Original Article

Anatomy Study to the Reproductive System in the Female Scorpions *Androctonus Crassicauda*

Zeina N.Al-Azawi[1]*

[1]Collage of Education For Pure Science, Ibn Al-Haitham, University of Baghdad, Baghdad, Iraq.
Email: zeinanabil196@yahoo.com

Abstract

Objectives: This study has investigated the anatomy of the reproductive system in the female scorpion *Androctonus Crassicauda*. **Methods:** Eight adult females were collected and dissected to investigate the structure and function of their reproductive organs. The adults female of scorpion *Androctonus Crassicauda* belonging to family Buthidae and the females of scorpion *Androctonus Crassicauda* were collected from provinces Baghdad and Wasit. Measurements of various body parts were taken, and the internal anatomy was examined under a microscope. **Results:** In general studies showed the female of scorpions have the ovariuterus consists of a reticular net are longitudinal and transverse ovarian tubes extend from third to seventh mesosomal segments, longitudinal ovarian tubes connected either by transverse ovarian tubes, but in the Buthidae family have an eight-celled reticular ovariuterus, that is five transverse ovarian tubes and the female *Androctonus Crassicauda* do not have five transverse tubes only the anterior and posterior forming a two-celled ovariuterus, and they have reproductive organs include ovaries, uterus, vagina. These results showed that female *Androctonus Crassicauda* has a simplified ovariuterus compared to other scorpions in the Buthidae family. It has only two cells because all the distal anastomosis are absent, the oocytes are contained in follicles directly in contact with the ovariuterus, **Conclusions:** This unique anatomy may be related to the reproductive strategies of this particular species, all scorpion juveniles derive some nutrients directly from females during development. The functions of these organs are involved in fertility, conception, pregnancy, and childbirth. The reproductive organs also have a significant influence on other aspects of health. The major function of the reproductive system in scorpions is to ensure the survival of the species and there are many systems in the body like the endocrine and urinary systems, which work to maintain homeostasis for survival. Reproduction plays a role in evolution as it creates variations via genetic recombination, therefore it is needed to have detailed study and experiments for the understanding of anatomy of the reproductive system in the Female Scorpions.

Keywords: Anatomy, *Androctonus Crassicauda*, Buthidae, Scorpion Reproduction, Ovariuterus.

Introduction

Understanding the reproductive anatomy of female scorpions is crucial for comprehending the processes of reproduction and the biological evolution of these organisms. *Androctonus Crassicauda* is one important species among scorpions that provides extensive research information within this area. This study provides a comprehensive account of the reproductive anatomy of female *Androctonus Crassicauda* as well on its internal structure. Importance: An understanding of the anatomy of female reproductive system in scorpions is important for several reasons, including insights into their reproductive strategies and behaviour; it provides essential information to investigate adaptive characters associated with survival and reproduction among different taxa. These data give important information in the evolution of scorpion genitalia and their function, (life) style adaptation.[1] Our work would contribute immensely in comprehension the reproductive mode of life in scorpions, its interaction with genetic evolution and ecological features that influence aspects associated to reproduction and then help explore other perspectives through comparison. Aims: In view of this background parameters were stated hypothetically as follows: To study detailed gross anatomy for genital system o/the female *Androctonus Crassicauda*. A few ideas were proposed with regard to the structural changes in the reproductive organs of *Androctonus Crassicauda* together with their functional significance. Reproductive strategies and behaviors of female scorpions, with a special reference to *Androctonus Crassicauda* A study on application the reproductive anatomy of female

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Address for Correspondence: Collage of Education For Pure Science, Ibn Al-Haitham, University of Baghdad, Baghdad, Iraq
Email: zeinanabil196@yahoo.com

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scorpions as a phenotypic marker in evolutionary research with special reference to *Androctonus Crassicauda*. The evolutionary biology is one of the key conceptual background for understanding the development of the reproductive system of the female scorpions including *Androctonus Crassicauda* that would increase reproductive success.[2] Natural Selection: Natural selection is the process by which heritable traits that confer advantages in a particular environment are more likely to be passed on to future generations. In the case of female scorpions, natural selection acts on traits related to reproduction, such as the structure and function of reproductive organs. For example, traits that increase the efficiency of egg production, sperm storage, or oviposition may be favored by natural selection because they enhance the reproductive success of females in their specific habitats.[3,4] Reproductive Organ Structure and Function: Natural selection influences the structure and function of reproductive organs in female scorpions. Traits such as the morphology of the ovaries, oviducts, and genital opening are subject to selection pressures based on their effectiveness in facilitating successful reproduction. For instance, the development of specialized structures likes spermathecal for sperm storage or modifications in the ovipositor for precise egg-laying can increase reproductive success and are therefore favored by natural selection.[1] Efficiency of Egg Production: Traits that enhance the efficiency of egg production are likely to be favored by natural selection. Female scorpions with ovaries capable of producing a greater number of eggs or producing eggs at a faster rate may have a higher likelihood of passing on their genes to the next generation. Natural selection acts on genetic variations that result in increased fecundity, ensuring that individuals with these advantageous traits contribute more offspring to future generations..[5] Sperm Storage and Fertilization: Natural selection also operates on traits related to sperm storage and fertilization success in female scorpions. Spermathecal, specialized structures for storing sperm, may evolve to increase sperm longevity or to facilitate selective sperm usage, ensuring successful fertilization of eggs. Traits that enhance the female's ability to store and utilize sperm effectively contribute to her reproductive success and are therefore favored by natural selection.[6,7] Oviposition Efficiency: Efficient oviposition, or egg-laying behavior, is crucial for the survival of offspring in many species, including scorpions. This means that improvements in the accuracy and timing of the act of oviposition, due to changes in the structure of the part of the insect's body that delivers eggs or the concurrent actions of the muscles involved in this process, can potentially increase the chances of offspring survival. These traits are subjected to natural selection in an attempt to enhance reproductive success through increasing the probability of the deposition of eggs in areas of improved microenvironments for the young. All in all, natural selection is the principal mechanism mediating the reproductive biology of the females of the scorpions due to the aspects enhancing reproductive effectiveness and success in their chosen environments. As the result, the analysis of the factors shaping the reproductive characters can provide new valuable information on the scorpions' evolution and diversification, as well as other organisms.[7,8] Male-female interactions during mating are the sources of sexual selection in scorpions that affect the evolution of the reproductive anatomy of the female. For instance, Female Genital Organs may undergo through a transformation as a result of the males mating systems or male genital organs' morphology. Also, female choice, may occasionally prefer some decorum or traits in the males and thus, there be a co-evolution between males and females.[9] Male-Male Competition: In many species of scorpions, male ones fight with the females very actively in order to mate. This competition can be of any type that may include fighting between males, examination of competitors by other males, competitions for territories, etc. Traits that confer advantages in these competitive interactions, such as larger body size, stronger chelae (pincers), or more elaborate courtship displays, may evolve in male scorpions due to sexual selection. As a result, females may be more likely to mate with males displaying these traits, leading to the spread of genes associated with them in the population.[8,10] Female Choice: Female scorpions may actively choose their mates based on certain traits exhibited by males. These traits could include aspects of male morphology, behavior, or pheromone signaling. For example, females may prefer males with larger body size, brighter coloration, or more vigorous courtship displays, as these traits may indicate genetic quality, vigor, or the ability to provide resources. Female choice can influence the evolution of male reproductive traits indirectly by selecting for males with specific characteristics.[7,11] Co-evolutionary Dynamics: Sexual selection can lead to co-evolutionary dynamics between males and females, where the evolution of traits in one sex influences the evolution of traits in the other. In scorpions, this could manifest as reciprocal adaptations between male and female reproductive anatomy. For instance, if males possess specialized structures or behaviors for efficient sperm transfer, females may evolve corresponding anatomical features to enhance fertilization success or to exert control over mating. The relationship that is here presented as a mutual interaction can lead to the evolution of a variety of structurally differentiated functions between males and females.[12] Genital Morphology and Behavior: The female genitalia hence might have evolved in response to either the behaviours of the male during mating or the morphology of the male genitalia. In this case, if the males possess ostentatious behaviours in mate choice or elaborate copulatory organs for the efficient delivery of sperm, the females will also evolve genitals that facilitate copulation or those that deter extra-pair mating. Likewise, female choice may drive certain male traits, which in turn, favor the evolution of the female reproductive structures that can improve compatibility or reproductive success with the preferred male partners.[13,14]

This adaptation helps the females to increase mate reproduction also because sperm is always available in

reserve, in case of fertilization. Optimal Egg Production: There could also be the differences in reproducing system and proportion in female parasites that also help in increasing the output of eggs. These organs are the only ones used in making eggs and changes in the structure and function of ovaries may improve the making of eggs. Some of these may general changes with respect to increase in size, shape or position of the ovarian follicle to enhance the number of eggs that can be produced and developed at a time. This implies the overall enhanced reproductive rate among the female scorpions together with the enhanced fitness in the zones of existence.[4,15] Survival Strategies for Descendants: Female scorpions may possess reproductive adaptations geared towards enhancing offspring survival. As an illustration, the ovipositor, which is the egg-laying organ, may be structured such that it allows precise laying of eggs in favorable microhabitats. If a mother does not lay eggs far from those predators that may feed or attack young ones once they are out of their shell. Furthermore, any other environmental stresses (e.g., desiccation) and predation threats would be reduced by this adaptation of egg clusters guarding behavior and maternal provisioning for scorpion babies growth and development.[16,17] Over the past few years, environmental specialization has been one of the most widely studied areas in biology. One can tell that female scorpions occupying different ecological niches adapt their reproductive anatomy differently. Various species living in diverse habitats for example deserts, forests and grasslands may have differing reproductive adaptations that are suitable to their environments. For instance, those scorpions found in arid areas may have various adaptations that help them conserve water while the eggs are developing or when they are selecting where to lay them with enough humidity. These adjustments facilitate successful reproduction by responding to particular demands and opportunities introduced by a variety of habitats.[18] The reproductive biology of female scorpions has been shaped by adjustation. This has influenced the evolution of around special systems and behaviors aimed astatine enhancing breeding winner over different environments. Female scorpions always adjust to environmental challenges that their niche offers and ensure survival for their children extremely as to keep up with this persistence and diversification in scorpion populations. Fruitful adjustations bear extremely been deliberate offer Understandings into the evolutionary strategies old away animals to go inch their spurious environments. By applying these principles researchers can understand how natural selection sexual selection or adjustation has driven the reproductive anatomy of female scorpions including *Androctonus Crassicauda* towards maximizing reproductive success within particular ecological settings. This cognition helps America to read break the wider implications of development along different complicated ties such as arsenic variety inch arachnids' fruitful strategies.

Comparative anatomy is vital towards the study of the reproductive organs in female scorpions such as *Androctonus Crassicauda*. These researchers are fit to read however these structures change betwixt variety. Therefore through comparing this with other scorpion species common Layouts and unique adjustations can be identified thereby providing Understanding into evolutionary history of scorpion reproductive systems. Relative form adds to our cognition around it.[6] Comparative anatomy enables researchers to establish homologous structures–organs or characteristics that are the same in different species as a result of a common ancestry. Researchers can identify which structures are shared among different taxa by comparing the reproductive organs of *Androctonus Crassicauda* with those of other scorpion species. That is, knowing the scorpions' ancestral origins and also what its reproductive anatomy was able to assist in arriving at what human beings know now about it ample understanding has been created concerning this matter.[19] For example, one way through which scientists can understand how lineages have changed over time is through comparative anatomy. To explain more on this process.[10] Homologous Structures: Homologous structures may be defined as organs or traits found in various organism types because they have evolved from a common ancestor. While these structures may change with time, they still remain similar in their underlying structure, function or even developmental origin. To deduce common ancestors and follow the evolutionary trajectory of such traits.[3] Scorpions and Comparative Anatomy: refers to the extensive examination and comparison of anatomical features in various species. In scorpions, details of reproductive organs like ovaries, oviducts, genitalia and structures associated with them are examined by researchers to determine their similarities and differences across species. This approach permits uncovering homologous reproductive structures that exist between taxonomically different groups of scorpion regardless of where they live on earth.[18] *Androctonus Crassicauda* and Evolutionary Relationships: through comparison with other scorpion species' reproductive organs, evolutionary relationships between these taxa can be clearly understood by researchers. This suggests that shared homologous structures may indicate a common ancestry of the organisms and hint at possible interpretations about phylogenetic relationships within the group of scorpion species. However, when it comes to their morphology during reproduction one can see differences due to adaptation or divergent evolution caused by different ecological conditions.[18] A comparison for Phylogenetic Inference: comparative anatomy data can also represent another source of information used to construct an evolutionary tree showing relationships among different scorpion species. The inclusion of such knowledge therefore helps in refining phylogenetic hypotheses which categorize them into distinct lineages based on sequence homology or similarity.[4,20] Reason the evolutionary relationships and hereditary origins of fruitful form inch scorpions care *Androctonus Crassicauda* depends greatly along relative form. By understanding homologous structures and their distribution among various taxa scientists can learn about the history of evolution and diversification of reproductive traits in scorpions as well as other organisms.[18] relative studies

service find evolutionary trends for scorpion breeding variety meat. Considering modifications and variations of reproductive structures throughout diverse species may enable researchers to postulate how these changes have happened over time. For case the cast or sized variations vis-a-vis fruitful variety meat power point adjustations for variable ecologic niches or fertility strategies. Comparative studies are important in identifying evolutionary trends in the reproductive anatomy of scorpions hence giving Understanding into how such structures developed across species as time went by inch amp further Fancy account. Zhang *et al*.[21] state that comparative studies provide valuable understandings into the evolutionary trends and adjustation. away analyzing variations inch fruitful structures passim great variety and although around ecologic behavioral and phyletic factors researchers get construct the evolutionary account of scorpion parallel and dig the exclusive pressures that bear intentional their fruitful form across billions of age. Understanding roleal Significance: Comparative anatomy enables elucidate the roleal significance of reproductive structures in scorpions. away comparison the form of *Androctonus Crassicauda* with close relevant variety researchers get understand however variations inch fruitful structures get work on to variations inch union behaviors fruitful techniques or environmental conditions. This presents valuable Understandings into the Adjustive importance of reproductive trends and their Role in reproductive fulfillment.[14] Reason the earnest implication of fruitful systems inch scorpions which admit *Androctonus Crassicauda* is important for decryption however variations inch form concern to differences inch union behaviors fruitful strategies and environmental conditions. Comparative anatomy lets in researchers to infer the adjustive significance of reproductive trends by means of comparing the anatomy of *Androctonus Crassicauda* with carefully associated species. Here's an extra special explanation of the way this technique offers precious Understandings.[9] Relative psychoanalysis of anatomy: relative form includes particular Check and rating of fruitful structures over particular variety of scorpions including *Androctonus Crassicauda* and its house. Researchers Examine variations within the size form and company of reproductive organs consisting of ovaries oviducts genitalia and associated structures. Away documenting variations inch form amongst variety researchers get understand however these variations get work on to variations inch fruitful strategies or environmental elements.

Conclusion of roleal Significance: By comparing the anatomy of *Androctonus Crassicauda* with closely related species researchers can infer the useful importance of reproductive tendencies. for case variations exclusive the geomorphology of fruitful variety meat power too muse diversifications to particular union behaviors or fruitful strategies. Species with promiscuous mating systems might also showcase reproductive anatomy improved for sperm opposition or selective fertilization while species with monogamous mating structures might also prioritize different elements of reproductive anatomy. Relative rating permits researchers to related anatomic Editions with right fruitful Characteristics or behaviors.[9] Environmental adjustations: Comparative anatomy also sheds light on how Editions in reproductive structures are connected to variations in environmental conditions. Scorpions dwell many habitats start from dry deserts to wet forests and fruitful form get too double adjustations to these environments. For instance species inhabiting arid areas may also have reproductive systems Improved for water conservation in the course of egg development or oviposition whilst species in humid habitats might also possess systems tailored for moisture retention or egg protection. Relative rating allows researchers to break diversifications to characteristic environmental conditions and read their pragmatic implication inch fruitful accomplishment.[8] Reproductive Strategies: Differences in reproductive anatomy among scorpion species may also be linked to editions in reproductive techniques. Relative studies help clear however fruitful structures bear advance to help particular fruitful behaviors including suit rituals union postures or maternal charge. By evaluating reproductive anatomy across species with distinctive mating structures or reproductive behaviors researchers can infer how Editions in anatomy add to reproductive achievement and fitness in exclusive ecological contexts. Evolutionary Understandings: relative form affords important Understandings into the evolutionary records of fruitful trends inch scorpions. By reading Editions in reproductive systems within a phylogenetic framework researchers can reconstruct the evolutionary modifications that have occurred over the years. This access lets inch researchers to line the accommodative grandness of fruitful traits and know however they bear got mature inch reaction to exclusive pressures and ecologic elements.[8] Comparative anatomy allows researchers to elucidate the practical significance of reproductive structures in scorpions via correlating anatomical variations with differences in mating behaviors reproductive strategies and environmental conditions. This facility presents important Understandings into the accommodative grandness of fruitful trends and their Role inch formation fruitful winner and evolutionary diversification inch scorpions care *Androctonus Crassicauda*. Reconstruction of Evolutionary History: Comparative anatomy lets in researchers to reconstruct the evolutionary history of scorpion reproductive structures. Away trace the evolutionary modifications inch fruitful systems over alone taxa researchers get understand the episode of activities that bear brought around the variety of fruitful form determined inch current scorpions. This evolutionary angle complements our know-how of the methods driving the evolution of reproductive tendencies in scorpions. Relative form serves arsenic amp right twist for reconstructing the evolutionary account of scorpion fruitful systems offer Understandings into the appeal of occasions that bear brought around the run of fruitful form determined inch contemporary scorpions. Here's how this technique improves our information of the evolutionary strategies driving the evolution of reproductive traits in scorpions.[18] Trace evolutionary changes: relative form allows researchers to line the evolutionary changes inch fruitful structures

passim clear taxa of scorpions. By examining similarities and variations in reproductive organs, together with ovaries, oviducts, genitalia, and related systems, researchers can infer how those structures have evolved over time. Comparative evaluation reveals ancestral trends shared among scorpion lineages and identifies derived developments that have advanced independently in one of kind taxa. Inferring ancestral States: By comparing the reproductive anatomy of extant scorpion species with statistics from the fossil file, researchers can infer ancestral states of reproductive structures and reconstruct the evolutionary history of scorpion replica. Phylogenetic Context: Comparative anatomy is performed within a phylogenetic framework, integrating anatomical information with facts about evolutionary relationships among scorpion taxa. Phylogenetic analyses assist researchers reconstruct evolutionary timber that depicts the branching styles of scorpion lineages and the evolutionary relationships among one-of-a-kind reproductive tendencies. By incorporating phylogenetic information, researchers can infer the sequence of evolutionary activities which have fashioned scorpion reproductive anatomy and recognize the evolutionary processes underlying its diversification.[18] Identification of Evolutionary Trends: Comparative anatomy permits researchers to pick out evolutionary developments in scorpion reproductive structures, along with modifications in organ morphology, reproductive behaviors, or reproductive techniques. By reading versions in reproductive systems across extraordinary taxa and thinking about ecological, behavioral, and phylogenetic elements, researchers can detect styles of evolutionary alternate and infer the selective pressures using the evolution of reproductive developments in scorpions. Understanding Adaptive Radiation: Comparative anatomy presents insights into the adaptive radiation of scorpions, where diverse reproductive strategies and anatomical adaptations have advanced in reaction to extraordinary ecological niches and environmental situations. By reconstructing the evolutionary records of reproductive tendencies, researchers can apprehend how scorpions have assorted and tailored to numerous habitats, climates, and reproductive demanding situations over thousands and thousands of years.

Comparative anatomy plays a decisive role in reconstructing the evolutionary history of scorpion reproductive structures permitting researchers to hint evolutionary adjustments infer ancestral states pick out evolutionary tendencies and understand the adjective significance of reproductive tendencies. This evolutionary fish complements our expertness of the strategies moving the development of fruitful form inch scorpions and sheds fall astatine the broader styles of diversification and edition inch arachnids and different organisms.[18] Overall comparative anatomy affords a powerful tool for reading the reproductive systems of lady scorpions like *Androctonus Crassicauda* and elucidating their evolutionary records. Away evaluating anatomic capabilities over variety researchers get break stock styles alone variations and evolutionary traits inch the pine check forward our expertness of scorpion fruitful biota.[22] Understanding the reproductive strategies of female scorpions which include *Androctonus Crassicauda* is essential for deciphering the practical significance of their reproductive anatomy. examining these techniques done abstract frameworks care r/k quality rule and lifestyles account rule sheds humble along the alternate-offs upset inch fruitful investing endurance and problem good thereby influencing the development of fruitful trends inch scorpions. Here's how those theoretical frameworks add to our expertise.[6,16]

Comparative Studies of Reproductive Anatomy

Comparative studies of reproductive anatomy among scorpion species can reveal Adjustations aligned with their respective reproductive strategies. Away examining variations inch fruitful structures researchers get understand whether amp variety exhibits r-selected or k-selected traits founded along anatomic characteristics.[21]

Behavioral Ecology

Behavioral ecology gives precious insights into how the reproductive anatomy of female scorpions, consisting of *Androctonus Crassicauda*, interacts with conduct to influence reproductive success. By reading mating behaviors, courtship rituals, and submit-mating interactions, researchers can elucidate the purposeful importance of reproductive anatomy within the context of mate choice, sperm opposition, and parental care. Here's how behavioral ecology contributes to our know-how.[2,21]

Mating Behaviors: Observing mating behaviors in female scorpions helps researchers understands how reproductive anatomy Eases successful copulation. for case the geomorphology of distaff crotch get determine the union set or length poignant spermatozoon change and dressing winner. Behavioral studies also reveal whether female's exhibit mate choice based on male traits such as size coloration or courtship displays which can drive the evolution of reproductive anatomy through sexual selection. Courtship Rituals: Courtship rituals play a crucial role in mate recognition and acceptance, contributing to reproductive success in female scorpions. Understanding courtship behaviors provides insights into the sensory mechanisms involved in mate assessment and the role of visual, tactile, or chemical cues in mate choice. Courtship interactions also reveal the behavioral adaptations of males and females to maximize reproductive success, shaping the evolution of reproductive anatomy through sexual selection pressures.[22] Post-Mating Interactions: Post-mating interactions between males and females, including mate guarding, sperm competition, and parental care, influence reproductive outcomes in female scorpions. Behavioral studies reveal whether females exhibit cryptic female choice, selective sperm usage, or post-copulatory mate choice, which can affect fertilization success and offspring quality. Observing parental care behaviors, such as provisioning of offspring or defense against predators, provides insights into the adaptive significance of reproductive anatomy in enhancing offspring survival.[21] By integrating behavioral ecology with studies of reproductive anatomy researchers

can uncover the Roleal significance of female scorpion reproductive traits in mate choice sperm competition and parental care. This interdisciplinary access improves our reason of the compound interactions betwixt fruitful form conduct and ecologic factors formation fruitful winner inch distaff scorpions care *Androctonus Crassicauda*. Also it provides Understandings into the evolutionary mechanisms driving the diversity and Complicatedity of reproductive strategies in arachnids and other organisms.

Endocrinology and Hormonal Regulation

Investigating the hormonal control of reproductive methods in female scorpions including *Androctonus Crassicauda* is essential for gaining a comprehensive understanding of their reproductive anatomy. Abstract frameworks inch endocrinology notably focus along the rule of fruitful hormones care ecdysteroids and puerile internal secretion render Understandings into the physical mechanisms inherent fruitful evolution ovulation and egg-laying conduct. Here's how endocrinology adds to our understanding.[20] Regulation of Reproductive Hormones: Endocrinological studies elucidate the synthesis release and regulation of reproductive hormones in female scorpions. ecdysteroids Generally renowned arsenic molt hormones run amp important Role inch regulation fruitful methods including oogenesis and ovulation. Juvenile hormone alternatively influences reproductive maturation and behavioral aspects of reproduction. Investigation the mechanisms away which these hormones are produced and orderly provides Understandings into the timing and coordination of fruitful events inch distaff scorpions. Reproductive Development: Endocrinological research helps unravel the hormonal control of reproductive development in female scorpions. ecdysteroids order ovarian development and oogenesis influencing the increase and distinction of ovarian follicles. Juvenile hormone in conjunction with ecdysteroids modulates the timing of reproductive maturation and the onset of sexual behavior. Understanding the interplay between these hormonal signals and their effects on reproductive problems adds to our knowledge of the developmental Methods underlying female reproductive anatomy. Ovulation and egg-laying behavior: endocrinological studies cast fall along the hormonal mechanisms triggering ovulation and regulation egg-laying conduct inch distaff scorpions. Ecdysteroids play a pivotal role in stimulating ovulation and coordinating the release of mature eggs from the ovaries. Puerile internal secretion influences the look of egg-laying conduct including the timing and frequencies of oviposition. Investigating how these hormones interact with sensory cues and environmental factors to modulate egg-laying behavior improves our understanding of the reproductive physiology of female scorpions.[8]

By integrating endocrinology with studies of reproductive anatomy and behavior researchers can uncover the intricate hormonal regulation of reproductive methods in female scorpions like *Androctonus Crassicauda*. This multidisciplinary approach provides a holistic understanding of the physiological mechanisms driving reproductive success and adaptation in scorpions, contributing to broader insights into the reproductive biology of arachnids and other invertebrates.

Materials and Methods

In this study we examined eight adults female of scorpion *Androctonus Crassicauda* belonging to family Buthidae and the females of scorpion *Androctonus Crassicauda* were collected during 12-4-2023 from provinces Baghdad and Wasit were found under objects wood, stone, trees and old building ,specimens were put in box and transferred to laboratory for study the genus and the species are identified in the laboratory according to the keys of Kovarik[1],[5], The scorpion were killed by thermal shock by immersing the scorpion with hot water (boiling point) until the metasoma area becomes straight in shape and this takes less five seconds, and then dissected using appropriate dissection tools, including a scalpel, tweezers, and pins, and distilled water was used to clean the abdominal side of the scorpion. This specimens were examined under dissecting microscope(20x) and compound microscope(10x), photographed using camera a high-zoom 10 pixel. A number of measurements were taken in millimeters for each piece.[6,23]

Results and Discussion

A number of measurements were taken in millimeters for each piece, and some differences were found in measurements between females (Table 1)

Table 1: Measurements of the Female Scorpions *Androctonus Crassicauda*.

Part of Body	Length/Mm	Width/Mm
Carapace	9.23	9.42
Anterior	–	4.16
Posterior	–	5.26
Mesasoma segments	19.03	–
Metasoma segments and telson	24.48	–
segment 1	2.07	5.52
segment2	3.37	6.13
segment3	3.79	6.12
segment4	4.86	6.36
segment5	4. 97	534
Telson	5.42	
Vesticle	3.23	–
Aculeus	2.19	–
Pedpalpe		
Femur	4.71	1.92
Patella	3.90	2.79
Chela	4.45	2.90
Finger movable	9.53	–
Total body	52.74	–
Pectin teeth		
Right number		28
Lift number		28

Plate 1,2 it can be identified by its dark black color, and its color may be vairity according to the region in which it lives, from dark brown to reddish-black. The tail piece is thick and wide,[6] the forceps are thin, the fixed fingers

have mesial teeth and basal teeth fused together, forming a biscup. Movable fingers are made up of sub-distal teeth and have two basal teeth. On the outer edge, the outer distal teeth are longer than the inner distal teeth, and there are two teeth on the inner edge, Chela has wide and cylindrical tweezers. There are always three serrations below the apical teeth for mobile toes, and the number of serrations reaches fourteen or more. Fixed toes have ten or twelve serrations (Plate 3,4,5). The front prosoma, granular, with distinct and clear granules at the top of the head. The median central crest does not connect with the median posterior crest. The posterior edge of the front area is always straight, a pair of small median eyes, in addition to the presence of three pairs. Side lenses (Plate6) The inner fulcrum is covered with fine hairs. The female has 24-26 serrations, The anal area contains the anal opening surrounding by four anal papillae, and anal arch with anal plate (Plate 7,8) The taxonomic importance are the number of transverse tubes present and the position of the follicles in relation to the ovariuterus, and the presence or absence The female reproductive system in scorpions consists of the ovariuterus and associated structures, the ovariuterus is constructed of a reticulate system of ovarian tubes, Longitudinal ovarian tubes are connected by transverse ovarian tubes giving the reticulate appearance. In the family Buthidae, five pairs of transverse ovarian tubes divide the ovariuterus to eight cells. In the Female *Androctonus Crassicauda* has only two cells because all the distal anastomoses are absent, the oocytes are contained in follicles direct contact with the ovariuterus, and the dissection revealed the internal anatomy of the female *Androctonus Crassicauda* reproductive system. The ovariuterus, a key reproductive organ, displayed a unique structure. the female *Androctonus Crassicauda* do not have five transverse tubes only the anterior and posterior forming a two-celled ovariuterus, and they have reproductive organs include ovaries, uterus, vagina, this results showed that female *Androctonus Crassicauda* has a simplified ovariuterus. This resulted in a simpler ovariuterus and the functional significance of this variation compared to other Buthidae species. (Plate 9,10,11)

Plate 1: Dorsal Side of Female *Androctonus Crassicauda*.

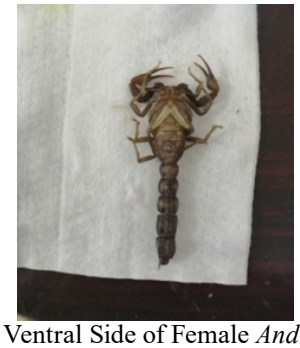

Plate 2: Ventral Side of Female *Androctonus Crassicauda*.

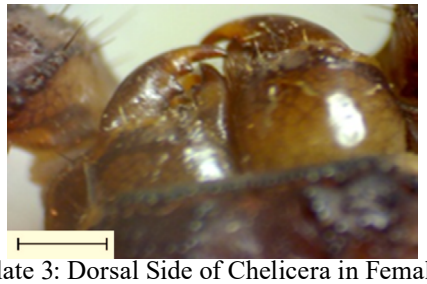

Plate 3: Dorsal Side of Chelicera in Female *Androctonus Crassicauda* 200x.

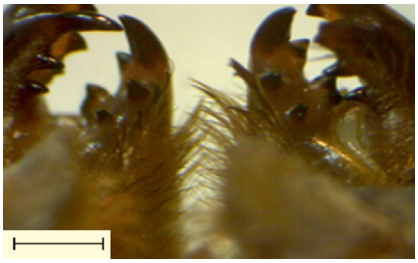

Plate 4: Ventral Side of Chelicera in Female *Androctonus Crassicauda* 200x.

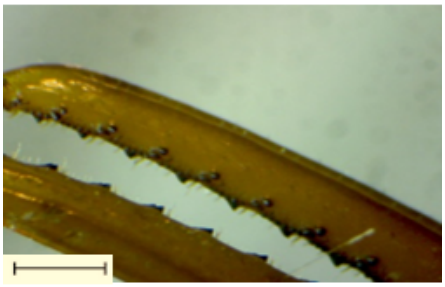

Plate 5: Chella Movable Finger in Female *Androctonus Crassicauda* 100x.

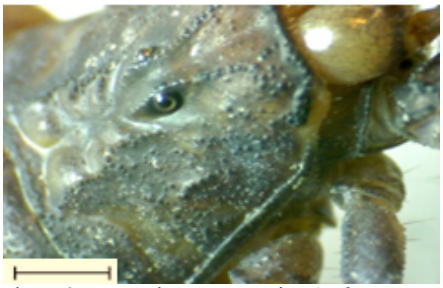

Plate 6: Lateral Carapace in *Androctonus Crassicauda* 200x.

Plate 7: Pectin Teeth in Female *Androctonus Crassicauda* 200x.

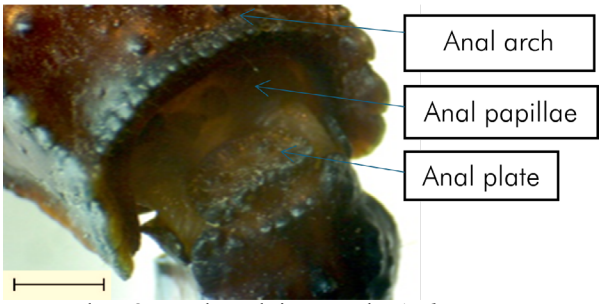

Plate 8: Anal Arch in Female *Androctonus Crassicauda* 200x.

Plate 9: Female Anatomy of *Androctonus Crassicauda*.

Plate 10: Female Anatomy of *Androctonus Crassicauda*.

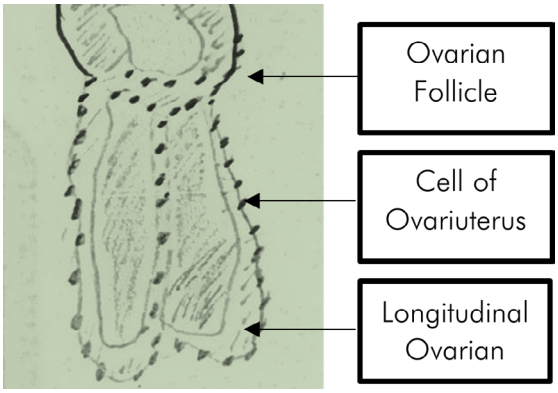

Figure 11: Draw of Female Anatomy in *Androctonus Crassicauda*.

Conclusions

The study found a distinct anatomical difference in the female *Androctonus Crassicauda* reproductive system compared to other Buthidae scorpions. The absence of transverse tubes within the ovariuterus creates a simplified structure with just two compartments. This unique feature may be it the specific reproductive strategies of *Androctonus Crassicauda*. Further research is needed to explore the implications of this anatomical variation on the scorpion's reproductive behavior and success. In summary, sexual selection plays a crucial role in shaping the reproductive anatomy and behavior of female scorpions through male-female interactions during mating. By driving the evolution of traits related to mate competition and mate choice, sexual selection influences the reproductive success and genetic diversity of scorpion populations. Studying these dynamics provides valuable insights into the evolutionary processes underlying the diversity and complexity of reproductive strategies in scorpions and other organisms.

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