Contribution to the individual marking techniques for small lizards: heat branding on Ablepharus kitaibelii (Bibron & Bory de Saint-Vincent, 1833)

When studying the population characteristics of diminutive lizards with secretive lifestyle, researchers will inevitably be faced with the problem of individual recognition. The Snake-eyed skink Ablepharus kitaibelii, distributed from Southern Slovakia to Anatolia (see Vergilov et al. 2016), is one of the few scincid species in Europe, being the smallest lizard on the continent, and is the best example for this issue. Its ecology and biology have received little attention and remain poorly studied (Pasuljević 1965, 1966, 1975, 1976, Herczeg et al. 2007). Heat/freeze branding has been used for marking different reptiles (e.g. snakes Clark 1971, Lewke & Stroud 1974, Winne et al. 2006 or turtles Woodbury & Hardy 1948, Clark 1971). Stumpel (1985) implemented branding with a cordless soldering iron with a micro tip when studying an Anguis fragilis population. He placed tiny point-shaped marks on the ventral scales and mentioned that even though their conspicuity decreased strongly over time they remained observable throughout the six-month study period. Similar approach was performed by Ferreiro & Galán (2004) for the same species, using an ophthalmic cautery but point burns were made on the dorsal scales and in addition to adults the neonates were also marked. Marking ventral
scales with medical cautery unit was also performed in a study of *Podarcis siculus* population done by Vervust & Van Damme (2009). They also marked both adults and juveniles and the markings remained visible for at least 16 months. Ehmann (2000) developed a soldering iron on batteries which had an electric jug element wire wound on three loops for a tip. He applied this tool for a gecko species of the Carphodactylidae family (*Nephrurus deleani*), without mentioning the size of the specimens.

In the present study, heat branding was successfully applied in a four-year population study of *A. kitaibelii* in Passtrina hill, Northwestern Bulgaria. The studied area of the hill covers ca. 0.6 ha of the ecotone zone between an oak forest and a meadow, with altitude of 280 m. The marking technique was performed not only on adults (SVL > 40 mm), but also on small specimens – juveniles (with SVL around 20–25 mm) and subadults with very small scales.

For the heat branding we used a portable soldering iron on batteries (Weller B7645) (Fig. 1). It is small and lightweight, with a thin metal tip (Fig. 1B) and requires only three AA type batteries. For even smaller specimens (if needed) the tip can be filed down. Some soldering iron models have different variability of tips. That kind of tools can be bought for the price of 10 to 30 € and can be used with only 2 or 3 batteries for many hours. The device can also reach a high temperature (420-510°C). Similar portable soldering iron was used also by Telenchev et al. (2017) for branding individuals of the much larger species *Pseudopus apodus* (Pallas, 1775). The portable soldering iron can be found in many ironware stores even in underdeveloped countries like Bulgaria.

Skinks were captured by hand and geographic coordinates for each individual were recorded using a GPS device. Every specimen was also photo-documented and recaptured specimens were recognized later by their individual markings. For a four-year period 415 specimens were individually marked of which 249 were recaptures, being successfully recognized by their markings (Fig. 2; Tab. 1).

For the branding we chose a new coding system that was applicable for the studied species – burning ventral scales on the two central rows and dorsal scales around the neck and the mid body (Fig. 3A,B).

This coding technique was developed because of the small size of the species and the visibility of the scales. The most visible and countable scales are the ventral ones and they seemed most suitable for our purposes. For that reason, we chose to start the marking on the two central rows of the ventral scales above the cloacal ones. For bigger numbers additional markings were used on the neck. Other marking (on the sides of the mid body, on the dorsal side near the hind limbs or on the limbs) can also be performed due to the well-developed osteoderms all over the body of the animal (Fig. 3C). The left central row of ventral scales of the specimen shows the numbers from 1 to 9, while the right central row shows the numbers from 10 to 90.
Figure 3. Marking code system used on Ablepharus kitaibelii. A – coding on the ventral scales (left central row showing numbers from 1 to 9 and right central row showing the numbers from 10 to 90); B – marking on the left side of the neck of a specimen; C – marking on the right side of the mid body of a specimen.

Table 1. Length of the periods between seasons, number of all recaptures by period and marked individuals with recaptures (without repeats) by season.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Interval length</td>
<td>62</td>
<td>63</td>
<td>242</td>
<td>88</td>
<td>57</td>
<td>212</td>
<td>94</td>
<td>85</td>
<td>204</td>
<td>76</td>
<td>61</td>
<td>-</td>
</tr>
<tr>
<td>Recaptures by period</td>
<td>2</td>
<td>3</td>
<td>9</td>
<td>14</td>
<td>8</td>
<td>30</td>
<td>37</td>
<td>23</td>
<td>43</td>
<td>28</td>
<td>22</td>
<td>30</td>
</tr>
<tr>
<td>n (adults)</td>
<td>33</td>
<td>25</td>
<td>23</td>
<td>32</td>
<td>21</td>
<td>50</td>
<td>43</td>
<td>40</td>
<td>40</td>
<td>38</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>n (juveniles)</td>
<td>11</td>
<td>0</td>
<td>20</td>
<td>13</td>
<td>2</td>
<td>14</td>
<td>15</td>
<td>7</td>
<td>19</td>
<td>12</td>
<td>5</td>
<td>36</td>
</tr>
<tr>
<td>n (total)</td>
<td>44</td>
<td>25</td>
<td>43</td>
<td>45</td>
<td>23</td>
<td>64</td>
<td>58</td>
<td>47</td>
<td>59</td>
<td>50</td>
<td>42</td>
<td>72</td>
</tr>
</tbody>
</table>

Acknowledgments. We would like to thank A. Antonov, O. Sivilov and B. Zlatkov for the technical support and also all of the friends and colleagues who helped us in the field research. The field study was partly supported by project N166/2015 of the Scientific Research Fund at Sofia University St. Kliment Ohridski. The Bulgarian Ministry of Environment and Water kindly provided permits No. 411/14.07.2011 and No. 520/23.04.2013, for which we are grateful.

References
Breeding territories of the Southern Grey Shrike (Lanius meridionalis meridionalis) was characterized by storing food on the imminent winter for inclement weather or periods of stress in the breeding areas. Such caching is performed by shrikes to demarcate territories, which is a unique behavior. The structure and growth of the Southern Grey Shrike have been extensively studied in Europe, especially in Spain from the sub-species (Hernández et al. 2005) in the northwest Iberian Peninsula. Animal Biology 54: 353-371.


**Key words:** heat branding, portable soldering iron, skink, coding system, ventral scales.

Article No.: e187504

Received: 21. April 2017 / Accepted: 02. March 2018

Available online: 05. March 2018 / Printed: December 2018

Vladislav VERGILOV* and Nikolay TZANKOV

Department of Vertebrates, National Museum of Natural History, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd., 1000 Sofia, Bulgaria.

*Corresponding author, V. Vergilov, E-mail: vladislav8807@gmail.com