**The supplementary materials of *Animal* journal**

**Genetic and morphology analysis** **among the pentaploid F1 hybrid fishes (*Schizothorax wangchiachii* ♀× *Percocypris pingi* ♂) and their parents**

H. R. Gu1, Y. F. Wan1, Y. Yang1, Q. Ao1, W. L. Cheng1, S. H. Deng2, D. Y. Pu1, X. F. He1, L. Jin1, Z. J. Wang1

1Key Laboratory of Freshwater Fish Reproduction and Development (Ministry of Education), Key Laboratory of Aquatic Science of Chongqing, School of Life Sciences, Southwest University, 400715 Chongqing, China

2Xichang Jiahe Agriculture Company Limited, 615000 Xichang, China

Corresponding author: Zhi Jian Wang. E-mail: wangzj1969@126.com

**Supplementary Table S1** *Karyotype comparison between Schizothorax fishes*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Species | Karyotype formula | 2n | NF | NF/2n | References |
| *S. grahami* | 2n=52m+30sm+66st-t | 148 | 230 | 1.55 | Zan *et al.*, 1985 |
| *S. taliensis* | 2n=48m+30sm+70st-t | 148 | 226 | 1.52 | Zan *et al.*, 1985 |
| *S. prenanti* | 2n=28m+40sm+36st+44t | 148 | 216 | 1.45 | Li *et al.*, 1987 |
| *S. lissolabiatus* | 2n=44m+36sm+20st+48t | 148 | 228 | 1.54 | Dai and Han, 2018 |
| *S. davidi* | 2n=20m+34sm+24st+20t | 98 | 152 | 1.55 | Li *et al.*, 1987 |
| *S. waltoni* | 2n=26m+28sm+22st+16t | 92 | 146 | 1.59 | Yu and Li, 1990 |
| *S. oconnori* | 2n=30m+26sm+20st+16t | 92 | 148 | 1.61 | Yu and Li, 1990 |
| *S. kozlovi* | 2n=18m+14sm+16st+44t | 92 | 124 | 1.34 | Dai and Han, 2018 |
| *S. macropogon* | / | 90-98 | / | / | Yu, 1989 |
| *S. richardsonii* | 2n=16m+40sm+42t | 98 | 154 | 1.57 | Lakara *et al.*, 1997 |
| *S. kumaonensis* | 2n=18m+10sm+70t | 98 | 126 | 1.29 | Lakara *et al.*, 1997 |
| *S. curvifrons* | 2n=26m+20sm+20st+28t | 94 | 140 | 1.49 | Ganai *et al.*, 2011 |
| *S. esocinus* | 2n=30m+22sm+10st+36t | 98 | 150 | 1.53 | Ganai *et al.*, 2011 |
| *S.* *labiatus* | 2n=24m+20sm+2st+52t | 98 | 142 | 1.45 | Ganai *et al.*, 2011 |
| *S. niger* | 2n=24m+32sm+22st+20t | 98 | 154 | 1.57 | Ganai *et al.*, 2011 |
| *S. plagiostomus* | 2n=24m+18sm+54t | 96 | 138 | 1.43 | Ganai *et al.*, 2011 |
| *S. zarudnyi* | 2n=18m+28sm+50st  | 96 | 142 | 1.48 | Kalbassi *et al.*, 2008 |
| *S.* *progastus* | 2n=16m+40sm+42t | 98 | 154 | 1.57 | Rishi *et al.*, 1983 |
| *S. wangchiachii* | 2n=36m+34sm+12st+66t | 148 | 218 | 1.47 | This study |

m= metacentric chromosome; sm= submetacentric chromosome; st= subterminal chromosome; t= terminal chromosome. NF= the total numbers of chromosome arms.

**Supplementary Table S2** *Number of polymorphic loci and the percentage in the hybrid fishes and their parents with a single primer by inter-simple sequence repeat (ISSR) analysis*

|  |  |  |  |
| --- | --- | --- | --- |
| Primers | No. of amplified bands | No. of polymorphic bands | Percentage of polymorphic bands (%) |
| (AG)8G | 8 | 5 | 62.5 |
| (AG)8T | 7 | 5 | 71.4 |
| (AG)8C | 20 | 14 | 70.0 |
| (AG)8YC | 7 | 4 | 57.1 |
| (AG)8YT | 11 | 10 | 90.9 |
| (AG)8YA | 10 | 8 | 80.0 |
| (AG)8GT | 12 | 8 | 66.7 |
| (AG)8CTA | 17 | 14 | 82.4 |
| (TC)8C | 4 | 3 | 75.0 |
| (TC)8RG | 5 | 4 | 80.0 |
| (TG)8RC | 6 | 6 | 100.0 |
| (CT)8RG | 3 | 2 | 66.7 |
| (CT)8A | 6 | 4 | 66.7 |
| (GA)8YT | 11 | 9 | 81.8 |
| (GA)8YG | 7 | 5 | 71.4 |
| (GA)8A | 7 | 6 | 85.7 |
| (GA)8CTA | 16 | 14 | 87.5 |
| (GACA)4 | 12 | 11 | 91.7 |
| (GAA)6 | 13 | 13 | 100.0 |
| Total | 178 | 149 | 83.7 |

R=(A, G); Y=(C, T).

**Supplementary Table S3** *The karyotype date of S. wangchiachii*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Chromosome No. | Relative length % | Arm ratio L/S | Type | Chromosome No. | Relative length % | Arm ratio L/S | Type |
| 1 | 1.66±0.16 | 1.33±0.18 | m | 38 | 0.67±0.08 | 3.78±0.63 | st |
| 2 | 1.27±0.12 | 1.42±0.25 | m | 39 | 0.63±0.11 | 3.76±0.50 | st |
| 3 | 1.08±0.11 | 1.41±0.19 | m | 40 | 0.59±0.13 | 3.69±0.39 | st |
| 4 | 1.07±0.07 | 1.28±0.23 | m | 41 | 0.58±0.08 | 3.49±0.31 | st |
| 5 | 1.11±0.12 | 1.33±0.23 | m | 42 | 0.74±0.08 | ∞ | t |
| 6 | 1.04±0.12 | 1.37±0.15 | m | 43 | 0.68±0.12 | ∞ | t |
| 7 | 0.88±0.10 | 1.32±0.18 | m | 44 | 0.66±0.12 | ∞ | t |
| 8 | 0.87±0.08 | 1.45±0.18 | m | 45 | 0.60±0.08 | ∞ | t |
| 9 | 0.85±0.08 | 1.43±0.21 | m | 46 | 0.59±0.11 | ∞ | t |
| 10 | 0.77±0.11 | 1.26±0.17 | m | 47 | 0.59±0.10 | ∞ | t |
| 11 | 0.70±0.09 | 1.36±0.21 | m | 48 | 0.58±0.06 | ∞ | t |
| 12 | 0.71±0.10 | 1.28±0.22 | m | 49 | 0.57±0.06 | ∞ | t |
| 13 | 0.68±0.10 | 1.39±0.21 | m | 50 | 0.57±0.07 | ∞ | t |
| 14 | 0.64±0.06 | 1.48±0.14 | m | 51 | 0.57±0.09 | ∞ | t |
| 15 | 0.60±0.09 | 1.23±0.15 | m | 52 | 0.56±0.10 | ∞ | t |
| 16 | 0.59±0.09 | 1.29±0.20 | m | 53 | 0.55±0.05 | ∞ | t |
| 17 | 0.59±0.09 | 1.43±0.18 | m | 54 | 0.54±0.09 | ∞ | t |
| 18 | 0.57±0.07 | 1.32±0.24 | m | 55 | 0.54±0.11 | ∞ | t |
| 19 | 1.63±0.21 | 2.55±0.36 | sm | 56 | 0.53±0.11 | ∞ | t |
| 20 | 1.17±0.11 | 2.44±0.31 | sm | 57 | 0.52±0.12 | ∞ | t |
| 21 | 1.07±0.13 | 2.21±0.30 | sm | 58 | 0.52±0.13 | ∞ | t |
| 22 | 0.93±0.10 | 2.45±0.36 | sm | 59 | 0.51±0.12 | ∞ | t |
| 23 | 0.97±0.12 | 2.52±0.26 | sm | 60 | 0.50±0.11 | ∞ | t |
| 24 | 0.89±0.12 | 2.20±0.27 | sm | 61 | 0.48±0.06 | ∞ | t |
| 25 | 0.87±0.12 | 2.41±0.46 | sm | 62 | 0.46±0.11 | ∞ | t |
| 26 | 0.84±0.10 | 2.22±0.27 | sm | 63 | 0.45±0.08 | ∞ | t |
| 27 | 0.71±0.06 | 2.25±0.44 | sm | 64 | 0.45±0.07 | ∞ | t |
| 28 | 0.67±0.11 | 2.43±0.34 | sm | 65 | 0.44±0.08 | ∞ | t |
| 29 | 0.65±0.12 | 2.28±0.28 | sm | 66 | 0.44±0.03 | ∞ | t |
| 30 | 0.63±0.08 | 2.40±0.39 | sm | 67 | 0.43±0.06 | ∞ | t |
| 31 | 0.58±0.07 | 2.92±0.49 | sm | 68 | 0.41±0.09 | ∞ | t |
| 32 | 0.58±0.08 | 2.26±0.40 | sm | 69 | 0.41±0.10 | ∞ | t |
| 33 | 0.56±0.09 | 2.36±0.37 | sm | 70 | 0.40±0.08 | ∞ | t |
| 34 | 0.53±0.08 | 2.84±0.60 | sm | 71 | 0.39±0.08 | ∞ | t |
| 35 | 0.51±0.11 | 2.77±0.47 | sm | 72 | 0.37±0.09 | ∞ | t |
| 36 | 0.90±0.09 | 3.73±0.41 | st | 73 | 0.36±0.07 | ∞ | t |
| 37 | 0.71±0.11 | 3.71±0.52 | st | 74 | 0.27±0.10 | ∞ | t |

m= metacentric chromosome; sm= submetacentric chromosome; st= subterminal chromosome; t= terminal chromosome. L/S= long arm/short arm

**Supplementary Table S4** *The karyotype date of the hybrid fishes*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Chromosome No. | Relative length % | Arm ratio L/S | Type | Chromosome No. | Relative length % | Arm ratio L/S | Type |
| 1 | 1.54±0.08 | 1.63±0.10 | m | 63 | 0.75±0.03 | 2.43±0.12 | sm |
| 2 | 1.53±0.02 | 1.43±0.06 | m | 64 | 0.75±0.03 | 2.22±0.12 | sm |
| 3 | 1.53±0.03 | 1.32±0.04 | m | 65 | 0.71±0.04 | 2.13±0.16 | sm |
| 4 | 1.25±0.04 | 1.53±0.03 | m | 66 | 0.71±0.04 | 2.43±0.22 | sm |
| 5 | 1.25±0.07 | 1.61±0.05 | m | 67 | 0.70±0.03 | 2.31±0.26 | sm |
| 6 | 1.10±0.07 | 1.61±0.07 | m | 68 | 0.89±0.04 | 3.53±0.27 | st |
| 7 | 1.08±0.05 | 1.59±0.07 | m | 69 | 0.85±0.09 | 3.49±0.22 | st |
| 8 | 1.08±0.03 | 1.69±0.12 | m | 70 | 0.85±0.13 | 3.57±0.18 | st |
| 9 | 1.03±0.04 | 1.42±0.14 | m | 71 | 0.78±0.10 | 3.12±0.09 | st |
| 10 | 1.03±0.05 | 1.45±0.09 | m | 72 | 0.64±0.06 | 3.11±0.18 | st |
| 11 | 1.02±0.04 | 1.33±0.05 | m | 73 | 0.87±0.04 | ∞ | t |
| 12 | 1.01±0.04 | 1.20±0.12 | m | 74 | 0.87±0.07 | ∞ | t |
| 13 | 1.01±0.06 | 1.59±0.09 | m | 75 | 0.85±0.11 | ∞ | t |
| 14 | 0.98±0.04 | 1.60±0.03 | m | 76 | 0.85±0.05 | ∞ | t |
| 15 | 0.97±0.03 | 1.55±0.02 | m | 77 | 0.84±0.06 | ∞ | t |
| 16 | 0.95±0.02 | 1.05±0.04 | m | 78 | 0.80±0.02 | ∞ | t |
| 17 | 0.95±0.01 | 1.32±0.03 | m | 79 | 0.79±0.03 | ∞ | t |
| 18 | 0.94±0.03 | 1.64±0.07 | m | 80 | 0.79±0.01 | ∞ | t |
| 19 | 0.93±0.03 | 1.40±0.08 | m | 81 | 0.77±0.02 | ∞ | t |
| 20 | 0.93±0.02 | 1.40±0.06 | m | 82 | 0.77±0.05 | ∞ | t |
| 21 | 0.90±0.03 | 1.42±0.15 | m | 83 | 0.76±0.02 | ∞ | t |
| 22 | 0.88±0.06 | 1.34±0.10 | m | 84 | 0.75±0.02 | ∞ | t |
| 23 | 0.88±0.02 | 1.51±0.04 | m | 85 | 0.75±0.04 | ∞ | t |
| 24 | 0.87±0.02 | 1.03±0.03 | m | 86 | 0.75±0.02 | ∞ | t |
| 25 | 0.87±0.03 | 1.50±0.03 | m | 87 | 0.75±0.02 | ∞ | t |
| 26 | 0.86±0.04 | 1.48±0.04 | m | 88 | 0.75±0.01 | ∞ | t |
| 27 | 0.81±0.08 | 1.54±0.05 | m | 89 | 0.74±0.04 | ∞ | t |
| 28 | 0.81±0.06 | 1.52±0.03 | m | 90 | 0.73±0.02 | ∞ | t |
| 29 | 0.81±0.04 | 1.42±0.07 | m | 91 | 0.73±0.03 | ∞ | t |
| 30 | 0.80±0.03 | 1.23±0.04 | m | 92 | 0.72±0.02 | ∞ | t |
| 31 | 0.79±0.02 | 1.44±0.11 | m | 93 | 0.72±0.05 | ∞ | t |
| 32 | 0.79±0.04 | 1.65±0.06 | m | 94 | 0.71±0.01 | ∞ | t |
| 33 | 0.76±0.03 | 1.35±0.10 | m | 95 | 0.70±0.02 | ∞ | t |
| 34 | 0.76±0.02 | 1.61±0.15 | m | 96 | 0.69±0.03 | ∞ | t |
| 35 | 0.75±0.02 | 1.44±0.05 | m | 97 | 0.69±0.01 | ∞ | t |
| 36 | 0.75±0.03 | 1.24±0.10 | m | 98 | 0.68±0.03 | ∞ | t |
| 37 | 0.72±0.04 | 1.67±0.06 | m | 99 | 0.68±0.03 | ∞ | t |
| 38 | 0.72±0.04 | 1.24±0.05 | m | 100 | 0.67±0.05 | ∞ | t |
| 39 | 0.69±0.04 | 1.37±0.12 | m | 101 | 0.67±0.04 | ∞ | t |
| 40 | 1.54±0.12 | 1.93±0.10 | sm | 102 | 0.66±0.05 | ∞ | t |
| 41 | 1.50±0.08 | 2.23±0.08 | sm | 103 | 0.65±0.03 | ∞ | t |
| 42 | 1.42±0.05 | 2.87±0.13 | sm | 104 | 0.65±0.06 | ∞ | t |
| 43 | 1.02±0.03 | 2.74±0.23 | sm | 105 | 0.63±0.02 | ∞ | t |
| 44 | 1.01±0.05 | 2.14±0.13 | sm | 106 | 0.63±0.01 | ∞ | t |
| 45 | 0.96±0.04 | 1.77±0.03 | sm | 107 | 0.61±0.05 | ∞ | t |
| 46 | 0.93±0.04 | 2.84±0.23 | sm | 108 | 0.59±0.03 | ∞ | t |
| 47 | 0.93±0.05 | 2.80±0.14 | sm | 109 | 0.58±0.03 | ∞ | t |
| 48 | 0.92±0.02 | 2.53±0.14 | sm | 110 | 0.57±0.03 | ∞ | t |
| 49 | 0.92±0.03 | 1.75±0.06 | sm | 111 | 0.56±0.01 | ∞ | t |
| 50 | 0.91±0.04 | 2.66±0.11 | sm | 112 | 0.55±0.02 | ∞ | t |
| 51 | 0.91±0.07 | 2.76±0.12 | sm | 113 | 0.55±0.01 | ∞ | t |
| 52 | 0.90±0.04 | 2.84±0.10 | sm | 114 | 0.54±0.04 | ∞ | t |
| 53 | 0.88±0.04 | 2.56±0.06 | sm | 115 | 0.54±0.03 | ∞ | t |
| 54 | 0.84±0.04 | 1.85±0.11 | sm | 116 | 0.53±0.02 | ∞ | t |
| 55 | 0.81±0.04 | 1.84±0.07 | sm | 117 | 0.53±0.04 | ∞ | t |
| 56 | 0.80±0.04 | 1.85±0.11 | sm | 118 | 0.52±0.01 | ∞ | t |
| 57 | 0.80±0.03 | 1.85±0.12 | sm | 119 | 0.50±0.03 | ∞ | t |
| 58 | 0.80±0.04 | 1.85±0.11 | sm | 120 | 0.44±0.03 | ∞ | t |
| 59 | 0.79±0.05 | 2.61±0.07 | sm | 121 | 0.41±0.06 | ∞ | t |
| 60 | 0.79±0.05 | 2.63±0.04 | sm | 122 | 0.33±0.05 | ∞ | t |
| 61 | 0.79±0.08 | 2.83±0.17 | sm | 123 | 0.31±0.04 | ∞ | t |
| 62 | 0.76±0.08 | 1.81±0.06 | sm |  |  |  |  |

The chromosomes are not paired. m= metacentric chromosome; sm= submetacentric chromosome; st= subterminal chromosome; t= terminal chromosome. L/S= long arm/short arm.

**Supplementary Table S5** *Genitic distance based on inter-simple sequence repeat (ISSR) between 24 individuals of the hybrid fishes and their parents*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | PS1 | PS2 | PS3 | PS4 | PS5 | PS6 | PS7 | PS8 |
| P1 | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2 | 0.0674  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3 | 0.0733  | 0.0388  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4 | 0.0445  | 0.0674  | 0.0969  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P5 | 0.0164  | 0.0616  | 0.0674  | 0.0388  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P6 | 0.0332  | 0.0674  | 0.0969  | 0.0220  | 0.0275  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P7 | 0.0791  | 0.0559  | 0.0850  | 0.0559  | 0.0616  | 0.0445  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P8 | 0.1090  | 0.0733  | 0.1029  | 0.0733  | 0.0910  | 0.0733  | 0.0388  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| S1 | 0.9383  | 0.9109  | 0.8711  | 0.9109  | 0.9245  | 0.9109  | 0.9109  | 0.8974  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| S2 | 0.9109  | 0.9383  | 0.8711  | 0.9383  | 0.9245  | 0.9109  | 0.9383  | 0.9245  | 0.0910  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| S3 | 0.9109  | 0.9383  | 0.8974  | 0.9383  | 0.9245  | 0.9109  | 0.9383  | 0.9245  | 0.0910  | 0.0559  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |
| S4 | 0.9109  | 0.9383  | 0.8974  | 0.9383  | 0.9245  | 0.9109  | 0.9383  | 0.9245  | 0.0910  | 0.0559  | 0.0000  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |
| S5 | 0.8711  | 0.8711  | 0.8582  | 0.8974  | 0.8842  | 0.8711  | 0.8711  | 0.8582  | 0.1335  | 0.0733  | 0.0850  | 0.0850  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |  |
| S6 | 0.9245  | 0.9245  | 0.8842  | 0.9808  | 0.9383  | 0.9245  | 0.9523  | 0.9664  | 0.1212  | 0.1212  | 0.0850  | 0.0850  | 0.1273  | \*\*\*\* |  |  |  |  |  |  |  |  |  |  |
| S7 | 0.9109  | 0.9109  | 0.8711  | 0.9383  | 0.9245  | 0.9109  | 0.8842  | 0.8711  | 0.1398  | 0.1523  | 0.1273  | 0.1273  | 0.1460  | 0.1460  | \*\*\*\* |  |  |  |  |  |  |  |  |  |
| S8 | 0.8455  | 0.8711  | 0.8582  | 0.8711  | 0.8582  | 0.8455  | 0.8205  | 0.8082  | 0.1335  | 0.1335  | 0.1090  | 0.1090  | 0.1273  | 0.1523  | 0.1090  | \*\*\*\* |  |  |  |  |  |  |  |  |
| PS1 | 0.5610  | 0.5998  | 0.6300  | 0.5802  | 0.5900  | 0.5421  | 0.5421  | 0.5705  | 0.4028  | 0.3551  | 0.3551  | 0.3551  | 0.3171  | 0.3787  | 0.3397  | 0.3321  | \*\*\*\* |  |  |  |  |  |  |  |
| PS2 | 0.5802  | 0.5610  | 0.5900  | 0.5421  | 0.5705  | 0.5421  | 0.5236  | 0.5328  | 0.4191  | 0.3866  | 0.3551  | 0.3551  | 0.3474  | 0.3787  | 0.3551  | 0.3321  | 0.1273  | \*\*\*\* |  |  |  |  |  |  |
| PS3 | 0.5236  | 0.5610  | 0.5705  | 0.5236  | 0.5328  | 0.4875  | 0.5054  | 0.5328  | 0.4528  | 0.4028  | 0.3866  | 0.3866  | 0.3947  | 0.3947  | 0.3707  | 0.3787  | 0.0910  | 0.0791  | \*\*\*\* |  |  |  |  |  |
| PS4 | 0.5145  | 0.5705  | 0.5802  | 0.5328  | 0.5421  | 0.5145  | 0.5145  | 0.5236  | 0.3787  | 0.3629  | 0.3474  | 0.3474  | 0.3397  | 0.3551  | 0.3474  | 0.2950  | 0.0850  | 0.0969  | 0.0850  | \*\*\*\* |  |  |  |  |
| PS5 | 0.5610  | 0.5421  | 0.5328  | 0.5802  | 0.5705  | 0.5610  | 0.5236  | 0.5328  | 0.3707  | 0.3551  | 0.3707  | 0.3707  | 0.3474  | 0.3629  | 0.3246  | 0.3171  | 0.1651  | 0.1523  | 0.1651  | 0.1587  | \*\*\*\* |  |  |  |
| PS6 | 0.5515  | 0.5705  | 0.5802  | 0.5515  | 0.5421  | 0.5328  | 0.4964  | 0.5236  | 0.3787  | 0.3787  | 0.3629  | 0.3629  | 0.3707  | 0.3707  | 0.3171  | 0.3551  | 0.1212  | 0.1335  | 0.0969  | 0.0791  | 0.1460  | \*\*\*\* |  |  |
| PS7 | 0.5236  | 0.5236  | 0.5515  | 0.5421  | 0.5328  | 0.5236  | 0.4875  | 0.5145  | 0.3866  | 0.3707  | 0.3866  | 0.3866  | 0.3321  | 0.3787  | 0.3397  | 0.2877  | 0.1911  | 0.1911  | 0.1780  | 0.1587  | 0.0910  | 0.1460  | \*\*\*\* |  |
| PS8 | 0.5515  | 0.5515  | 0.5802  | 0.5515  | 0.5610  | 0.5515  | 0.5145  | 0.5236  | 0.3474  | 0.3629  | 0.3629  | 0.3629  | 0.3397  | 0.3707  | 0.3171  | 0.3246  | 0.1977  | 0.1715  | 0.1977  | 0.1780  | 0.0850  | 0.1651  | 0.0850  | \*\*\*\* |

P=*P. ping*; S=*S. wangchiachii*; PS=The hybrid fishes.



#### Supplementary Figure S1 The morphological clustering by euclidean distance in the hybrid fishes and their parents; *P=P. pingi*, n=30; S=*S. wangchiachii*, n=30; PS= the hybrid fishes, n=30.



#### Supplementary Figure S2 The original inter-simple sequence repeat (ISSR) genetic clustering based on unweighted pair group method average (UPGMA) in the hybrid fishes and their parents by Popgen 1.32; *P. pingi*, n=8; *S. wangchiachii*, n=8; the hybrid fishes, n=30



#### Supplementary Figure S3 The inter-simple sequence repeat (ISSR) patterns in the hybrid fishes and their parents; (a) ISSR pattern amplified by primer (GA)8CTA; (b) ISSR pattern amplified by primer (GAA)6; 1-8: *P. pingi*; 9-16: *S. wangchiachii*; 17-24: the hybrid fishes

**References**

Dai YG and Han FH 2018. Karyological Analysis of Two Species in the Subfamily Schizothoracinae (Cypriniformes: Cyprinidae) from China, with Notes on Karyotype Evolution in Schizothoracinae. Turkish Journal of Fisheries and Aquatic Sciences 18, 175-186.

Ganai FA, Yousuf AR, Dar SA, Tripathi NK and Wani SU 2011. Cytotaxonomic status of Schizothoracine fishes of Kashmir Himalaya (Teleostei: Cyprinidae). Caryologia 64, 435-445.

Kalbassi MR, Hosseini SV and Tahergorabi R 2008. Karyotype analysis in *Schizothorax zarudnyi* from Hamoon Lake, Iran. Turkish Journal of Fisheries and Aquatic Sciences 8, 335-340.

Lakara WS, John G and Barat A 1997. Cytogenetic studies on endangered and threatened fishes. II karyotypes of two species of snow-trout, *Schizothorax richardsonii* (Gray) and *S. kumaonensis* (Menon). Proceedings of the National Academy of Sciences India Section B (Biological Sciences) 67, 79-81.

Li Y, Li K, Gui J and Zhou D 1987. Studies on the karyotypes of Chinese Cyprinid fishes XI. Karyotypes of two species of Schizothoracinae and three species of Gobiobotinae. Acta Hydrobiologica Sinica 11, 184-186.

Rishi KK, Singh J and Kaul MM 1983. Chromosomal analysis of *Schizothoraichthys progastus* (McClelland) (Cyprinidae: Cypriniformes). Chromosome Information Service 34, 12-13.

Yu X and Li Y 1900. Karyotype studies of cyprinid fishes in china-Comparative study of the karyotypes of 8 species of Schizothoracine fishes. Journal of Wuhan University (Natural Science Edition) 2, 97-104.

Yu X, Zhou D, Li Y, Li K 1989. Chromosomes of Chinese fresh-water fishes. Science Press, Beijing, China.

Zan R, Liu W and Song Z 1985. [Tetraploid-hexaploid](http://xueshu.baidu.com/usercenter/paper/show?paperid=6b1834602f993a0492b29551d549271f" \t "http://xueshu.baidu.com/usercenter/paper/_blank) relationship in Schizothoracinae. Journal Genetics Genomics 12, 137-142+167-168.