

The Validity of *Sacalia quadriocellata*

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Introduction

Sacalia quadriocellata was first described by Siebenzock in 1903 as *Clemmys bealei quadriocellata*. Pope (1935) described *Clemmys quadriocellata* from Hainan, and compared it with *Clemmys bealei*. But most people except Pope thought that *S. quadriocellata* was a synonym of *S. bealei*. Sachsse (1984a) held that it was the female of *S. bealei*.

Methods

Specimens of *Sacalia quadriocellata* from Hainan and Guangxi provinces, along with specimens of *S. bealei* from Hainan, Fujian and Anhui provinces were examined. Data were taken on external, skull, and shell suture characters. Sexual differences were also examined.

Results

External differences

1) The dorsal surface of the head is uniform olive or chocolate brown in *Sacalia quadriocellata*, but it is vermiculated with black in *S. bealei*.

2) *Sacalia quadriocellata* have two ocelli on each side of the dorsal surface of the head. The ocelli always have distinct boundaries and there is one black spot within each ocellus (Fig. 1). In contrast, *S. bealei* have one or two ocelli on each side of the dorsal surface of the head (Fig. 1). If two ocelli are present, they may not have clear boundaries, but tend to run together. There are from one to three black spots within each ocellus.

3) The anterior margin of the carapace has many little black or chocolate brown speckles in *Sacalia bealei*. There are few or none in *S. quadriocellata*.

Differences in skull characters

1) The length from anterior of prefrontal to posterior of basi occipital to supra occipital is 2.59-2.62 (N = 3) in *S. bealei*; but 2.92-3.39 (N = 3) in *S. quadriocellata*.

2) The quadrate is not in contact with the opisthotic in *Sacalia bealei*, but in *S. quadriocellata* the posterior part of the quadrate tends to contact the opisthotic.

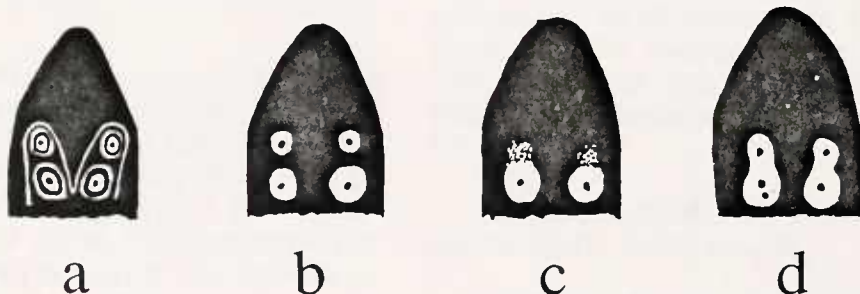


FIG. 1. Ocelli of *Sacalia quadriocellata* and *S. bealei*. A: Male *S. quadriocellata*. B: Female *S. quadriocellata*. C: *S. bealei* with a pair of ocelli. D: *S. bealei* with two pairs of ocelli.

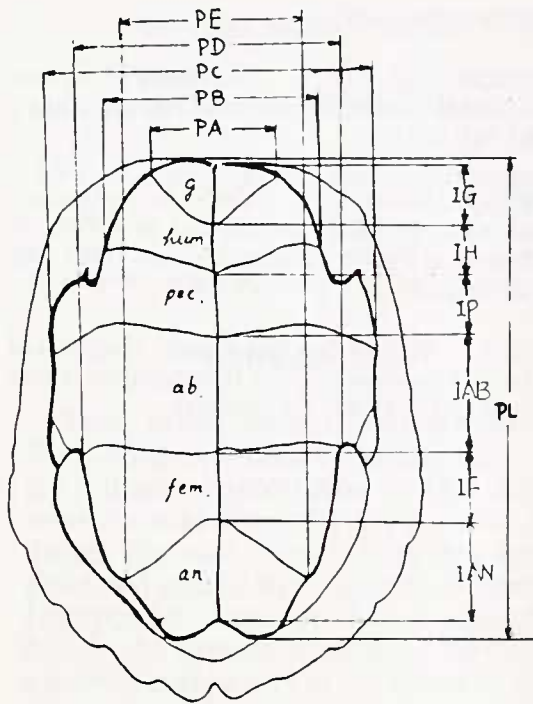


FIG. 2. Means of measurement of shell sutures.

3) The posterior process of the jugal turns up in *S. bealei*, but turns down in *S. quadriocellata*.

4) The shortest distance between the orbital is located at the anterior prefrontal in *Sacalia bealei*. It is located at the joint of the frontal and prefrontal in *S. quadriocellata*.

Shell suture differences

Thirteen shell suture characters in *S. bealei* (N = 27) and *S. quadriocellata* (N = 26) were analyzed (Fig. 2). Seven characters (PA/PL, PB/PL, PE/PL, IH/PL, IAB/PL, IAN/PL, BL/PL) are different from each other (t, $p < 0.05$), [Table 1].

Sexual dimorphism

Sexual dimorphism was evident in *Sacalia quadriocellata*. In life, males have very distinct orange-red speckles near the neck and limbs, whereas females have not.

The carapace is narrower at the anterior end than the posterior end in females, but both

TABLE 1. Analysis of shell suture data. See Fig. 2 for details of measurement.

Measure	<i>Sacalia bealei</i> (N=27)	<i>Sacalia quadriocellata</i> (N=26)
	mean \pm SE	mean \pm SE
PA/PL	0.259 \pm 0.0180	0.249 \pm 0.0137
PB/PL	0.424 \pm 0.0240	0.417 \pm 0.0207
PC/PL	0.620 \pm 0.0280	0.616 \pm 0.0337
PD/PL	0.501 \pm 0.0198	0.520 \pm 0.0226
PE/PL	0.377 \pm 0.0140	0.367 \pm 0.0140
IG/PL	0.114 \pm 0.0140	0.109 \pm 0.0117
IH/PL	0.105 \pm 0.0160	0.096 \pm 0.0150
IP/PL	0.171 \pm 0.0240	0.169 \pm 0.0172
IAB/PL	0.230 \pm 0.0177	0.248 \pm 0.0218
IF/PL	0.164 \pm 0.0140	0.157 \pm 0.0154
IAN/PL	0.194 \pm 0.0163	0.180 \pm 0.0168
BL/PL	0.359 \pm 0.0200	0.370 \pm 0.0163
FL/PL	0.387 \pm 0.050	0.383 \pm 0.0150

ends are nearly equal in males. The most interesting character is ocelli coloration. They tend to be greyish with a white ring surrounding the two ocelli on each side in males (Fig. 1), but tend to be yellow without a white ring in females. The skulls of the males were somewhat flat, narrow and long. The skulls of the females were somewhat convex, wide and short.

Discussion

Since *Sacalia bealei* and *S. quadriocellata* have distinguishable characters, we consider *S. quadriocellata* to be a valid name. *Sacalia quadriocellata* occurs in China on Hainan Island and Guangxi Province. It is also found in central Annam. The specimens reported on by Zheng and Ding (1965) from Fujian Province and by Zhong (1981) from Jiangxi Province are misidentified *S. bealei*. The later species ranges over most of southern China, including Guizhou, Anhui, Jiangxi, Fujian, Guangdong provinces, Hainan Island, and Hong Kong.

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