**Supplemental Information**

**Supplemental Information 1.** Gekkotan genera known to exhibit subcaudal adhesive pads. Number of species allocated to each genus, not the number of species investigated, is listed. D, Diplodactylidae; G, Gekkonidae; S, Sphaerodactylidae.

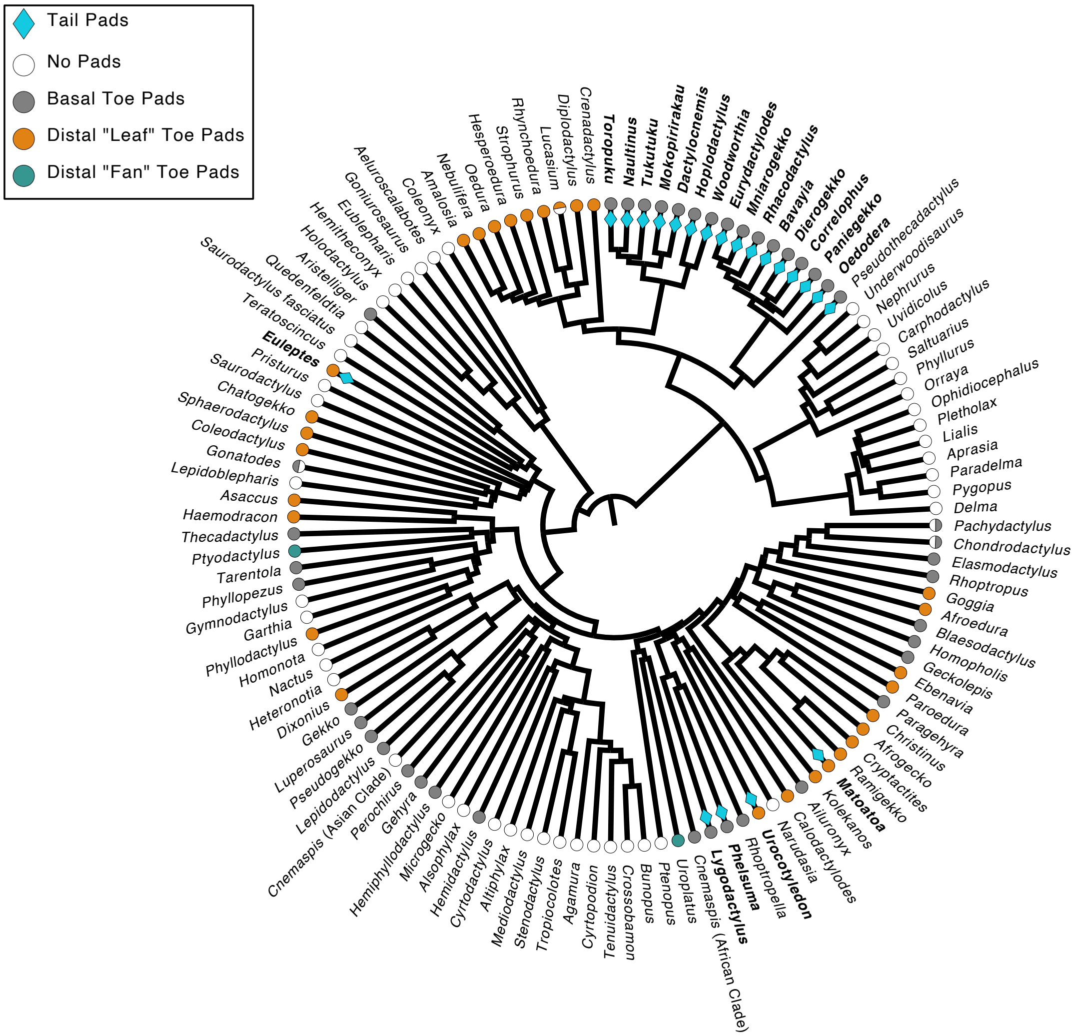
| Family | Genus | Species | Geographic Distribution | References |
|---|---|---|---|---|
| G | *Urocotyledon* | 5 | Equatorial Africa, Tanzania, Seychelles Islands | Müller, 1910; Eijsden, 1962; Perret, 1963; Mertens, 1964 |
| G | *Lygodactylus* | 77 | Sub-Saharan Africa, Madagascar, South America | Tornier, 1899; Fitzsimons, 1943; Loveridge, 1947; Mertens, 1964; Pasteur, 1964; Greer, 1967; Maderson 1971; Vitt & Ballinger |
| G | *Phelsuma* | 52 | Madagascar, Indian Ocean Islands | Mertens, 1964; Nussbaum *et al*., 1998 |
| G | *Matoatoa* | 2 | Madagascar | Nussbaum *et al*., 1998 |
| S | *Euleptes* | 1 | Southern France, Italy, Mediterranean Islands | Fitzinger, 1843; Wiedersheim, 1876; Lataste, 1877; Boulenger, 1878, 1879; Mourgue, 1910; Schreiber, 1912; Angel, 1946; Freytag, 1975; Rieppel & Schneider, 1981 |
| D | *Pseudothecadactylus* | 3 | Northern Australia | Cogger, 1975; Bauer, 1998 |
| D | *Oedodera* | 1 | New Caledonia | Bauer, pers. obs. |
| D | *Paniegekko* | 1 | New Caledonia | Bauer & Sadlier, 2000; Bauer *et al*., 2000 |
| D | *Dierogekko* | 9 | New Caledonia | Bauer & Sadlier, 2000 |
| D | *Correlophus* | 3 | New Caledonia | Boulenger, 1883; Meier, 1979; Bauer & Russell, 1990, 1994; Bauer, 1998; Bauer & Sadlier, 2000 |
| D | *Bavayia* | 12 | New Caledonia | Boulenger, 1883; Bauer 1990; Bauer, 1998; Bauer & Sadlier, 2000 |
| D | *Eurydactylodes* | 4 | New Caledonia | Boulenger, 1883; Bauer & Russell, 1990, 1994; Bauer, 1998; Bauer & Sadlier, 2000 |
| D | *Mniarogekko* | 2 | New Caledonia | Bauer & Russell, 1990, 1994; Bauer & Sadlier, 2000 |
| D | *Rhacodactylus* | 4 | New Caledonia | Boulenger, 1878, 1879, 1883; Bauer & Russell, 1990, 1994; Bauer, 1998; Bauer & Sadlier, 2000 |
| D | *Hoplodactylus* | 1 | New Zealand | Bauer & Russell, 1990, 1994 |
| D | *Woodworthia* | 3 | New Zealand | Bauer & Russell, 1990, 1994; Bauer, 1998 |
| D | *Mokopirirakau* | 4 | New Zealand | Bauer & Russell, 1990, 1994 |
| D | *Dactylocnemis* | 1 | New Zealand | Bauer & Russell, 1990, 1994; Bauer, 1998 |

| | | | | |
|---|---|---|---|---|
| D | *Tukutuku* | 1 | New Zealand | Bauer & Russell, 1990, 1994 |
| D | *Toropuku* | 2 | New Zealand | Bauer & Russell, 1990, 1994; Bauer, 1998 |
| D | *Naultinus* | 9 | New Zealand | Bauer & Russell, 1990, 1994; Bauer, 1998 |

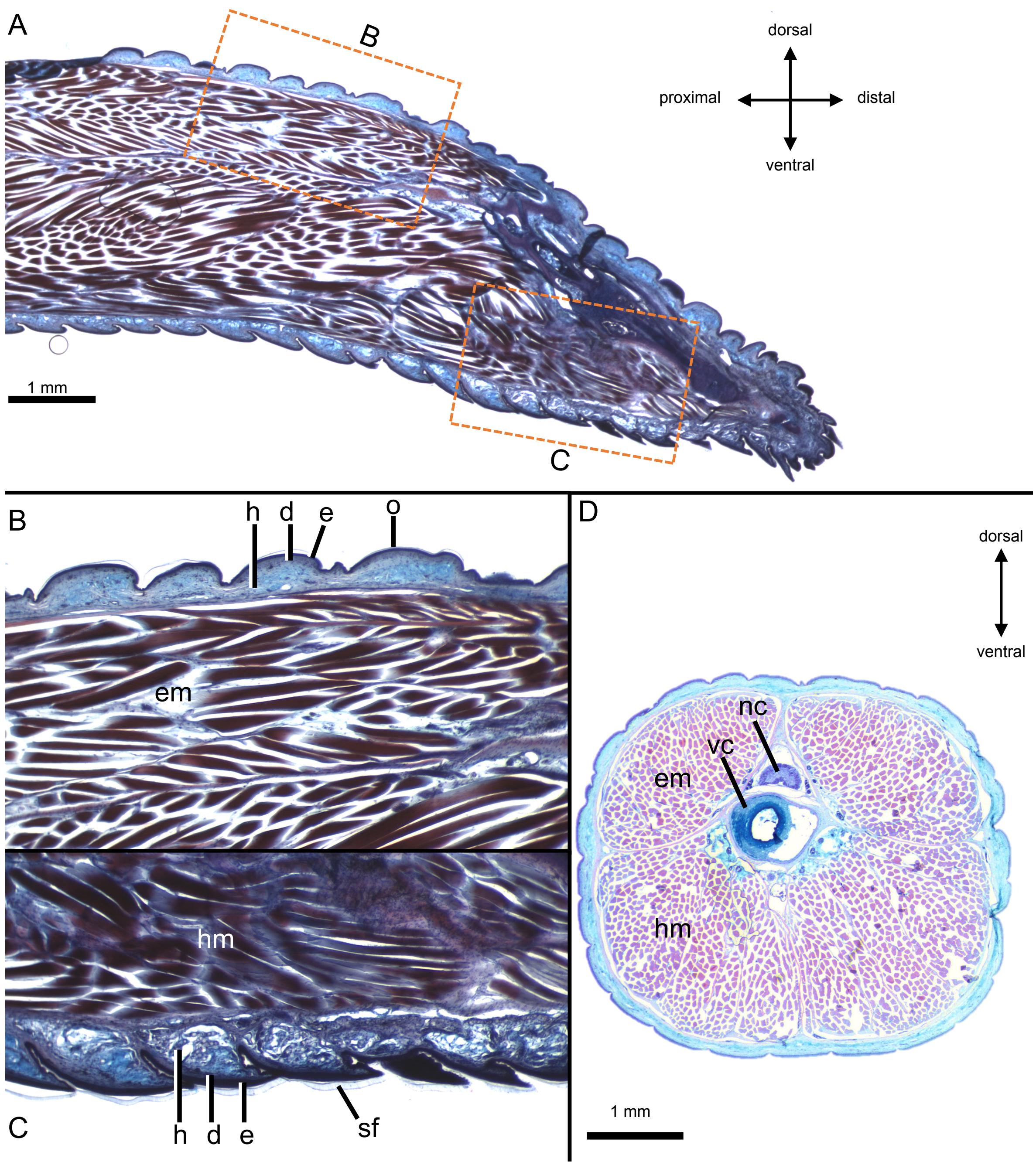
**Supplemental Information 2.** Features of diplodactylid gecko scale microstructures. Updated from Bauer (1998). BSW, basal setal width (µm); MSL, maximum setal length (µm); NCP, New Caledonian + *Pseudothecadactylus* Clade; NZ, New Zealand Clade; SD, setal density ($10^2$ setae/mm$^2$); STW, setal tip width (µm). *Dactylocnemis pacificus* data from Schleich & Kästle (1986). *Publishing error in Bauer (1998) as "($10^3$ setal stalks/mm$^2$)" — correct unit is$10^2$ setal stalks/mm$^2$.

| Clade | Taxon | Structure | MSL | BSW | STW | SD* |
|---|---|---|---|---|---|---|
| NZ | *Woodworthia maculata* | Tail (regen.)<br>Toe | 13.0<br>13.0 | 0.6<br>0.6 | 0.7<br>0.7 | 340<br>342 |
| NZ | *Dactylocnemis pacifius* | Toe | 17.0 | 1.5 | — | 280 |
| NZ | *Toropuku stephensi* | Toe | 17.0 | 0.8 | — | 458 |
| NZ | *Naultinus elegans* | Tail (orig.)<br>Toe | 9.0<br>15.0 | —<br>0.8 | —<br>— | 773<br>621 |
| NZ | *Naultinus rudis* | Toe | 21.0 | 0.8 | — | 490 |
| NCP | *Pseudothecadactylus australis* | Tail (orig.) | 38.0 | — | 0.6 | 120 |
| NCP | *Pseudothecadactylus lindneri* | Tail (orig.)<br>Toe | 40.0<br>37.0 | 1.4<br>1.2 | 0.5<br>0.6 | 160<br>142 |
| NCP | *Eurydactylodes viellardi* | Tail (orig.)<br>Toe | 15.0<br>19.0 | —<br>— | —<br>— | —<br>363 |
| NCP | *Bavayia cyclura* | Tail (orig.)<br>Toe | 32.0<br>32.0 | 1.3<br>1.3 | 0.5<br>0.5 | 356<br>429 |
| NCP | *Bavayia sauvagii* | Tail (orig.)<br>Tail (regen.)<br>Toe | 31.0<br>29.0<br>31.0 | 1.2<br>1.3<br>1.5 | 0.5<br>0.5<br>0.5 | 375<br>—<br>335 |
| NCP | *Rhacodactylus auriculatus* (juv.) | Tail (orig.) | 18.0 | — | 0.5 | 360 |
| NCP | *Rhacodactylus auriculatus* (adult) | Tail (orig.)<br>Tail (regen.)<br>Toe | 35.0<br>37.0<br>38.0 | 1.4<br>—<br>— | 0.6<br>0.6<br>0.6 | 137<br>—<br>172 |
| NCP | *Rhacodactylus leachianus* | Tail (orig.) | 34.0 | 1.3 | 0.6 | 180 |
| NCP | *Correlophus sarasinorum* | Tail (regen.)<br>Toe | 27.0<br>36.0 | 1.3<br>1.3 | 0.6<br>0.6 | 138<br>134 |
| NCP | *Correlophus ciliatus* | Tail (orig.)<br>Toe | 26.6<br>32.7 | 1.1<br>1.1 | 1.6<br>2.0 | 329<br>300 |

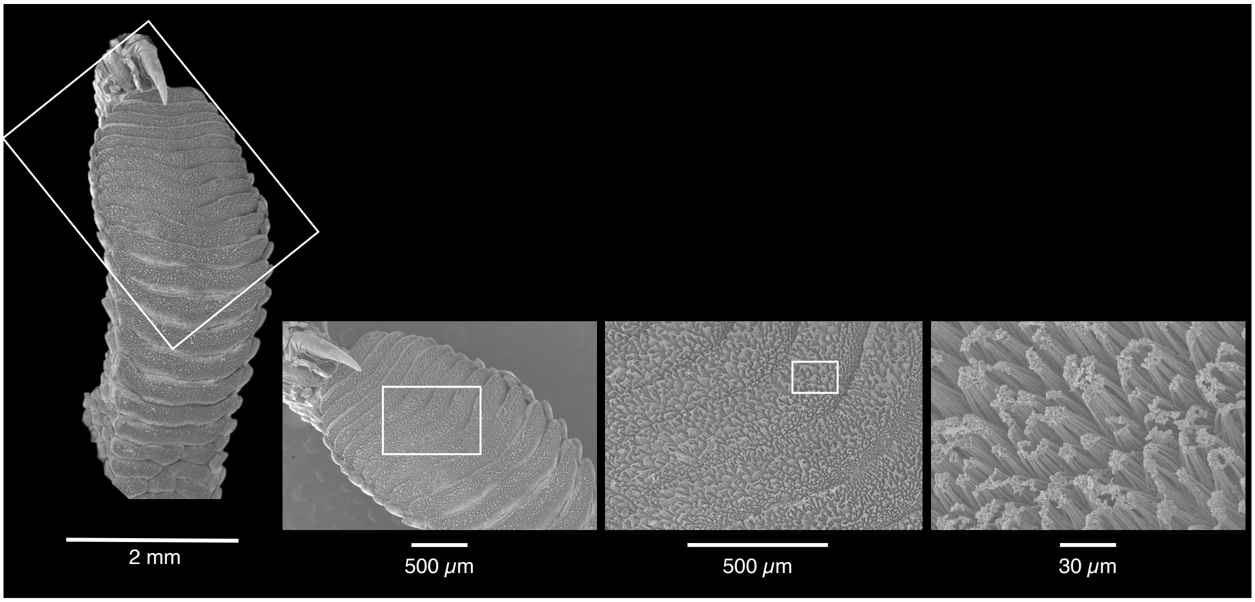
**Supplemental Information 3.** Phylogeny of gecko genera demonstrating phylogenetic diversity of adhesive pads. Taxa with tail pads are bolded. Phylogeny and character state information modified from Gamble et al. (2015) and Russell & Gamble (2019), respectively.



**Supplemental Information 4.** Histology of an adult *Correlophus ciliatus* tail. Hall-Brunt Quadruple stain. **A)** Sagittal section of distal most tip of adhesive tail pad. **B)** Magnified dorsal portion of tail tip exhibiting dome-shaped scales with thin Oberhäutchen layer. **C)** Magnified ventral portion of tail tip exhibiting imbricate adhesive scansors with setae-bearing Oberhäutchen layer. **D)** Transverse section through tail at mid-length exhibiting enlarged hypaxial muscle bundles. d, dermis; e, epidermis; em, epaxial muscle; h, hypodermis; hm, hypaxial muscle; nc, nerve cord; o, non-setal spinulate Oberhäutchen; sf, setal field; vc, vertebral centrum.

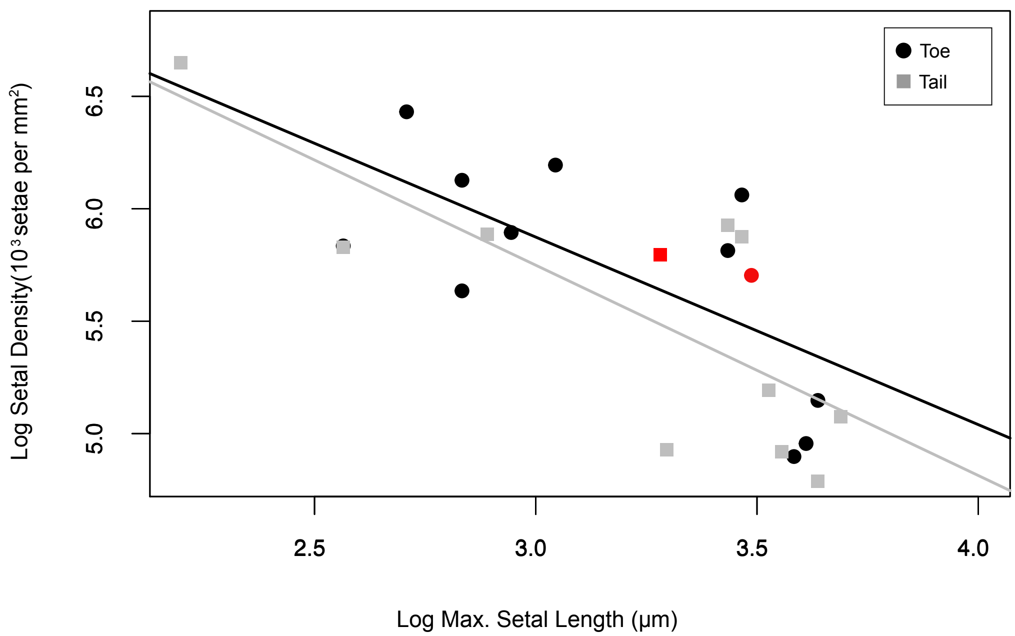


**Supplemental Information 5**. Scanning electron micrographs in ventral view of an adult *Correlophus ciliatus* toe pad (manus, digit IV). Magnified images of the distal portion of the toe tip are framed by solid white boxes.

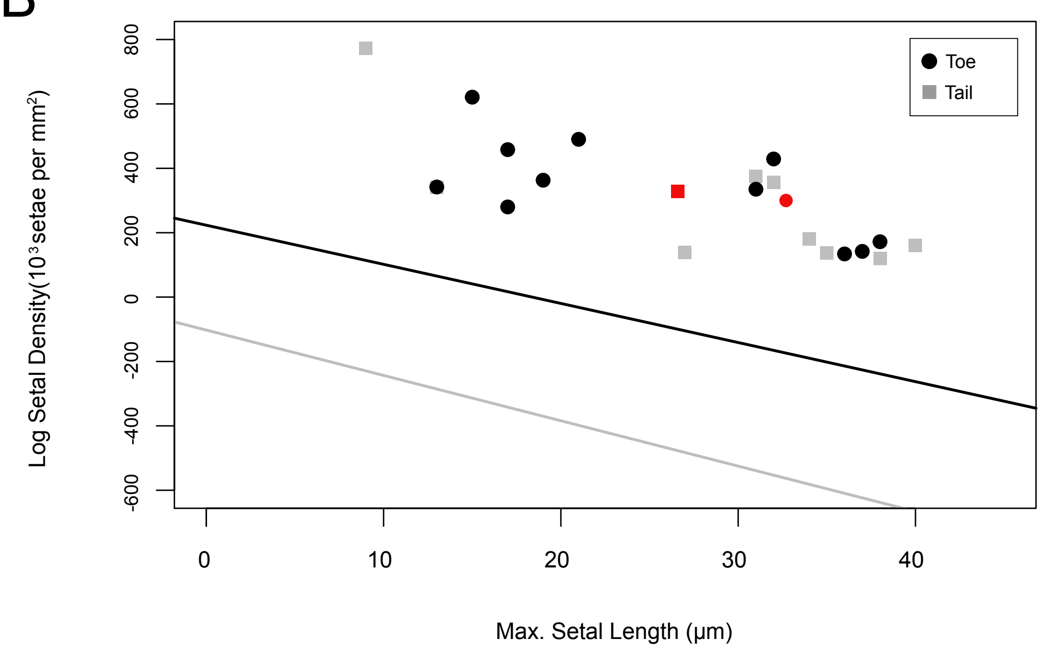


**Supplemental Information 6. A)** Relationship between maximum setal length and setal density. **B)** Raw data for setal length and setal density with fitted lines from phylogenetic independent contrasts (PIC). Significant relationship between setal length and density exists for toe pads but not tail pads. *Correlophus ciliatus* data are colored as a red square (tail data) and red circle (toe data).

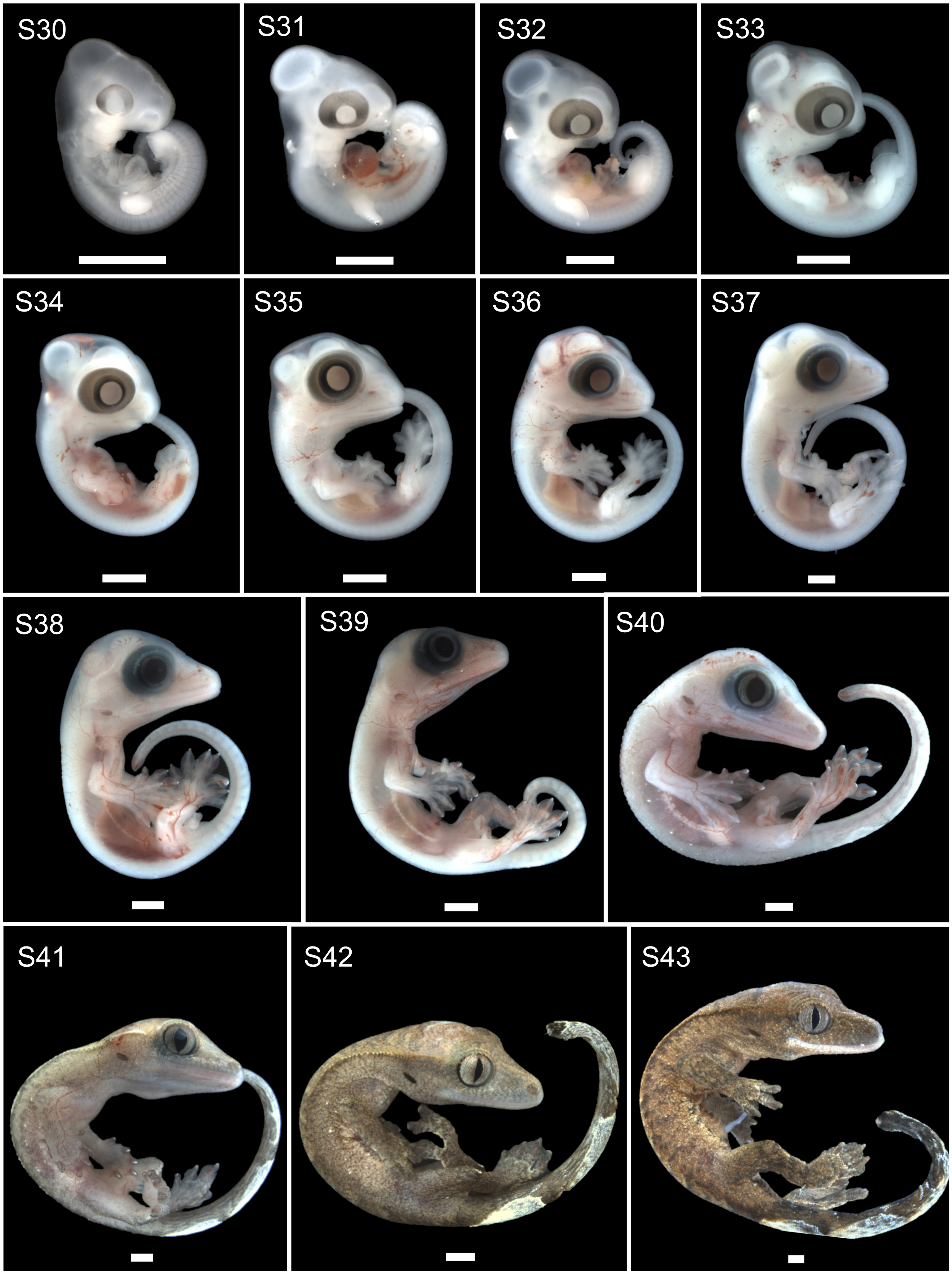
A




B



**Supplemental Information 7. Stages 30–43 of *Correlophus ciliatus* embryonic development. Lateral views of whole embryos. Scale bars = 2mm.** When incubated at 25.6ºC, *Correlophus ciliatus* hatched approximately 60 days post-oviposition. **Stage 30:** *Correlophus ciliatus* are oviposited at this stage, a later stage at oviposition than any other gecko, and exhibit 43–44 somites, fewer somites at stage 30 than *L. lugubris* (Griffing *et al*., 2019). The eyes are ovoid, with choroid fissure visible, and exhibiting condensed pigment in both the anterior and posterior regions of the retinal pigmented epithelium (RPE). The developing optic tectum, the telencephalon, and translucent otic capsules are visible. The heart is subdivided into a unified atrium and ventricle. Both fore- and hindlimbs are paddle-shaped and exhibit an apical ectodermal ridge (AER). **Stage 31:** Somites are present along the full length of the tail. The eye exhibits dense pigment in the RPE. The optic tectum is bulging dorsally. The mandibular arch is spans halfway along the length of the cranium. The endolymphatic ducts are opaque. The lungs, liver, and mesonephros are visible and the heart now exhibits two atria. The autopodia are distinct from the rest of both the fore- and hindlimbs. **Stage 32:** Iris development is underway and visible as dense pigment along the rim of the lens. The choroid fissure of the eye is still visible. The mandibular arch has grown anteriorly but does not meet the unfused maxillary process and medial nasal processes (i.e. facial primordia). The gallbladder is now visible ventral to the liver. Paired cloacal swellings are visible, indicating the onset of cloacal and genital development. The autopodia, zeugopodia, and stylopodia are distinct in the forelimbs while only the autopodia is distinct from the remaining forelimb. **Stage 33:** The areas of the brain adjacent to the optic tectum are relatively larger, giving the optic tectum a smaller appearance. The choroid fissure is not visible via light microscopy. The facial primordia are fused, forming a snout, and the mandibular arch has grown anteriorly. The autopodia, zeugopodia, and stylopodia are now distinct in the hindlimbs and both fore- and hindlimbs exhibit digital condensations. **Stage 34:** The mandible nearly meets the snout. The autopodia have grown in size. Cloacal swellings, or developing genital buds, of all embryos examined now resemble developing hemipenes more than squamate hemiclitores (Gredler *et al.*, 2015). Digital webbing recession is underway; however, the distal tip of each digit is not yet free. **Stage 35:** The areas of the brain adjacent to the optic tectum have grown further, giving the optic tectum a smaller appearance than previous stages. The iris has doubled in size and is darker than previous stages. An external ear is visible. The mandible meets the snout. Digital webbing recession continues and the distal tip of each digit is free. The tissue directly adjacent to digital condensations does not recess to the same degree as seen in other gecko species (Griffing *et al*., 2019). The tip of the tail is slightly laterally expanded, obscuring its initial pointed tip appearance. **Stage 36:** The upper and lower eyelids are visible and appear to be fused with the spectacle. The snout and mandible are more elongate than the previous stages. Digital webbing recession is complete despite much of the webbing remaining. The overall lesser degree of apoptosis at this stage, when compared to other gecko species (Wise *et al*., 2009; Griffing *et al*., 2019), is a precursor for the adult *C. ciliatus* phenotype of wide toes and intermediate interdigital webbing. Toe pad and tail pad development begins shortly after digital webbing recession is complete. **Stage 37:** Fleshy papillae are visible on the dorsal margin of the fused eyelid where the adult *C. ciliatus* will exhibit its characteristic superciliary "crests." The snout and mandible are more elongate than the previous stage. Translucent claws on the developing digits are distinct and visible via light microscopy. **Stage 38:** Little to no dorsal bulging of the optic tectum is visible. The chromatophores (xanthophores and melanophores) of the iris are faintly visible in a thin strip, marking the boundary of the circular pupil. Nares are faintly visible. The snout and mandible are more elongate than the previous stage. The fleshy papillae which will constitute the adult *C. ciliatus* dorsolateral crest is faintly visible along the cervical region. Ribs are visible in the trunk as well as a fleshy, opaque strip that will become the lateral fold. In all embryos examined at this stage, the hemipenes are fully everted. Claws are well-developed and opaque white. The tail is more robust than previous stages. **Stage 39:** The iris occupies more of the eye, creating an ovoid pupil. The post-cranial body has grown substantially compared to the cranial region. The body wall is less translucent, beginning to obscure the view of viscera. Some of the larger tubercular scales of the dorsum are visible. **Stage 40:** The brain is not visible through the opaque skin. The iris occupies more of the eye and the snout and mandible are more elongate than previous stages. The body wall is more opaque. Tubercular scales and "crests" are more distinct than previous stages. The first pigment patterns are present on the dorsum of the trunk and tail. **Stage 41:** The iris occupies more of the eye than the previous shape, making an almond-shaped pupil. The body wall completely opaque with the exception of the ventral surface of the trunk which remains faintly translucent. Pigment is now wide-spread on the dorsal and lateral surfaces. **Stage 42:** The body wall completely opaque, scales full developed, and pigment development complete. Toe pad and tail pad development is complete. Hemipenes remain everted. **Stage 43:** The scales are noticeably hydrophobic when the embryo is submerged in PBS. The hemipenes are inverted. The embryo is ready to hatch.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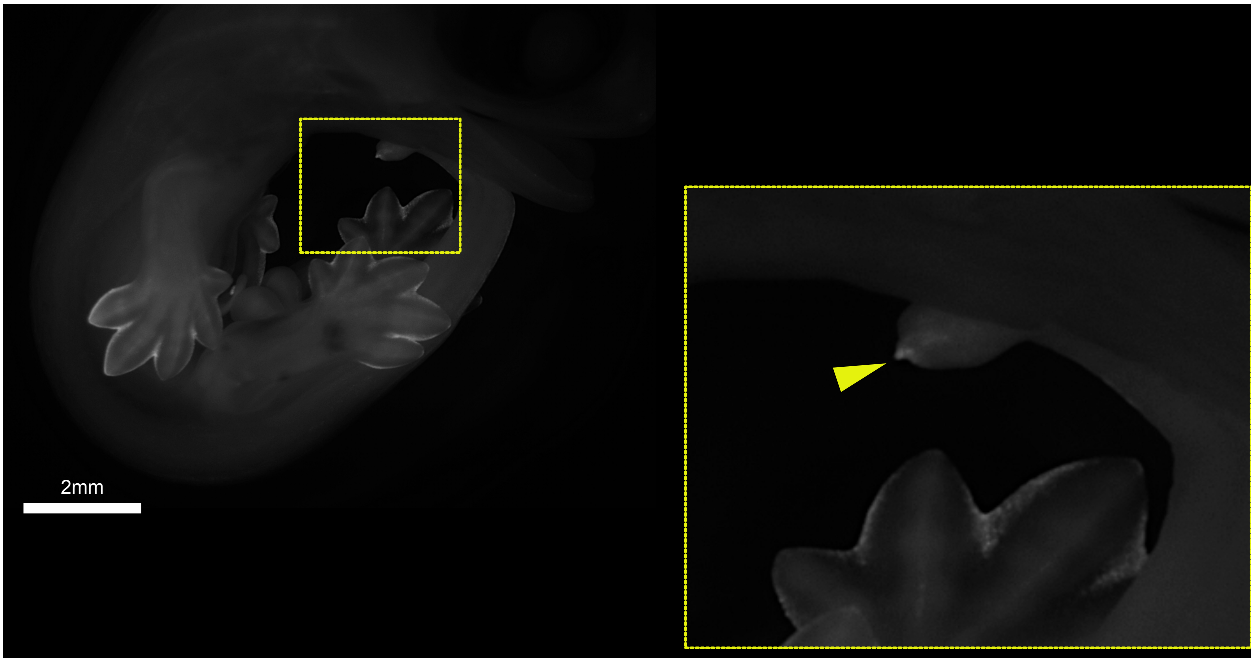
**Supplemental Information 8.** Fluorescent image of a stage 35 *Correlophus ciliatus* in lateral view. Brighter areas indicate areas of intense apoptotic activity. Yellow dashed-line box corresponds to a magnified image of the developing tail tip. Yellow arrow points toward area of high apoptotic activity in the tail. Interdigital webbing also exhibits high-levels of apoptosis. Scale bar = 2mm.



## Literature Cited


Angel F. 1946 *Faune de France. Reptiles et Amphibiens*. Paris: Lechavalier.

Bauer AM. 1990. Phylogenetic systematics and biogeography of the Carphodactylini (Reptilia: Gekkonidae). *Bonn. Zool. Monogr.* **30**, 1–217.

Bauer AM. 1998 Morphology of the adhesive tail tips of carphodactyline geckos (Reptilia: Diplodactylidae). *J. Morphol.* **235**, 41–58.

Bauer AM, Jones JPG, Sadlier RA. 2000 A new high-elevation *Bavayia* (Reptilia: Squamata: Diplodactylidae) from northeastern New Caledonia. *Pac. Sci.* **54**, 63–69.

Bauer AM, Russell AP. 1990 Alternative digital scansor design in the New Caledonian gekkonid genera *Bavayia* and *Eurydactylodes*. *Mem. Queensl. Mus.* **29**, 299–310.

Bauer AM, Russell AP. 1994 Is autotomy frequency reduced in geckos with 'actively functional' tails. *Herpetol. Nat. Hist.* **2**, 1–15.

Bauer AM, Sadlier RA. 2000 *The Herpetofauna of New Caledonia*. Ithaca: Society for the Study of Amphibians and Reptiles.

Boulenger GA. 1878 Descriptions d'un genre nouveau et d'une espèce nouvelle de la famille des geckotidés. *Bull. Soc. Zool. Fr.* **3**, 68–70, pl. 2.

Boulenger GA. 1879 Sur l'identité spécifique de *Chameleonurus trachycephalus* Boulenger et *Platydactylus chahoua* Bavay. *Bull. Soc. Zool. Fr.* **4**, 141–142.

Boulenger GA. 1883 On the geckos of New Caledonia. *Proc. Zool. Soc. Lond.* **1883**, 116–131.

Cogger HG. 1975 New lizards of the genus *Pseudothecadactylus* (Lacertilia: Gekkonidae) from Arnhem Land and northwestern Australia. *Rec. Aust. Mus.* **30**, 87–97.

Eijsden EHT van. 1962 Een grijpstaartgecko. *Lacerta* **20**, 30–31.

Fitzinger LJ. 1843 *Systema Reptilium*. Vindobonae: Braumüller et Seidel.

Fitzsimons VF. 1943 The Lizards of South Africa. *Mem. Transvaal Mus.* **1**, 1–528.

Freytag J. 1975 *Guide des Reptiles et Batraciens de France*. Paris: Hatier.

Gamble T, Greenbaum E, Jackman TR, Bauer AM. 2015 Into the light: Diurnality evolved multiple times in geckos. *Biol. J. Linn. Soc.* **115**, 896–910.

Gredler ML, Sanger TJ, Cohn MJ. 2015 Development of the cloaca, hemipenes, and hemiclitores in the green anole, *Anolis carolinensis*. *Sex. Dev.* **9**, 21–33.

Greer AE. 1967 The ecology and behavior of two sympatric *Lygodactylus* geckos. *Breviora* **268**, 1–19.

Griffing AH, Sanger TJ, Daza JD, Nielsen SV, Pinto BJ, Stanley EL, Gamble T. 2019 Embryonic development of a parthenogenetic vertebrate, the mourning gecko (*Lepidodactylus lugubris*). *Dev. Dyn.* **248**, 1070–1090.

Lataste MF. 1877 Sur le *Phyllodactylus europaeus* Gené, trouve en France et sur le *Ph. doriae*, n. sp. de l'ile de Tinetto. *Bull. Soc. Zool. Fr.* **3**, 467–469.

Loveridge A. 1947 Revision of the African lizards of the gamily Gekkonidae. *Bull. Mus. Comp. Zool.* **98**, 1–469.

Maderson PFA. 1971 The regeneration of caudal epidermal specializations in *Lygodactylus picturatus keniensis* (Gekkkonidae, Lacertilia). *J. Morph*. **134**, 467–477.

Meier H. 1979 Herpetologische Beobachtungen auf Neukaledonien. *Salamandra* **15**, 113–139.

Mertens R. 1964 Der Eidechsenschwanz als Haftorgan. *Senck. Biol.* **45**, 117–122.

Mourgue M. 1910 Etude sur le phyllodactyle d'Europe *Phyllodactylus europaeus* Gené. *La Feuille des Jeunes Naturalistes* **40**, 57–61.

Müller L. 1910 Beiträge zur Herpetologie Kameruns. *Ab. Math.-Phys. Kl. K. Bayer. Akad. Wiss.* **24**, 545–627.

Nussbaum RA, Raxworthy CJ, Pronk O. 1998 The ghost geckos of Madagascar: a further revision of the Malagasy leaf-toed geckos (Reptilia, Squamata, Gekkonidae). *Misc. Publ. Mus. Zool. Univ. Mich.* **186**, 1–26.

Pasteur G. 1964 Recherches sur l'èvolution des lygodactyles, lézards afro-malgaches actuels. *Travaux de l'Institut Scientifique Cherifien. Ser. Zool.* **29**, 1–132.

Perret J-L. 1963 Les Gekkonidae du Cameroun avec la description de deux sous-espèces nouvelles. *Rev. Suisse Zool.* **70**, 47–60.

Rieppel O, Schneider B. 1981 *Phyllodactylus europaeus* Gené 1838 - Europäischer Blattfingergecko. *In* Böhme (ed), *Handbuch der Reptilien und Amphibien Europas, vol. 1*. (ed Böhme W), pp. 79–160. Wiesbaden: Akademische Verlagsgesellschaft.

Russell AP, Gamble T. 2019 Evolution of the gekkotan adhesive system: does digit anatomy point to one or more origins?. *Integr. Comp. Biol.* **59**, 131–147.

Schleich HH, Kästle W. 1986 Ultrastrukturen an Gecko-Zehen (Reptilia: Sauria: Gekkonidae). *Amphibia-Reptilia* **7**, 141–166.

Schreiber E. 1912 *Herpetologia Europaea*. Jean: G. Fischer.

Tornier G. 1899 Ein Eidechsenschwanz mit Saugscheibe. *Biol. Zentralbl.* **19**, 549–552.

Vitt LJ, Ballinger RE. 1982 The adaptive significance of a complex caudal adaptation in the tropical gekkonid lizard *Lygodactylus klugei*. *Can. J. Zool.* **60**, 2582–2587.

Wiedersheim R. 1876 Zur Anatomie and Physiologie des *Phyllodactylus europaeus* mit besonderer Berücksichtigung der Aquaeductus vestibuli der Ascalaboten im Allgemeinen. Zugleich als zweiter Beitrag zur Insel-fauna des Mittelmeeres. *Gegenbaurs Morphol. Jahrb.* **1**, 495–534.

Wise PAD, Vickaryous MK, Russell AP. 2009 An embryonic staging table for in ovo development of *Eublepharis macularius*, the leopard gecko. *Anat. Rec.* **292**, 1198–1212.