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Karyotype of *Tilapia zillii* (Gervais, 1848) from University of Ilorin reservoir, Ilorin, Nigeria.

Ademola*, O. J. and Muhammed, K. A.

Department of Zoology, University of Ilorin, Ilorin, Nigeria

Abstract

There is paucity of data on the karyotype of *Tilapia zillii* in Nigeria. The present study was undertaken to determine the karyotype of *T. zillii*. Eight specimens of *T. zillii* were collected from the University of Ilorin reservoir located on the Southeastern part of the University. Each specimen was injected with 0.02% colchicine (1ml/100g body weight) and left for 4 hours. Chromosome preparation was done from the anterior kidney. Eighty mitotic metaphases were examined and the diploid chromosome number ranged from 42-48 per metaphase. The modal diploid number for *T. zillii* was found to be 2n=44 and this represented 53.75%. The chromosomes were of small size and aggregated in compact form. All the chromosomes were acrocentric. Sex chromosomes and polyploidy were not observed.

Keywords: *Tilapia zillii*, chromosome, karyotype, colchicine, University of Ilorin reservoir

1. Introduction

Tilapia zillii belongs to the family Cichlidae. This family occupies the fourth place among fishes concerning the number of species with about 900 species found in Africa (Kullander, 1998; Felberg *et al*., 2003). Nzeh *et al*. (2005) reported that the cichlids are among the most cultured fish species in Nigeria. They are commercially important fishes and good sources of animal protein. *T. zillii* is endemic to Africa (Bolarin, 1979). It inhabits fresh and brackish waters (Shep *et al*., 2013). In culture systems, their uncontrolled and prolific breeding at small size constitutes a constraint to their efficient production (Mair and Little, 1991). However, *T. zillii* possesses important culture traits for aquaculture. It can adapt to adverse environmental conditions. It is salt-tolerant (El- Sayed, 2006) and can survive low oxygen concentrations (Bolarin, 1979). It has the potential of hybridization with close relatives and such relatives are fertile (Shep *et al*., 2013). The aforementioned good traits make *T. zillii* a potential material for the production of fish hybrid.

*Corresponding Author: Ademola, O. J.
Email: ademola.oj@unilorin.edu.ng

Knowledge of fish karyotype has broad applications in taxonomy, phylogenetics, toxicology and aquaculture (Kiliç-Demirok and Ünlü, 2001; Sofy *et al*., 2008). Karyotypic information is applied in screening for potential hybrids and characterization of species. As part of environmental monitoring and conservation, karyotypic analysis can be carried out to check for natural hybridization in the wild.

However, there is paucity of information on the karyotype of this species in Nigeria. Hence, the present study was undertaken to determine the karyotype of *T. zillii* from the University of Ilorin reservoir, Ilorin, Nigeria. This reservoir serves the University of Ilorin community. The karyotype of *T. zillii* obtained in the course of the study could indicate the presence of clastogenic pollutants in the reservoir.

2. Materials and Methods

Sampling site and sample collection

Specimens of *T. zillii* were collected from the University of Ilorin reservoir located on the Southeastern part of the University. It lies on latitude 8^{o} 30" N and longitude 4^{o} 32" E. The fishes were gotten at the early hours of the morning and transported in well aerated containers to the laboratory of the Department of Zoology, University of Ilorin, Nigeria for identification.

Chromosome preparation

Each specimen was injected with 0.02% colchicine (1ml/100g body weight) and left for 4 hours. Fish sacrifice was by pitting. The anterior kidney was removed and placed in a beaker containing isotonic solution (0.9 NaCl). The tissues were squashed and cut into small pieces and transferred into hypotonic solution (0.56% KCl) for 45 minutes. Tissues were transferred using a Pasteur pipette into centrifuge tubes, homogenized and centrifuged for 7 minutes at 1000 rpm. After centrifuging, the supernatant was removed. Fixation was carried out by adding the cold mixture of the freshly prepared fixative for 30 minutes. Afterwards it was centrifuged for 10 minutes and the supernatant was removed. Refixation for about 10 minutes was carried out twice as above. The cell suspension was spread on the slides. Four slides were prepared from each fish sample using a Pasteur pipette. Slides were dried 24 hours. Cell spreading was aided by rocking of slides back and forth. The slides were stained in freshly prepared 10% Giemsa solution for 45 minutes. Excess stains were rinsed off from slides using distilled water

and dried. The slides were viewed under a light microscope at a magnification of x100 with immersion oil. Ten well separated metaphase spreads per specimen were eye karyotyped and photographed with a digital camera.

3. Results and Discussion

The range of diploid chromosome numbers observed and their percentage occurrence are presented in Table 1. Plate 1 shows the mitotic metaphase spread of *T. zillii*. The modal diploid number for *T. zillii* was found to be 2n = 44 and this represented 53.75%. The chromosomes were of small size and aggregated in compact form. All the chromosomes were acrocentric. The sex chromosomes and polyploidy were not observed.

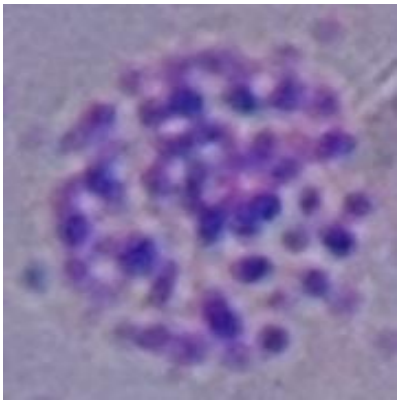

Plate 1: Somatic metaphase spread of *T. zillii* from the University of Ilorin reservoir, Nigeria.

This is the first report on the chromosome number of *T. zillii* from University of Ilorin reservoir. Information on the karyotype of fishes from Nigerian waters is very scarce. This may be due to difficulty in obtaining good spreads, the small size and compact nature of fish chromosomes which hinder counting (Denton, 1973; Thorgaard and Disney, 1990). Karyotype of cichlid fishes ranges from 2n = 32 to 2n = 60 and African cichlids have a modal diploid number of 44 chromosomes (Feldberg *et al.*, 2003; Poletto *et al.*, 2010). The result of this study showed that *T. zillii* has diploid number of 2n = 44. This is in agreement with the work of Sofy *et al.* (2008) that reported *T. zillii* from Egypt to have a diploid number of 2n = 44. The observed diploid number suggests that *T. zillii* has a conserved karyotype as the modal diploid number was constant in all specimens of *T. zillii* observed. The chromosomes of *T. zillii* were found to be acrocentric. Sex chromosomes and polyploidy were not observed in the course of the study.

Table 1: Range of diploid chromosome numbers and their percentage occurrence in *T. zillii* from the University of Ilorin reservoir, Nigeria.

T. zillii	**2n = 42**	**2n = 44**	**2n = 46**	**2n = 48**
A	2	6	2	0
B	2	4	3	1
C	2	4	2	2
D	1	6	2	1
E	0	7	2	1
F	3	5	2	0
G	1	6	2	1
H	2	5	2	1
% occurrence	16.25	53.75	21.25	8.75

Chromosomal breaks were not found in the course of scoring. This suggests that the reservoir is free of clastogenic pollutants. Clastogens are known to compromise the integrity of chromosomes (Ma *et al*., 1995; Iji and Adeogun, 2014) and could be introduced into water bodies through anthropogenic activities such as farming. Anthropogenic activities are prohibited on or around the campus of the University of Ilorin.

4. Conclusion

This study found the modal diploid number of *T. zilli* from University of Ilorin reservoir to be 2n = 44. The absence of chromosomal breaks in the metaphase spread of *T. zilli* from the reservoir may suggest the absence of clastogenic pollutants, however, continuous monitoring for these agents through karyotyping is recommended.

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References

Bolarin, J. D. (1979): *Tilapia: a guide to their biology and culture in Africa*. University of Stirling press. Stirling, UK, 174.

Denton, E. T. (1973): *Fish Chromosome Methodology*. Charles Thomas Publisher, Springfield, 166.

Feldberg, E., Porto, J. I. R. and Bertollo, L. A. C. (2003): Chromosomal changes and adaptation of cichlid fishes during evolution. In: Fish adaptations, Val, A. L. and Kapoor, B. G. (eds.) Science Publishers, Inc, Enfield – NH, USA, 285-308.

Iji, O. T. and Adeogun, A. O. (2014): Industrial effluent induced chromosomal aberration in catfish from Ogun River, Lagos, Nigeria. *Pakistan Journal of Biological Sciences.* **17** (5): 675-681.

Kiliç-Demirok, N. and Ünlü, E. (2001): Karyotypes of cyprinid fish *Capoeta trutta* and *Capoeta capoeta umbla* (Cyprinidae) from the Tigris River. *Turkish Journal of Zoology.* **25**, 389-393.

Kullander, S.O. (1998): A phylogeny and classification of the South American Cichlidae (Teleostei: Perciformes). In: Phylogeny and Classification of Neotropical Fishes. Part 5. Malabarba, L.R., Reis, R.E., Vari, R.P., Lucena, Z.M., Lucena, C.A.S. (Eds.). Porto Alegre, RS, Brasil. EDIPUCRS, 461-498.

Ma, T. H., Xu, Z., Xu, C., Mcconnell, H., Rabago, E. V., Arreola, G. A. and Zhang, H. (1995): The improved *Allium/Vicia* root tip micronucleus assay for clastogenicity of environmental pollutants. *Mutation Research*. **334**,185–195.

Mair, G. C. and Little D. C. (1991): Population control in farmed tilapias. *NAGA, the ICLARM Quarterly*. **4** (2), 8-13.

Nzeh, C. G., Obaroh, I. and Adeniyi, V. (2005): Lipase activity in the liver and digestive tract of some cichlids (Pisces: Cichlidea). *African Journal of Applied Zoology and Environmental Biology*. **7**, 136-139.

Poletto, A. B., Ferreira, I. A., Cabral-de-Mello, D. C., Nakajima, R., Mazzuchelli, J., Ribeiro, H. B., Venere P. C., Nirchio, M., Kocher, T. D. and Martins, C. (2010): Chromosome differentiation patterns during cichlid fish evolution. *BMC Genetics* **11**, 50.

Shep, H., Konan, M. K., Doumbia, L. and Ouattara, M. (2013): Feeding relationships among *Tilapia zillii* (Gervais, 1848), *Tilapia guineensis* (Bleaker, 1862) and their hybrid in Ayame man-made lake, Coted'Ivoire. *Pakistan Journal of Zoology*. **45**(5), 1405-1414.

Sofy, H. I., Layla, A. M., Iman, M. K. A. (2008): Karyotypic diversity of three tilapia species from Egypt. *Nature and Science.* **6**(1), 19-37.

Thorgaard, G. H. and Disney, J. E. (1990): Methods for fish biology. Schreck, C. B. and Moyle, P. B. (eds.) American Fisheries Society, U.S.A., 171-187.