

**Sexual Variability of Histological Skin Parameters  
of *Salamandrella keyserlingii* (Amphibia, Caudata)  
in the Aquatic and Terrestrial Phases of its Seasonal Cycle**

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**Abstract.** Histological features of the dorsal (DS), throat (TS) and tail skins (caudal skin, CS) were examined in *Salamandrella keyserlingii* females of the aquatic and terrestrial morphotypes. Using histological and statistical methods, sexual differences in the relative areas of epidermis, strata compactum and spongiosum, connective tissue in the whole, granular and mucous glands were measured. In the aquatic phase, males, in comparison with females, have larger areas of the connective tissue in TS and DS, a larger area of the epidermis in CS, but smaller areas of the granular glands in the upper part of CS and elements of the connective tissue in the lower part of CS. In the terrestrial phase, sexual differences were weakly expressed. Females, in comparison with males, have larger areas of the connective tissue in the whole and its stratum spongiosum in the upper part of CS. Elements of the connective tissue made the greatest contribution to the formation of sexual differences of the skin in *S. keyserlingii*.

**Keywords:** tailed amphibians, integument, morphotype, skin histology, secondary sexual characteristics.

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## REFERENCES

Kuranova V. N., Yartsev V. V. Sexual, Seasonal, and Interannual Variability of Morphological Characteristics of Siberian Newt, *Salamandrella keyserlingii* Dybowski, 1870, from the South-east of Western Siberia. *The Problems of Herpetology: Proceedings of the 4th Meeting of the Nikolsky Herpetological Society*. Saint Petersburg, Russkaia kolleksiia Publ., 2011, pp. 136–141 (in Russian).

Sokolov V. E. Morphological Adaptations of the Amphibian Skin in USSR Fauna to the Terrestrial Mode of Life. *Zoologicheskii Zhurnal*, 1964, vol. 18, iss. 9, pp. 1410–1411 (in Russian).

Yartsev V. V. *Osnovy gistologicheskoy tekhniki dlya zoologov: uchebno-metodicheskoye posobiye dlya biologicheskikh spetsialnostey vuzov* [Basics of Histological Techniques for Zoologists: Teaching Aid for Biological Specialties of Universities]. Tomsk, Izdatel'skii Dom Tomskogo gosudarstvennogo universiteta, 2019. 84 p. (in Russian).

Yartsev V. V., Evseeva S. S. Histological Characteristics of the Skin of *Salamandrella keyserlingii* (Caudata, Hynobiidae) Males in the Aquatic and Terrestrial Phases of Their Seasonal Cycle. *Current Studies in Herpetology*, 2018 a, vol. 18, iss. 1–2, pp. 54–63 (in Russian). DOI: <https://doi.org/10.18500/1814-6090-2018-18-1-2-54-63>

Yartsev V. V., Evseeva S. S. Histological Characteristics of the Skin of *Salamandrella keyserlingii* (Caudata, Hynobiidae) Females in Aquatic and Terrestrial Phases of Seasonal Cycle. *Current Studies in Herpetology*, 2018 b, vol. 18, iss. 3–4, pp. 159–167 (in Russian). DOI: <https://doi.org/10.18500/1814-6090-2018-18-3-4-159-167>

Aoto T. A Remarkable Swelling of male Skin of a Salamander (*Hynobius retardatus* Dunn) in the Breeding Season. *J. of the Faculty of Science Hokkaido University, Zoology*, 1950, vol. 10, no. 1, pp. 45–53.

Exbrayat J. M. Classical Methods of Visualization. In: J. M. Exbrayat, ed. *Histochemical and Cytochemical Methods of Visualization*. Boca Raton, London,

New York, CRC Press Taylor and Francis Group, 2013, pp. 3–58.

Fox H. Epidermis. In: J. Bereiter-Hahn, A. G. Matoltsy, K. S. Richards, eds. *Biology of the Integument. 2 Vertebrates*. Berlin, Heidelberg, New York, Springer-Verlag, 1986. pp. 78–110.

Hasumi M., Iwasawa H. Seasonal Changes in Body Shape and Mass in the Salamander, *Hynobius nigrescens*. *J. of Herpetology*, 1990, vol. 24, no. 2, pp. 113–118.

Hasumi M., Iwasawa H. Wandering Behavior and Cutaneous Changes in Winter-dormant Male Salamanders (*Hynobius nigrescens*). *Herpetologica*, 1992, vol. 48, no. 3, pp. 279–287.

Hasumi M., Iwasawa H., Nagahama Y. Seasonal Changes in Plasma Concentrations of Sex Steroids in the Salamander *Hynobius nigrescens*. *General and Comparative Endocrinology*, 1993, vol. 90, no. 1, pp. 51–57.

Mosconi G., Yamamoto K., Kikuyama S., Carnevali O., Mancuso A., Vellano C. Seasonal Changes of Plasma Prolactin Concentration in the Reproduction of the Crested Newt (*Triturus cristatus* Laur.). *General and Comparative Endocrinology*, 1994, vol. 95, no. 3, pp. 342–349.

Norris O., Lopez K. H. *Hormones and Reproduction of Vertebrates. Vol. 2. Amphibian*. San Diego, Academic Press, 2011. 240 p.

Polzonetti-Magni A., Carnevali O., Yamamoto K., Kikuyama S. Growth Hormone and Prolactin in Amphibian Reproduction. *Zoological Science*, 1995, vol. 12, no. 6, pp. 683–694.

Vitt L. J., Caldwell J. P. *Herpetology: An Introductory Biology of Amphibians and Reptiles*. 4th ed. Amsterdam, Academic Press, 2014. 757 p.

Wells K. D. *The Ecology and Behavior of Amphibians*. London, University of Chicago Press, 2007. 1148 p.

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