phallus and the pygophore. In the Lygaeidae, the parameres are typically separated into two sections: an apical "blade" that is typically flattened and curled, and a basal "shank". Both could have distinct processes. In particular, the shank frequently includes processes before the blade's base near its distal end. Moreover, hairs or tiny tubercules may be present on the surface of the paramere. These features are most likely sensory in nature. Often, the inside curvature of the blade has tiny teeth which are only visible at very high magnification.	(Ashlock, 1957)
	Almost hook-shaped parameres.	(Hamed and Mawlood, 2023)
Aedeagus	Important structure of genitalia, during copulation to transfer	(Gupta et al., 2015)

	sperms.	
	Aedeagus is helpful for classification at the tribal and subfamilial levels.	(Piper, 1985)
Phallus	The proximal phallotheca and the distal endosoma, the two primary parts of the heteropterans phallus, also known as the intromittent organ.	(Ashlock, 1957)
	The sperm reservior and the clasper, two components of the phallus, are also crucial structure in male genitalia.The basal part of the clasper is called the Shank, while the distal curving portion is called the Blade.	(O'Donnell, 1991)
Endophallus	It is split into vesical and conjunctival components and flows entirely through the phallus' lumen. Its division may be determined by looking at the location of the intricate ejaculatory reservoir, which is located at the base of the vesica.	(Ashlock, 1957)
	The endosoma and the sclerotized phallotheca, into which the remaining portion of the phallus fits when it is not inflated, make up the endophallus, also known as the seminal duct. A distal vesica and proximal conjunctiva are two further divisions of the endosoma.	(O'Donnell, 1991)
Phallotheca	The area into which the endosoma invaginates when the phallus is deflated and not in use is known as the phallotheca, and it is roughly cup shaped.	(Ashlock, 1957)
Ductus Seminis	The seminal duct is a narrow tube that splits into conjunctival and	(Ashlock, 1957)

	vesical components by the ejaculatory reservoir. It travels through the phallus' lumen and ends at the secondary gonopore. Whereas the ductus seminis visicae is typically thicker, less flexible, and frequently darkly pigmented, the ductus seminis conjunctivae is always narrow, flexible, and faintly pigmented. What look to be tiny, thicker annulations that make up the walls of both duct components are really near spirals. The process gonopori, which is sometimes coiled and varies widely in length, is the distal end of the vesical seminal duct that commonly breaks free of the inflatable portions of the phallus.	
Conjunctiva	The conjunctiva of the Lygaeidae is tubular and roughly elongated. It is separated from the distal end by a fold that develops at the base of the ejaculatory reservoir when it is pulled into the phallotheca.	(Ashlock, 1957)
Vesica	Defined basally by the conjunctival fold, the vesica, or distal region of the phallus, encompasses the ejaculatory reservoir.	(Ashlock, 1957)
Ejaculatory Reservoir	The ejaculatory reservoir is a complicated structure that is permanently attached to the dorsal wall of the vesica at its proximal end.	(Ashlock, 1957)

Table 2: showing the information about external genitalia of female

External Genitalia	Characteristics	References
Ovipositor	The base of the ovipositor is typically overlapped by the seventh segment, which has a very deep mid-ventral cleft. The ovipositor's anterior end is stretched downward and posteriorly into the position when it is in use. The ovipositor's mode of extension is unique to the Lygaeidae family.	(Drake and Davis, 1959)
	Male tapped her ovipositor with his genital capsule during copulation. The female rolled her hind legs backwards, stroking her abdomen and wings while using her tibiae and tarsi to push against his abdomen and vaginal capsule. and afterwards as the female's ovipositor was penetrated by His endophallus and sperm reservoir, causing her to release a spermatophore containing live sperm during copulation.	(Rodriguez and Lucas, 1998)
Genital Plate	The eight segment's gonocoxopodites, or valvifers, are observably big triangular sclerites. Although they are not visible, the gonocoxopodites of the ninth segment are significantly smaller and located below the segment's ventral borders. The eighth segment's gonapohyses, or valvulae, unite ventrally by a membrane and extend from the anterior apex of the gonocoxopodites. Additionally, the inner rami, sclerotized rods that extend from	(Drake and Davis 1959)

	the base of the ninth paratergites, bind the first gonapophyses to their ventral edges. The typical tongue-in-groover mechanism seen in heteropteron ovipositors joins the second gonapophyses to the first gonapophyses for the majority of their length. Despite typically being seen in other hemiptera, the third gonapophyses cannot be identified.	
Female Genital Chamber	The female genital chamber is made up of a basic cuticular sac within. The common oviduct extends anteriorly from it, and its lumen extends posteriorly into the ovipositor. The spermatheca is a complicated tubular gland that emerges from the female genital chamber's ceiling.The female genital chamber's roof differentiates into a pouch-like structure near the base of the spermatheca, from which a groove extends posteriorly. During copulation, this structure may serve to direct the vesica of the phallus into the spermatheca.	(Drake and Davis 1959)
	The paired ovaries' ovarioles terminate in a terminal filament that extends distally. The oviductuslaterales is where the ovarioles open closest to one another. These unite to form an oviductus communis, which then opens into the genital chamber, or bursa copulatrix.	(Gschwentner and Tadler, 2000)
Spermatheca and Spermathecal Duct	Two valvulae joined by a membrane form the vaginal opening. The spermathecal duct, or ductus receptaculi, creates a distal	(Gschwentner and Tadler, 2000)

	loop that is 1.5 turns in diameter as it exits the bursa copulatrix's dorsum and enters the receptaculum seminis or spermatheca.	
	An insemination duct, distinct from the spermathecal duct, is also present in the proximal part of the spermathecal complex. The male intromittent organ can reach the spermatheca from the vagina without having to pass via the spermathecal duct due to the insemination duct.	(Gary Chiang, 2010)
	The proximal portion of the receptaculumseminis(spermatheca) is a corkscrew-shaped, convoluted tube. This tube's epithelial cells, cuticle type, and coloration are similar to those of the ductus receptaculi; nonetheless, the tube serves as a sperm storage space, making it a component of the receptaculum.	(Gschwentner and Tadler, 2000)

Conclusion

Abdominal parts of male and female varies insect to insect, and external genitalia can never be the same of every insect. So, to get a better understanding ofinsects, evolutionary aspects, and function, external genitalia play an important role in it.

References

1. Ashlock, P.D., 1957. An investigation of the taxonomic value of the phallus in the Lygaeidae (Hemiptera-Heteroptera). Annals of the entomological Society of America, 50(4), pp.407-426.
2. Burdfield-Steel, E.R. and Shuker, D.M., 2014. The evolutionary ecology of the L ygaeidae. Ecology and Evolution, 4(11), pp.2278-2301.
3. Chandra, K. and Kushwaha, S., 2014. Ground bugs (Hemiptera: Lygaeidae) of Madhya Pradesh, with their distribution in India. Munis Entomology and Zoology, 9, pp.535-539.

4. Chattopadhyay, S., 2022. New record of lygaeid bugs of genus Graptostethus Stal (Hemiptera: Heteroptera: Lygaeidae) on Dalbergia sissoo from Jharkhand, India.
5. Dougherty, L.R. and Shuker, D.M., 2015. Natural breakage of the very long intromittent organ of the seed bug Lygaeussimulans (Heteroptera: Lygaeidae). European Journal of Entomology, 112(4), pp.818-823.
6. Drake, C.J. and Davis, N.T., 1959. A new subfamily, genus, and species of Lygaeidae (Hemiptera-Heteroptera) from Australia. Journal of the Washington Academy of Sciences, 49(1), pp.19-26.
7. Gary Chiang, R., 2010. A newly discovered sperm transport system in the female of Lygaeidae bugs. Physiological Entomology, 35(1), pp.87-92.
8. Gschwentner, R.O.B.E.R.T. and Tadler, A.N.D.R.E.A.S., 2000. Functional anatomy of the spermatheca and its duct in the seed bug Lygaeus simulans (Heteroptera: Lygaeidae). European Journal of Entomology, 97(3), pp.305-312.
9. Gupta, R., Sidhu, I.S. and Singh, D., 2015. Studies on two Indian species of genus Graptostethus Stal (Hemiptera: Lygaeidae).
10. Hamed, B.H. and Mawlood, N.A., 2023. Morphological study of the cotton seed bug, Oxycarenushyalinipennis (Costa, 1847)(Hemiptera: Lygaeidae) in some localities of Kurdistan region–Iraq. Kirkuk University Journal For Agricultural Sciences, 14(2), pp.1-8.
11. Henry, T.J., Dellapé, P.M. and de Paula, A.S., 2015. The big-eyed bugs, chinch bugs, and seed bugs (Lygaeoidea). True bugs (Heteroptera) of the Neotropics, pp.459-514.
12. Magsi, I.A., Khatri, I., Khoso, F.N., Shah, R.A., Brohi, M.U. and Dahri, Z.H., 2018. Some Lygaeid Bugs (Hemiptera: Lygaeidae) of Tandojam. University of Sindh Journal of Animal Sciences, 2(3), pp.19-22.
13. O'Donnell, J.E., 1991. A survey of male genitalia in lethaeine genera (Heteroptera: Lygaeidae: Rhyparochrominae). Journal of the New York Entomological Society, pp.441-470.
14. Piper*, R.G., 1985. The male genitalia of some Australian Rhyparochromini (Hemiptera: Lygaeidae). Australian Journal of Entomology, 24(1), pp.45-56.
15. Rodríguez, S. and Lucas, R., 1998. Copulation, fighting behavior and life cyle of Neopamerabilobata (Heteroptera: Lygaeidae). Revista de biología tropical, 46(3), pp.837-840.
16. Saha, P.C., Chandra, K., Kushwaha, S., Hassan, M.E., Biswas, B., Chakrabarty, A., Mukherjee, P. and Jahan, S., 2020. A preliminary study of family Lygaeidae from Andhra Pradesh, India. Records of the Zoological Survey of India, pp.175-188.

17. Scudder, G.G.E., 1959. The female genitalia of the Heteroptera: morphology and bearing on classification 1. Transactions of the Royal entomological Society of London, 111(14), pp.405-467.