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Karyotypic and morphometric analyses of Dawkinsia rohani (Cyprinidae), an endemic barb from the Western Ghats, India

BALAKRISHNA G N[1], BELA ZUTSHI[2]
[1, 2]*Department of Zoology, Jnana Bharathi Campus, Bangalore University, Bengaluru, Karnataka, India*

Abstract- ***The current study provides the first karyotypic and morphometric characterisation of Dawkinsia rohani, an endemic ornamental cyprinid fish species from the Western Ghats, India. Specimens obtained from the local aquarium trade sources were subjected to standard cytogenetic protocols involving colchicine treatment, hypotonic treatment in KCl solution, and fixation in Carnoy's fixative. Chromosomes prepared from kidney and gill tissues were stained conventionally with Giemsa solution. Karyotypes constructed from about 200 well-spread metaphase plates revealed a diploid chromosome number (2n) of 50 and a fundamental number (NF) of 74 in both sexes. The karyotype formula was determined as 2 m + 22 sm + 14 st + 12 t, with chromosome lengths ranging from 5.64 µm (largest submetacentric) to 2.48 µm (smallest subtelocentric) in the karyotypes. The ideogram showed a gradual decrease in chromosome size across pairs, consistent with the typical cyprinid karyotypic pattern. Morphometric analysis indicated an elongated and laterally compressed body with distinctive colouration: greenish dorsally and cream- white ventrally, with black and reddish fin markings. The results confirm that D. rohani conforms to the modal karyotype of Cyprinidae (2n = 50) and provide the first cytogenetic reference for this vulnerable, endemic species, which is invaluable for future taxonomy, evolutionary, and conservation genetics studies.***

Keywords- ***dawkinsia rohani, endemic species, evolution, fundamental number, and karyotype***

I. INTRODUCTION

The Western Ghats of India represent one of the world's most significant hotspots of biological diversity, supporting exceptionally high levels of freshwater fish endemism [1]. Among the ichthyofaunal components of this region, indigenous ornamental fishes, particularly barbs belonging to the family Cyprinidae, have gained considerable global attention owing to their striking colouration, morphological diversity, and high demand in the ornamental fish trade [2]. This economic and ecological importance has intensified scientific interest in the taxonomy, evolution, and genetic architecture of these fishes.

In recent decades, advances in cytogenetic methodologies and the growing recognition of chromosomal data as valuable biological markers have led to a renewed focus on fish cytogenetics. Cytogenetic studies provide critical insights into taxonomy, stock identification, heredity, and evolutionary relationships among fish species [3-6]. Beyond systematics, chromosomal investigation plays an important applied role in fish breeding programmes by facilitating the detection of chromosomal rearrangements, the identification of inbred lines, and the validation of cytotaxonomic status [7]. Furthermore, cytogenetic tools are widely used to determine ploidy levels, particularly in commercially and conservationally important taxa such as sturgeons; consequently, fish cytogenetics has emerged as a crucial interdisciplinary approach linking evolutionary biology with applied fisheries science.

Within Cyprinidae, cytogenetic analyses have revealed that while many species share a conserved diploid chromosome number, substantial variation exists in chromosome morphology, karyotypic symmetry, and fundamental number (NF) [4, 8, 9]. Such variations are informative for understanding chromosomal differentiation, adaptive divergence, and the speciation process, particularly in groups where external morphological traits may be influenced by environmental factors alone [6]. Because karyotypic traits are generally stable and heritable, cytogenetic analysis has become an indispensable tool in fish systematics and evolutionary studies [10].

The genus Dawkinsia comprises sixteen valid species endemic to peninsular India and Sri Lanka, with the

Western Ghats representing a major centre of diversification for the group [11]. Species of Dawkinsia are not only ecologically important components of freshwater ecosystems but are also highly valued in the ornamental fish trade [11, 12]. Previous cytogenetic studies on a limited number of species within the genus, including D. arulius, D. tambraparniei, and D. denisonii, have consistently reported a diploid chromosome number of 2n = 50, which corresponds to the model chromosomal pattern observed in Cyprinidae [13]. However, these studies have also documented notable interspecific variation in karyotype structure, fundamental number, and chromosomal symmetry, suggesting that chromosomal evolution within Dawkinsia has proceeded along distinct evolutionary trajectories across different river basins [13, 14].

Dawkinsia rohani, a relatively recently described species, is restricted to hillstream habitats of the southern Western Ghats and exhibits a narrow geographic distribution and specific ecological preferences [12]. Although its taxonomic status has been established based on morphological and meristic characteristics, cytogenetic information for this species remains unavailable. Given the high degree of endemism, geographic isolation, and ecological specialisation characteristic of Western Ghats freshwater fishes, the absence of chromosomal data for D. rohani represents a significant gap in understanding karyotype evolution within the genus [14, 15]. In addition to cytogenetics, morphometric analysis is a fundamental component of systematic ichthyology, offering quantitative measures of phenotypic variation, population differentiation, and adaptive divergence [16, 17]. Integrating morphometric data with cytogenetic evidence provides a robust and complementary framework for species characterisation and evolutionary inference, minimising ambiguities arising from phenotypic plasticity or convergent evolution [18, 19].

In this context, the present study reports, for the first time, the karyotype and morphometric characteristics of Dawkinsia rohani. The findings contribute baseline cytogenetic data essential for taxonomic clarification, comparative evolutionary studies, and future conservation and management strategies for endemic freshwater fishes of the Western Ghats.

II. MATERIAL AND METHODS

Chromosome preparation

Five specimens of *Dawkinsia rohani* fish (n=5), representing two female and three male specimens, were procured from the local aquarium trade. Three days prior to the experiment, the collected specimens were acclimatised and maintained under controlled laboratory conditions before chromosomal analysis. The fish were kept in a glass aquarium containing dechlorinated freshwater at 26-28 °C under a natural photoperiod (12 h light:12 h dark). Adequate aeration was provided, and water quality parameters such as pH (7.0-7.5) and dissolved oxygen (>6 mg/L) were maintained within acceptable limits through partial water exchange. The fish were fed a commercially formulated feed twice daily, and feeding was stopped 24 h before chromosome preparation. Healthy and active individuals were selected for cytogenetic studies.

Chromosome preparations were carried out following the protocol [20]. Chromosomes were prepared as follows: 0.1 ml of colchicine per 100 g of body weight was administered intramuscularly or intraperitoneally, after which the animals were left undisturbed for 1 hour. Subsequently, the kidney was excised, sliced into small fragments, gently macerated, and mixed with 0.075 M KCl. 8ml of cell sediment was transferred to a centrifuge tube and incubated for 30 - 40 minutes at room temperature, followed by removal of large tissue fragments. The suspension was centrifuged for 8 min at 1200 rpm, and the KCl was removed from the supernatant. Before being centrifuged again at 1200 rpm for 8 minutes, the cells were fixed in fresh, cool Carnoy's fixative (3 parts methanol and 1 part glacial acetic acid), which preserves the nuclear internal structure for better chromosome staining [21]. The supernatant was then discarded. This step was repeated until the supernatant was clear. Finally, 1ml of fixative was added to the pellet, and the cell suspension was dropped onto chilled, clean glass slides using a Pasteur pipette and allowed to air-dry at room temperature.

Chromosome staining and microphotography

Conventional staining was performed using 5% Giemsa solution for 15 minutes [22]. Chromosome

analysis was performed on 200 distinct metaphase plates, with evenly distributed chromosomes, for each male and female specimen.

Photographs of well-spread metaphase chromosomes were captured under a light microscope (Zeiss Axioskop 2 plus) with an Axiom MRc camera. Chromosomes were categorised according to their arm ratio and centromere position as metacentric (m), submetacentric (sm), subtelocentric (st), and telocentric (t). Karyotypes were constructed according to the definitions [23, 24].

III. RESULTS

Morphology of *Dawkinsia rohani*

The general body appearance of *Dawkinsia rohani* is illustrated in Fig. 1A. The fish exhibits a laterally compressed and elongated body. The dorsum is greenish, and the ventrum is Cream-White in colour. The fins display black, reddish, and hyaline markings characteristic of the species. Morphometric measurements were performed using a Vernier caliper (accuracy ±0.1 mm). With the total length (TL) 89-98 mm (mean 94.00 ± 3.39 mm) and standard length (SL) 64 - 73 mm (mean 69.00 ± 3.24 mm). Head length (HL) represented 24.6 ± 0.9% of SL, and body depth accounted for 33.8 ± 1.3% of SL. No significant sexual dimorphism was recorded in either size or colouration. The preserved specimens exhibited greenish dorsal and cream-white ventral colouration with black and reddish fin markings typical of this ornamental fish. Morphometric ratios such as head length, eye diameter, and pre-dorsal length were found to be consistent among individuals, indicating low intraspecific variation.

Karyology of *Dawkinsia rohani*

For cytogenetic analysis, both male and female specimens were examined using the kidney and gill cells. A total of 200 well-spread metaphase plates were analysed. The study revealed a diploid (2n) chromosome number of 50 and a fundamental number (NF) of 74 in both sexes, indicating no chromosomal sex dimorphism. The karyotype formula was determined to be 2 m + 22 sm + 14 st + 12 t. Chromosome lengths varied between 5.64 µm for the largest submetacentric and 2.48 µm for the smallest subtelocentric pairs. The ideogram constructed from these data showed a gradual reduction in chromosome length with increasing chromosome number (Fig. 2). The chromosomal distribution pattern was consistent across all observed metaphase plates.

IV. DISCUSSION

The present study represents the first comprehensive cytogenetic characterisation of *Dawkinsia rohani*, an endemic and vulnerable cyprinid species from the Western Ghats. The karyotypic formula 2n = 50, (2m + 22sm + 14st + 12t), and NF = 74 revealed a diploid number of 50 in this family [8, 9]. The karyotype of *D. rohani* showed moderate asymmetry, indicating a predominance of submetacentric and subtelocentric chromosomes. Such chromosomal configurations are often associated with a relatively stable evolutionary lineage among cyprinids [3, 4]. Karyotypic comparisons with other *Dawkinsia* species, such as *D. arulius, D. tambraparniei* [25], and *D. denisonii* [13], revealed a conserved diploid number (2n = 50) but with varying karyotypic formulae. Such interspecific differences suggest intrachromosomal rearrangements, including pericentric inversions or centromeric shifts, which are typical mechanisms of karyotype evolution in teleosts [4, 26]. These variations may reflect adaptive divergence among species inhabiting different ecological niches across the river systems of the Western Ghats.

The karyotype of *D. rohani* provides a valuable cytotaxonomic marker that can aid in resolving taxonomic ambiguities within *Dawkinsia*. Traditional morphological classification alone has been challenging in this genus due to overlapping characters such as filamentous dorsal rays, colour patterns, and scale counts [11, 12]. The chromosomal data presented here thus offer an additional diagnostic tool for species delimitation. NOR (nucleolar organizer region) and C-banding techniques, though not applied in this study, would further enhance species distinctness by highlighting specific chromosomal regions associated with ribosomal DNA clusters [10, 27].

The conservation of diploid number but variation in chromosomal morphology among *Dawkinsia* species supports the hypothesis of karyotypic stasis with structural rearrangements - a pattern typical of teleost evolution. Chromosomal rearrangements such as

inversions and translocations may have played a significant role in reproductive isolation and speciation. Given that *D. rohani* is geographically restricted to the Kanyakumari District hill streams draining into the Arabian Sea [14], such isolation may have facilitated chromosomal divergence from its congeners through allopatric mechanisms.

Moreover, the ideogram pattern demonstrates a gradual decline in chromosome size, reflecting a balanced karyotype organisation that maintains genetic stability. These structural arrangements may be an adaptive response to the environmental heterogeneity of hill stream habitats, where strong water currents and fluctuating conditions impose selective pressures on population structure and genetic composition.

Dawkinsia rohani is currently classified as "Vulnerable" on the IUCN Red List [28]. Its limited distribution, combined with habitat degradation from urbanisation, agriculture, and tourism, underscores the urgency of conservation planning. Cytogenetic data, such as those obtained here, are critical for conservation genetics, as they help to identify population integrity, detect hybridisation, and provide a baseline for *ex situ* breeding programs [7, 29]. Establishing karyotypic norms can help monitor genetic stability in captive breeding initiatives and in ornamental fish trade regulations.

Further, studies employing advanced cytogenetic techniques such as fluorescence *in situ* hybridisation (FISH), C-banding, Ag-NOR banding, and molecular karyotyping are recommended. Integration of mitochondrial and nuclear DNA analyses could provide a chromosomal evolution within the genus and contribute to effective conservation strategies for *D. rohani* and other endemic barbs of the Western Ghats.

REFERENCES

[1] N. Myers, R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, and J. Kent, “Biodiversity hotspots for conservation priorities,” *Nature*, vol. 403, pp. 853–858, 2000, doi:10.1038/35002501.

[2] U. K. Sarkar and W. S. Lakra, “Small indigenous freshwater fish species of India: Significance, conservation, and utilisation,” *Aquacult. Asia*, vol. 15, no. 3, pp. 34–35, 2010.

[3] J. R. Gold, Y. C. Li, N. S. Shipley, and P. K. Powers, “Improved methods for working with fish chromosomes with a review of metaphase chromosome banding,” *J. Fish Biol.*, vol. 37, no. 4, pp. 563–575, 1990.

[4] T. Ueda, H. Naoi, and R. Arai, “Flexibility on the karyotype evolution in bitterlings (Pisces, Cyprinidae),” *Genetica*, vol. 111, no. 1–3, pp. 423–432, 2001.

[5] Barat, P. K. Sahoo, and A. G. Ponniah, “Karyotype and nucleolar organiser regions (NORs) in a few hill stream fishes,” in *Proc. 5th Indian Fisheries Forum*, S. Ayyappan, J. K. Jena, and M. M. Joseph, Eds. Mangalore, India: AFSIB; Bhubaneswar, India: AoA, 2002, pp. 111–114.

[6] Barat and P. K. Sahoo, “Karyotype analysis of *Channa punctatus* (Pisces) using restriction endonucleases,” *Cytologia*, vol. 72, no. 4, pp. 471–473, 2007.

[7] V. S. Kirpichnikov, *Genetic Bases of Fish Selection*. Berlin, Germany: Springer-Verlag, 1981.

[8] G. K. Manna, “Progress in fish cytogenetics,” *Nucleus*, vol. 27, no. 1–3, pp. 203–231, 1984.

[9] K. K. Rishi, “Current status of fish cytogenetics,” in *Fish Genetics in India*, P. Das and V. G. Jhingran, Eds. New Delhi, India: Today and Tomorrow’s Printers and Publishers, 1989, pp. 1–20.

[10] C. T. Amemiya and J. R. Gold, “Chromosomal NORs as taxonomic and systematic characters in North American cyprinid fishes,” *Genetica*, vol. 76, no. 1, pp. 81–90, 1988.

[11] R. Pethiyagoda, M. Meegaskumbura, and K. Maduwage, “A synopsis of the South Asian fishes referred to *Puntius* (Pisces: Cyprinidae),” *Ichthyol. Explor. Freshwaters*, vol. 23, no. 1, pp. 69–95, 2012.

[12] U. Katwate, P. Kumkar, R. Raghavan, and N. Dahanukar, “Taxonomy and systematics of the ‘Maharaja Barbs’ (Teleostei: Cyprinidae), with the description of a new genus and species from

the Western Ghats, India," *Zootaxa*, vol. 4803, no. 3, pp. 544–560, 2020.

[13] N. S. Nagpure, R. Kumar, S. K. Srivastava, A. Gopalakrishnan, M. S. Verma, and V. S. Basheer, "Cytogenetic studies of fish species *Horabagrus nigricollaris*, *Puntius denisonii* and *Puntius sarana subnasutus* endemic to the Western Ghats," *Indian J. Fish.*, vol. 51, no. 2, pp. 185–191, 2004.

[14] K. R. Devi, T. J. Indra, and J. D. M. Knight, "*Puntius rohani* (Teleostei: Cyprinidae), a new species of barb in the *Puntius filamentosus* group from the southern Western Ghats of India," *J. Threat. Taxa*, vol. 2, no. 9, pp. 1121–1129, 2010.

[15] R. J. R. Daniels, "Endemic fishes of the Western Ghats and the Satpura hypothesis," *Curr. Sci.*, vol. 81, no. 3, pp. 240–244, 2001.

[16] R. E. Strauss and F. L. Bookstein, "The truss: Body form reconstructions in morphometrics," *Syst. Zool.*, vol. 31, no. 2, pp. 113–135, 1982.

[17] A. L. Ibanez, I. G. Cowx, and P. O Higgins, "Geometric morphometric analysis of fish scales for identifying genera, species, and local populations within the Mugilidae," *Can. J. Fish. Aquat. Sci.*, vol. 64, no. 8, pp. 1091–1100, 2007.

[18] M. J. Cavalcanti, L. R. Monteiro, and P. R. D. Lopes, "Landmark-based morphometric analysis in selected species of serranid fishes (Perciformes: Teleostei)," *Zool. Stud.*, vol. 38, no. 3, pp. 287–294, 1999.

[19] T. O. Mojekwu and C. I. Anumudu, "Advanced techniques for morphometric analysis in fish," *J. Aquacult. Res. Dev.*, vol. 6, no. 8, pp. 1–6, 2015.

[20] W. Supiwong, T. Liehr, B. M. Cioffi, A. Chaveerach, N. Kosyakova, K. Pinthong, T. Tanee, and A. Tanomtong, "Chromosomal evolution in naked catfishes (Bagridae, Siluriformes): A comparative chromosome mapping study," *Zool. Anz.*, vol. 253, no. 4, pp. 316–320, 2014.

[21] P. J. Pradeep, T. C. Srijaya, R. B. M. Zain, A. Papini, and A. K. Chatterji, "A simple technique for chromosome preparation from embryonic tissues of teleosts for ploidy verification," *Caryologia*, vol. 64, no. 2, pp. 235–241, 2011.

[22] S. Phimphan, W. Supiwong, A. Tanomtong, K. Pinthong, W. Sangpakdee, and S. Kaewsri, "Karyotypic study of five Lutjanid species using conventional and Ag-NORs banding techniques," *Cytol. Genet.*, vol. 51, no. 4, pp. 315–324, 2017.

[23] A. Levan, K. Fredga, and A. A. Sandberg, "Nomenclature for centromeric position on chromosomes," *Hereditas*, vol. 52, pp. 201–220, 1964.

[24] K. Chaiyasut, "Cytogenetics and cytotaxonomy of the family Zephyranthes," M.S. thesis, Dept. Botany, Fac. Sci., Chulalongkorn Univ., Bangkok, Thailand, 1989.

[25] M. Arunachalam and M. Murugan, "Cytogenetics and cytotaxonomic consideration of two endangered ornamental fishes *Puntius arulius* and *P. tambraparniei* (Cypriniformes: Cyprinidae) from Western Ghats, India," *Zoo's Print J.*, vol. 22, no. 7, pp. 2739–2741, 2007.

[26] L. F. Almeida-Toledo, F. Foresti, and S. A. Toledo-Filho, "Karyotypic evolution in neotropical freshwater fish," in *Chromosomes Today*, vol. 13, 2000, pp. 169–182.

[27] P. M. Galetti Jr., "Chromosome diversity in neotropical fishes: NOR studies," *Ital. J. Zool.*, vol. 65, suppl. 1, pp. 53–56, 1998.

[28] N. Dahanukar, "*Dawkinsia rohani*," *The IUCN Red List of Threatened Species*, ver. 2015, e.T188749A70367702, 2015.

[29] H. Zhou, T. Fujimoto, S. Adachi, S. Abe, E. Yamaha, and K. Arai, "Molecular cytogenetic study on the ploidy status in *Acipenser mikadoi*," *J. Appl. Ichthyol.*, vol. 29, no. 1, pp. 51–55, 2013.

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Table.1. Cytogenetic reports in the genus *Dawkinsia.*

	SPECIES	2N	CYTOTYPE	NF	LOCALITIES	REFERENCE
1	*Puntius denison / Dawkinsia denison*	50	(4m + 20sm + 18st + 8 t)	74	Chalakudy river of Kerala	Nagapure et.al., (2004)
2	*Puntius tambraparniei / Dawkinsia tambraparniei*	50	(12m+16sm+16st+6t)	96	Tamiraparani river basin	Manavalan, M., & Murugan, M. (2007).
3	*Puntius arulius / Dawkinsia arulius*	50	(10m+18sm+ 12st+10t)	90	Cauvery river basin	Manavalan, M., & Murugan, M. (2007).
4	*Dawkinsia rohani*	50	(2m + 22sm + 14st + 12t)	74	Aqua venders	Present study

Table. 2. Morphometric characters of *Dawkinsia Rohani*

Character in mm	Mean ±SD (n=5)	Range
Total length	94.00 ±3.39	89-98
Standard length	69 ±3.24	64-73
Head length (HL)	18.52 ±1.33	16.91-20.26
Head depth	14.71 ±0.78	13.65 - 15.82
Head width	10.25 ±0.75	9.07 - 11.13
Body depth	22.77 ±0.45	22.10 - 23.31
Body width at dorsal fin origin	10.54 ±1.06	9.42 - 11.86
Body width at anal fin origin	6.14 ±0.44	5.73 - 6.80
Fork length	78.25 ±3.27	74 - 83
Pre-dorsal length	33.66 ±1.38	31.57 - 34.97
Pre-pectoral length	20 ±1.97	17.94 - 22.81
Pre-pelvic length	36.11 ±2.44	33.34 - 39.55
Dorsal fin length	20.79 ±0.99	19.58 - 21.99
Dorsal fin spine length	17.90 ±0.87	16.57 - 18.69
Length of dorsal fin base	13.09 ±1.05	11.84 - 14.43
Caudal peduncle depth	9.83 ±0.54	9.06 - 10.50
Pre-anal length	51.70 ±2.43	48.75 - 55.13
Base pectoral length	3.07 ±0.47	2.38 - 3.54
Base pelvic length	3.73 ±0.26	3.46 - 4.13
Base anal length	7.08 ±0.55	6.31 - 7.76

Character in mm	Mean ±SD (n=5)	Range
Base caudal length	10.14 ±0.85	9.01 - 11.40
Pectoral fin length	13.33 ±1.62	10.88 - 15.32
Pelvic fin length	13.77 ±0.71	12.73 - 14.66
Anal fin length	11.77 ±0.54	10.83 - 12.24

Character in mm	Mean ±SD (n=5)	Range
Caudal fin length	23.16 ±2.84	18.43 - 25.97
Caudal peduncle length	10.18 ±0.30	9.85 - 10.65
Eye diameter	5.95 ±0.27	5.67 - 6.38
Pre-Orbital length	5,61 ±0.51	4.74 - 6.02
Post-Orbital length	11.39 ±0.73	10.18 - 12.13

Table 3. - The mean lengths of short arm (Ls), long arm (Ll), and total length (LT); arm ratio (AR) and Centromeric index (CI) from *Dawkinsia rohani* (50). All Measurements are in µm.

Chromosome pair number	(Ls)	(Ll)	(LT)	(CI)	AR	Chromosome type
1	2.2948	2.5396	4.8344	0.4746	1.1066	Metacentric
2	1.4796	4.1638	5.6434	0.2621	2.8141	Sub metacentric.
3	1.7709	3.4055	5.1764	0.3421	1.9230	Sub metacentric.
4	1.5575	2.7520	4.3096	0.3614	1.7669	Sub metacentric.
5	1.3760	2.8367	4.2128	0.3266	2.0615	Sub metacentric.
6	1.4796	2.6868	4.1664	0.3551	1.8158	Sub metacentric.
7	1.3760	2.6311	4.0072	0.3433	1.9121	Sub metacentric.
8	1.3760	2.5044	3.8804	0.3546	1.8200	Sub metacentric.
9	1.3099	2.4806	3.7906	0.3455	1.8937	Sub metacentric.
10	1.0817	2.6311	3.7128	0.2913	2.4323	Sub metacentric.
11	1.4098	2.0988	3.5086	0.4018	1.4887	Sub metacentric.
12	1.0817	2.2426	3.3243	0.3253	2.0732	Sub metacentric.
13	1.0029	3.2453	4.2483	0.2360	3.2359	Sub telocentric

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14	1.0029	3.1622	4.1652	0.2407	3.1530	Sub telocentric
15	0.9129	2.7196	3.6325	0.2513	2.9790	Sub telocentric
16	0.9332	2.6311	3.5643	0.2618	2.8194	Sub telocentric
17	0.9029	2.6199	3.5228	0.2563	2.9016	Sub telocentric
18	0.7297	2.4325	3.1622	0.2307	3.3335	Sub telocentric
19	0.6770	1.8044	2.4814	0.2728	2.6652	Sub telocentric
20	0	4.0118	4.0118	O.OOOO	O.OOOO	Telocentric
21	0	3.7051	3.7051	O.OOOO	O.OOOO	Telocentric
22	0	3.2653	3.2653	O.OOOO	O.OOOO	Telocentric
23	0	3.2635	3.2635	O.OOOO	O.OOOO	Telocentric
24	0	3.0769	3.0769	O.OOOO	O.OOOO	Telocentric
25	0	2.7196	2.7196	O.OOOO	O.OOOO	Telocentric

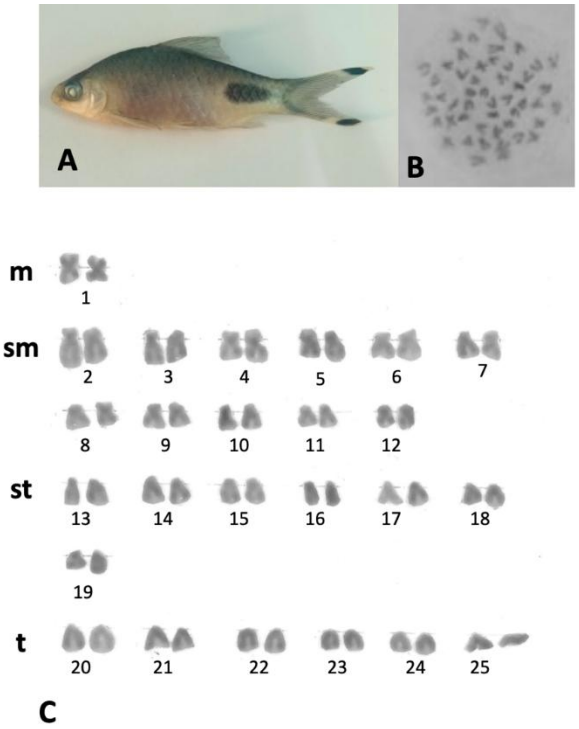

Fig. 1. preserved specimen(A), Giemsa-stained metaphase complement (B), and karyotype of D. rohani (C)

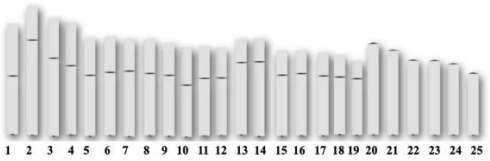

Fig. 2 – Ideogram of Dawkinsia rohani