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Remarks on the taxonomic status of the Argentine subspecies of *Pantodactylus schreibersii* (Wiegmann, 1834) (Gymnophthalmidae, Scleroglossa, Squamata)

ABSTRACT

A comparative research on osteological and exo-somatic characters of the Argentine subspecies *Pantodactylus schreibersii schreibersii* (Wiegmann, 1834) and *Pantodactylus schreibersii parkeri* Ruibal 1952, were carried out, utilising the enzyme clearing and staining whole vertebrates technique, as well as, metric and meristic measurements. Results pointed out significant morphological differences which enable us to support the specific status of both these allopatric taxa, from Eastern Argentine and Northernwestern Argentine respectively, and apparently without populational intergradation.

INTRODUCTION

To the genus *Pantodactylus* belong Neotropical lizards, with two species and three subspecies present in the South American continent. Only *Pantodactylus schreibersii* is known in Argentina, with the nominal form *P. s. schreibersii* (Wiegmann, 1834) and *P. s. parkeri* Ruibal, 1952. The nominal subspecies is distributed in Santiago del Estero, Chaco, Formosa, Corrientes, Misiones, Entre Ríos, Buenos Aires and Córdoba provinces; *P. s. parkeri* is known for Tucumán province and forest areas of Salta and Jujuy provinces (Cei, 1993).

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In spite of several preliminary morphological studies carried out in both subspecies by Ruibal (1952), Viñas & Daneri (1991) and López & Cabrera (1995), the last with special interest in the cranial osteology of *P. s. schreibersii*, we undertook to extend and detail this kind of comparative research on cranial as well as on post-cranial characters. Our purpose was to make evident any morphological features differentiating the subspecies *P. s. schreibersii* and *P. s. parkeri* and contributing to a critical evaluation of their present taxonomic status.

MATERIALS AND METHODS

For the osteological study of cranial and post-cranial characters we utilized a sample of 6 adult specimens (3 males - 3 females) for each subspecies from Argentine and 2 specimens (1 male - 1 female) of *P. schreibersii* from Brasil, as detailed below. In accordance with the Dingerkus & Uhler's methods (1977), the technique of enzyme clearing and staining whole vertebrates was used: photographic records of cleared and differentially stained specimens were obtained by mean of a stereoscopic microscope Olympus SZH (10 X).

For a general revision of exo-morphological characters 47 adult specimens have been analysed: 40 specimens belonging to the taxon *P. s. schreibersii* (25 from Argentine, 15 from Brasil) have been studied, 7 specimens of *P. s. parkeri* from the Argentine provinces of Tucumán and Salta have been available. All these specimens belong to the herpetological collections of the Universidad Nacional del Nordeste, Corrientes (UNNE); the Museo de la Plata (MLP.S: Saurios); the Universidad Federal de Rio Grande do Sul (UFRGS).

List of materials from Argentine:

Pantodactylus schreibersii schreibersii: UNNEC- 04382 -05001 - 05049 - 04832, Reserva Natural Mburucuyá, Corrientes; 01300, Laguna Galarza, Corrientes; 00758, Cnia. San Antonio, Corrientes; 01242, Corrientes, Capital; 00690, Ea. Don Theo, Formosa; 00179 - 00756, El Mistolar, Formosa; 01337 - 01338, Reserva Natural, Formosa; 04923, Tostado, Santa Fé; 01180, Las Delicias, Chaco (males). 01178 - 01181 - 01182, Corrientes, Capital; 00674, San Miguel, Corrientes; 01274, Santa Lucia, Corrientes; 05236, Reserva Natural Mburucuyá, Corrientes; 00752, Santa Ana, Corrientes; 00757, Itati, Corrientes; 01299, Laguna Galarza, Corrientes; 00759, Basail, Chaco (Females).

Pantodactylus schreibersii parkeri: UNNEC- 00897, Cerro San Javier, Tucumán (male); 00896, Cerro San Javier, Tucumán, (female). MLP.S - 1577 - 1579, Salta (males), 1580 - 1581 - 1587, Salta (females).

List of materials from Brasil:

Pantodactylus schreibersii schreibersii: UFRGS - 002696, Aramberé RS; 000247, Candiota RS; 002236 - 002447 - 002651, Porto Alegre RS; 000003, San Francisco de Paulo RS; 000012, Joao Pessoa RS; 000027 - 000035 - 000036, Sede E. de Taim RS (males). 002248 - 002249, Candiota RS; 000029 - 000032 - 000040; Sede E. de Taim RS (females).

Results

On the basis of our comparative analytical research, *P. s. parkeri* can be differentiated from *P. s. schreibersii* by a number of characters as evidenced by the following:

Exo-somatic morphological characters

Reports of former authors dealing with metric and meristic characters of *P. s. schreibersii* did not provide complete statistical data about the snout/vent disance, either in *parkeri* or in *schreibersii* subspecies. The snout/vent average for the samples here considered (n= 40 for *schreibersii*, n= 7 for *parkeri*) are, in mm, $\bar{X}$= 390 (360 - 420) and $\bar{X}$= 344 (323 - 365), respectively. Thus, given the maximum snout/vent measurement (480 mm) reported by Ruibal (1952) for *P. s. parkeri* (n= 43), and respectively (520 mm) for *P. s. schreibersii* (n= 22), a larger size of the *P. s. schreibersii* populations could be assumed.

The number of scales around midbody presented in our measurements a $\bar{X}$= 22 (20 - 24) for *P. s. parkeri*, a $\bar{X}$= 23 (21 - 25) for *P. s. schreibersii*. Ruibal's data gave a $\bar{X}$= 26.5 (24 - 29) for *P. s. parkeri* and $\bar{X}$= 25.2 (23 - 27) for *P. s. schreibersii*. In both cases a statistically insignificant difference between the taxa can be assumed for this lepidosis character. A statistically insignificant difference was also found between *parkeri* and *schreibersii* samples for the scale number from occiput to groin being $\bar{X}$= 32 in both taxa, as well as for the transverse ventral scales: $\bar{X}$= 21 (20 - 22) in *parkeri*, $\bar{X}$= 22 (20 - 24) in *schreibersii*. The same data, according to Ruibal, are similar for the latter character: $\bar{X}$= 19.9 (18 - 22) in *parkeri*, $\bar{X}$= 22.1 (19 - 26) in *schreibersii*.

Insignificant intersubspecies differences were shown also for the dorsal scale width, and for the ventral scale high or ventral scale width. However, dorsal scales appear to be somewhat larger in *schreibersii* than in *parkeri* (1.2 mm versus 1.0 mm), being besides distinctly shaped, with a hexagonal outline in *parkeri* but with a lanceolate outline in *schreibersii*, such as reported by Viñas & Daneri (1991). The right and left femoral pores, individually varying from 5 to 1, do not represent apparently a significant intersubspecific difference.

Regarding the coloration, a grayish or ochreous dorsal ground is generally present in both taxa. Laterodorsally, from the supraocular region to the groin and extending on the tail, two parallel pale yellowish stripes are shown, more or less evident, in *parkeri* as well as in *schreibersii*. A faint dark vertebral line is always present; in some *schreibersii* populations (San Luis

Sierras; Buenos Aires province) an irregular whitish row of one scale spots, bordering the ventral region, can be often observed. This latter detail is also lacking in several other samples, e.g. in the Sierras de Córdoba samples. Between the latero-dorsal stripes the average of 8 interposed scales in *parkeri*, of 9 or more interposed scales in *schreibersii*, are the rule.

A peculiar coloration character may be emphasized in all *parkeri* specimens. That is the striking brilliant white stripe from the supralabials to the shoulder, under the tympanum, extending backward as a broken but uninterrupted line from the axilla to the groin.

Osteological characters

Cranial region: Recently it has been studied by López & Cabrera (1995) to whose good description we will refer in our present paper. No valuable differences for the general osteological characters in this region were put in evidence between *P. s. schreibersii* and *P. s. parkeri* through our comparative observations (Plate 1, *1*, *2*). However, the major number of premaxillary teeth in the jaw of *P. s. schreibersii* was remarkable (10 - 13), as formerly reported by López & Cabrera (1995), ranging from 9 to 10 in *P. s. parkeri*. The mandibular coronoid process shows a sharpened vertical tip in *P. s. parkeri*, but a more rounded and backward inclined tip in *P. s. schreibersii*. A more prominent articular condyle, expanded toward the labial face; a larger and wider meckelian fossa; and an evident supra-angular-articular torsion toward the lingual face, are also all characteristic features of the *parkeri* jaw (Plate 2). Insignificant intersubspecific differences can be pointed out in the hyoid region of these lizards (Plate 1, *3*, *4*).

Post-cranial region: It was not previously studied in the genus, and several noticeable differences between *parkeri* and *schreibersii* populations shall be described now in pectoral and pelvic girdles. In the pectoral girdle, the outstanding lateral process of the interclavicle of *P. s. schreibersii* must be stressed (Plate 3, *2*, Lp.). However, mesocoracoid and pre-coracoid are stronger in *P. s. parkeri*, being their lenght equal to the major scapula or coracoid high in their central area (Plate 3, *3*, Mc, Pc). Meso-coracoid and pre-coracoid are more slender and relatively more enlarged in *P. s. schreibersii*, being their lenght almost twice the major high of scapula and coracoid in their central area (Plate 3, *4*, Mc, Pc).

In the pelvic girdle the significant size of the epi-ischium, shorter in *P. s. parkeri*, must be pointed out (Plate 4, *1* and *2*, Eis). In the sacral region, moreover, the sacral vertebrae are usually opposing in *P. s. parkeri* (Plate 5, *1* and *2*, S1, S2), but they are alternate in the specimens of *P. s. schreibersii* (Plate 5, 3 and 4, S1, S2), either from Argentine or Brasil. Caudal vertebrae, at last, exhibit triangular, sharpened transverse apophyses in *P. s. parkeri*, but wide, flattened and roundly ended apophyses in *P. s. schreibersii* (Plate 5, *3*, *4*, Ta).

Together with the above mentioned peculiarities of lepidosis and coloration, our osteological findings provide several significant characters of evident anatomical as well as taxo-genetic value, being related to the evolutionary history and the present taxonomic status of the *Pantodactylus* taxa taken into account.

Between these discriminant osteological characters, five belong to the jaw morphology, the other to the pectoral and pelvic girdle, or to sacral region. The morphological differences observed in the jaw, as well as in the post-cranial regions, have been supported, for their polarity, by a criterion almost similar to those used by some recent authors to select diagnostic characters leading to recognizing species groups or to postulate better phyletic classifications. Of course the taxonomic level dealing with such a wider kind of research, may be obviously higher than the taxonomic level fitting in our present study. We are only applying, in fact, to make clear the real systematic position of a questionable subspecific complex such as the *Pantodactylus schreibersii* complex. We could refer, e.g., to the very recent contribution on the iguanian *Sceloporus* by Wiens & Reeder (1997), determining phyletic trees on the basis of all available morphological and molecular evidence. In its description of discriminant morphological characters, considered as diagnostic by their polarity (Wiens & Reeder, 1997: Appendix IV: 49-62), characters of teeth, mandibular bones, coracoid, sternum, pelvic girdle, etc. have been reported which appear very similar, or coincident, with our here reported and discussed characters.

According to our results, most of the described differential jaw characters are meristic and difficult to be numerically exposed. A different size and shape of the coronoid; a more prominent expansion of the articular condyle in the labial face; a major extension of the meckelian fossa; a prominent major torsion toward the lingual face of the supra-angular-articular bone, in fact, have been cited for *P. s. parkeri*. However, at a first sight, the morphological and numerical differences in premaxillary teeth of *P. s. parkeri* and *P. s. schreibersii* can be more easily assumed.

In the post-cranial regions, the polarity of several peculiar characters of the pectoral girdle is evident, such as the protruding wing-like lateral process of the *schreibersii* interclavicle, only outlined in *parkeri*. Also significant are the relative mesocoracoid and precoracoid sizes, facing the scapulo-coracoid, anterior coracoid and posterior coracoid fenestrae: being shorter and stout in *parkeri*, but larger and slender in *schreibersii*.

In the pelvic girdle, the peculiar size of the epi-ischium is distinctive, being significantly reduced in *parkeri*. In the sacral region, structure and position of sacral vertebrae are distinct enough, being opposite in *parkeri*, alternate in *schreibersii*. This latter remarkable condition, apparently usual in *schreibersii*, is often observed by extensive fusion of pleurapophyses in most of the Teiidae, Scincidae and Gerrhosauridae, with asymmetry and presence of alternate sacral structure (Hoffstetter & Gasc, 1969). Obviously different in shape the caudal vertebrae apophyses of *parkeri* and *schreibersii*, formerly described and illustrated.

Concluding, a significant combination of fourteen characters having diagnostic value is recognizable, osteologically as well as for lepidosis and coloration, to which likely the significant major size of *P. s. schreibersii* could be added. This morphological condition, together with other critical arguments, can reasonably support a true specific status for *Pantodactylus parkeri*, as well as for *Pantodactylus schreibersii*. That is also sustained by the apparent lack of population intergradation observed up to date in the wide distribution area of both forms, in spite of the general absence of geographical or topographic barriers.

Ecological differences in their present and ancestral habitat could have played an important role in the speciation process of these marginal Gymnophthalmidae. A process not too recent chronologically, taking into account some anatomical divergences shown by the post-cranial osteology. Suggestive of a somewhat parallel process, as a biogeographical pattern, is the case of the Argentine teiid *Kentropyx*, just studied by the authors (Tedesco & Cei, 1997). The western form *lagartija* Gallardo 1962 and the eastern form *viridistriga* (Boulenger, 1894) were each recognized at a specific level. *Kentropyx lagartija* has been considered as subspecies of *K. viridistriga*, or directly synonymized with this latter taxon (Gallagher & Dixon, 1992).

Since its presentation, the "evolutionary species" concept according to Frost & Hillis (1990) was improving its dialectic value for a rational decision about the true specific status of several subspecific taxa, often questioned or uncertain, some time inertly maintained by lack of satisfactory bio-morphological information. Such as in other similar cases, the theme of our present research fit into the well known discussion of the Frost and Hillis's "evolutionary species" category.

Thus, as conclusion of our work, we recall our fundamental proposal, determined by different kinds of evidence, for establishing the specific position of *Pantodactylus parkeri* Ruibal, 1952, from the Northwestern Argentine.

ACKNOWLEDGEMENTS

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RIASSUNTO

In queste ricerche comparative sui caratteri somatici esterni e osteologici delle sottospecie argentine di *Pantodactylus schreibersii* (*P. s. schreibersii e P. s. parkeri*) è stata utilizzata la tecnica enzimatica di trasparenza e colorazione di piccoli vertebrati *in toto*, oltre alle misure correnti, metriche e meristiche. I risultati del presente studio hanno permesso di evidenziare significative differenze morfologiche, e in particolare osteologiche, la cui combinazione, unitamente ad altre considerazioni biogeografiche e biologiche, può giustificare uno *status* specifico, e non sottospecifico, del taxon *Pantodactylus parkeri* Ruibal, 1952, distribuito nel Nordovest d'Argentina, apparentemente senza intergradazione con il taxon *Pantodactylus schreibersii* dell'area orientale d'Argentina e zone limitrofe (Brasile, Uruguay).

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PLATE 1

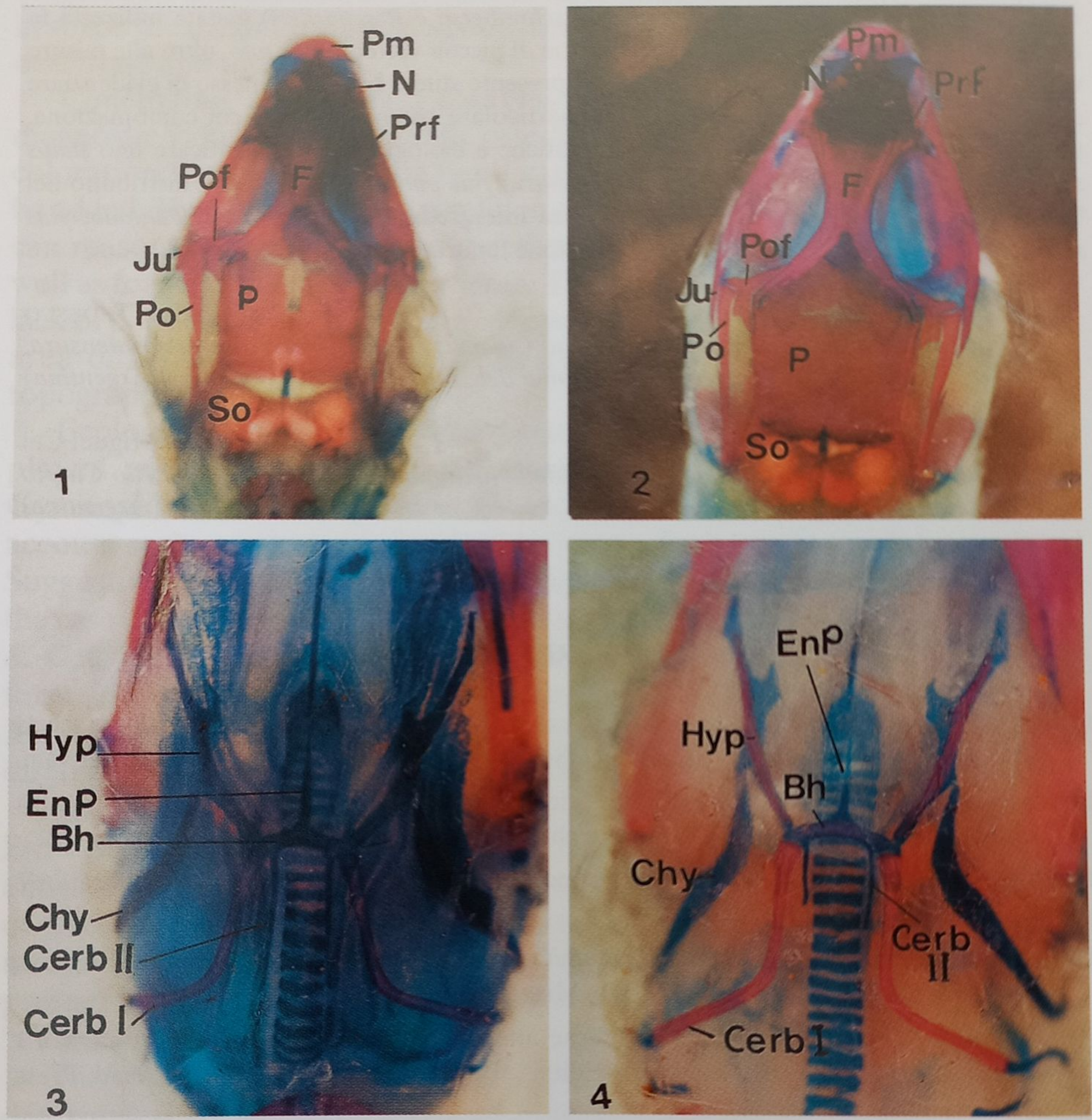
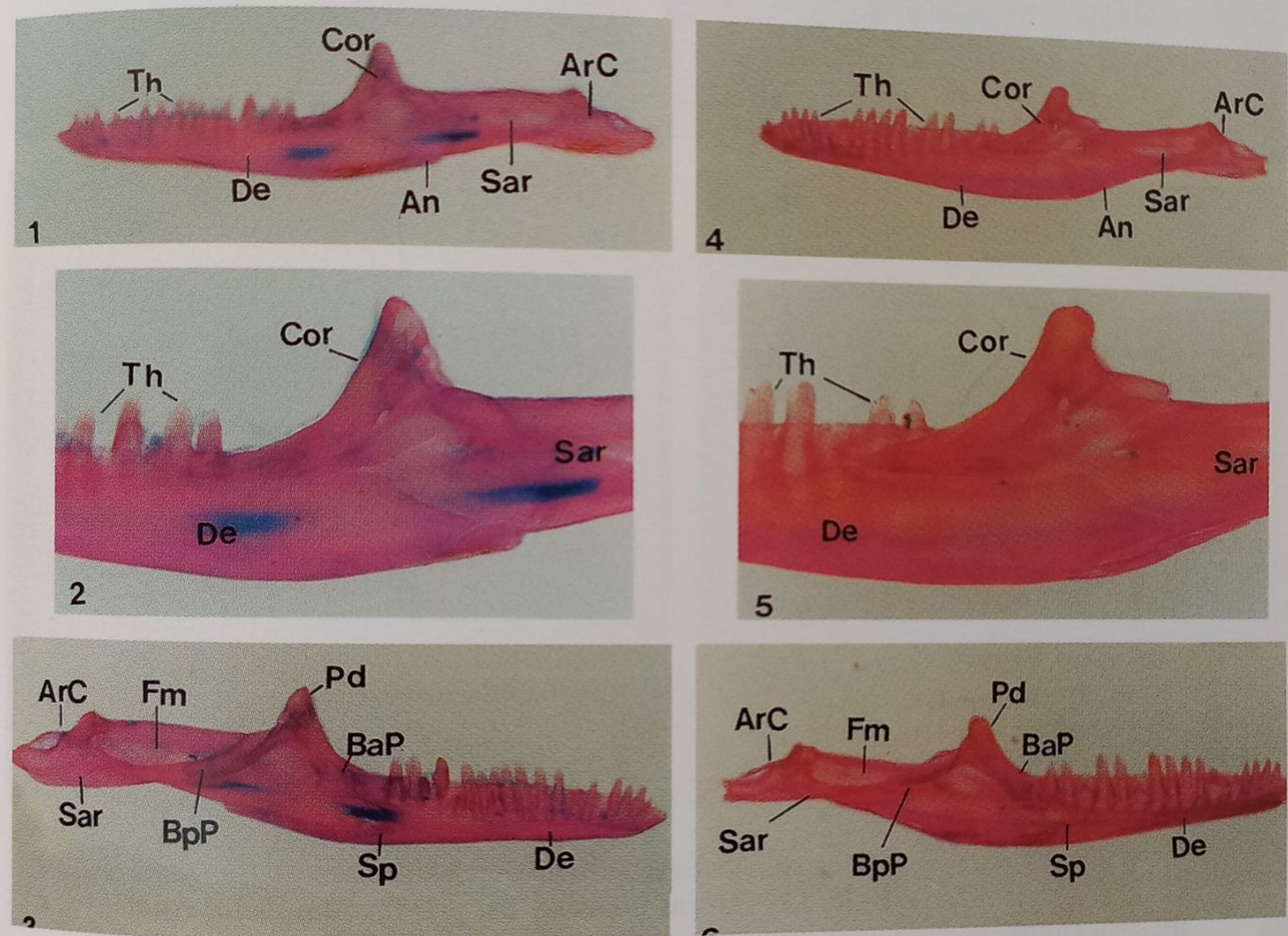


Fig. 1 - Cranial region of *Pantodactylus s. parkeri* (dorsal view).
Pm: premaxillary; N: nasal; Prf: prefrontal; F: frontal; P: parietal; So: supraoccipital; Po: postorbital; Pof: postfrontal; Ju; jugal. (specimen 1577).

Fig. 2 - Cranial region of *Pantodactylus s. schreibersii* (dorsal view).
Pm: premaxillary; N: nasal; Prf: prefrontal; F: frontal; P: parietal; So: supraoccipital; Po: postorbital; Pof: postfrontal; Ju: jugal. (specimen 05001).

Fig. 3 - Hyoid region of *Pantodactylus s. parkeri* (ventral view).
Hyp: hypohyal; Bh: basihyal; EnP: entoglossus process; Chy: ceratohyal; Cerb I: ceratobranchial I; Cerb II; ceratobranchial II. (specimen 1581 and 1577).

Fig. 4 - Hyoid region of *Pantodactylus s. schreibersii* (ventral view).
Hyp: hypohyal; Bh: basihyal; EnP: entoglossus process; Chy: ceratohyal; Cerb I: ceratobranchial I; Cerb II; ceratobranchial II. (specimen 05236 and 000003).



Figs. 1-3 - Jaw of *Pantodactylus s. parkeri* (labial view and detail; lingual view). Th: teeth; Cor: coronoid; De: dentary; ArC: articular condyle; An: angular; Sar: suprangular-articular; BaP: basal anterior process; BpP: basal posterior process; Fm: fosa meckeliana; Pd: processus dorsalis; Sp: splenial. (specimen 00896).

Figs. 4-6 - Jaw of *Pantodactylus s. schreibersii* (labial view and detail; lingual view). Th: teeth; Cor: coronoid; De: dentary; ArC: articular condyle; An: angular; Sar: suprangular-articular; BaP: basal anterior process; BpP: basal posterior process; Fm: fosa meckeliana; Pd: processus dorsalis; Sp: splenial. (specimen 01182).

PLATE 3

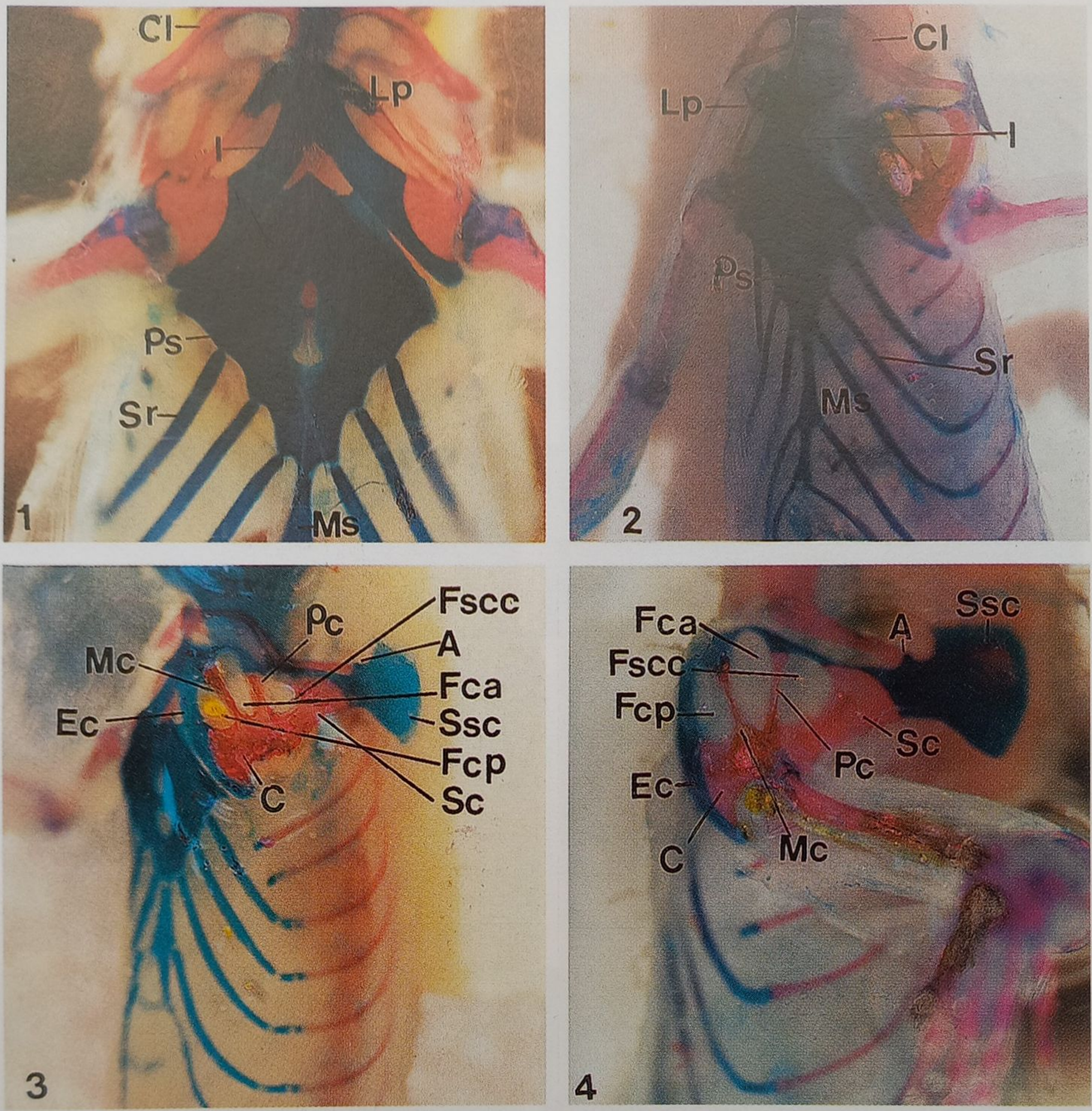
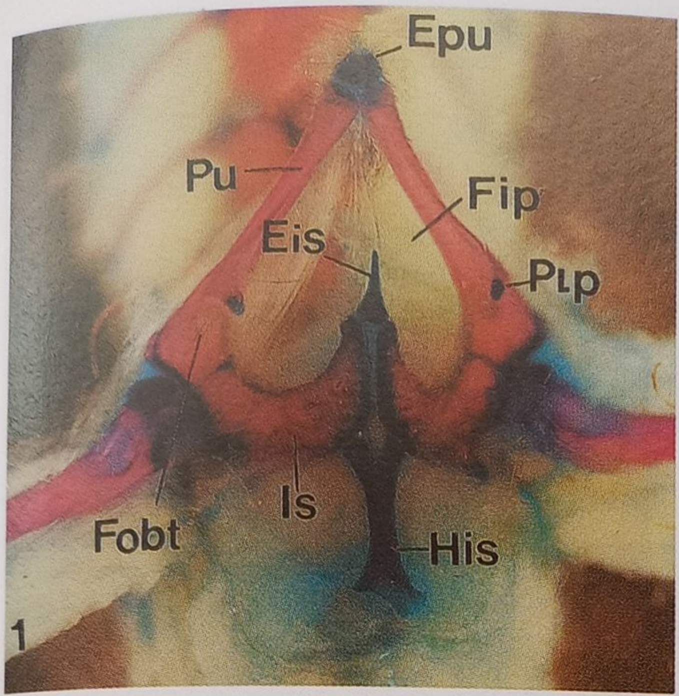


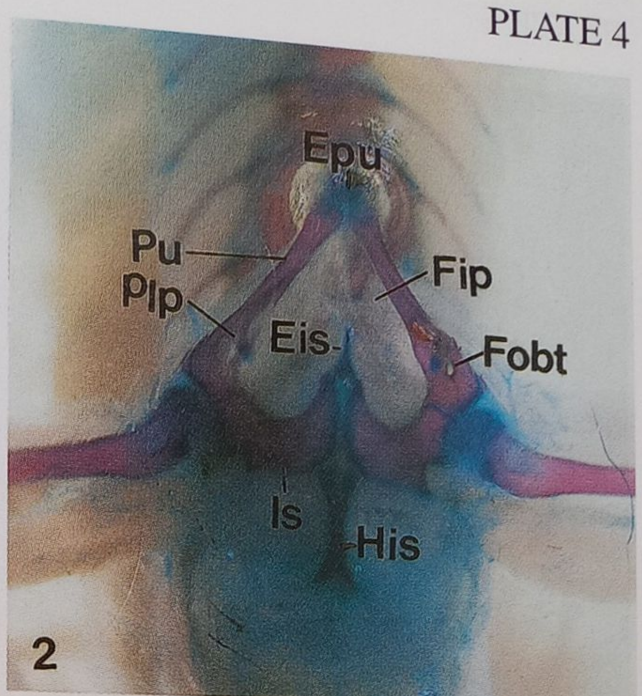
Fig. 1 - Clavicle and sternum of *Pantodactylus s. parkeri* (ventral view).
Cl: clavicle; I: interclavicle; Lp: lateral process; Ps: presternum; Sr: sternal ribs; Ms: mesosternum.
(specimen 1579).

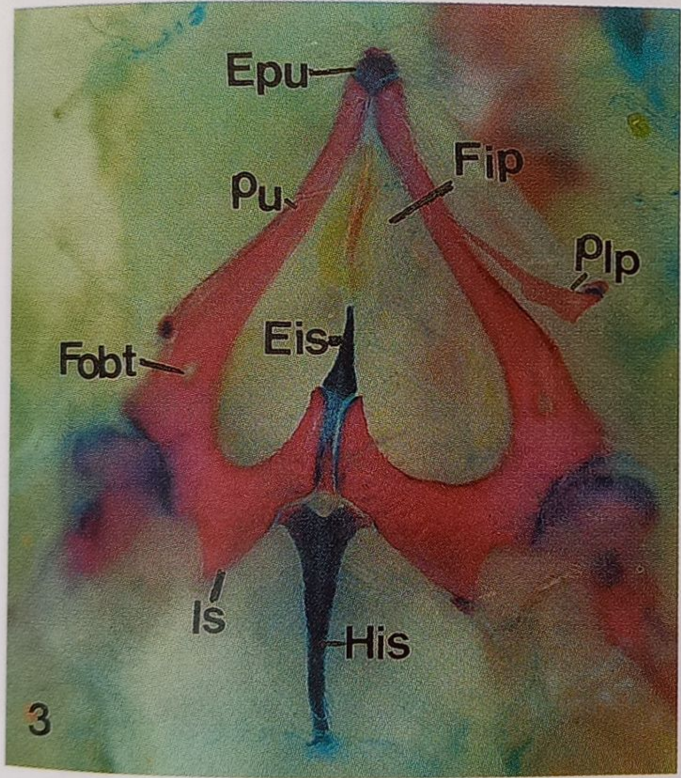
Fig. 2 - Clavicle and sternum of *Pantodactylus s. schreibersii* (ventral view).
Cl: clavicle; I: interclavicle; Lp: lateral process; Ps: presternum; Sr: sternal ribs; Ms: mesosternum.
(specimen 1577).

Fig. 3 - Scapulo-coracoid region of *Pantodactylus s. parkeri* (lateral view).
A: acromion; Fscc: fenestra scapulo-coracoide; Fca: fenestra coracoidea anterior; Ssc: suprascapula; Fcp: fenestra coracoida posterior; Sc: scapula; Pc: procoracoid; Mc: mesocoracoid; Ec: epicoracoid; C: coracoid.
(specimen 1577).

Fig. 4 - Scapulo-coracoid region of *Pantodactylus s. schreibersii* (lateral view)
A: acromion; Fscc: fenestra scapulo-coracoide; Fca: fenestra coracoidea anterior; Ssc: suprascapula; Fcp: fenestra coracoida posterior; Sc: scapula; Pc: procoracoid; Mc: mesocoracoid; Ec: epicoracoid; C: coracoid.
(specimen 01182).







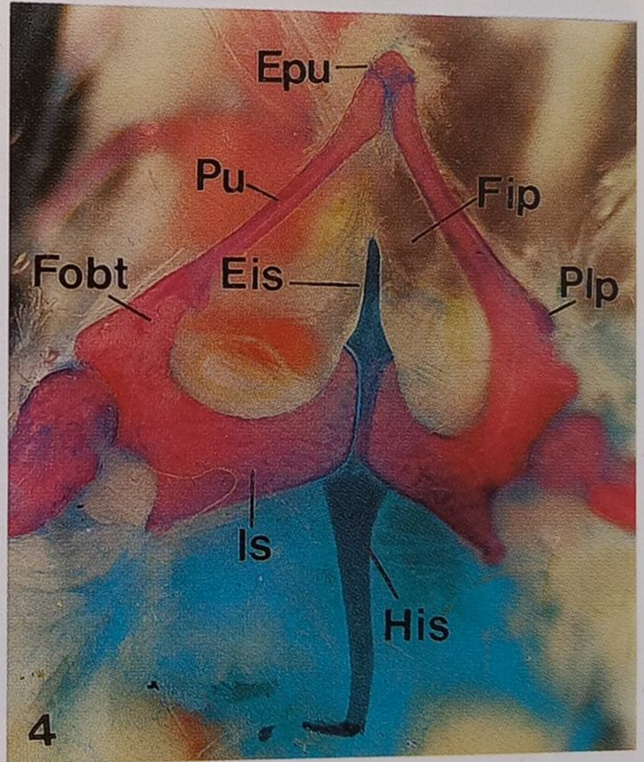


Fig. 1 - Pelvic girdle of *Pantodactylus s. parkeri* (ventral view). Epu: epi-pubis; Pu: pubis; Eis: epi-ischium; Fip: fenestra ischio-pubica; Fobt: foramen obturador; Plp: pubis lateral process; Is: ischium; His: hypo-ischium. (specimen 00896).

Fig. 2 - Pelvic girdle of *Pantodactylus s. parkeri* (ventral view). Epu: epi-pubis; Pu: pubis; Eis: epi-ischium; Fip: fenestra ischio-pubica; Fobt: foramen obturador; Plp: pubis lateral process; Is: ischium; His: hypo-ischium. (specimen 1577).

Fig. 3 - Pelvic girdle of *Pantodactylus s. schreibersii* (ventral view). Epu: epi-pubis; Pu: pubis; Eis: epi-ischium; Fip: fenestra ischio-pubica; Fobt: foramen obturador; Plp: pubis lateral process; Is: ischium; His: hypo-ischium. (specimen 04832).

Fig. 4 - Pelvic girdle of *Pantodactylus s. schreibersii* (ventral view). Epu: epi-pubis; Pu: pubis; Eis: epi-ischium; Fip: fenestra ischio-pubica; Fobt: foramen obturador; Plp: pubis lateral process; Is: ischium; His: hypo-ischium. (specimen 05236).

PLATE 5

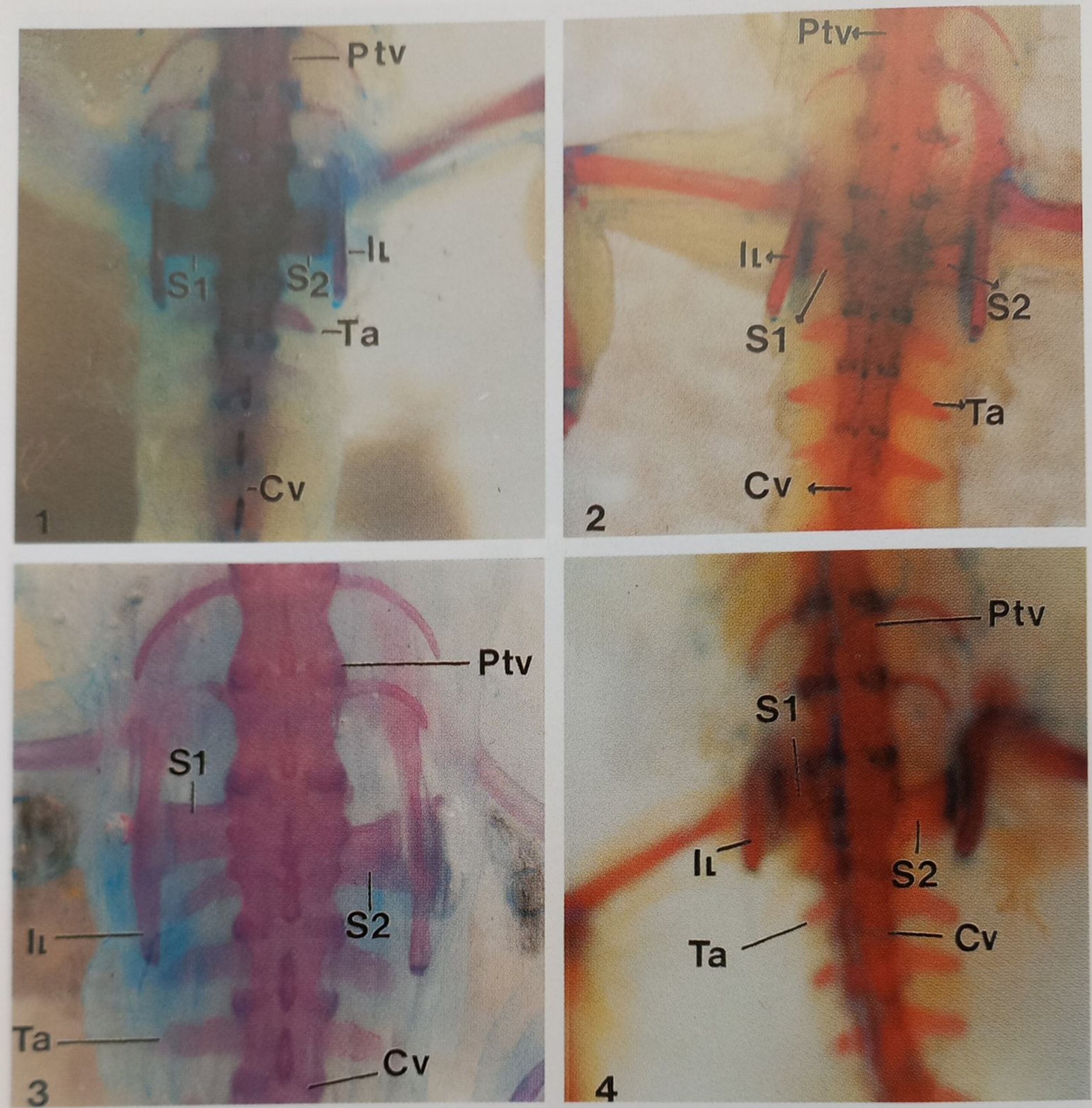


Fig. 1 - Sacral region of *Pantodactylus s. parkeri* (dorsal view).
Ptv: post-toracic vertebrae; S1 and S2: Sacral 1 and Sacral 2 vertebrae (opposite); Il: ilium; Ta: transverse apophyses of caudal vertebrae; Cv: caudal vertebrae. (specimen 00896).

Fig. 2 - Sacral region of *Pantodactylus s. parkeri* (dorsal view).
Ptv: post-toracic vertebrae; S1 and S2: Sacral 1 and Sacral 2 vertebrae (opposite); Il: ilium; Ta: transverse apophyses of caudal vertebrae; Cv: caudal vertebrae. (specimen 1577).

Fig. 3 - Sacral region of *Pantodactylus s. schreibersii* (dorsal view).
Ptv: post-toracic vertebrae; S1 and S2: Sacral 1 and Sacral 2 vertebrae (alternate); Il: ilium; Ta: transverse apophyses of caudal vertebrae; Cv: caudal vertebrae. (specimen 000003).

Fig. 4 - Sacral region of *Pantodactylus s. schreibersii* (dorsal view).
Ptv: post-toracic vertebrae; S1 and S2: Sacral 1 and Sacral 2 vertebrae (alternate); Il: ilium; Ta: transverse apophyses of caudal vertebrae; Cv: caudal vertebrae. (specimen 001182).