

Leon ZANIEWSKI¹⁾**Sex Determination in the European beaver,
Castor fiber Linnaeus, 1758**

[With 1 Table]

To determine sex differences in European beaver, use was made of the anticipated effect of the action of Combelen, that is, the lapse of the penis in males into the cloaca, which was visually confirmed. The experiments made showed that Combelen may be successfully used not only as a tranquilizer, but also as an aid to diagnosis in an objective method of sex determination in live European beavers.

The topography of the uro-genital organs in the beaver, which are hidden in the cloacal chamber (Owen, 1868; Hinze, 1950) and the absence of distinct secondary sex characters in live beavers make it difficult to determine sex in these animals (Bradt, 1938; Hinze, 1950; Osborn, 1955; Herman, 1957; Taber, 1960; Panfil, 1960; Richard, 1962; Longley, 1963).

Grinnell et al. (1937 — after Osborn, 1955) described in fetuses of the Canadian beaver, *Castor canadensis*, the mammary stigmata which correspond to the teats in adult females; fetuses devoid of these stigmata are males. Cook et al. (1949) and Osborn (1955) found in embryos of the Canadian beaver in different stages of development that both males and females have mammary stigmata. The sex of dead beavers can be determined without difficulty by dissection.

Esquimos can distinguish sex in swimming beavers from the way the animals hold their heads. Males swim with the head raised further above the surface of the water than the females, which keep the head almost completely submerged while swimming (Bailey, 1926).

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Young (1936 — after Osborn, 1955) and Bradt (1938) when examining Canadian beavers used the technique of internal palpation through the cloacal orifice in order to feel for the penis together with *os penis*, in males. Osborn (1949 — after Osborn, 1955) developed this method further by searching for the testes in addition to the penis. This method can only be used for males over one year old, in which the cloacal orifice is sufficiently large to permit palpation. Another difficulty involved in these methods is the different position of the penis and testes in different individuals. Sex determination in beavers by these methods, despite the fact that they are not very exact, has been used and recommended by many authors (Kennedy, 1952 — after Taber, 1960; Osborn, 1953; Townsend, 1953; Taber, 1960).

A less accurate method than the above is the external palpation through the integument in order to feel the *os penis* in old males, used by, *inter alia*, Denney (1950 — after Osborn, 1955).

The females were identified by the presence of nipples which can be found with complete certainty in live animals during the lactation period (Bradt, 1938; Townsend, 1953; Osborn, 1955; Taber, 1960).

Hinze (1950) drew attention to the differences in the shape of the tail in beavers depending on their sex. The tail in males is of uniform breadth at the base and halfway along its length, narrowing in a wedge-shape at the end. In females the tail is narrower at the base, broadens gently up to halfway along its length, then ends symmetrically in a rounded apex.

Richard (1962) distinguishes the sex of beavers by the characteristic arrangement of squamae on the dorsal side of the tail at the apex itself. The males have squamae arranged centrifugally which produces a sharp end to the tail. In females the squamae are arranged centripetally, forming a very slight depression in the apex of the tail.

It would seem that the above methods of sex determination in live beavers are not sufficiently accurate and cannot be used as objective criteria.

Experiments were made on European beavers (*Castor fiber* Linnaeus, 1758) in January and April 1963 in the Experimental Station of the Polish Academy of Sciences at Popielno, in which Combelen²⁾, a drug belonging to the tranquilizer group, was given to these animals. The aim of the experiments was to observe the effect of Combelen on beavers (Zaniewski, 1963) and to try the application of this drug as an aid to diagnosis in sex determination in live beavers.

Four females and six males were brought to the laboratory from the beaver farm at Popielno, where the beavers were kept under artificial conditions (Żurowski, 1962).

²⁾ Combelen-Bayer: N-(3'-Dimethylaminopropyl)-3-propionylphenothiazin.

The experiments were made in a laboratory at a temperature of approximately 16°C. The beavers were weighed and measurements made of their internal temperature and number of respirations rate and heart rate. All the animals exhibited a strongly developed defensive reaction, which in certain of them necessitated their being held down by two strong men during the initial examinations. The beavers were next given appropriate intramuscular injections of Combelen (Table 1), after which observations of the animals were continued.

Combelen began to take effect on the beavers on an average about 6 minutes after injection, and the peak of reaction, on an average after

Table 1.
Dosage of Combelen.

Beaver No.	Sex	Date of birth	Body weight in kg	Dosage of Combelen mg/kg
10	♂	1960	8.6	1.97
22	♂	7. V. 1961	14.8	1.15
23	♂	7. V. 1961	15.9	1.01
5	♂	—	21.3	0.94
7	♂	—	16.4	0.91
14	♂	—	15.4	0.84
24	♂	7. V. 1961	17.8	0.84
3	♂	1955	20.7	0.40
32	♂	11. V. 1962	10.2	0.20
31	♂	11. V. 1962	8.6	0.09

about 29 minutes. Its effect was to reduce their internal temperature heart rate and respiration rate. The space between the eye-lids narrowed. Skeletal muscle tension was reduced and with doses of Combelen over 0.91 mg/kg live weight of the animal, was completely eliminated. This reaction was accompanied by corresponding reduction or elimination of defensive reactions³⁾.

In order to determine sex in beavers, endoscopy was made of the cloaca with simultaneous pressing of the abdominal wall. This examination showed that in beavers nos. 5, 7, 14, 3, 32, 31 as a result of the atony of the muscles, probably of the retractor of the penis, the penis lapses into the cloaca. It proved possible to extrude the penis outside the cloaca even with the smallest dose of Combelen (Table 1). The penis proved to be a triple-duct organ livid in colour (probably as the result of passive congestion of the corpora cavernosa). The penis was not observed to lapse into the cloaca before Combelen was given.

³⁾ A detailed paper on the effect of Combelen on the European beaver will be published separately.

As there was no manifestation of lapse of the penis into the cloaca in beavers nos. 10, 22, 23, 24 (Table 1), these animals were held to be females.

Continued observations of the beavers which were tested in the experiments confirmed the results of examinations. These animals were kept in pairs in 1963 and 1964 and some of them produced young. Combelen was not found to exert a harmful effect on the beavers during this observation period.

The results of the experiments showed that even the smallest dose of Combelen — 0.09 mg/kg (Table 1) made it possible to determine sex in a male aged 11 months old. With this dose, however, during endoscopy of this beaver it was necessary to press the abdominal region of the cloaca more firmly in the caudal direction. In addition this male was not entirely safe to handle and had to be held down by an assistant. A diagnostic dose of Combelen proved to be 0.40 mg/kg live weight of the beaver, this amount proving sufficient to permit of easy extrusion of the penis from the cloaca, in beaver no. 3 (Table 1). The optimum dose of Combelen for beavers was 0.9 mg/kg of live weight of the animal. This dose making it easy to determine sex and manipulate the beaver safely.

It would seem that the use of Combelen has supplied an objective method of sex determination in live European beavers.

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ROZPOZNAWANIE PŁCI
U BOBRA EUROPEJSKIEGO, *CASTOR FIBER* LINNAEUS, 1758

Streszczenie

W styczniu i kwietniu 1963 roku, w Z. D. PAN Popielno przeprowadzono doświadczenia na 10 bobrach europejskich z zastosowaniem odpowiednich, domięśniowych dawek Combelenu (Tabela 1).

Dotychczas istniejące metody rozpoznawania płci u żywych bobrów opierają się na:

- wewnętrznej palpacji prącia i jąder przez otwór kloaki,
- wymacaniu kości prąciowej przez powłoki ciała,
- wymacaniu sutek u samic,
- różnicy w kształcie ogona,
- różnicy w układzie łusek w szczycie ogona.

W rozpoznawaniu płci u biorących udział w doświadczeniach bobrów, wykorzystano spodziewany efekt działania Combelenu, a mianowicie fakt wypadania u samców prącia do kloaki, co stwierdzano naocznie.

Doświadczenia wykazały, że Combelen może być z powodzeniem stosowany nie tylko jako trunkwilizator, lecz także, jako diagnostyczny środek w obiektywnej metodzie rozpoznawania płci u żywych bobrów europejskich.