Preliminary Studies on Biology of *Enhydris plumbea* (Boie, 1827)
(Serpentes: Colubridae: Homalopsinae)

(Plate inside front cover upper)

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**Abstract:** Based on field observations and dissection of a lot of preserved specimens, this paper deals about the external characteristics, variation of lepidosis, vertical distribution, habitats, food habits, reproductive habits (secondary sex character, sex ratio, sexual maturation, number of offsprings, developing of embryos in oviparous, length and weight of hatching, etc.) of the homalopsinae snake, *Enhydris plumbea* (Boie, 1827). All the specimens examined are preserved in the collections of Chengdu Institute of Biology, Chinese Academy of Sciences, Chengdu, Sichuan, China.

**Key words:** *Enhydris plumbea*; lepidosis; variation; food habits; reproduction.

铅色水蛇 *Enhydris plumbea* (Boie, 1827) 的生物学初探
(蛇亚目: 游蛇科: 仰鼻蛇亚科)

【图版封 2，上】

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**摘要**：根据野外观察和解剖标本，本文报道水蛇亚目，游蛇科，水游蛇亚科中南方常见一种黄褐色游蛇的生物学研究初步结果。1. **长度**：112 号雄蛇全长范围 286–466 mm，151 号雌蛇全长范围 306–504 mm。海南陵水 103 号雄蛇最大全长 358 ± 54 = 412 mm，137 号雌蛇最大全长 443 ± 61 = 504 mm。2. **鳞片的变异**：根据 299 号标本观察，数量恒定或无变异的鳞片有：吻鳞 (1)，鼻间鳞 (1)，前额鳞 (2)，额鳞 (1)，顶鳞 (2)，鼻鳞 (每侧)，颊鳞 (每侧)，瞬膜鳞 (每侧)，前额鳞 (每侧)，额鳞 (1)，颈鳞 (2) 对，背鳞 (19–19–17 行)，肛鳞 (完整)；根据鳞片有变异的 67 号标本观察，可出现变异鳞片的变异范围及其频率：眶前鳞 1–2，4.5%；眶后鳞 2–3，3.0%；后颈鳞 2–1，1.5%；上唇鳞 3–2–3 (3–4，0.75%)，下唇鳞 10 (9，0.75%)，11，2.25%)；腹鳞与尾下鳞则绝对无变异；腹鳞雄性 112 号变异程度 124–136 (平均 128.2)，雌性 151 号变异程度 123–132 (平均 126.1)，尾下鳞雌性 107 号变异程度 36–41 (平均 39.7) 对，雌性 149 号变异程度 31–36 (平均 33.7) 对。3. **两栖间隙变异的消失和出现**：两条每对的右侧眶前鳞均变异为 2，她们的全部仔蛇 21 号均正常并为 1；一条母蛇的下唇鳞为正常的 10 枚，而她的仔蛇 6 号中有两号分别有一侧或两侧变异为 9。4. **垂直分布范围**：沿海低地到海拔 985 m。5. **栖息环境**：各种水域，以静水域水生蛙，云南丽水县上罗山大乡以慢性流水的稻田为主，极少数发现在静水域或流动缓慢的灌木丛内。6. **摄食和食性**：每年 4 月开始摄食，6 月为摄食高峰，9 月停止；食物以小形蛙类和蜗牛为主，其次为小鱼。7. **繁殖习性**：以小型蛙为主要捕食者，雌性尾的长较短，下颌的数目相应较多；二级性比（出生时的性比）接近 1：1；三级性比在居群较大的情况下也约为 1：1，而在居群较小的情况下统计约为 0.5：1；性成熟度期（以开始产仔为依据）全长都在 350 mm 以上：解剖 28 号雄猴得知输精管长度 3–12 (平均 6.3) 枚；卵在卵腔内发育过程：解剖 41 号成熟蛙的 4 号卵尚未发育，5 月及 6 月处于发育中或晚卵，产仔并已产出 7，7 月基本都已产仔；统计两窝 21 号得知共产出仔蛇全长 127–139 mm，母蛇体长大于其仔蛇亦较长，统计同窝 9 仔得知初生仔蛇重量 2.4–2.5 g，平均 2.47 g。本文是作者早期未发表的工作，现整理供对蛇类有兴趣的青年同行参考。本研究所用全部标本（包括 3 号雌蛇及其刚产出的仔蛇）均保存在中国科学院成都生物研究所两栖爬行动物标本馆。

**关键词**：铅色水蛇；鳞片；变异；食物及食性；繁殖习性

A total of 299 specimens of the Homalopsinae snake, *Enhydris plumbea* (Boie, 1827) were stud-
ied. Among which, 103 males, 137 females, 9 juveniles and 27 hatchlings of Hainan population, 7 males and 10 females of Fujian population, 2 males and 4 females of other provinces.

1. Total length (SVL + t, in mm)
   a) Range of total length
      Male (n = 112): 244 ~ 358 + 42 ~ 55
      Female (n = 151): 244 ~ 443 + 31 ~ 61
   b) Maximal total length
      Male (n = 112): 358 + 54 = 412 mm (Lingshui Co., Hainan Prov.)
      Female (n = 151): 443 + 61 = 504 mm (Lingshui Co., Hainan Prov.)

2. Variation of Lepidosis
   a) Scales no variation observed (n = 299).
      The following scales are very constant, no variation is observed in 299 specimens examined. They are: rostral (1), internasal (1), prefrontal (2), frontal (1), parietal (2), nasal (1 on each side), loreal (1 on each side), supraocular (1 on each side), anterior temporal (1 on each side), mental (1), chin shields (2 pairs), dorsals (19-19-17 rows), and anal (entire).
   b) Variation may be observed in following scales (n = 67).
      i. Preocular
         Normal condition: one on each side.
         Range of variation: 1 to 2.
         Variation frequency: 4.5%.
      ii. Postocular
         Normal condition: two on each side.
         Range of variation: 2 to 1.
         Variation frequency: 3.0%.
     iii. Posterior temporal
         Normal condition: two on each side.
         Range of variation: 2 to 1.
         Variation frequency: 1.5%.
     iv. Supr alabials or upper labials
         Normal condition: 8, in formula 3-2-3.
         Range of variation: 8, 3-1-4.
         Variation frequency: 0.75%.
     v. Infra labials or lower labials
         Normal condition: 10.

   Range of variation: 10 to 9 or 11.
   Variation frequency: 2.25% (11), 0.75% (9).

   c) Variation is constantly (absolutely) observed in following scales
      i. Ventral
         Range of variation:
         Males (n = 112) 124 ~ 136 (mean 128.2).
         Females (n = 151) 123 ~ 132 (mean 126.1).
      ii. Subcaudals (in pairs)
         Range of variation:
         Males (n = 107) 36 ~ 41 (mean 39.7).
         Females (n = 149) 31 ~ 36 (mean 33.7).

3. Lepidosis of female and her offsprings
   Ex. A. CIB 64II1533 and her 9 offsprings
      Mother: preocular 1 (left) or 2 (right), all offsprings is identical with one preocular.
      4 male offsprings:
      ventrals 126 ~ 128 (mean 127.3).
      subcaudals 41 ~ 42 (mean 40.2).
      5 female offsprings:
      ventrals 126 ~ 129 (mean 127.6).
      subcaudals 34 ~ 36 (mean 34.4).

      All the other scales of both mother and offsprings are normal.

   Ex. B. CIB 64II16387 and her 12 offsprings
      Mother: preocular 1 (left) or 2 (right), all offsprings is identical with one preocular.
      6 male offsprings:
      ventrals 125 ~ 128 (mean 126.8).
      subcaudals 39 ~ 40 (mean 39.7).
      6 female offsprings:
      ventrals 120 ~ 127 (mean 123).
      subcaudals 32 ~ 35 (mean 33.5).

      All the other scales of both mother and offsprings are normal.

   Ex C. CIB 64I6478 and her 6 offsprings
      3 male offsprings:
      ventrals 128 ~ 130 (mean 129.3).
      subcaudals 35 ~ 40 (mean 38.3).
      3 female offsprings:
      ventrals 129 ~ 130 (mean 129.7).
      subcaudals 33 ~ 34 (mean 33.3).
Lower labials of right side of one and both sides of one another offsprings are nine.

All the other scales of both mother and offsprings are normal.

4. Vertical distribution

Hainan population: from coastal low land upto 450 meters (Yinggeling of Baisha Co.)

Guangxi population: 110 m (Longzhou Co.) upto 210 m (Pingxiang City)

Fujian population: 320 m (Chong’an Co.) upto 985 m (Dehua Co.)

5. Habitats

Most specimens were caught at night in paddy fields of Dali Village, Mt. Diaoluo, Lingshui County, Hainan. A very few specimens were caught in small ponds, or irrigation canals.

6. Feeding and food

a) Feeding in different months

<table>
<thead>
<tr>
<th>No. of stomach</th>
<th>Full (empty)</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>48 (53)</td>
<td>1</td>
<td>4</td>
<td>2 (11)</td>
<td>34 (30)</td>
<td>9 (4)</td>
<td>2 (3)</td>
</tr>
</tbody>
</table>

It seems that beginning to eat in April, the maximal feeding period is June, and ceasing to eat in September.

b) Analysis of stomach contents

<table>
<thead>
<tr>
<th>Food content in stomach</th>
<th>Frequency of appearance (%)</th>
<th>Number</th>
<th>Maximal quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rana limnocharis</td>
<td>13 (26.16)</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Microlyta pachira</td>
<td>2 (4.08)</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Species uncertain</td>
<td>10 (20.41)</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Tadpole</td>
<td>16 (32.64)</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Small fish</td>
<td>4 (8.16)</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Insect</td>
<td>1 (2.04)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Leaf of rice</td>
<td>2 (4.08)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Unidentifiable matter</td>
<td>4 (8.16)</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

It seems that the main food was small frogs and tadpoles, occasionally small fishes.

7. Reproduction

a) Secondary sexual characters

i. Ratio of total length/tail length

Males: 7.2 (20 males of Nanxi, Mt. Diaoluo, Hainan)

Females: 8.6 (20 females, the same population as above)

ii. Number of subcaudals (20 individuals of each sex from Nanxi, Mt. Diaoluo, Hainan)

Males: 36 - 41 (mean 39.7)

Females: 31 - 35 (mean 33.5)

b) Sex ratio

i. Secondary sex ratio

92.9 ♀ : 100 ♂ based on 27 newly hatchlings of three females (CIB nos. 6416478, 641115333, and 641116387).

ii. Tertiary sex ratio

49 ♀ : 100 ♂ in population (n = 76) of Nanxi, Mt. Diaoluo, Hainan.

94.7 ♀ : 100 ♂ in population (n = 146) of Dali, Mt. Diaoluo, Hainan.

c) Sex maturation

Based on measuring all the produced specimens, female Enhydris plumbea reached sex maturation over 350 mm in total length.

d) Number of eggs in oviducts

Based on dissection of 28 gravid females showing that:

Left oviduct: 3 - 7 eggs (mean 2.3)

Right oviduct: 0 - 7 eggs (mean 4.1)

Both two oviducts: 3 - 12 eggs (mean 6.3)

e) Development of eggs or embryos during different months

<table>
<thead>
<tr>
<th>Month</th>
<th>Locality</th>
<th>Number of dissection</th>
<th>Eggs</th>
<th>Developmental Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>Qiantang</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>May</td>
<td>Lingshu Co.</td>
<td>8</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>June</td>
<td>Lingshu Co.</td>
<td>30</td>
<td>-</td>
<td>19</td>
</tr>
<tr>
<td>July</td>
<td>Lingshu Co.</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(下转第 329 页，To page 329)
Subfamily Elapinae

3.66 Bungarus multicinctus: 2 females, Nanxi, Wuzishan, 82–500 m, Apr. 20–Jun. 22.
3.67 Naja atra: 1 male and 6 females, Dali, Diaoloushan, Haikou, Nanxi, Wuzishan, Yinggeling, 220–500 m, May 7–September.
   Female T/t (W): 912/128 (165).
3.68 Ophiophagus hannah: 1 male, Dali, 220 m, Jun. 16.
3.69 Sinomicrurus kelloggi: 1 sex uncertain (broken), Wuzishan, 500 m, May 10.
3.70 Sinomicrurus macellandi: 1 male, Nanxi, Jun. 9.

Subfamily Hydrophiinae

3.71 Hydrophis cyanocinctus: 1 female and 17 subadults, Yinggehai, Sept. 11–15; 3 females bought from Haikou, Sept. 27.
3.72 Hydrophis fasciatus atriceps: 1 male, 11 females, and 49 subadults, Yinggehai, Sept. 11–15.
3.73 Hydrophis gracilis: 3 males and 2 females, bought from Haikou.
   Male T/t (W): 1008/110 (110), 952/85 (1), 943/89 (1).
   Female T/t (W): 963/107 (1).

4 ARTICLES ALREADY PUBLISHED OF THIS SURVEY.


Ex. Mother snake (CIB 64115333)
   Weight before producing: 75 g.
   Weight after producing: 52.5 g.
   Weight of 9 newly hatchlings: 2.4–2.5 g, total 22.2 g, mean 2.47 g.

8 References


329
ZHAO Er-mi: Preliminary Studies on Biology of *Enhydris plumbea* (Boie, 1827) [赵尔宓：铅色水蛇 *Enhydris plumbea* (Boie, 1827) 的生物学初探]

1. 海南产铅色水蛇  2. 铅色水蛇头背鳞片  3. 从蛙后部开始吞吃的铅色水蛇  （赵 薰摄）