February 1992 *Asiatic Herpetological Research* Vol. 4, pp. 141-145

Karyotypes of Two *Rana* from Xinjiang, China

GANG WEI[1], NING XU[1], DEJUN LI[1] AND MIN WU[2]

[1]*Zunyi Medical College, Zunyi, Guizhou, China*

[2]*Xinjiang Normal University, Urumqi, Xinjiang, China*

Abstract. -Karyotypes, C-bands, and Ag-NORs of *Rana ridibunda* (Ili River Valley, Xinjiang) and R. *altaica* (Altai Mountains, Xinjiang, China) are reported. The specimens of *R. ridibunda* from central Europe have a karyotype with chromosome nos. 8 and 11 being both metacentric. They have a telomeric C-band on almost every chromosome arm and a few interstitial C-bands on some chromosomes. The specimens from the Ili River Valley have a karyotype with chromosome no. 8 being subtelocentric and no. 11 submetacentric, and no telomeric or interstitial C-bands. Chromosome polymorphism of the different populations of the same species may explain this. We suggest that *R. altaica* and *R. arvalis* are in a middle stage of chromosome evolution from a karyotype with 2n=26 to a karyotype with 2n=24 and chromosome no. 6 being submetacentric.

Key words: Amphibia, Ranidae, *Rana ridibunda, Rana altaica,* China, Xinjiang, karyotype, C-band, Ag-NORs, polymorphism, evolution.

Introduction

The karyotype, C-band and Ag-NORs of *Rana ridibunda* from central Europe were investigated by Schmid (1978) and the karyotype and Ag-NORs of the same species from Korgas, Bole and Urumqi in Xinjiang Autonomous Region, China were investigated by Wu (1990). In the present study, the karyotype, C-bands and Ag NORs of *R. ridibunda* were reexamined and those of *R. altaica* are examined for the first time.

Methods

The frogs used in this study are: *R. ridibunda* Pallas, a male and a female from the Ili River region in Xinjiang, China and *R. altaica* Kastschenko, two males and two females from the Altai Mountains (= Altay Shan) region in Xinjiang. Both ends of the femur, tibio-fibula, and humerus bones were cut off, and the marrow cells were washed out with 0.46 M KCl for chromosome preparation by a centrifugal air-drying method. Testing of C-bands and Ag-NORs were carried out following the methods of Wei et al. (1990) and Xu et al. (1990).

Results

Figure 1 depicts the karyotype, C-bands, and Ag-NORs of *R. ridibunda*. For the measurements of the karyotypes, see table 1.

The diploid number of *R. ridibunda* is 2n=26, which can be divided into two groups. The large chromosome group includes chromosome nos. 1-5, with a relative length (R. L.) larger than 9%. Chromosome nos. 1, 2, 4 and 5 are metacentric and no. 3 is submetacentric. The small chromosome group consists of chromosome nos. 6-13, with R. L. less than 7%. Numbers 6, 7 and 11 are metacentric, nos. 9, 10, 12 and 13 are submetacentric and no. 8 is subtelocentric. The only secondary constrictions can be readily observed on the long arms of no. 10.

With regard to C-bands, there is a centromeric C-band on each chromosome of *R. ridibunda,* but some of them are weakly stained and no interstitial or telomeric C-band can be observed. There are a pair of standard Ag-NORs on the long arms of no. 10, in the same position as the

FIG. 1. The karyotype, C-band and Ag-NORs of *Rana ridibunda*.

secondary constrictions.

Figure 2 depicts the karyotype, C-bands, and Ag-NORs of *R. altaica*. The diploid number of *R. altaica* is 2n=24, which are compose of three groups. The large chromosome group includes chromosome nos. 1-5. All of them are metacentric. The prominent secondary constrictions can be readily observed on the long arms of no. 1, where the standard NORs are located. The middle sized chromosome group only includes chromosome no. 6, with the R. L. between 7-9%. It is also metacentric. The

TABLE. 1. Chromosome measurements of *R. ridibunda* and *R. altaica*.

Chromosome Number	*R. ridibunda*		*R. altaica*	
	Relative Length	Arm Ratio	Relative Length	Arm Ratio
1	15.60±1.07	1.20±0.08M	14.97±1.04	1.27±0.21M
2	12.63±0.68	1.61±0.22M	13.83±1.18	1.27±0.18M
3	11.79±0.66	2.20±0.31SM	12.34±0.84	1.58±0.25M
4	11.32±0.62	1.44±0.17M	11.26±0.60	1.31±0.23M
5	9.75±0.64	1.33±0.10M	9.80±0.64	1.28±0.16M
6	5.99±0.56	1.32±0.16M	8.82±0.71	1.25±0.21M
7	5.60±0.44	1.42±0.31M	6.26±0.52	1.40±0.23M
8	5.19±0.28	3.37±0.41ST	5.37±0.34	2.31±0.32SM
9	4.82±0.39	2.61±0.36SM	4.86±0.42	2.33±0.31SM
10	4.68±0.32	1.74±0.40SM	4.51±0.37	1.29±0.27M
11	4.40±0.38	1.61±0.37M	4.19±0.38	1.97±0.34SM
12	3.95±0.48	2.09±0.39SM	3.59±0.60	1.74±0.31SM
13	3.58±0.26	2.11±0.35SM		

small chromosome group includes chromosome nos. 7-12. Numbers 7 and 10 are metacentric. Numbers 8, 9, 11 and 12 are submetacentric. No heteromorphic chromosome is observed. In connection with C-bands, there is a weakly stained centromeric C-band on chromosome nos. 1, 2, 6, 8 and one homologous of nos. 3, 4. An obvious interstitial C-band can be observed on 1p. Some weakly stained interstitial C-bands could also be seen on 2p, 3p, 4p, 4q, 6p and 7q, and a C block on the long arm of one homologous of no. 9. It is noted that on the basis of C-band and arm ratio pairing, one homologous of chromosome no. 2 of the C-banding plate is much shorter than the other. The R. L. of the longer chromosome no. 2 is larger than that of chromosome no. 1. We suggest that translocation might have taken place between the two homologous of chromosome no.2.

Discussion

Rana ridibunda is distributed in central Europe east of northwestern France, north to the southern shore of the Baltic Sea, south to northern Italy and the Balkans; southwestern Asia, east to ca. 81°E latitude in asiatic Russia and Xinjiang, China, south to Afghanistan and Pakistan (Frost, 1985). The type locality of *R. ridibunda* is the Caspian Sea, Volga and Jaico (USSR). The place where Schmid (1978) collected specimens and the places where we collected are the nearly opposite margins of the distribution of *R. ridibunda*.

Comparing the results, we found that the differences between them are as follows: chromosome nos. 8 and 11 of Schmid's result are both metacentric, but for Wu's and our results, no. 8 is subtelocentric and no. 11 is submetacentric. Schmid's result indicates that a telomeric C-band is located at the end of each arm of every chromosome except the short arms of no. 6 and long arms of no. 12. An interstitial C-band is on lq, 3p, 4p, 5q, 7q, 8p, 8q, and 11 q, but no telomeric or interstitial C-band could be observed in our result. The differences between them might be polymorphism of chromosomes between the different populations of the same species.

Rana altaica is distributed in northern Xinjiang (China) and southern Siberia (Russia). The type locality of it is Altai, USSR. It is a species of woodfrog, belonging to the *R. temporaria* group. In this group, *R. temporaria* is distributed throughout Europe east to the Urals, *R. arvalis* from the northeast of France to the west of Siberia (124° E). *R. chensinensis* is distributed from the Russian Far East to Sakhalin and southern Kurile islands; Hokkaido, Japan; Korea; eastern Mongolia; northeastern and central China, south to

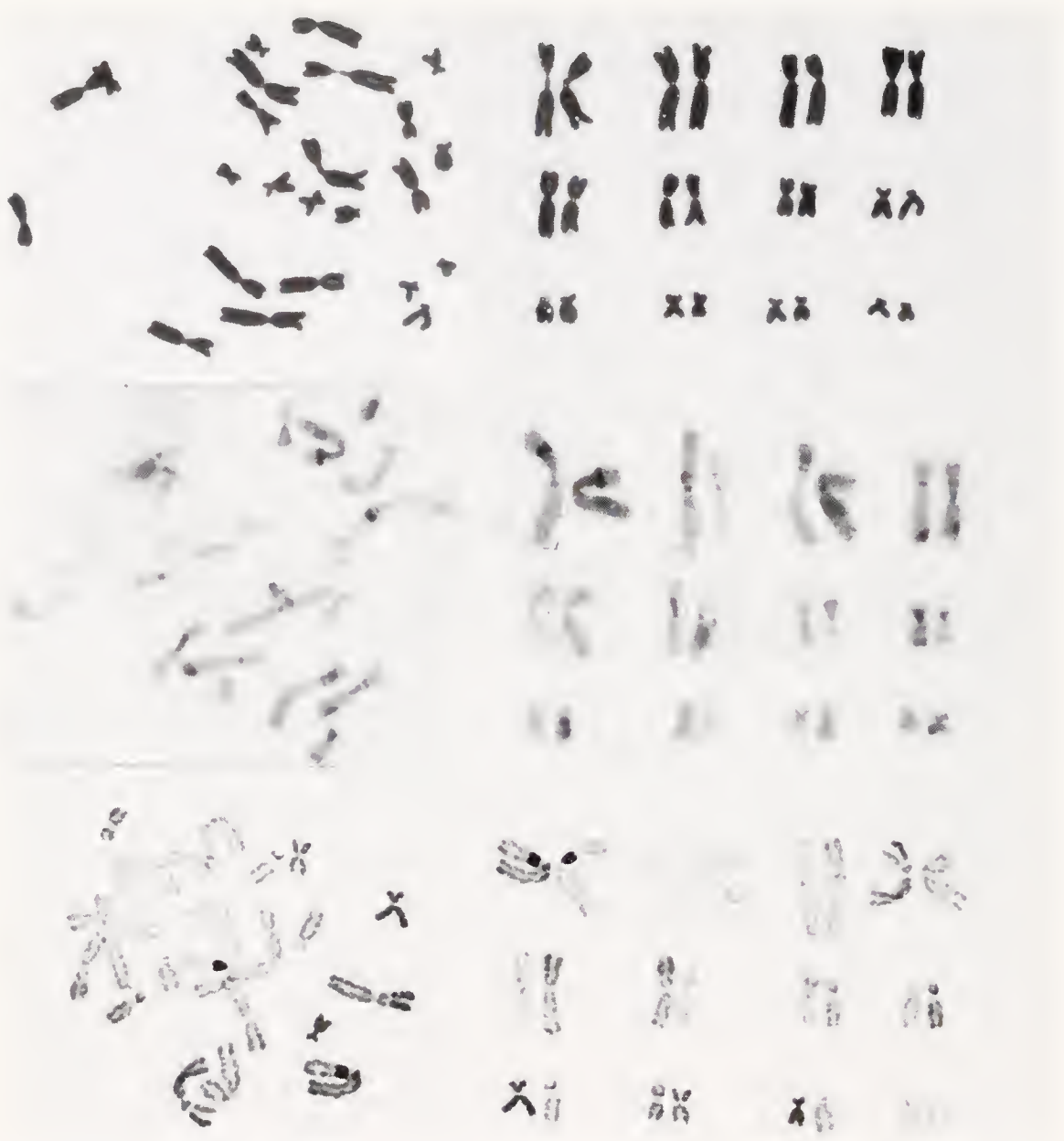

FIG. 2. The karyotype, C-band and Ag-NORs of *Rana asiatica*.

Sichuan and Hubei. *R. dybowskii* is distributed from the Russian Far East; Korea, Tsushima Island., Japan and *R. ornativentris* on Honshu, Shikoku and Kyushu islands, Japan.

Rana temporaria have a karyotype with 26 chromosomes, divided into a large chromosome group (nos. 1-5, with R. L. > 9%) and a small chromosome group (nos. 6-13, with R. L. < 7%). However *R. arvalis, R.altaica, R. chensinensis, R. dybowskii* and *R. ornativentris* each have a karyotype with 24 chromosomes, divided into a large chromosome group (nos. 1-5), a middle size chromosome group (no. 6 with R. L. 7-9%) and a small chromosome group (nos. 7-12). Chromosome no. 6 of *R. arvalis* and *R. altaica is* metacentric, while that of *R. dybowskii, R. ornativentris* and *R. chensinensis* is submetacentric (Wei and Chen, 1990). Considering that the distributional areas of *R. arvalis* and *R. altaica* are between *R.*

temporaria and the three other species, *R. chensinensis, R. dyhowskii* and *R. ornativentris,* it is suggested that the two small chromosomes of the ancestor of *R. temporaria* merged into one middle sized, metacentric chromosome which is chromosome no. 6 of *R. arvalis* and *R. altaica*. This metacentric chromosome transformed into a submetacentric chromosome by inversion between arms and formed chromosome no. 6 of *R. chensinensis, R. ornativentris* and *R. dybowskii*.

Acknowledgments

The authors would like to express their thanks to Prof. Ermi Zhao for encouraging this research and allowing us to examine the amphibian collection at the Chengdu Institute of Biology. This research was financially supported by the Guizhou Scientific Committee.

Literature Cited

FROST, D. R. (ed.) 1985. Amphibian species of the world. Allen Press and The Association of Systematics Collections, Lawrence, Kansas. 832 pp.

SCHMID, M. 1978. Chromosome banding in Amphibia. II. Constitutive heterochromatin and nucleolus organizer regions in Ranidae, Microhylidae and Rhacophoridae. Chromosoma 68:131-148.

WEI, G., AND F. CHEN. 1990. [On the phylogenetic relationship and speciation of *Rana chensinensis*]. Acta Zoologica Sinica 36(1):76-81. (In Chinese).

WEI G., F. CHEN, AND N. XU. 1990. [An investigation for the karyotypic, C-banding and Ag-NORs pattern on *Rana chensinensis* from type locality]. Hereditas (Beijing) 12(1):24-26. (In Chinese).

WU, M. 1990. Study on the karyotype and Ag-NORs on *Rana ridibunda* Pallas. Hereditas (Beijing) 12(5):15-16. (In Chinese).

XU, N., G. WEI, AND D. LI. 1990. An investigation of the karyotype, C-band and Ag-NORs pattern on *Rana schmakeri*. Hereditas (Beijing) 12(3):22-24. (In Chinese).