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KURZE MITTEILUNG / SHORT NOTE

The mandibular trigeminus branch and the mandibular adductor muscles. Topograpic conditions in Ranidae (Anura: Ranidae)

Die Lagebeziehung des mandibularen Trigeminusastes zu den Mandibularadduktoren. Die topographischen Verhältnisse bei Raniden (Anura: Ranidae)

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KURZFASSUNG

Bei Raniden wurde die topographische Beziehung zwischen dem mandibularen Ast des Nervus trigeminus und dem Komplex des Musculus adductor mandibulae untersucht. Dabei war nur Typ "E" (sensu STARRET 1968) feststellbar, auch deshalb, weil ein Musculus adductor mandibulae posterior subexternus bei Raniden nicht ausgebildet ist. Die Eignung des Grobverlaufes des mandibularen Trigeminusastes zur Klärung phylogenetischer Zusammenhänge bei Raniden wird in Abrede gestellt.

ABSTRACT

In Ranidae, the topographic relation of the mandibular branch of the trigeminal nerve and the musculus adductor mandibulae complex is analyzed.Only STARRETT's (1968) "E" condition was found in Ranidae which lack the musculus adductor mandibulae posterior subexternus. The qualification of gross topography of the mandibular branch of the trigeminal nerve for phylogenetic studies in Ranidae is denied.

KEY WORDS

Anura, Ranidae; morphology, systematics, ramus mandibularis of nervus trigeminus, musculus adductor mandibulae complex

The relationship between the mandibular branch of the trigeminal nerve and the musculus adductor mandibulae complex has been described by LUTHER (1914), for *Xenopus clivii* PERACCA, 1898, *Pelobates fuscus* (LAURENTI, 1768), *Bombina variegata* (LINNAEUS, 1758), *Bufo bufo* (LINNAEUS, 1758), *Hyla arborea* (LINNAEUS, 1758), *Rana catesbeiana* SHAW, 1802, *Rana esculenta* LINNAEUS, 1758, and *Rana temporaria* LINNAEUS, 1758; EDGEWORTH (1935), for *Rana temporaria*, *Bombina* sp., *Xenopus fraseri* BOULENGER, 1905, and *Pipa pipa* (LINNAEUS, 1758); SAVE-SÖDERBERGH (1945), for *Rana* sp. and *Bufo* sp.; LIMESES (1965), for several species of Ceratophrynidae, and STARRETT (1968), for various Ascaphidae, Pipidae, Rhinophrynidae, Discoglossidae, Pelobatidae, Pelodytidae, Leptodactylidae, Hylidae, Pseudidae, Centrolenidae, Rhinodermatidae, Dendrobatidae, Ranidae, Bufonidae, Rhacophoridae, Microhylidae, and Phrynomeridae species. Later, MIYAMOTO & TENNANT (1984), LYNCH (1986), and SAVAGE (1987) employed this character in the systematic context to define anuran clades (see below).

This musculus adductor mandibulae complex is composed of six muscles that I describe following STARRETT's (1968) terminology:

(1) Musculus adductor mandibulae posterior longus, arising from the upper surface of the prootic bone, and inserting in the inner surface of the coronoid process of the jaw;

(2) Musculus adductor mandibulae externus superficialis, and

(3) Musculus adductor mandibulae posterior subexternus, both originating in the zygomatic portion of the squamosal, and inserting in the lateral margin of the angular bone;

(4) Musculus adductor mandibulae anterior, originating in the frontoparietal, in a portion of the prootic, and inserting in the inner surface of the angular bone behind the musculus adductor mandibulae posterior longus.

In her unpublished doctoral dissertation, STARRETT (1968) identified three topographic situations of the mandibular branch of the trigeminal nerve relative to the musculus adductor mandibulae complex: (1) "S" condition, when the nerve passes lateral to the musculus adductor mandibulae posterior subexternus; (2) "E" condition, when the nerve passes medial to the musculus adductor mandibulae externus superficialis, and (3) "S+E" condition when the nerve passes between these two muscles.

Similarly, IORDANSKY (1992) examined the position of the trigeminal nerve branches relative to the jaw muscles in some anuran species: *Bombina bombina* (LINNAEUS, 1761), *Bufo melanostictus* SCHNEIDER, 1799, *B. viridis* LAURENTI, 1768, *Conraua beccarii* (BOULENGER, 1911), *Hyla arborea*, *Microhyla berdmorei* (BLYTH, 1856), *Pelobates fuscus*, *Pipa carvalhoi* (MIRANDA-RIBEIRO, 1937), *Rana ridibunda* PALLAS, 1771, *R. temporaria*, *Rhacophorus leucomystax* (GRAVENHORST, 1829) and *Xenopus laevis* (DAUDIN, 1802). Although he did not use STARRETT's (1968) terminology, IORDANSKY (1992) identified the same three descending route patterns of the mandibular branch of the trigeminus to the mandible: (1) medial to the external adductor; (2) lateral to this muscle, and (3) within this muscle. He did not describe each state deeply and did not make drawings, but we can presume, however, that condition (1) corresponds to the "E" pattern, condition (2) to the "S" state, and pattern (3) to the condition "S+E".

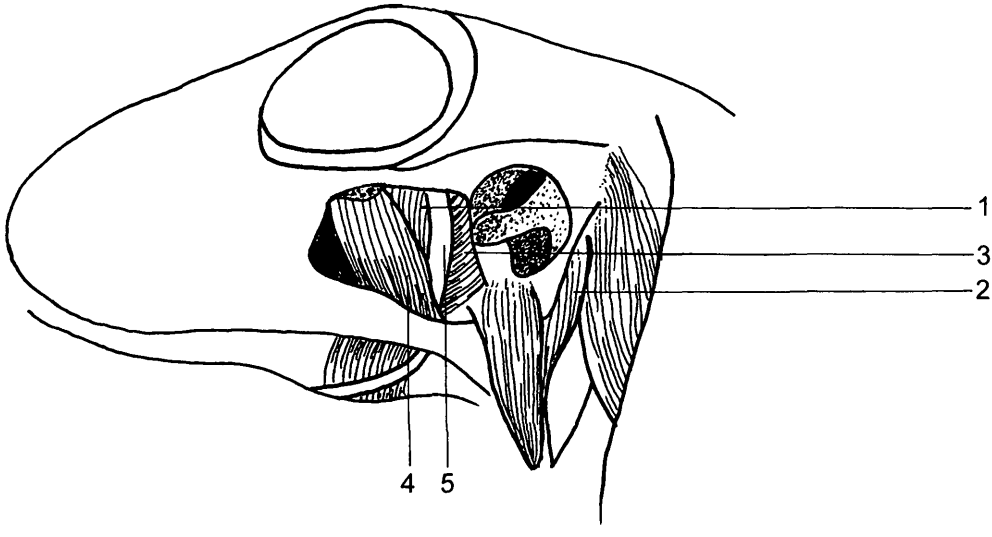

Fig. 1: Lateral view (left side of head) of the mandibular musculature and the mandibular branch of the trigeminal nerve ("E" condition sensu STARRETT 1968) in *Rana lessonae* (MNHN 1995.9770). The musculus adductor mandibulae externus superficialis is partially removed to show the mandibular branch of the trigeminal nerve, and the musculus adductor mandibulae posterior longus. Scale bar represents 1mm.
1 - musculus adductor mandibulae posterior longus; 2 - musculus cucullaris;
3 - musculus adductor mandibulae posterior articularis; 4 - musculus adductor mandibulae externus superficialis;
5 - mandibular branch of the trigeminal nerve.

Abb. 1: Seitenansicht (linke Kopfseite) der Mandibularmuskulatur und des mandibularen Astes des Nervus trigeminus (Typ "E" sensu STARRETT 1968) bei *Rana lessonae* (MNHN 1995.9770). Der Musculus adductor mandibulae externus superficialis ist teilweise entfernt, um den mandibularen Ast des Nervus trigeminus und den Musculus adductor mandibulae posterior longus darzustellen. Die Balkenlänge entspricht 1 mm.
1 - Musculus adductor mandibulae posterior longus; 2 - Musculus cucullaris;
3 - Musculus adductor mandibulae posterior articularis; 4 - Musculus adductor mandibulae externus superficialis;
5 - mandibularer Ast des Nervus trigeminus.

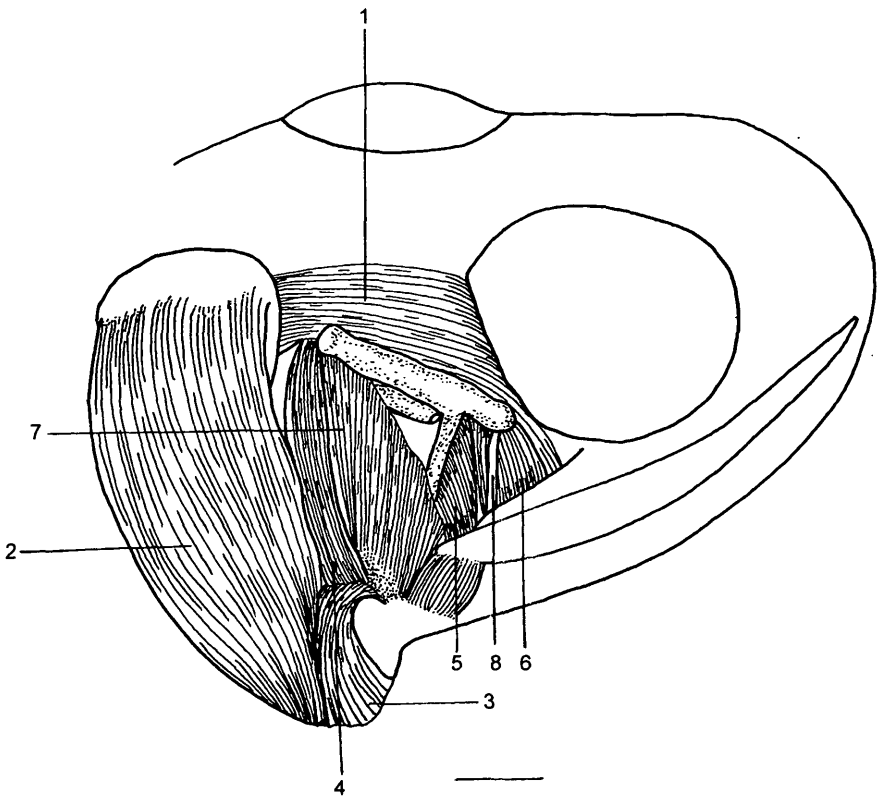

Fig. 2: Dorsolateral view (right side of head) of the mandibular and cephalic (partim) musculature and the mandibular branch of the trigeminal nerve ("S" condition sensu STARRETT 1968) in *Eleutherodactylus martinicensis* (MNHN 755). Scale bar represents 1mm.
1 - musculus adductor mandibulae posterior longus; 2 - fascial fibers of the musculus depressor mandibulae externus; 3 - squamosal fibers of the musculus depressor mandibualae externus; 4 - musculus cucullaris; 5 - musculus adductor mandibulae posterior articularis; 6 - musculus adductor mandibulae posterior subexternus; 7 - musculus depressor mandibulae internus; 8 - mandibular branch of the trigeminal nerve.

Abb. 2: Dorsolateralansicht (rechte Kopfseite) der Mandibular- und teilweise der Kopfmuskulatur sowie des mandibularen Astes des Nervus trigeminus (Typ "S" sensu STARRETT 1968) bei *Eleutherodactylus martinicensis* (MNHN 755). Die Balkenlänge entspricht 1 mm..
1 - Musculus adductor mandibulae posterior longus; 2 - fasziale Fasern des Musculus depressor mandibulae externus; 3 - Squamosumfasern des Musculus depressor mandibualae externus; 4 - Musculus cucullaris; 5 - Musculus adductor mandibulae posterior articularis; 6 - Musculus adductor mandibulae posterior subexternus; 7 - Musculus depressor mandibulae internus; 8 - mandibularer Ast des Nervus trigeminus.

In all 52 species of the family Ranidae studied (see appendix), I exclusively found condition "E" (figure 1). For comparison, I dissected also one species of Hyperoliidae, two of Microhylidae and one of Leptodactylidae. Only in the leptodactylid *Eleutherodactylus martinicensis* (TSCHUDI, 1837) I observed condition "S" (figure 2), while in the Hyperoliidae and Microhylidae species I found pattern "E" again.

Although STARRETT (1968) recognized most ranid species to represent type "E", she described the "S+E" condition for some species of this family [*Rana areolata* BAIRD & GIRARD, 1852, one specimen of *R. clamitans* LATREILLE, 1801, *R. catesbeiana*, *R. pipiens* SCHREBER, 1782, *R. virgatipes* COPE, 1891, *R. grylio* STEJNEGER, 1901, *R. hecksheri* WRIGHT, 1924, *R. palmipes* SPIX, 1824, *R. macroglossa* BROCCHI, 1877, *Strongylopus grayi* (SMITH,

1849), and *Occidozyga lima* (GRAVENHORST, 1829)]. I could not find the character state "S+E" expressed in these species as observed by STARRETT (1968); maybe this author erroneously identified the musculus adductor mandibulae posterior longus as the musculus adductor mandibulae posterior subexternus. LYNCH (1986) pointed STARRETT (1968) to this mistake concerning some species of Leptodactylidae examined by her.

However,"E" condition was observed in all groups of Ranidae (sensu DUBOIS, 1992): Raninae, Rhacophorinae, Dicroglossinae, Ptychadeninae, Pyxicephalinae, Ranixalinae and Tomopterninae.

Furthermore, LYNCH (1986) found this character state in 56 species of *Eleutherodactylus* from Middle America and MIYAMOTO & TENNANT (1984) detected this condition in species of *Eleutherodactylus melanostictus* (COPE, 1876), *E. fitzingeri* (SCHMIDT, 1859), and in species of the *E. rugulosus* (COPE, 1870 "1869") group. Likewise, STARRETT (1968) noted this pattern in some species of Microhylidae, Hyperoliidae and Leptodactylidae. Thus, in Anura state "E" is likely to be more common than LYNCH (1986) and MIYAMOTO & TENNANT (1984) thought, and possibly represents a plesiomorphy for Ranidae if we take the other species examined as outgroups in a phylogenetic analysis.

LYNCH (1986) interpreted the "E" condition as a synapomorphy uniting 65 species of *Eleutherodactylus* and three species of *Hylactophryne* as a Middle American clade of *Eleutherodactylus*, but my observations in Ranidae falsify this point of view.

Thus, one can say: (1) Ranidae species do not have something like the musculus adductor mandibulae posterior subexternus, but only the musculus adductor mandibulae externus superficialis and (2) the mandibular branch of the trigeminal nerve passes between the musculus adductor mandibulae externus superficialis and the musculus adductor mandibulae posterior longus (condition "E").

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APPENDIX

Acronyms

CAS - California Academy of Sciences, San Francisco; MNHN - Muséum National d'Histoire Naturelle, Paris.

Specimens examined

● Ranidae: *Amolops monticola* (ANDERSON, 1871) (MNHN 1987.2077, 9533), *Aubria subsigillata* (DUMÉRIL, 1856) (MNHN 1989.2051; 1993. 1470), *Boophis brachychir* (BOETTGER, 1882) (MNHN 2495), *Boophis goudotii* (TSCHUDI, 1838) (MNHN 1975.2732), *Chiromantis rufescens* (GÜNTHER, 1868) (MNHN 1993.5702), *Conraua alleni* (BARBOUR & LOVERIDGE, 1927) (MNHN 1979.7007), *Conraua crassipes* (BUCHOLZ & PETERS, 1875) (MNHN 1979.6145), *Euphlyctis cyanophlyctis* (SCHNEIDER, 1799) (MNHN 1977.1364, 1977.1368, 1979.1379, 1979.1392) *Hoplobatrachus occipitalis* (GÜNTHER, 1859) (MNHN 1979.764, 1979.766), *Hoplobatrachus rugulosus* (WIEGMAN, 1835) (MNHN 1997.4900), *Indirana gundia* (DUBOIS, 1986 "1985") (MNHN 1985.626), *Ingerana tenasserimensis* (SCLATER, 1892) (MNHN 724), *Limnonectes blythii* (BOULENGER, 1920) (MNHN 1988.2468), *Limnonectes kuhlii* (TSCHUDI, 1838) (MNHN 1987.334), *Limnonectes (Fejervaria) limnocharis* (GRAVENHORST, 1829) (MNHN1987. 2371), *Limnonectes (Bourretia) pileatus* (BOULENGER, 1916) (MNHN 1987, 3139), *Nanorana (Altirana) parkeri* STEJNEGER, 1927 (MNHN 1982.1082), *Occidozyga lima* (GRAVENHORST, 1829) (MNHN 336; CAS 195994), *Paa blanfordii* (BOULENGER, 1882) (MNHN 1994.6783), *Paa vicina* (STOLICZKA, 1872) (MNHN 1985.1105), *Phrynoglossus laevis* (GÜNTHER, 1859) (CAS 195994), *Phrynoglossus martensii* PETERS, 1867 (MNHN 1987.288), *Platymantis vitiensis* (GIRARD, 1853) (MNHN 1992.5264), *Ptychadena floweri* (BOULENGER, 1917) (MNHN 1996.6147), *Ptychadena mascareniensis* (DUMÉRIL & BIBRON, 1841) (MNHN 1995.1952, 1995.1962, 1995.1965, 1995.1979, 1995.2066, 1995.2067, 1995.2085, 1995.2091, 1995.2092, 1995.3069), *Ptychadena pujoli* LAMOTTE & OHLER, 1997 (MNHN 1995.1446), *Ptychadena superciliaris* (GÜNTHER, 1859) (MNHN 1970.949, 1970.963), *Ptychadena tournieri* (GUIBÉ & LAMOTTE, 1955) (MNHN 1996.8909, 1996.8948), *Pyxicephalus adspersus* TSCHUDI, 1838 (MNHN 1994.5528), *Rana albolabris* HALLOWELL, 1856 (MNHN 1989.764, 793), *Rana angolensis* BOCAGE, 1866 (MNHN 1989.49, 1989.108), *Rana arvalis* NILSSON, 1842 (MNHN 1982.2201, 1982.2213), *Rana chapaensis* (BOURRET, 1937) (MNHN 1938.64), *Rana clamitans* (LATREILLE, 1801) (MNHN 1997.4903-4904), *Rana dalmatina* BONAPARTE, 1840 (MNHN 1988.7106), *Rana erythraea* (SCHLEGEL, 1837) (MNHN 1988.4330, 1988.7467), *Rana galamensis* DUMÉRIL & BIBRON, 1841 (MNHN 1979.7143), *Rana graeca* BOULENGER, 1891 (MNHN 1985.2431, 1985.2460), *Rana iberica* BOULENGER, 1879 (MNHN 1970.1074, 1970.1078), *Rana lateralis* BOULENGER, 1887 (D 201), *Rana lessonae* CAMERANO, 1882 (MNHN 1991.167; 1995.9771), *Rana nigrovittata* (BLYTH, 1855) (MNHN 1997.4043, 1997.4044, 1997.4045, 1997.4046), *Rana perezi* SEOANE, 1885 (MNHN 1981.536, 1981.543), *Rana pipiens* SCHREBER, 1782 (MNHN 1997.4901-4902), *Rana taipehensis* (VAN DENBURGH, 1909) (MNHN 3404, 3416), *Rana temporaria* LINNAEUS, 1758 (MNHN 1988.7883, 1988.7888), *Rhacophorus leucomystax* GRAVENHORST, 1829 (MNHN 1987.3554, 1987.3574), *Rhacophorus nigropalmatus* BOULENGER, 1895 (not catalogued), *Tomopterna breviceps* (SCHNEIDER, 1799) (MNHN 1989.2117), *Tomopterna marmorata* (PETERS, 1854) (MNHN 1995.2138).

● Microhylidae: *Breviceps mossambicus* PETERS, 1854 (MNHN 1995.9910), *Kaloula pulchra* GRAY, 1831 (MNHN 1986.2771, 1988.4362).

● Hyperoliidae: *Leptopelis christyi* (BOULENGER, 1912) (MNHN 1989.2455, 1989.2457).

● Leptodactylidae: *Eleutherodactylus martinicensis* (TSCHUDI, 1837) (MNHN 755)

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