

OBSERVATIONS ON *HYLA VESICOLOR* IN OKLAHOMA

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The tree toad, *Hyla vesicolor*, is abundant over a wide range in forested areas of eastern North America (Wright and Wright 1924, Stejneger and Barbour 1943) including approximately the eastern half of Oklahoma (Bragg 1943) as well as adjacent regions of Texas (Wright and Wright 1938) and Kansas (Smith 1934). As is commonly found in wide-ranging forms, reproductively isolated populations of this species have tended gradually to become separated from the main group, probably in response to minute but rather constant differences in the several ecological communities of which the respective isolated populations have become parts. At least two subspecies are commonly recognized, *H. v. vesicolor* Le Conte and *H. v. chrysoceles* (Cope). In addition, *Hyla phaeocrypta* (Cope) is mentioned with considerable question as to its validity by Wright and Wright (1942) but is omitted from the last edition of the check list (Stejneger and Barbour in 1943). Smith (1934) is among those who think that *H. phaeocrypta* is most likely identical with *H. v. vesicolor*.

Hyla v. vesicolor Le Conte is separated from *H. v. chrysoceles* (Cope) on no very clear-cut morphological characters. This is seen best, perhaps, in a contrasting list such as follows:

*H. v. vesicolor**H. v. chrysoceles*

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| 1. Larger average size (size ranges overlap). | 1. Smaller average size (size ranges overlap). |
| 2. Considerable rugosity on the dorsum, but varying through a wide range; essentially rough-skinned. | 2. Slight rugosity or none on the dorsum; essentially smooth-skinned. |
| 3. Black (or dark) reticulations on yellow or orange on the concealed surfaces of the thighs, rarely with a few yellow or orange rounded spots admixed. | 3. Fewer dark reticulations on thighs with correspondingly more yellow or orange spotting there. |
| 4. Habitat, general wooded areas (including valleys when <i>H. v. chrysoceles</i> does not occur). | 4. Habitat, restricted to wooded and fairly deep valleys (at least in Arkansas and probably Texas). |
| 5. Geographic range extensive, from southern Canada, south to Florida, west to Minnesota and Texas. | 5. Geographic range more limited—in the South and Southeast only—principally in Arkansas and Texas. |
| 6. Call a short medium-pitched loud trill, very distinctive to those who know it. | 6. Call also a short loud trill but, as emphasized later herein, probably much coarser and deeper in tone. |

If the validity of these two subspecies be assumed, it is evident from the geographic ranges given that either or both might occur in Oklahoma and that, if both were present, then *H. v. chrysoceles* would be more likely to be present in the southeastern section of the State particularly south of the Arkansas River, whereas *H. v. vesicolor* could be expected in the northeastern and central parts. The habitat restriction of *H. v. chrysoceles*, however, if strictly valid, might allow *H. v. vesicolor* to occur on the uplands of the southeast also, and possibly allow the extension (in valleys only) of *H. v. chrysoceles* into the southern portion of the Ozarks to the north of the Arkansas River. On the other hand, if the habitat restriction of *H. v. chrysoceles* be more apparent than real (as may be true due to inadequate opportunity for observation), then most tree toads of this group in Oklahoma could be *H. v. chrysoceles* with *H. v. vesicolor* not present at all or restricted to the northeast as

a southward extension of the population of southeastern Kansas (Smith 1934).

Years ago I was very familiar with the common tree toad in New England (principally in Maine and New Hampshire). I have also seen it many times in its native habitat in various other places (principally in New York, upper Michigan, and Wisconsin) and I have been familiar with its reproductive call and have always recognized it as such for more than thirty-five years. When, therefore, I first heard this call in central Oklahoma in 1935 and caught calling specimens, I was puzzled that the animals were only very slightly rugose and that some had yellow spotting on the thighs. At first I was tempted to refer these specimens to *H. v. chrysoceles*; but on examining the tadpoles, which I have now seen by the thousands, they were found to be in all respects like the larvae of the northern form, even including the very distinctive bright red developed in the tail fin just prior to metamorphosis (Wright 1929, Bragg 1943). Subsequent experience has shown abundantly that such specimens in Oklahoma are not confined to valleys (they even do not follow the flood plain forests up the prairie rivers in Oklahoma to any extent from the Canadian River northward). Consequently, till quite recently I referred all specimens in Oklahoma to *H. v. versicolor* but recognized a tendency toward *H. v. chrysoceles*. This tendency, however, is not increased, so far as I can see, to the south and east as one might perhaps expect. So far as I can tell specimens which I have called *H. v. versicolor* from McCurtain County in the southeast, Delaware County in the northeast, Love County in the south, and Cleveland County in the central portions of Oklahoma have been identical and I have detected no differences in their breeding calls nor in their tadpoles. Nor have I found any differences, till recently, on higher and lower ground, whether with reference to local topography or to sea level within the limits of Oklahoma.

In a forthcoming paper (Bragg 1948), however, I report *H. v. chrysoceles* from two counties in southeastern Oklahoma, both from limited deep-valley populations which were bordered by larger populations of *H. v. versicolor* on higher ground above the valleys. In McCurtain County an intermediate population (as shown by difference in calls) was recognized between the uplands and the river bottoms, but in Le Flore County the two kinds of tree toads were found migrating together to a common breeding site at the head of a valley, above which only *H. v. versicolor* occurred and below which for several miles down the valley only *H. v. chrysoceles* was heard.

The distinctions in the field were based mostly on differences in calls. In Le Flore County, I stalked and collected individuals giving the two types of calls, keeping them separate in order later to compare them with each other and with others taken elsewhere while they were giving the call typical of *H. v. versicolor* (Tables I, II, and III). Most differences are very slight, the hoarse-

TABLE I

H. v. chrysoceles males from breeding congress at head of Black Fork Valley, Le Flore Co., Oklahoma*

CUMZ	SV	HW	Th	FE	L	Dorsal rugosity
23622	42	14.5	12.0	23.0	53.0	medium
23623	39	15.0	11.0	24.0	53.0	slight-medium
23624	39	15.0	11.0	24.0	25.5	medium
23625	35	14.0	11.0	19.0	47.0	slight
23626	39	15.0	15.0	25.0	57.0	slight
23627	38	13.0	12.0	18.5	52.0	slight
Means	38.67	14.46	11.83	22.17	52.3	

*Measurements in mm. Legend: CUMZ, catalog number in University of Oklahoma Museum of Zoology; SV, snout-vent length; HW, greatest width of head; Th, length of inner surface of thigh; FE, extent of longest toe beyond head when leg is laid along lateral surface of body; L, length of leg from mid-line to end of longest toe.

TABLE II

H. v. versicolor males from same place and time as specimens of Table I*

OUMZ	SV	HW	Th	FH	L	Dorsal rugosity
23631	45	17	20	26	62	none
23632	42	17	15	23	65	very slight
23633	45	16	14	20	62	slight-medium
23634	41	14	17	21	55	slight
23635	44	16	16	26	65	medium
Means	43.33	16.0	14.5	23.0	61.8	

*See footnote to Table I.

TABLE III

Comparisons of measurements of populations of *H. versicolor* with voice typical of the species and all available supposed *H. v. chrysocelis* specimens with hoarse voice in Oklahoma*

County	N	SV	HW	Th	FH	L	
Delaware	3	43.31-	11.17-	14.5	23.00	59.67	
Le Flore	5	43.40	16.00	16.4	25.20	59.60	<i>H. v. versicolor</i>
Totals	8	43	14	16	23	60	
Le Flore	6	38.67	14.46	11.83	22.17	52.33	
McCurtain	5	40.20	15.00	14.20	21.20	53.20	<i>H. v. chrysocelis</i>
Totals	11	39	14	13	22	53	
Differences	4	0	3	1	7		

*N, number of specimens. Other symbols used as in Table I. Totals and differences expressed to nearest mm.

calling form being, as expected, slightly smaller and with slightly shorter hind legs. Only two slight differences in behavior were noted in the field: (1) The smaller, hoarse-calling individuals were more difficult to secure because of a marked tendency to utilize vine-covered trees or other tangled vegetation in their migrations toward the pool; and (2) a mated pair, thought to be *H. v. chrysocelis*, was taken from an oak branch some six feet above the ground. Never have I in my experiences with breeding congresses of this form seen *H. v. versicolor* mating in trees.

Sometimes a comparison of tadpoles of closely related salientians will throw light on taxonomic relationships not revealed clearly by the adults. Since the tadpoles of *H. v. chrysocelis* had not been described, I sought tadpoles in the valleys thought to be inhabited by *H. v. chrysocelis* but not by *H. v. versicolor*. I was not successful in McCurtain County. I found them, however, in one place in Le Flore County. I have visited this place on three occasions, each in different years—in July 1939 before I knew of the difference in the population of the valley, in May 1946, when I first noticed it, and in July 1947, twice under the auspices of the University of Oklahoma Biological Survey.

On the first visit, hundreds of hylid tadpoles were present, in all stages from half-developed individuals to a few just metamorphosed. A few were collected but were too-poorly preserved to give reliable data. Their behavior was typical of *H. v. versicolor* and I took them to be of this form as seen alive. However, I was puzzled somewhat by the fact that none had red tails. On the second visit hatching tadpoles only were present. These were emerging from a jelly mass attached lightly to a twig and were floating out from it on

the water surface exactly as typical of *H. v. versicolor* and this is what I labeled the collection on the spot. On the third visit, conditions of the first were practically duplicated and I secured a large well-fixed collection for comparison with *H. v. versicolor* freshly collected elsewhere and fixed and preserved in exactly the same manner. Again none of the tadpoles found here had any red whatever in the tail fin.

Two fixing agents were used: Bouin's picroformal solution at full strength and 3-percent formalin. After fixation for several hours, preservation was in 65-percent ethyl alcohol in both cases. Coloration was not preserved but structural details were clear and sharply defined after either fixation and distortion seemed to be at a minimum. Bouin's fluid, however, made the skin very tender and easily torn. Hence, for permanent specimens, the formalin method is better so far as *Hyla versicolor* is concerned. (I have not noted this skin tenderness on specimens of some other species fixed in Bouin's fluid.)

A comparison of these tadpoles with those of *H. v. versicolor* from Adair, Delaware, and Cleveland Counties, Oklahoma, showed practically no differences. The mouth parts were identical and proportions of the body were clearly within the limits both of natural variation and of observational error. Samples of such data are given in Tables IV and V. Thus the only distinctive feature about these tadpoles, supposedly of *H. v. chrysoceles*, was the lack of red coloration in the tail fin.

TABLE IV

Comparisons of measurements from tadpoles of *H. v. versicolor* and *H. v. chrysoceles**

Subsp.	N	TL	HBL	IOD	IND	County
<i>H. v. v.</i>	20	22.40	16.50	6.20	3.05 ^b	Adair
<i>H. v. c.</i>	20	18.20	13.05	5.40	2.00	Le Flore
Difference		4.20	3.45	0.80	1.05	

*Legend: N, number of specimens; TL, tail length; HBL, head-body length; IOD, interorbital distance; IND, internasal distance. Measurements in mm.

^bThis figure is too high for the typical conditions because of two individuals with much-larger measurements here than usual. Since the selection of tadpoles for measurement was at random these two were included.

TABLE V

Mean ratios of head-body length in tail length (TL/HBL) and internasal distance in interorbital distance (IOD/IND)

Subspecies	No. of Specimens	TL/HBL	IOD/IND
<i>H. v. chrysoceles</i>	20	0.721	0.370
<i>H. v. versicolor</i>	20	0.736	0.456
Difference		0.015	0.086

I was quite happy about finding at least one difference which seemed consistent until a visiting herpetologist (who immediately and spontaneously recognized my adults as *H. v. chrysoceles* such as he was familiar with in Texas) told me that he had seen the red in the tails of tadpoles which he regarded as *H. v. chrysoceles* in southeastern Texas.

One other fact needs to be mentioned. In eastern Cleveland County, Oklahoma, I have twice heard a single specimen with the hoarse voice which I believe distinguishes *H. v. chrysoceles* (if anything does). It came from a large chorus of typical *H. v. versicolor* calls. The specimens were stalked and secured. So far as I can see they are not different from others in the same chor-

uses which gave the typical *H. v. versicolor* call and whose tadpoles *did* have red tails. They, along with some others taken at the same time, have the spots on the femora and the very slight rugosity on the back (also like many others collected in this region both at these and other times).

Several possibilities emerge from the reported observations: (1) *Hyla versicolor chrysoceles* Cope should be removed from the list of North American salientians and all records of it be interpreted as *H. versicolor* Le Conte; (2) two subspecies actually exist but the differentiation is extremely slight and difficult to recognize; (3) if two subspecies are valid, then all in Oklahoma may be *H. v. chrysoceles* rather than *H. v. versicolor* as now supposed; or (4) all in Oklahoma may be intergrades between the northern and southern subspecies. While any of these conclusions is possible, I tend to favor the second at least temporarily till further evidence comes to light. This is because there must be some explanation for the consistent difference in tone of call in the valley habitats as reported above. But it must be admitted that this leaves no explanation for the single exception from eastern Cleveland County. Verily, the products of evolution do not easily pigeon-hole into man-made schemes.

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