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Morphology of the skin scales and sense organs of *Anolis carolinensis*

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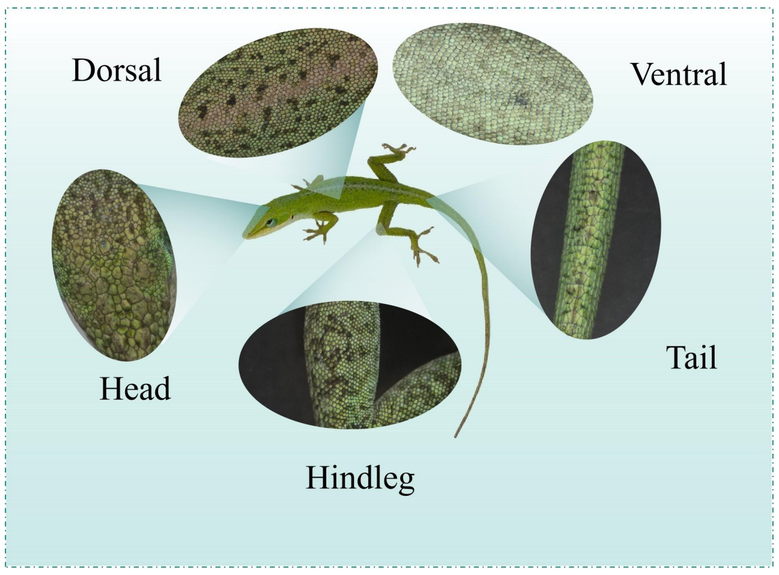
INTRODUCTION & AIM

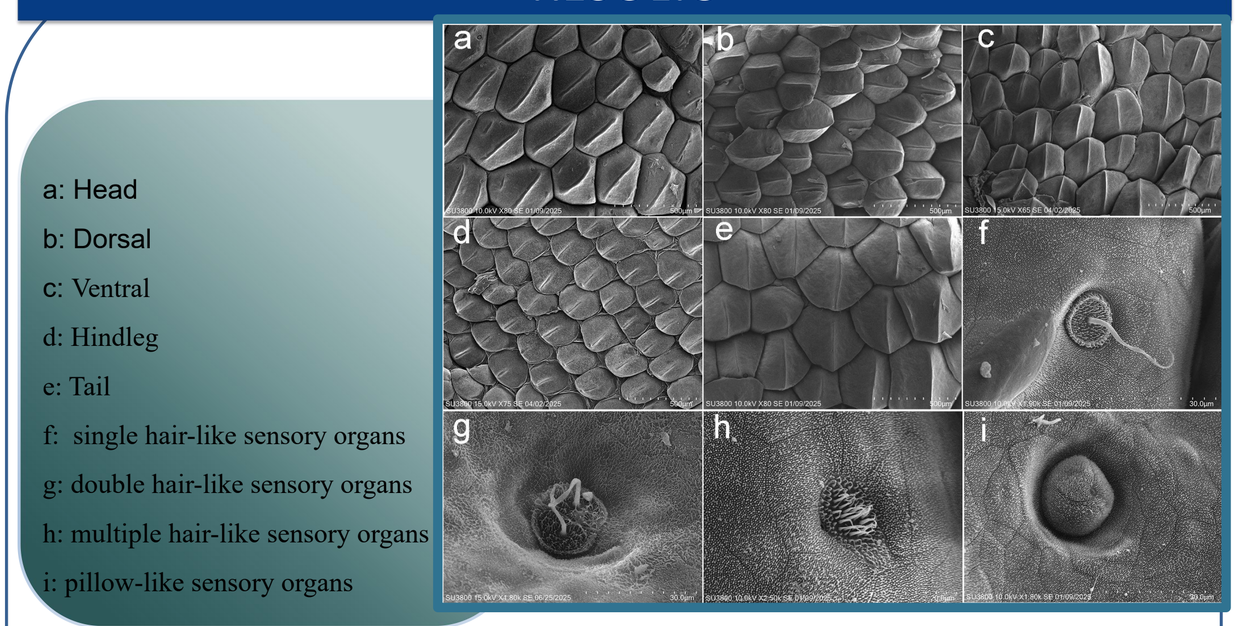
- Although the skin-scale microstructures of squamate reptiles are known to be highly adapted for habitat-specific functions, including protection, camouflage, and thermoregulation, the structural adaptations of the skin of the color-changing ectotherm *Anolis carolinensis* have not been systematically investigated.
- This study details the adaptive microstructures of scales and sensory organs in *A. carolinensis*, providing key morphological insights into their interactions with the environment. Beyond deepening our knowledge of squamate integumentary adaptations, the work directly contributes to understanding the mechanistic basis of color change and thermoregulation.

Method

The scale microstructures across key body regions (head, dorsum, venter, tail, and hindleg) of *A. carolinensis*(♂=2, ♀=1) were meticulously examined using scanning electron microscopy. Statistical analyses were further conducted on the morphological types, density, and distribution of skin sense organs.



RESULTS



a: Head
b: Dorsal
c: Ventral
d: Hindleg
e: Tail
f: single hair-like sensory organs
g: double hair-like sensory organs
h: multiple hair-like sensory organs
i: pillow-like sensory organs

Two morphotypes of cutaneous sensory organs can be identified on the scales, namely hair-like sensory organs and pillow-like sensory organs, with the former being approximately 20 times as numerous as the latter. The pillow-like sensory organs exhibit a pillow-shaped raised structure and are commonly found in the incompletely mature epidermal layer.

Acknowledgements

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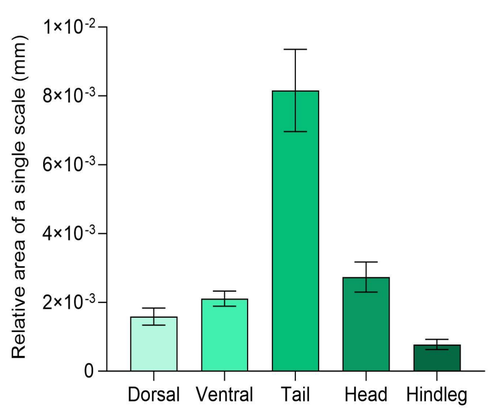
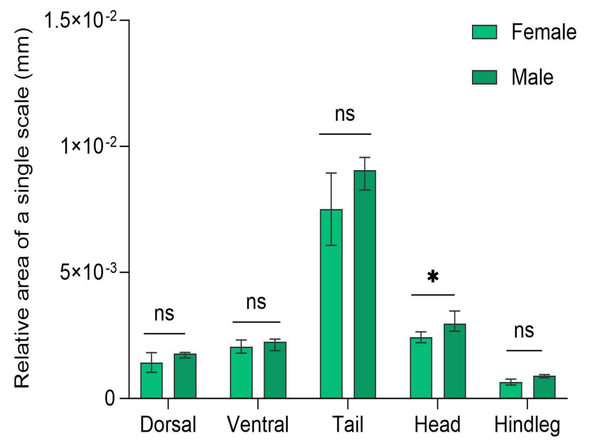
RESULTS

Sex	Body Part	Scale Shape	Side Length of Polygon / mm	Perimeter of Sub-circular Shape / mm	Area per Scale / mm²	Number of Sensory Organs per Scale
Male	Head	Polygon	0.23±0.06		0.11±0.02	1-2
		Sub-circular		0.96±0.07	0.07±0.01	
	Dorsal	Polygon	0.15±0.03		0.07±0.01	0-1
	Ventral	Sub-circular		1.13±0.07	0.10±0.01	0
	Hindleg	Sub-circular		0.89±0.07	0.06±0.01	0-1
	Tail	Hexagonal imbricate	0.24±0.06		0.12±0.02	0-2
Female	Head	Polygon	0.18±0.06		0.09±0.04	0-4
		Sub-circular		0.81±0.09	0.05±0.01	
	Dorsal	Polygon	0.14±0.04		0.06±0.01	0-1
	Ventral	Sub-circular		1.09±0.06	0.09±0.01	1-3
	Hindleg	Sub-circular		0.67±0.08	0.03±0.01	0-4
	Tail	Hexagonal imbricate	0.16±0.05		0.11±0.02	1-3

- cutaneous sensory organs, located adjacent to a raised median ridge on each scale, were more densely distributed on the head, venter, hindlegs, and tail (0-4 per scale) compared to the dorsum (0-1 per scale).
- Females were dominated by single sensory hairs, while males were dominated by multiple sensory hairs, and the number of organs in males was about half of that in females.





Relative area of a single scale: Area of a single scale (mm²) / Snout-vent length (SVL, mm)

- The scales mainly exhibit irregular hexagonal and sub-circular shapes. Scale area varied significantly across body regionsd ($p<0.05$), with the largest scales located on the tail .
- All morphological traits (e.g., snout-vent length, SVL) of male individuals were larger than those of females. No significant difference was observed in the relative area of scales between the two sexes across most body regions, except for the head($t = -2.736$, $p = 0.190$).

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CONCLUSION

We found that the scales of this species were predominantly irregular hexagonal and sub-circular in shape, with significant differences in scale area across different body regions. Two types of cutaneous sensory organs, hair-like and pillow-like, were distributed on the scales. The distribution of these cutaneous sensory organs exhibits distinct regional specificity and significant sexual dimorphism.

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