Evolution of the cloacal and genital musculature, and the genitalia morphology in liolemid lizards (Iguania: Liolaemidae) with remarks on their phylogenetic bearing

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Supplementary Material

Character list

The continuous characters (2, 18, 22, 26 and 27) were coded as discrete to facilitate analysis and optimizations, states assigned were following Thiele (1993) and were coded according to their variation in: binary, multistate, and polymorphic (based on male characters).

Characters assignation are shown in Table S1.

1– Tendinal origin of ischiocaudalis: (0) lateral side of ischium; (1) dorsal.

2– Ischiocaudalis tendon length (standarized with SVL).

3– Insertion of retractor penis magnus: (0) 7th vertebra; (1) 8th vertebra; (2) 9th vertebra; (3) 10th vertebra; (4) 11th vertebra; (5) 12th vertebra.

4– Origin of the retractor penis magnus: (0) vertebral centre; (1) transverse processes.

5– Ischiocaudalis rami connected to the roof of the cloaca: (0) absent; (1) present.

6– Superficialis cloacalis retractor: (0) absent; (1) present.

7– Posterior cloacal retractor muscle (0) present; (1) absent.

8– Position of the posterior cloacalis retractor: (0) restricted to the medial region; (1) covering the transversus penis.

9– Retractor lateral anterior. (0) absent; (1) present.

10– Site of origin of most posterior vertebra of retractor lateral anterior: (0) absent; (1) 3rd vertebra; (2) 4th vertebra; (3) 5th vertebra; (4) 6th vertebra.

11– Number of vertebrae where retractor lateral anterior is originated: (0) absent; (1) only one vertebra; (2) two vertebrae.

12– Retractor lateral posterior: (0) absent; (1) present.

13– Most posterior vertebra site of origin of retractor lateral posterior: (0) 6th vertebra; (1) 7th vertebra; (2) 8th vertebra; (3) absent

14– Number of vertebrae where retractor lateral posterior is originated: (0) absent; (1) 1 vertebra; (2) 2 vertebrae; (3) 3 vertebrae; (4) 4 vertebrae.

15– Most posterior vertebra site of insertion of iliocaudalis: (0) 7th vertebra; (1) 8th vertebra; (2) 9th vertebra; (3) 10th vertebra; (4) 11th vertebra.

16– Most posterior vertebra site of insertion ischiocaudalis. (0) 7th vertebra; (1) 8th vertebra; (2) 9th vertebra; (3) 10th vertebra; (4) 11th vertebra.

17– Most posterior vertebra site of origin of transversus penis: (0) 4th vertebra; (1) 5th vertebra; (2) 6th vertebra; (3) 8th vertebra.

18– Hemipenis length/SVL.

19– Hemipenis apex ornamentation: (0) smooth; (1) valves; (2) plicae; 3) calyces.

20– Round prominence of the asulcate side of the hemipenis: (0) present; (1) absent.

21– Hemipenis pigmentation: (0) absent; (1) present.

22– Sulcus spermaticus width/hemipenis length (continuos).

23– Ornamentation in the sulcate face: (0) smooth; (1) flounces; (2) calyces.

24– Ornamentation in the asulcate face: (0) flounces; (1) calyces.

25– Hemipenes terminal tip morphology: (0) simple; (1) little lobed; (2) moderately lobed; (3) strongly lobed.

26– Hemipenis width at its half length/total length of hemipenis (continuos).

27– Hemipenis width at its free ending/total length of hemipenis (continuos).

Table S1. Muscles variation encoded for phylogenetic and evolutionary interpretations. The numbers within the table correspond to the assigned status. For character definitions see character list. ?: not applicable; two numbers: two states assigned or polymorphic states.

Species/ Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
C. adspersa	1	0	0-1	1	1	0	1	?	1	3	2	1	0	2	2	2	0	0	0	0	0	0	0	0	0	2	0
L. irregularis	1	2	0-1	0	1	1	0	1	1	1	1	1	0	1	1	1	?	1	1	0	0	2	1	0	2	1	1
L.austromendocinus	1	3	0-1	1	1	1	0	1	1	2	1	1	1	2	0	0	1	2	1	0	0	1	2	0-1	2	1	2
P. laurenti	1	1	2-3	1	0	0	0	0	1	0	2	1	2	3	2-3	2-3	?	1	2	1	1	1	2	1	1	0	2
P. palluma	1	1	3	0	0	0	0	0	1	1	1	1	1	2	2	2	1	0	2	1	1	1	2	1	1	0	2
P. patagonicus	1	2	4	0	0	0	0	0	1	2	1	1	1	2	3	3	2	1	2	1	0	1	0	1	1	2	0
T. melanopleurus	0	1	3	0	0	0	0	0	0	?	0	0	?	0	3	3	1	3	3	1	0	2	2	1	3	0	1
D. leopardinus	0	1	5	0	0	0	0	0	1	2	1	1	2	3	4	4	3	1	3	1	0	2	2	1	3	0	1