Ciência Animal Brasileira
Brazilian Animal Science

DOI: 10.1590/1809-6891v26e-82444E

e-ISSN 1809-6891
Veterinary medicine | Research article

Morphology of the female and male reproductive system in the porcupine (*Coendou* spp.)

Morfologia do sistema reprodutor feminino e masculino em ouriço-cacheiro (*Coendou* spp.)

Amanda Gabriela Abonizio*[1], André Luis Filadelpho[1], Vania Maria de Vasconcelos Machado[1], Elton Luís Ritir Oliveira[2], Alessandra Regina Dhom Pimentel de Moraes[1], Luis Baselly Cueva[1]

1 Universidade Estadual Paulista (UNESP), Botucatu, São Paulo, Brazil

2 Faculdade FGP, Pederneiras, São Paulo, Brazil

*corresponding author: amanda.abonizio@unesp.br

Received: April 28, 2025. Accepted: August 13, 2025. Published: October 29, 2025. Editor: Luiz Augusto B. Brito

Abstract: The morphology of wild animals has been the subject of extensive research, with a focus on the reproductive system and the pelvic region as important tools. The aim of this study was to identify, differentiate, and compare information regarding the anatomical and macroscopic morphological bases, as well as imaging findings, of the male and female reproductive systems of the porcupine (*Coendou* spp.), in comparison with other rodent species previously studied. The study used 5 male and 5 female porcupines, already deceased, from zoological gardens and parks. The specimens were subjected to dissection techniques for macroscopic analysis of the reproductive system, and imaging tests, such as computed tomography (CT), were also conducted to obtain additional information about the reproductive anatomy. The results revealed unique characteristics of the reproductive system of the porcupine compared to other rodent species. Females exhibited a bicornuate uterus with two separate uterine horns, while males had intra-abdominal testes and a long, convoluted epididymis. The comparison with other rodent species showed similarities and differences in reproductive anatomy, and the results contribute to the understanding of the reproductive anatomy of the porcupine, providing valuable information for future studies on reproduction and reproductive behavior in this species. Furthermore, the study may aid in the development of reproductive management techniques and conservation efforts for the porcupine.

Keywords: antimicrobial; antioxidant; monogastric; phenolic compounds; ruminant.

Resumo: A morfologia de animais silvestres tem sido objeto de muita pesquisa, com foco no sistema reprodutor e na região pélvica como ferramentas importantes. O presente estudo teve como objetivo identificar, diferenciar e comparar informações sobre as bases anatômicas e morfológicas macroscópicas, e de imagenologia encontradas, sobre o sistema reprodutor feminino e masculino de ouriço-cacheiro (*Coendou* spp.), em comparação com outras espécies de roedores anteriormente estudadas. Foram utilizados 5 machos e 5 fêmeas de ouriço-cacheiro, já em óbito, provenientes de zoológicos e parques. Os espécimes foram submetidos às técnicas de dissecção, para análise macroscópica do sistema reprodutor, onde também foram realizados exames de imagem, como a tomografia computadorizada, para obter informações adicionais sobre a anatomia reprodutiva. Os resultados revelaram características únicas do sistema reprodutor de ouriço-cacheiro em comparação com outras espécies de roedores. As fêmeas apresentaram um útero bicorno, com dois cornos uterinos separados, enquanto os machos possuíam testículos intra-abdominais e um epidídimo longo e sinuoso. A comparação com outras espécies de

roedores mostrou semelhanças e diferenças na anatomia reprodutiva, cujos resultados contribuem para a compreensão da anatomia reprodutiva do ouriço-cacheiro e fornecem informações valiosas para estudos futuros sobre a reprodução e o comportamento reprodutivo desta espécie. Além disso, o estudo pode auxiliar no desenvolvimento de técnicas de manejo reprodutivo e conservação do ouriço-cacheiro..

Palavras-chave: anatomia; dissecação; histricognatos; roedores.

1. Introduction

Rodents originated in the Paleocene, over 75 million years ago, and today are distributed worldwide due to their remarkable adaptability. They constitute the largest order of mammals, accounting for approximately 42% of global mammalian biodiversity [(1)]. The order Rodentia is divided into five suborders: *Sciuromorpha*, which includes squirrels; *Castorimorpha*, the beavers; *Myomorpha*, the rats and mice; *Anomaluromorpha*, the springhares (*Pedetes capensis*), and *Hystricomorpha*, which includes the capybara *(Hydrochoerus hydrochaeris)*, agoutis, and pacas (*Cuniculus paca*) [(2)].

Porcupines (*Coendou* spp.), commonly called prehensile-tailed porcupines, are arboreal herbivores inhabiting tropical forests from Mexico to South America [(3)]. The morphology of wild animals has been widely studied, particularly the reproductive system and pelvic region, which are essential for understanding mechanisms related to reproduction, ejaculation, and erection, as well as general aspects of the reproductive cycle and comparative embryonic development [(4, 5)].

The objective of this study is to describe the macroscopic anatomy and morphology, as well as imaging features, of the male and female reproductive tracts of *Coendou* spp. The findings aim to improve anatomical sexing and visualization through modern imaging techniques, such as computed tomography, thereby enhancing knowledge of the species, its reproductive biology, and its potential for conservation and clinical management.

2. Material and methods

2.1 Animal origin

The methodology employed in this study was approved by the Animal Use Ethics Committee (CEUA) under protocol no. 0255/2022 and authorized by SISBIO-IBAMA under permit no. 84446-2. Cadaveric specimens from five male and five female porcupines (*Coendou* spp.) were used. The animals were obtained through partnerships with institutions and zoological parks, including the Cidade das Crianças Zoological Park (Presidente Prudente), CEMPAS – Center for Medicine and Research in Wildlife at FMVZ/UNESP, Quinzinho de Barros Municipal Zoological Park, and Bauru Municipal Zoological Park. All specimens had died of causes unrelated to this project.

2.2 Dissection of anatomical specimens for identification of reproductive organs

After collection, the carcasses were thawed and immersed in 10 % buffered formaldehyde solution for 24 hours. Fixation was performed exclusively by immersion due to the small size of the specimens. Following fixation, macroscopic dissection of the reproductive organs was initiated.

The samples were subsequently submitted for structural evaluation using imaging and computed tomography at the Veterinary Hospital of FMVZ/UNESP (Botucatu) and were then returned to the formaldehyde solution until all analyses were completed to ensure effective preservation.

For macroscopic analysis, genital structures of both sexes were differentiated, and the peritoneal cavity was accessed by a midline skin incision extending from the trachea to the pelvic region. The skin, subcutaneous tissue, and muscles were reflected, and the pelvic symphysis was incised to allow optimal observation and exposure of the male and female reproductive organs.

2.3 Computed tomography assessment

Computed tomography was performed to compare imaging results with the macroscopic findings from dissection. Examinations were conducted using a single-channel Shimadzu SCT-7800 helical CT scanner.

The acquisition protocol consisted of 120 kV, 150 mA, and 1-mm slice thickness, except for three specimens, which were scanned at 2-mm thickness. The field of view (FOV) ranged from 15 to 16 cm, with the pilot specimen scanned at 19 cm. Images were obtained in the rostrocaudal direction using a soft tissue window.

3. Results

3.1 Macroscopic evaluation of the female reproductive system by dissection

The ovaries were yellowish, ellipsoidal, dorsoventrally flattened, relatively large, and located caudal to the kidneys in the dorsal abdominal cavity (Figure 1A). The ovarian sac did not completely enclose the ovary, leaving only a single ovarian capsule.

The uterus of female porcupines (*Coendou* spp.) was double and Y-shaped, with two long, cylindrical horns extending caudally and terminating in two completely independent cervices (Figure 1B, D). The cervix displayed variable thickness, isolating the uterus from the external environment; the cervical canal remained closed except during estrus or parturition.

The vulva consisted of two labia that met at the commissures to delimit the external urogenital opening. The clitoris, partially homologous in structure to the penis, was located ventrally within the clitoral fossa. A distinctive feature of the female genitalia was the presence of separate genital and urinary orifices (Figure 1C).

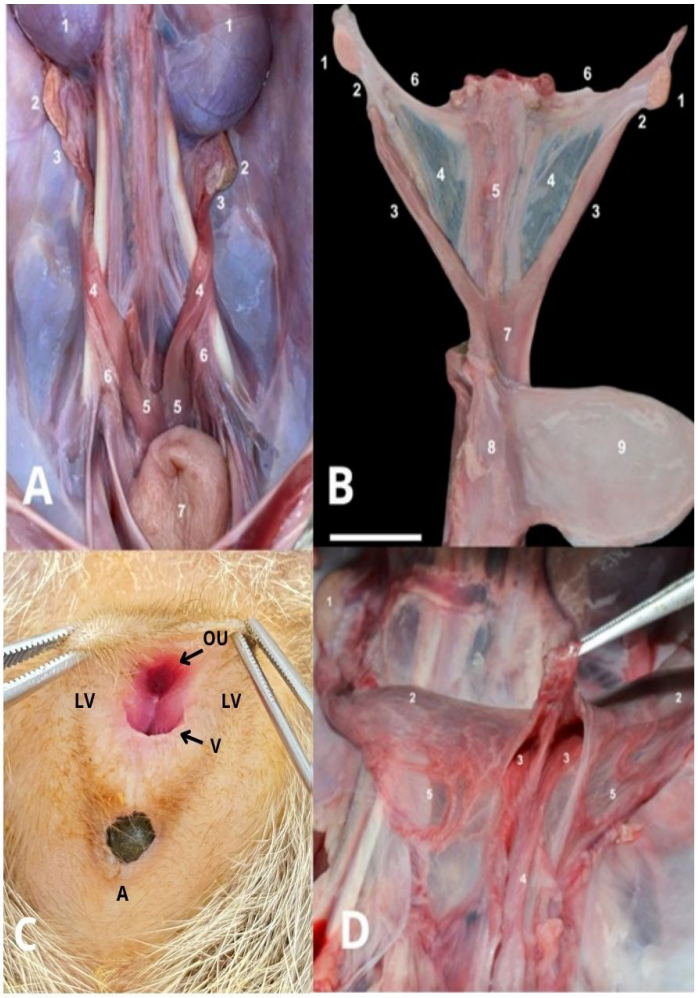

Figure 1. (A) Photomacrograph of the ventral view of the peritoneal cavity after reflection of the intestines, showing the urogenital organs: 1. kidneys; 2. ovaries; 3. utero-ovarian ligament; 4. uterine horns; 5. cervix; 6. broad ligaments of the uterus; 7. urinary bladder. **(B)** Photomacrograph of the dorsal view of the female urogenital organs, highlighting the uterine ligaments: 1. ovary; 2. proper ligament of the ovary; 3. uterine horns; 4. broad ligaments of the uterus; 5. connective tissue surrounding the rectum; 6. round ligament of the uterus; 7. cervices; 8. vagina; 9. urinary bladder. **(C)** Photomacrograph of the caudoventral view of the female perineal region, showing the labia majora (LV), external urethral ostium (OU), vaginal vestibule (V), uterine ostium (Out), and anal opening (A). **(D)** Photomacrograph of the dorsal view of the partially dissected female reproductive system, showing two independent cervices: 1. ovary; 2. uterine horn; 3. cervices; 4. vagina; 5. broad ligament of the uterus. Scale bar = 2 cm.

3.2 Macroscopic evaluation of the male reproductive system by dissection

The male reproductive system of the porcupine (Coendou spp.) consists of the penis, scrotum, prepuce, paired testes (Figure 2A–B), epididymides (head, body, and tail) (Figure 2C), and accessory genital glands, including the seminal vesicles, bulbourethral glands (Figure 2D), and prostate. The testes may be located temporarily within the peritoneal cavity or in the inguinal canal (Figure 3A–B).

The vesicular glands (seminal vesicles) are paired, tubular structures situated in the pelvic cavity, each positioned on either side of the dorsal surface of the urinary bladder, parallel to the vas deferens, and dorsally adjacent to the rectum. The prostate is also paired, ovoid in shape, and located lateral to the urethra, functioning exclusively as a pelvic organ.

As in other mammals, the testes are enveloped by a firm, thick, whitish connective tissue capsule, the tunica albuginea (Figure 3C). The penis bears spicules on the glans, which impart a rough surface appearance.

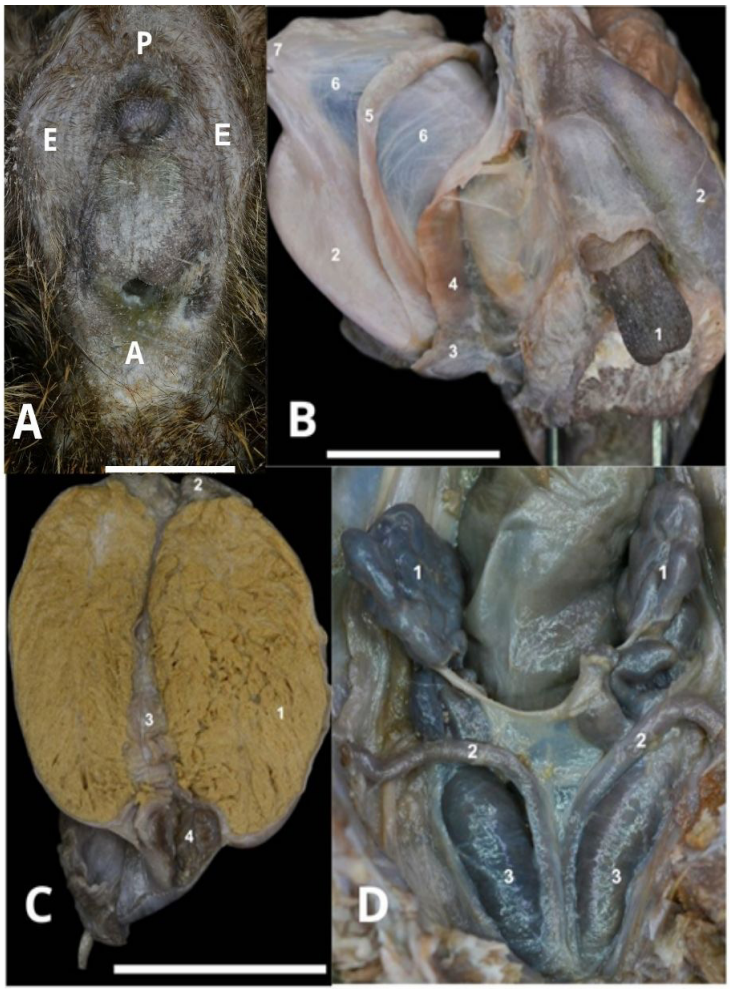

Figure 2. (A) Photomacrograph of the ventral view of the male perineal region, showing the retracted penis, with the prepuce (P) located above the anus (A), and redundant skin corresponding to the empty scrotum (E). **(B)** Photomacrograph of the dorsal view of the internal genital organs after dissection, showing: 1. penis; 2. testes; 3. cauda epididymis; 4. ligament of the cauda epididymis; 5. vas deferens; 6. proximal mesorchium; 7. pampiniform plexus. **(C)** Photomacrograph of the sagittal section of the testis, showing: 1. testicular parenchyma; 2. head of the epididymis; 3. body of the epididymis; 4. cauda epididymis. **(D)** Photomacrograph of the accessory genital glands, showing: 1. seminal vesicle; 2. vas deferens; 3. bulbourethral glands. Scale bar = 2 cm.

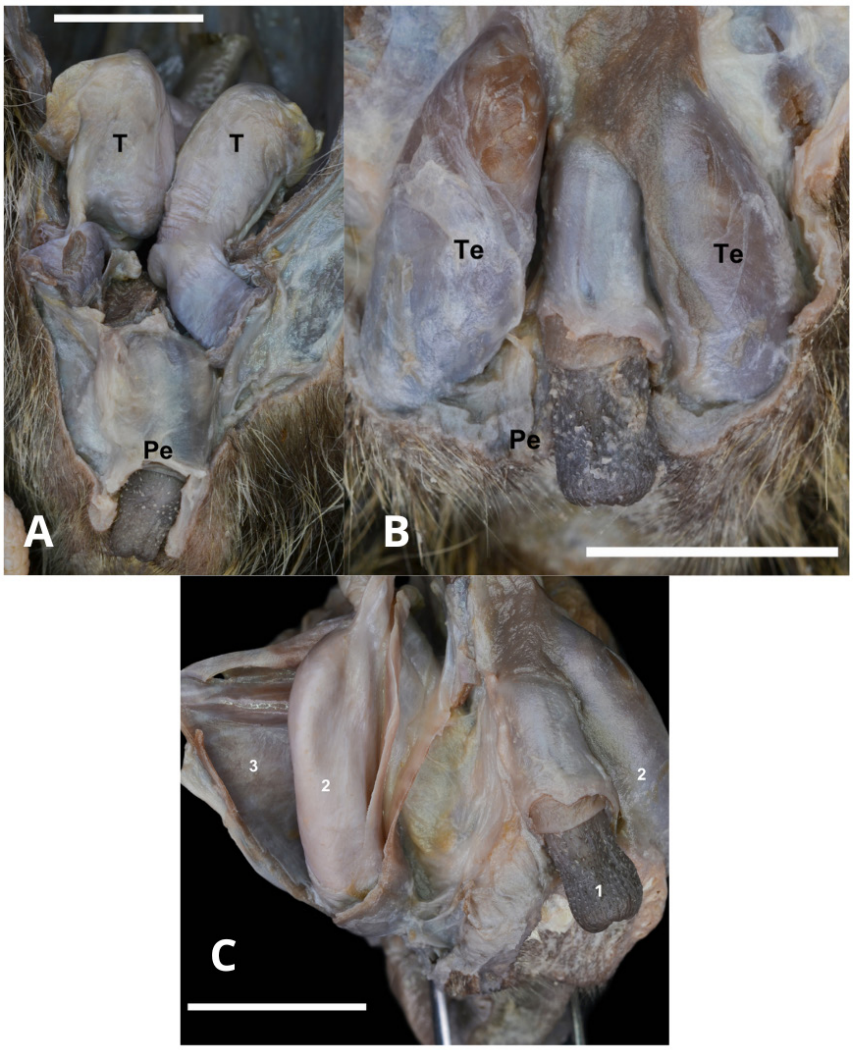

Figure 3. (A) Digital photomacrograph of the ventral view of the male reproductive organs, showing the penis (Pe) exposed after retraction of the prepuce, with the testes (T) visible within the peritoneal cavity. Spicules on the glans are also evident. **(B)** Digital photomacrograph showing the penis (Pe) exposed and the testes (T) positioned outside the peritoneal cavity, in the region corresponding to the scrotum. **(C)** Digital photomacrograph illustrating the tunica vaginalis, tunica albuginea, and spicules of the penis, showing: 1. penis; 2. testes; 3. tunica albuginea. Scale bar = 2 cm.

3.3 Computed tomography assessment

Computed tomography of the hedgehogs enabled the identification of specific characteristics in both female and male individuals. The analysis of the organs was based on attenuation values expressed in Hounsfield units (HU) and on their anatomical positioning, with the results compared to radiographic images and anatomical sections previously documented in published studies.

In females, at the anatomical level of L5, the ovaries were visualized caudal to the kidneys, with a maximum HU measurement of 179 (Figure 4A). The uterine horns showed HU values of approximately 127 (Figure 4B). Structures with HU values near 72, located in the marked area, were interpreted as the vagina, with density consistent with soft tissue (Figure 4C).

In males, images consistent with the testes were identified, with HU measurements of 72 (Figure 5A). A structure compatible with the os penis was also visualized, with HU values of 441 (Figure 5B).

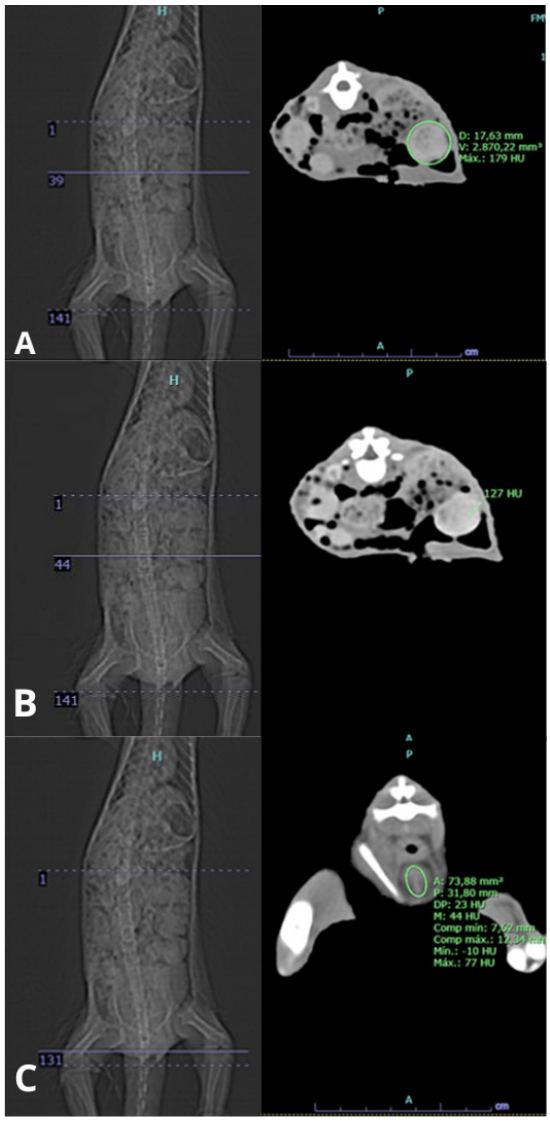

Figure 4. (A) Cross-sectional CT image of the perirenal (caudal) region of a female *Coendou* spp. at the level of L5, showing a site with maximum HU measurement consistent with the ovaries. **(B)** Cross-sectional CT image of the mid-abdominal region of a female *Coendou* spp., showing HU measurements compatible with the uterine horn. **(C)** Cross-sectional CT image of the pelvic region of a female *Coendou* spp., showing HU measurements consistent with the vagina.

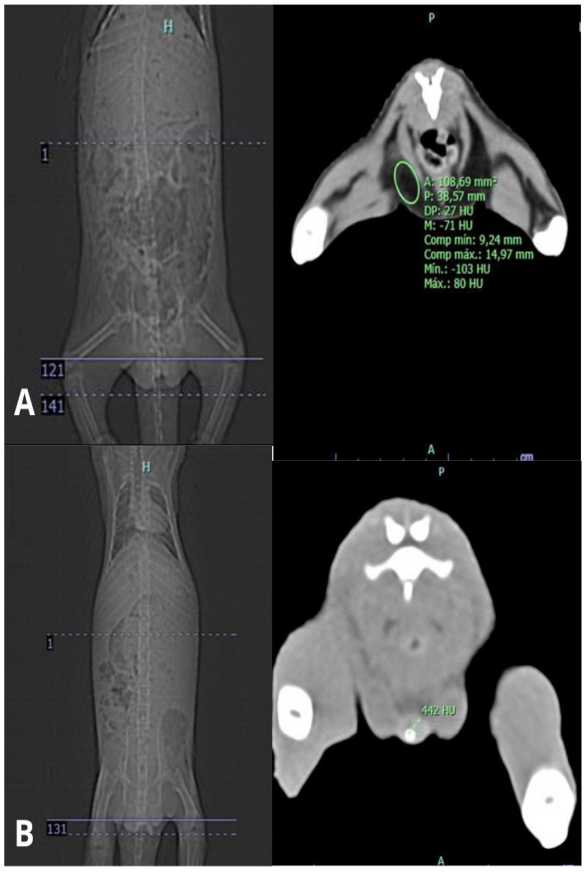

Figure 5. (A) Cross-sectional CT image of the perineal region of a male *Coendou* spp., showing HU measurements consistent with the testis. **(B)** Cross-sectional CT image of the perineal region of a male *Coendou* spp., showing HU measurements consistent with the os penis.

4. Discussion

Hystricomorph rodents display considerable diversity in reproductive habits, yet the general morphology of their reproductive system of this suborder is relatively uniform, as described in several South American species, including the North American porcupine (*Erethizon* sp.) [7], chinchilla (*Chinchilla laniger*) [8], agouti (*Myoprocta pratti*) [9], viscacha (*Lagostomus maximus*) [10], coypu (*Myocastor coypus*) [11], and black agouti (*Dasyprocta fuliginosa*) [6], with *Coendou* spp. also belonging to this group.

Macroscopic dissection combined with computed tomography of the reproductive system of porcupines revealed anatomical and physiological particularities of the species. In males, the absence of an inguinal ring permits bidirectional displacement of the testes between the peritoneal cavity and the scrotum. This condition has also been described in other rodents, such as the white rat (*Rattus norvegicus*) [12], the house mouse (*Rattus rattus*) [13], and the agouti [14]. This contrasts with most mammals, in which the testes remain permanently within the scrotum.

The male reproductive system of *Coendou* spp. is similar to that of the guinea pig (*Cavia porcellus*) [15], capybara [16], agouti [14], and viscacha [17]. These species share the presence of a penis, scrotum, prepuce, paired testes, epididymides, and accessory genital glands, including the bulbourethral glands, seminal vesicles, and prostate. The main distinction is the absence of ampullae of the vas deferens in *Coendou* spp.

The male did not present a pendulous scrotum; only redundant skin was observed in the perineal region, resembling the vulva, and therefore not markedly visible. The external genitalia were firm and showed no positional changes relative to body posture. In quadrupedal stance, the scrotum and vulva remained in the same position, similar to what was reported in the viscacha [18] by Pieri *et al*. [5]. This contrasts with certain primates and didelphids, in which the scrotum may assume a pendulous disposition in quadrupedal posture [2]. However, this characteristic cannot be generalized across hystricomorphs, as it is absent in the paca [18], which possesses a larger and more conspicuous scrotum.

The penis remained entirely within the pelvic cavity, with the glans covered by a discreet prepuce and bearing spicules. Similar structures have been reported in other hystricomorphs [2, 19], where the surface of the glans is described as spiculated, giving it a rough appearance. This feature has also been documented in the rat [20], capybara [16], and guinea pig [21]. In *Coendou* spp., the seminal vesicles were paired, tubular, and craniocaudally elongated. They were located in the pelvic cavity, each positioned dorsolateral to the urinary bladder, parallel to the vas deferens, and dorsally related to the rectum [16], as observed in the capybara.

The female reproductive system of *Coendou* spp. is similar to that of other hystricognath rodents, characterized by a double uterus with two rectilinear uterine horns, intra-abdominal in position and running caudally to terminate in two completely independent cervices [22]. The external genitalia also exhibit distinctive features noted in other female hystricognaths, including capybaras, agoutis, and pacas, where a separate genital orifice and urinary orifice are present [22].

The ovaries were located in the sublumbar region of the peritoneal cavity, caudal to the kidneys, and displayed an oval, dorsoventrally flattened shape. These features are consistent with most hystricomorphs, as reported in guinea pigs [23], pacas [24], and agoutis [12, 13, 25]. In contrast, the ovarian morphology differs in certain other rodents, e.g., albino rat [12, 13] and mice (*Mus musculus*) [26]. The latter have round ovaries [23], whereas capybaras show irregularly shaped ovaries, and in rats the ovary appears as a follicular mass [27, 28]. The light-yellow coloration and smooth external surface of the ovaries in *Coendou* spp. are also typical of most hystricomorphs [29].

Advanced non-invasive imaging techniques, such as computed tomography (CT) and microCT, have made the study of sexual dimorphism in small wild mammals increasingly relevant. These methods permit detailed visualization of internal structures, particularly the reproductive system, without the need for dissection. Such approaches represent an important advance for comparative anatomy and for the conservation of endangered species. CT can effectively identify sexual differences, even when external distinctions are subtle or absent [30, 31].

In the present study, notable reproductive differences between male and female *Coendou* spp. were observed, including intra-abdominal testes in males and a bicornuate uterus in females. Freitas *et al*. [30] described morphological differences in the perineal region of *Coendou prehensilis*, although with less anatomical detail and limited to external aspects. In Syrian hamsters (*Mesocricetus auratus*), microCT images have revealed well-differentiated seminal vesicles and other accessory glands. Because of their glandular and vascular composition, these structures showed higher attenuation than adjacent adipose tissue and appeared as relatively hyperdense areas in comparison with surrounding tissues [31].

The uterus of *Coendou* spp. was visualized as a cavitary structure containing fluid and bounded by a muscular wall, resulting in a hypodense to moderately dense appearance, particularly when compared with the denser testes and accessory glands of males.

Studies of weasels (*Mustela erminea*) using CT and magnetic resonance imaging (MRI) have shown that the uterus and vagina, owing to their predominantly muscular and fluid-filled composition, display lower densities than pelvic bones or male reproductive glands. These results reinforce the value of CT densitometry for sexual differentiation when the appropriate anatomical regions are examined [32].

Quantifying the radiological density of reproductive organs using CT, expressed in Hounsfield units (HU), is a robust method for comparing reproductive structures. In intact adult dogs, the prostate on non-contrast scans showed an average density of 40–70 HU, indicating the relatively higher density of male reproductive glands [33]. These findings support the expectation that glandular tissues, such as testes and seminal glands, appear hyperdense, whereas fluid-containing or less dense structures, such as the uterus or seminal vesicles, appear hypodense (0–50 HU) [33].

The growing use of CT and MRI in the study of reproductive anatomy in terrestrial mammals is noteworthy. These tools enable non-invasive assessment of sexual development and differentiation, with applications extending to ecological and evolutionary contexts [30, 32]. The three-dimensional reconstructions and detailed morphometric analyses achieved with these techniques, as demonstrated in Mustela erminea, further highlight their feasibility across different mammalian orders [32]. The integration of traditional anatomy, advanced imaging, and statistical morphometry therefore represents a promising direction for future research in this field.

5. Conclusion

This study confirmed that sexual dimorphism in porcupines (*Coendou* spp.) is difficult to detect externally, as males and females are similar in size, weight, and coloration, and both exhibit firm external genitalia without notable changes in quadrupedal posture. The only clear external distinction was the greater anogenital distance in males compared with females. Overall, the reproductive tracts of both sexes share features common to other hystricognath rodents. Moreover, our findings contribute to a more detailed understanding of the anatomical particularities of male and female *Coendou* spp.

Conflicts of interest statement

The authors declare no conflicts of interest.

Data availability statement

The data will be provided upon request.

Author contributions

Conceptualization: A. G. Abonizio and A. L. Filadelpho. Data curation: A. G. Abonizio and A. L. Filadelpho. Formal analysis: A. G. Abonizio, A. L. Filadelpho, E. L. R. Oliveira, A. R. D. P. Moraes and L. B. Cueva. Funding acquisition: A. G. Abonizio. Investigation: A. G. Abonizio, A. L. Filadelpho, V. M. V. Machado, E. L. R. Oliveira, A. R. D. P. Moraes and L. B. Cueva. Methodology: A. G. Abonizio and A. L. Filadelpho. Project administration: A. G. Abonizio. Research: A. G. Abonizio, A. L. Filadelpho, V. M. V. Machado, E. L. R. Oliveira, A. R. D. P. Moraes and L. B. Cueva. Supervision: A. L. Filadelpho. Validation: V. M. V. Machado, A. R. D. P. Moraes and L. B. Cueva. Visualization: A. G. Abonizio. Writing (original draft): A. G. Abonizio, A. R. D. P. Moraes and L. B. Cueva. Writing (review and editing): A. L. Filadelpho and V. M. V. Machado.

References

1. Cubas ZS, Silva CR, Catão JLD. Tratado de animais selvagens: medicina veterinária. 2.ed. ed. São Paulo: Roca, 2014. p. 2382-2386.

2. Cury FS, Ambrósio CE. Dimorfismo sexual e estrutura perineal em *Coendou* prehensilis (Ouriço-cacheiro). Pesq. Vet. Bras. 2016; 36;1215-1220. Available at: https://doi.org/10.1590/S0100-736X2016001200013

3. Woods CA, KIlpatrick CW. Infraorder hystricognathi, 2005. p.1538-1600. In: Wilson DE, Reeder DM (Eds), Mammalian Species of the World: a taxonomic and geographic reference. Vol.2. 3rd ed. John Hopkins University Press, Baltimore.

4. Franciolli ALR, Ambrósio CE, Oliveira MF, Morini AC, Favaron PO, Machado MRF, Miglino MA. Os histricomorfos sul-americanos: uma análise comparativa do desenvolvimento embriológico. Pesq. Vet. Bras. 2011; 31;441-446. Available at: https://doi.org/10.1590/S0100-736X2011000500012

5. Pieri NCG, Flamini AM, Barbeito CG, Casals JB, Roque BK, Favaron PO, Miglino MA, Martins DS. Forma e função dos músculos perineais da viscacha (*Lagostomus maximus*). Pesq. Vet. Bras. 2012; 32;183-187. Available at: https://doi.org/10.1590/S0100-736X2012000200016

6. Mayor P, Bodmer RE, Lopez-Bejar M. Functional anatomy of the female genital organs of the wild black agouti (*Dasyprocta fuliginosa*) female in the Peruvian Amazon. Anim. Reprod. Sci. 2011, 123:249-257. Available at: https://doi.org/10.1016/j.anireprosci.2010.12.006

7. Mossman HW, Judas, I. Accessory corpora lutea, lutein Cell origin and the ovarian cycle in the Canadian porcupine. Journal of Anatomy, 1949; 85; 1-39. Available at: https://doi.org/10.1002/aja.1000850103

8. Weir BJ. Aspects of reproduction in chinchilla. J. Reprod. Fertil. 1966;12;410-411.

9. Rowlands IW, Tam WH, Kleiman DG. Histological and Biochemical Studies on the ovary and of progesterone levels in the systemic blood of the green acouchi (*Myoprocta pratti*). J. Reprod. Fertil. 1970; 22;533-545.

10. Weir BJ. The reproductive organs of the female plains viscacha, Lagostomus maximus J. Reprod. Fertil. 1971; 25;365-373.

11. Felipe A, Calleja J, Cabodevila J. Anatomicohistological characteristics of female genital tubular organs of the South American nutria (*Myocastor coypus*). Anat. Histol. Embryol. 1998;27;245-250. Available at: https://doi.org/10.1111/j.1439-0264.1998.tb00188.x

12. Chiasson, RB. Laboratory anatomy of the white rat. 2. ed. Dubuque: Wm. C. Brown, 1969. 81 p. Available at: https://doi.org/10.2307/1005513

13. Greene EC. Anatomy of the rat. New York: Hafner, 1963.

14. Menezes AJD, Carvalho MAM., Assis Neto CA, Oliveira FM, Farias CE, Miglino MA, Medeiros XG. Morfologia dos órgãos genitais externos do macho de cutia (*Dasyprocta aguti* Linneus, 1766). Braz. J. Vet. Res. Anim. Sci. 2003; 40;148-153. Available at: https://doi.org/10.1590/S1413-95962003000800009

15. Cooper G, Schiller, AL. Anatomy of the guinea pig. Cambridge: Harvard University Press, p. 417,1975.

16. Lange RR; Schmidt EMS. Rodentia-Roedores Silvestres (capivara, cutia, paca, ouriço) In: Zalmir SC, Jean CRS; Catão-Dias JL. Tratado de Animais Selvagens. cap. 2007, 29, p.475-491.

17. Chaves EM, Aguilera-Merlo C, Filippa V, Mohamed F, Dominguez SS, L. Anatomical, histological and immunohistochemical study of the reproductive system accessory glands in male Viscacha (*Lagostomus maximus maximus*). Anatomia, Histologia, Embryologia, Berlin, 2010; 40;11-20. Available at: https://doi.org/10.1111/j.1439-0264.2010.01032.x

18. Borges EM, Branco E, Lima AR, Leal LM, Martins LL, Reis ACG, Cruz C, Machado MRF, Miglino MA Morfologia e topografia dos órgãos genitais masculinos externos da paca (*Cuniculus paca* Linnaeus, 1766). Biotemas. 2013; 26:209-220. Available at: https://doi.org/10.5007/2175-7925.2013v26n4p209

19. Pocock, RI. On the external characters of some hystricomorph rodents. Proceeding Zoological Society, London. 1922; 365-427. Available at: https://doi.org/10.1111/j.1096-3642.1922.tb02149.x

20. JunqueriA, LCU, Martins, EO. Atlas de anatomia microscópica do rato. São Paulo - USP: Tipografia Rossolillo, 1947. 142 p.

21. Elsenberg JF. Order rodentia. In: Mammals of the neotropics - The Northern Neotropics. Chicago: The University of Chicago Press. 1989; 1;395-97.

22. Aparicio PM, Plana CL. Atlas de anatomia de Espécies silvestres amazônicas. Volume III – Mamíferos, Órgãos urinários e Órgãos genitais. Belém - Pará: Edufra, 2021.

23. Dumas J. Les animaux de laboratoire. Paris: Éditions Médicales Flammarion, 1953.

24. Matamoros Y. Anatomía e histología del sistema reproductor del tepezcuinte (*Cuniculus paca*). Revista de Biología Tropical. 1981; 29;155-164.

25. Almeida MM.; Carvalho MAM.; Cavalcante Filho MF, Miglino, MA.; Menezes, DJA. Estudo Morfologico e Morfometrico do Ovarios de Cutias (*Dasyprocta aguti*, Linnaeus, 1766). Brazilian Journal of Veterinary Research and Animal Science. 2003; 40;55-62. Available at: https://doi.org/10.1590/S1413-95962003000100006

26. Cook MJ. The anatomy of the laboratory mouse London: Academic press, 1965.

27. Ojasti J. Estudo biologico del chiguire o capibara. Caracas: Fondo Nacional de Investigaciones Agropecuarias, 1973. 262 p.

28. Silva CL., Perdomo F. Algunos aspectos anatomicos e histologicos del sistema genital femenino del chiguire (*Hidrochoerus hidrochaeris*). Revista da Faculdade de Ciências Veterinárias da Universidade Central da Venezuela. 1983, v. 30, n. 1/8, p. 89-97.

29. Weir, B. J.; Rowlands, I. W. Functional anatomy of the hystricomorph ovary. In: Symposium of The Zoological Society of London, 34., [s.l.], 1974. Proceedings... p. 303-332.18- AARDE, R. J.; SKINNER, J. D. Functional anatomy of the ovaries of pregnant and lactating cape porcupines, Hystrix africae australis Journal of Reproduction and Fertility, v. 76, n. 2, p. 553-559, 1986.. Available at: https://doi.org/10.1017/S0952836902000055

30. Freitas MC. *et al*. Dimorfismo sexual e estrutura perineal em *Coendou prehensilis* (ouriço-cacheiro). Pesquisa Veterinária Brasileira. 2016; 36(12);1173–1178. Available at: https://doi.org/10.1590/S0100-736X2016001200012

31. Mohammadzadeh, N. et al. Sectional Anatomy with Micro-Computed Tomography and Magnetic Resonance Imaging Correlation of the Middle and Caudal Abdominal Regions in the Syrian Hamster (*Mesocricetus auratus*). Available at: https://doi.org/10.3390/ani15091315

32. Fenelon JC, Pereira MR, Johnston, GC. MRI-based analysis of female reproductive morphology in *Mustela erminea*. Journal of Anatomy. 2023. Available at: https://doi.org/10.1093/icb/icac027

33. Kuhnt Felix *et al*. Computed tomographic appearance of the prostate gland in intact male dogs: Evaluation of different age groups. BMC Veterinary Research. 2017; 13;123. Available at: https://doi.org/10.1186/s12917-020-02374-8