

Hemipenal Transillumination as a Sexing Technique in Varanids

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Abstract - A technique for assisting in the determination of gender in varanids of various ages is described. The technique, termed hemipenal transillumination technique or HTI technique, is based around the candling of the tail base using a bright light. The basic technique, technique variations and expected results are described.

Introduction

In 2007, Davis and Leavitt adapted a means of checking for gravidity in the very small xantusiid species *Xantusia vigilis* as a means of sexing these very small skinks. I have adopted this technique (which I have called the hemipenal transillumination technique or HTI technique) and have subsequently utilised it for sexing over 60 species of Australian lizards including agamids, gekkonids, varanids and scincids of various ages. The technique can be used on both juveniles and adults and does not require that the individuals are sexually mature before the characteristics are visible. Like any technique, practice makes perfect and regular examination of individuals of known gender can allow you to develop a “feel” for what to expect.

Technique

The animal is positioned on its back so that the tail is directed towards the handler. A small, focused, very bright (but non-heat producing) light source is positioned behind the dorsal side of the tail to direct a beam of light through the tail base. I have found that visualization is improved if the light beam is directed only behind the tail, where stray light around the edges of the tail is limited. This light allows the internal anatomy of the tail base to be visualized. In male lizards, the hemipenes are visualized both by their increased blood supply compared to adjacent tissue and the increased density of tissue in this area. They will be seen as either red dots, red ovals or as a “dull redness” (Figs. 1 and 2). The latter refers to an overall red glow in the tail base. This is caused by a combination of an increase in blood supply and tissue density in the tail base (dorso-

ventral thickening to accommodate the hemipenes) and degrees of “shadowing” (limiting light penetration) and “luminance” (as the light penetrates the hemipene and shines through what essentially becomes a red light filter) that creates an appearance of an overall red glow. In a female, an absence of red structures and a general yellowish glow is observed (as the light is only penetrating pure tail tissue) (Figs. 3. and 4). In some adults, the appearance will vary with mood, body temperature and breeding season depending on factors such as seasonal hemipenal size, voluntary extrusion of hemipenes, tail position and hemipenal blood supply changes (often one will appear more “engorged” than the other).

The primary limitations of this technique are light intensity and tissue penetration of light. These two go hand in hand to some degree in that specimens with a dorso-ventral tail diameter of 8-10 mm or smaller are the most ideal candidates for this technique. Specific features such as heavy dorsal pigmentation, heavy dorsal scalation, tail thickness > 8-10 mm and handling difficulties may also limit this technique although technique modifications such as side-on viewing, can be used to work around this. The “side-on” technique involves placing the light source against the side of the tail. In those species where this technique is warranted due to dorsal visualization issues, males exhibit the “dull redness” as described above whilst females exhibit a clean yellow glow. In species with laterally compressed tails and tail bases, such as *V. mitchelli*, side-on viewing through this narrower area of tissue may allow hemipenes to be observed in the same detail as if the light was dorsally directed, as in other species.

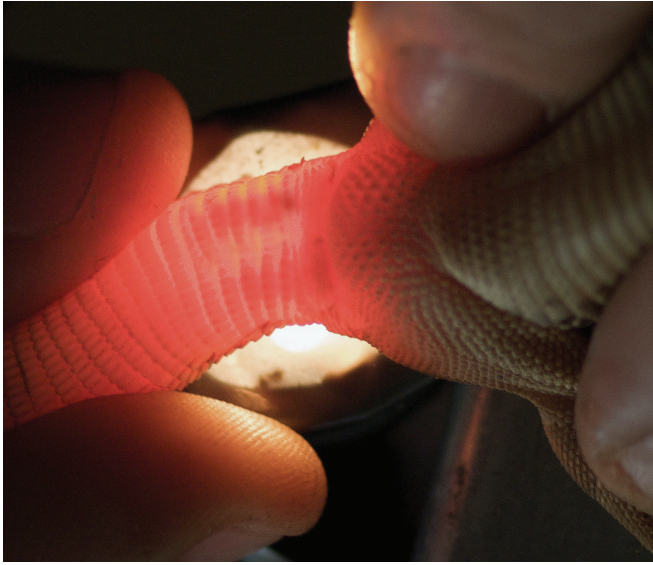


Fig. 1. HTI technique in an adult male *V. storri ocreatus* showing two hemipenes

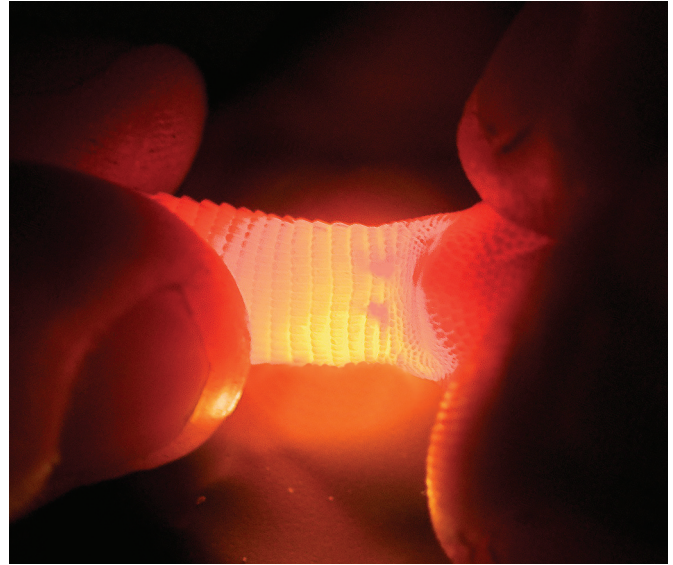


Fig. 2. HTI technique in a juvenile male *V. storri ocreatus* showing hemipenes visible as red "dots"

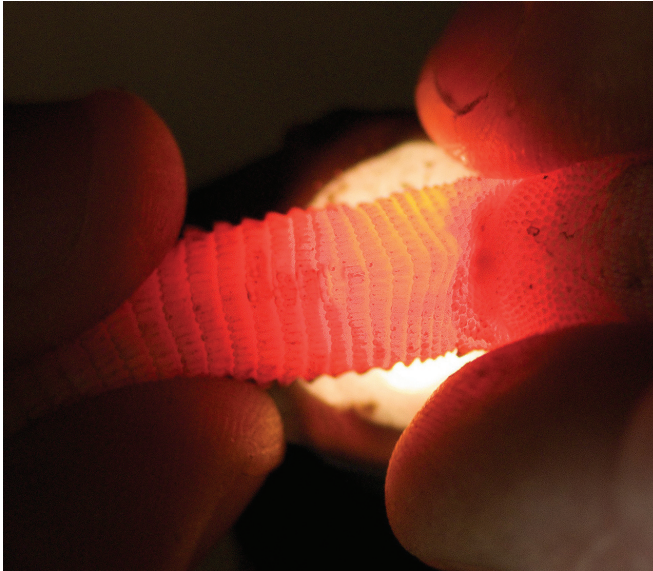


Fig. 3. HTI techniques in an adult female *V. storri ocreatus* showing clear yellow glow and absence of additional structures

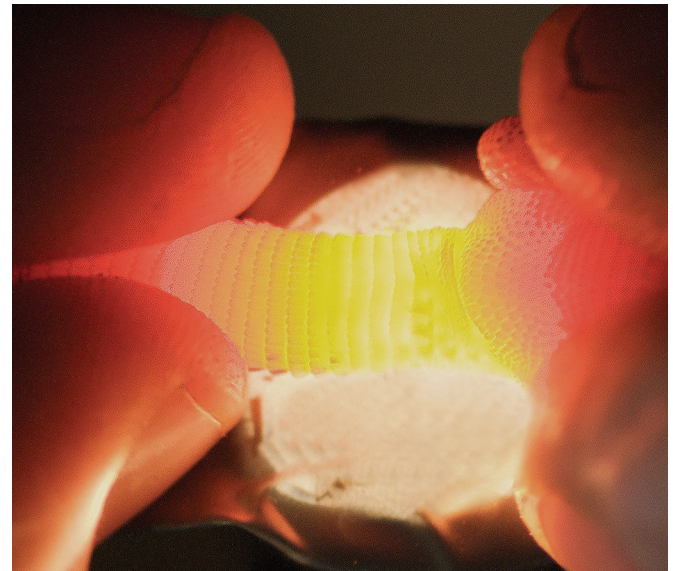


Fig. 4. HTI technique in a juvenile female *V. storri ocreatus* showing no visible hemipenes

I maintain two light types, an incandescent or halogen bulb producing a yellowish light and an LED torch producing bright white light. In some species, tail density is too thin for the use of an LED light as the light "blasts straight through" whereas an incandescent bulb produces a less harsh light that enhances the hemipenes more appropriately. In larger or spiny species, an incandescent bulb may be too subtle and a LED light is required to "blast past" the impediments to visualization. The reduction of light scatter around the edges of the tail can also improve visualization. This may be easily

overcome using thick tape over the lens with a viewing hole cut centrally, or by placing a cap over the end (plastic chair leg rubbers are ideal) with a viewing hole cut centrally. Oval-shaped viewing holes are preferred over round ones. Technically, a purpose-built sexing table or box can also be built and may allow a much larger light to be used (or alternatively a dimmable electric globe). It is important to be very careful with excessively intense light sources as these may also produce significant heat and may cause heat damage or thermal burns to the tail if the animal is left in position for an excessive period. The

Table 1. Checklist of species trialed whose gender was confirmed using the HTI technique as well as secondary techniques.

Species	HTI Technique		Gender Confirmed With Other Techniques			
	Adult	Juvenile	X-ray	Popping/Eversion	Secondary Characteristics	Breeding
<i>Varanus acanthurus</i>	✓	✓	✓	✓	✓	✓
<i>V. breviceauda</i>	✓	✓	✓			✓
<i>V. bushi</i>	✓	✓	✓		✓	
<i>V. caudolineatus</i>	✓	n/a	✓	✓		
<i>V. eremius</i>	✓	n/a			✓	
<i>V. gilleni</i>	✓	✓	✓		✓	✓
<i>V. glauerti</i>	✓	✓		✓	✓	
<i>V. mitchelli</i>	✓	n/a	✓		✓	✓
<i>V. primordius</i>	✓	✓		✓	✓	
<i>V. scalaris</i>	✓	n/a	✓	✓	✓	✓
<i>V. spenceri</i>	n/a	✓		✓		
<i>V. storri storri</i>	✓	n/a	✓	✓	✓	✓
<i>V. storri ocreatus</i>	✓	✓	✓	✓	✓	
<i>V. tristis tristis</i>	✓	n/a	✓	✓	✓	✓
<i>V. tristis orientalis</i>	✓	✓			✓	

darker the room that the technique is used in, the better the visualization. In the field, I have used this technique inside a dark backpack with good results.

Discussion

In summary, using this technique in monitors has produced the following results (see also Table 1):

- Small arboreal species (e.g., *V. bushi*, *V. gilleni*, *V. caudolineatus*) are very easy to sex.
- Small terrestrial species (e.g. *V. storri*, *V. breviceauda*, *V. primordius*) are quite easy up to 10 mm in tail thickness.
- Juveniles of many smaller species are sexable from 5 cm SVL.
- Juveniles of larger species such as *V. varius*, *V. gouldii*, *V. giganteus* and *V. panoptes* may be sexed as long as tail thickness is < 10 mm, however only a single larger species, a 3 month old *V. spenceri* was tested. In this specimen, hemipenes were clearly visible.
- Some species may partly evert hemipenes when handled (e.g., *V. primordius* and *V. breviceauda*), making them difficult to visualize in this state. The hemipenes are essentially tucked up under the cloacal rim but not visible externally. This can be overcome by sexing whilst cooled at room temperature or by placing light pressure at the hemipenal base with a finger to stop the hemipenes from being extruded.
- Hemipenes will appear as long red ovals except if partly extruded, where they will then be seen as red dots very close to the cloacal edge.
- Larger species with a tail thickness of > 10 cm can be sexed “side-on”, with males appearing as a “dull redness” rather than a clear yellow glow.

I would welcome feedback from anybody with regards to the use of this technique in species that I did not have access to for trials, particularly *V. prasinus*, *V. glauerti*, *V. kingorum* and *V. pilbarensis*, as well as larger species such as *V. varius*, *V. gouldii* and *V. giganteus* as well as non-Australian species.

References

Davis, A.R. and Leavitt, D. H., 2007. Candlelight *vigilis*: A noninvasive method for sexing small, sexually monomorphic lizards. Herpetological Review 38(4): 402-404.

Received 30 January 2009; Accepted 15 February 2009