

## ON THE DISTRIBUTION OF BIDDER'S ORGAN IN BUFONIDS

by

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It is a well-known fact that Bidder's organ is an undeveloped ovary. It is found in all adult male and in many adult female as well as in all juvenile male and female specimens of *Bufo*-species, and it is situated between the fatbody and the gonad.

The fact that Bidder's organ is a potential ovary is not only derived from its morphology, but has also been proved experimentally by Harms (1923) and Ponse (1924), for after castration of male toads and after ovariectomy of female common toads (*Bufo vulgaris* Laur. (= *B. bufo* (L.)) Bidder's organ may develop into a normally functioning ovary.

In 1931 Stohler compiled our knowledge concerning the distribution of Bidder's organ in the Bufonidae; in addition the occurrence of the organ was described in several other species in which hitherto it had not been recorded. We refer the reader interested in these species to Stohler's publication. After 1931 some useful papers appeared on the presence of Bidder's organ in certain Bufonids: Witschi (1933), Koch (1934), De Vos (1935) and Davis (1936). In these publications much older information was confirmed and some new facts were added (table I).

In connection with investigations on the physiology and histophysiology of Bidder's organ in *Bufo bufo* (L.), carried out in our laboratory under the guidance of Prof. G. J. van Oordt, I have traced the presence of Bidder's organ in several species of Bufonids from the Amsterdam Zoological Museum and from the Leiden Rijksmuseum van Natuurlijke Historie, which had not yet been investigated by preceding authors in this respect <sup>1</sup>).

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TABLE I,  
relating to Bufonids in which Bidder's organ is present, according to papers  
published since Stohler (1931).

Species	ad. ♂	ad. ♀	Author
<i>Bufo americanus</i> Holbrook . . . . .	+	+	Witschi (1933)
<i>Bufo americanus</i> Holbrook . . . . .	+		Davis (1936)
<i>Bufo angusticeps</i> A. Smith . . . . .	+	—	De Vos (1935)
<i>Bufo bufo</i> (L.) . . . . .	+	+	Witschi (1933)
<i>Bufo bufo</i> (L.) . . . . .	+	+	Koch (1934)
<i>Bufo canorus</i> Camp. . . . .	+	—	Witschi (1933)
<i>Bufo carens</i> A. Smith . . . . .	+		Davis (1936)
<i>Bufo fowleri</i> Hinckley . . . . .	+		Davis (1936)
<i>Bufo fowleri</i> Hinckley . . . . .	+	—	Witschi (1933)
<i>Bufo garipepensis</i> A. Smith . . . . .	+	—	De Vos (1935)
<i>Bufo terrestris</i> (Bonn.) . . . . .			
[= <i>B. lentiginosus</i> (Shaw)] . . . . .	+	+	Witschi (1933)
<i>Bufo leptopus</i> Günther . . . . .	+		Davis (1936)
<i>Bufo marinus</i> (L.) (= <i>B. aqua</i> Daudin) . .	+		Koch (1934)
<i>Bufo melanostictus</i> Schneider . . . . .	+		Koch (1934)
<i>Bufo muelleri</i> Blgr. . . . .	+		Davis (1936)
<i>Bufo quercicus</i> Holbrook . . . . .	+	+	Witschi (1933)
<i>Bufo rosei</i> Hewitt . . . . .	+	—	De Vos (1935)
<i>Bufo tradowi</i> Hewitt . . . . .	+		De Vos (1935)
<i>Bufo vertebralis</i> A. Smith . . . . .	+	—	De Vos (1935)
<i>Bufo viridis</i> Laur. . . . .	+	—	Witschi (1933)
<i>Nectophryne afra</i> Bucc. & Ptrs. . . . .	—		Davis (1936)
<i>Nectophrynoides vivipara</i> (Tornier) . . . .	+		Davis (1936)
<i>Pedostibes hosii</i> (Blgr.) . . . . .	+		Davis (1936)
<i>Pelophryne</i> (= <i>Pedostibes</i> ) <i>guentheri</i> (Blgr.)	+		Davis (1936)
<i>Pelophryne</i> (= <i>Pedostibes</i> ) <i>signata</i> (Blgr.) .	+		Davis (1936)
<i>Pseudobufo subasper</i> Tschudi . . . . .	+		Davis (1936)
<i>Pseudobufo</i> ( <i>Pseudophryne</i> ) <i>guentheri</i> (Blgr.)	—		Davis (1936)

The presence of Bidder's organ has been ascertained macroscopically in male specimens of 17 more *Bufo*-species: *Bufo brauni* Nieden (Leiden Museum); *B. cognatus* Say (Leiden Mus.); *B. coniferus* Cope (Leiden Mus.); *B. diptychus* Cope (Amsterdam Mus.); *B. glabberimus* Gthr. (Amsterdam Mus.); *B. granulatus* Spix (Amsterdam Mus.); *B. guttatus* Schn. (Amsterdam and Leiden Mus.); *B. gymnauchen* Blkr. (Amsterdam Mus.); *B. haematiticus* Cope (Leiden Mus.); *B. polycerus* Wern. (Leiden Mus.); *B. marmoreus* Wieg. (Leiden Mus.); *B. quadriporcatus* Blgr. (Amsterdam Mus.); *B. spinulosus* Wieg. (Leiden Mus.); *B. tuberosus* Gthr. (Leiden Mus.); *B. valhallae* Meade-Waldo (Amsterdam and Leiden Mus.) and *B. veraguensis* O. Schmidt (Amsterdam Mus.).

From the studies by Spengel (1876), Knappe (1886), Rau and Gatenby (1923), Stohler (1931), Koch (1934), De Vos (1935), Davis (1936) and myself, it therefore appears that Bidder's organ is found in all male specimens of all the species belonging to the genus *Bufo*. In a few species it was found only in young males; in the adult males of these species it was not visible macroscopically. Nevertheless I consider it quite probable that in these cases Bidder's organ was also present but hidden in the testis; Koch (1934) proved this to be the case in *Bufo melanostictus* Schneider.

Witschi (1933) stated that in the female of *Bufo fowleri* Hinckley Bidder's organ is present in the juvenile, and that during its later development it assumes the structure of true ovarian tissue, being incorporated in the ovary. In the females of many other species, however, Bidder's organ seems to degenerate and to disappear at an earlier stage of development.

Most authors are of opinion that in *Bufo bufo* (L.) and in some other species Bidder's organ is present in adult males as well as in adult females during lifetime. I wonder, however, whether this is really the case. In very old specimens of female common toads (*Bufo bufo* (L.)), having reached a length of more than 7 cm, I could not find a Bidder's organ either macroscopically or microscopically. So it seems that in female specimens of *Bufo bufo* (L.) it degenerates also in the course of time, and that it disappears in old females. In male *Bufo bufo* (L.) it was always present, however.

Apart from *Bufo* Bidder's organ has been found in adult specimens of some other more closely related species. Thus it has been found in the male *Pedostibes* (= *Nectophryne*) *hosii* (Blgr.) (Ponse, 1924), in the male *Nectophrynoidea* (= *Nectophryne*) *tornieri* (Roux), as well as in both sexes of *Pseudophryne bibronii* Günther and in adult males and juvenile females of *Nectophrynoidea* (= *Pseudophryne*) *vivipara* (Tornier) (Stohler, 1931).

According to Davis (1936) it also occurs in the male of *Pseudobufo subasper* Tschudi, of *Pelophryne guentheri* (Blgr.), and of *Pelophryne signata* (Blgr.). The presence of Bidder's organ in the adult males of *Pedostibes hosii* (Blgr.) and of *Nectophrynoidea vivipara* (Tornier) was confirmed by Davis (1936), who, however, denies its occurrence in *Pseudophryne guentheri* Blgr. in contradiction to Stohler (1931), by whom it is recorded in *Pseudophryne guentheri* Blgr. Neither have Rau and Gatenby (1923) been able to state its presence in *Pseudophryne bibronii* Günther, from which I gather that Stohler's observation cannot be correct.

The presence of Bidder's organ in other genera of Bufonids has been summarized in table II.

TABLE II,

relating to the distribution of Bidder's organ in other genera of Bufonids. (From the table it is obvious that the observations of Stohler on the one hand and those of Rau and Gatenby and of Davis on the other are at variance concerning the genus *Pseudophryne*).

Species	ad. ♂	ad. ♀	Author
<i>Nectophryne</i> spec. . . . .	—	—	Rau and Gatenby (1923)
<i>Nectophryne afra</i> Buchh. & Ptrs. . . . .	—	—	Ponse (1924)
<i>Nectophryne afra</i> Buchh. & Ptrs. . . . .	—	—	Davis (1936)
<i>Nectophrynoides</i> (= <i>Nectophryne</i> ) <i>tornieri</i> (Roux) . . . . .	+	—	Stohler (1931)
<i>Nectophrynoides</i> (= <i>Pseudophryne</i> ) <i>vivipara</i> (Tornier) . . . . .	+	—	Stohler (1931)
<i>Nectophrynoides</i> (= <i>Pseudophryne</i> ) <i>vivipara</i> (Tornier) . . . . .	+	—	Davis (1936)
<i>Pedostibes hosii</i> (Blgr.) . . . . .	+	—	Ponse (1924)
<i>Pedostibes hosii</i> (Blgr.) . . . . .	+	—	Davis (1936)
<i>Pelophryne guentheri</i> (Blgr.) . . . . .	+	—	Davis (1936)
<i>Pelophryne signata</i> (Blgr.) . . . . .	+	—	Davis (1936)
<i>Pseudobufo subasper</i> Tschudi . . . . .	+	—	Davis (1936)
<i>Pseudophryne bibronii</i> Günther . . . . .	—	—	Rau and Gatenby (1923)
<i>Pseudophryne bibronii</i> Günther . . . . .	—	—	Ponse (1924)
<i>Pseudophryne bibronii</i> Günther . . . . .	+	+	Stohler (1931)
<i>Pseudophryne guentheri</i> Blgr. . . . .	—	—	Davis (1936)

The presence of Bidder's organ in the adult ♂ of *Pedostibes hosii* (Blgr.) (Ponse, 1924; Davis, 1936) was established in a specimen from the Leiden Museum, and in an adult ♂ from the Amsterdam Museum; according to Rau and Gatenby (1923) it is lacking in this species, however.

Finally the presence of Bidder's organ in the genus *Cacophryne* must be mentioned. According to osteological characteristics of the shoulder-girdle Davis (1935) proposed a separate genus *Cacophryne* for *Bufo borbonica* (Tschudi). For similar reasons Brongersma (1935) suggested that *Bufo cruentatus* (Tschudi) should be placed also in the genus *Cacophryne*.

In the adult ♂ of *Cacophryne borbonica* Bidder's organ was not found by Davis (1935). However, in a juvenile specimen of *C. borbonica* (from the Leiden Museum) and in an adult ♂ of *Cacophryne cruentata* (Tschudi) (from the Amsterdam Museum) I found that Bidder's organ is present; in a juvenile female specimen of the latter species (from the Amsterdam Museum) it was lacking. Bidder's organ was also found in a male of *Bufo jerboa* Blgr. (Amsterdam Mus.), a species which, according to Smith (1930, p. 130), is identical with *Cacophryne borbonica* (Tschudi).

Consequently Bidder's organ is found in all genera, which Noble (1922) brought together in the subfamily Bufoninae, i.e., in the genera *Bufo*, *Pseudobufo*, *Pedostibes*, *Pelophryne*, *Nectophryne* and *Nectophrynoides*; moreover, it is present in the related genera *Cacophryne* and *Rhinophrynus*. According to Davis (1935), who brings these genera together into the family Bufonidae with the exception of *Cacophryne* and *Rhinophrynus*, *Nectophryne* is supposed to be an exception as in this genus Bidder's organ is lacking. As, however, Bidder's organ is also present in *Cacophryne* and *Rhinophrynus* these genera, in my opinion, also belong to the family Bufonidae.

From the above it follows that Bidder's organ is an organ characteristic of the Bufonidae, and that it is lacking in other anuran families.

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