An Occurrence of Intergeneric Hybrid Cross, *Pungtungia herzi* X *Pseudopungtungia nigra* from the Ungcheon River, Korea

Ik-Soo Kim, Youn Choi* and Jae-Hwan Shim**
Dept. of Biology, Chonbuk National University, Chonju 560–756, Korea
*Dept. of Marine Development, Kunsan National University, Kunsan 573–360, Korea
**Seo Kang Junior College, Kwangju 500–170, Korea

A suspected intergeneric hybrid cross between *Pungtungia herzi* and *Pseudopungtungia nigra* was collected at the Ungcheon River. Overall hybrid index did not show the hybrid connection clearly, but the most striking key character between two genus, pigmentation on the all fins except pectoral, the shape and position of the mouth part appeared to show the intermediary. So this specimen was thought to be an intergeneric natural hybrid which merits further study.

Introduction

Many hybrids among the teleost fishes have been artificially produced and considerable number of natural hybrids have been also discovered especially in freshwater fishes (Trautman, 1981). In Korea, there have been reports on the occurrence of hybrid in cobitid fishes in the Dongjin River (Kim, 1985) and on the subspecies of the genus *Pungitius* (Chae and Yang, 1990).

During the environmental survey at the lower parts of the Ungcheon River, locating in mid-western Korea Peninsula from June to August, 1988, one suspected intergeneric hybrid specimen was collected. Subsequent examination revealed that it could be a probable hybrid cross of *Pungtungia herzi* and *Pseudopungtungia nigra*. *Pungtungia herzi* is widely distributed in almost all rivers and lakes of the Southern Korea, while *Pseudopungtungia nigra*, an endemic species, is restricted to the Kum River, the Mankyung River and the Ungcheon River (Choi, 1973). These two species become particular interest as they appear to have close phylogenetic affinity for their morphological similarities and rather distinctive zoogeographic distributional patterns.

The occurrence of this hybrid prompted us a study to verify its systematic status and to provide a morphometric, meristic and descriptive analysis of this hybrid.

Material and Methods

The single hybrid (82.5 mm, TL) specimen was collected in the Ungcheon-
monyon, Boryung-gun, Chungnam-do, Korea. The suspected hybrid brought in the laboratory and fixed in 10% formalin solution. To examine the character expression of the hybrid, 32 characters were selected for analysis, all of which are generally used to describe the morphology of cyprinids. Methods for counting were followed Hubbs and Lagler (1958). Measurements of specimen were made using vernier calipers (0.05 mm) and were estimated to nearest 0.1 mm.

Identification of the hybrid was based on the criterion of Hubbs (1955), i.e. the morphometric and meristic intermediary of the hybrids in most characters with respect to the parental species. Although individual characters were not always intermediated between the parental values, intermediary of the typical characters of the putative parent species which are the key generic and species characters, was the primary evidence for indentifying natural hybrid. Hybrid specimen is deposited in the Department of Biology, Chonbuk National University.

Results

**Fish fauna from the studied area:** A total of 134 fish specimens were collected which were composed of 3 family, including 12 species (Table 1). Among the 12 species, 10 species were the Cyprinidae, and others were Plecoglossidae and Gobiidae. The dominant species was *Tridentiger obscurs*, which comprised 39% of the all collected specimens.

Cyprinids other than *Pungtungia herzi* and *Pseudopungtungia nigra* were ruled out as possible parents by examining the key generic and species characters and constructing preliminary hybrid indices. The suspected parents, *Pungtungia herzi* and *Pseudopungtungia nigra* accounted for 9% and 1% of the all specimens, respectively.

**Description:** Data for 18 morphometric and 3 meristic characters are summarized in Table 2. Hybrid in dices were intermediated for four characters, closer to *Pungtungia herzi* in four characters and closer to *Pseudopungtungia nigra* in four characters. Some hybrid characters were within the range for both parents, while some mean characters were considered to be extreme and thus outside the range. Body depth (expressed as proportions of the standard length, SL) and eye diameter (as proportions of the head length) were greater than the mean for either parent while caudal peduncle length (as proportions of the head length), interorbital width (as proportions of the eye diameter) were lower than the mean for either parents. The

<table>
<thead>
<tr>
<th>species</th>
<th>number of individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Plecoglossus attivelis</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Acheilognathus intermedia</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Acheilognathus yamatsutae</em></td>
<td>3</td>
</tr>
<tr>
<td><em>Cobitis striata</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Carassius auratus</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Zacco platypus</em></td>
<td>24</td>
</tr>
<tr>
<td><em>Zacco temmincki</em></td>
<td>14</td>
</tr>
<tr>
<td><em>Pseudogobio esocinus</em></td>
<td>6</td>
</tr>
<tr>
<td><em>Squalidus maizimae</em></td>
<td>15</td>
</tr>
<tr>
<td><em>Pungtungia herzi</em></td>
<td>12</td>
</tr>
<tr>
<td><em>Pseudopungtungia nigra</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Tridentiger obscurs</em></td>
<td>52</td>
</tr>
</tbody>
</table>
intermediated hybrid indices (30-70) were head length, distance from the snout to pectoral fin and caudal peduncle length/caudal peduncle depth and the numbers of lateral line scale. The others were same mean value as their parents.

Above all, the most striking intermediate characters occurred in the aspects of the pigmentation on the all fins except pectoral (Fig.1), and the morphology and position of the mouth (Fig.2), which are the key generic and species characters. That is, the genus *Pseudopungtungia* having inferior and horse-shoe shaped mouth, and all fins except pectoral with distinct broad black cross bars while the genus *Pungtungia* have terminal mouth, well developed flesh substance around the mouth part and no pigmentation on the fins. However the hybrid have intermediate type mouth and diffusely pigmented cross bars on the fins.
Fig. 2. Ventral view of the mouth parts
A. Pseudopuntungia nigra  B. Hybrid  C. Puntungia herzi

Discussion

A single suspected hybrid (Fig.3) collected at the Ungcheon River was considered to be a hybrid between Puntungia herzi and Pseudopuntungia nigra. Although the overall hybrid index did not indicated the hybrid connection clearly, the most striking intermediate characters, pigmented black cross bars on the all fins except pectoral, the shape and position of mouth part which are the key generic characters showed the intermediate form.

The probability of hybridization between fish species is increased by crowding of spawning fishes, removal of isolating barriers, environmental stress or a scarcity of one species relative to a related abundant species (Hubbs, 1955). It is thought to be that the latter two circumstances may have aided the principal causative agent of hybridization between the two species.

The hybrid was originally described as a species by Goldsborough and Clark (1908, cited in Stauffer et al., 1979) and subsequently redefined as a hybrid by Raney (1940). This situation is not unique in the ichthyological literatures. Wagner (1969) listed several differences between hybrids and species, including the duration of the taxon and the number of generations. Hubbs et al. (1943, cited in Stauffer et al., 1979) also addressed this problem and indicated that hybrids are usually too few to represent an established species, and have characteristics which are
Table 2. Comparison of proportional measurements of the hybrid *P. herzi* × *P. nigra* with parental type

<table>
<thead>
<tr>
<th>Characters</th>
<th><em>P. herzi</em></th>
<th>Hybrid</th>
<th><em>P. nigra</em></th>
<th>Hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>Standard length, mm</td>
<td>55.3–79.9</td>
<td>82.5</td>
<td>52.5–80.7</td>
<td>-100</td>
</tr>
<tr>
<td>Proportions of standard L.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body depth</td>
<td>4.0–4.6</td>
<td>4.4</td>
<td>4.5</td>
<td>4.3</td>
</tr>
<tr>
<td>Head length</td>
<td>3.4–3.8</td>
<td>3.7</td>
<td>4.2</td>
<td>4.6</td>
</tr>
<tr>
<td>Dorsal fin</td>
<td>1.8–2.0</td>
<td>1.9</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Pectoral fin</td>
<td>3.2–3.7</td>
<td>3.5</td>
<td>3.8</td>
<td>4.1</td>
</tr>
<tr>
<td>Ventral fin</td>
<td>1.8–1.9</td>
<td>1.9</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Anal fin</td>
<td>1.3–1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>P–V</td>
<td>4.0–4.4</td>
<td>4.2</td>
<td>4.1</td>
<td>3.7</td>
</tr>
<tr>
<td>Caudal peduncle length</td>
<td>4.6–5.6</td>
<td>4.9</td>
<td>4.8</td>
<td>5.3</td>
</tr>
<tr>
<td>Caudal peduncle depth</td>
<td>7.8–8.7</td>
<td>8.4</td>
<td>7.7</td>
<td>7.5</td>
</tr>
<tr>
<td>Proportions of head length</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caudal peduncle length</td>
<td>1.2–1.6</td>
<td>1.4</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Caudal peduncle depth</td>
<td>2.1–2.5</td>
<td>2.3</td>
<td>1.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Snout length</td>
<td>2.3–2.7</td>
<td>2.5</td>
<td>2.5</td>
<td>2.3</td>
</tr>
<tr>
<td>Eye diameter</td>
<td>4.2–4.6</td>
<td>4.4</td>
<td>4.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Inter-orbital width</td>
<td>2.8–3.1</td>
<td>3.0</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Barbel length</td>
<td>5.1–6.5</td>
<td>5.8</td>
<td>7.5</td>
<td>13.7</td>
</tr>
<tr>
<td>Proportions of eye diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inter-orbital width</td>
<td>0.6–0.8</td>
<td>0.7</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Barbel length</td>
<td>1.1–1.6</td>
<td>1.3</td>
<td>1.6</td>
<td>3.5</td>
</tr>
<tr>
<td>CPL/CPD</td>
<td>1.6–1.9</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>No. dorsal fin rays</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>No. anal fin rays</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Lateral line scales</td>
<td>37–38</td>
<td>38</td>
<td>38–39</td>
<td></td>
</tr>
</tbody>
</table>

clearly intermediate between the putative parents. Probably the best evidence of the role of hybridization in the process of evolution of fishes was demonstrated by Hubbs and Hubbs (1932) when they reported apparent parthenogenesis in a hybrid Poeciliidae. Hubbs (1961) also hypothesized that the genus *Carassius* may have been of hybrid origin between carp and goldfish. It is suggested that hybridization may be a viable mode of speciation.

In spite of subsequent several trials at the studied area, we could not find out any more hybrid specimens. Therefore, we tentatively concluded the studied specimen as an intergeneric natural hybrid. Further study with more hybrid samples is needed to determine the exact status of hybrid.

References


돌고기 *Pungtungia herzi*와 감돌고기 *Pseudopungtungia nigra* (Pisces; Cyprinidae)의 屬間 自然雛種의 發生


 돌고기 *Pungtungia herzi*와 감돌고기 *Pseudopungtungia nigra* (Pisces; Cyprinidae)의 屬間 自然雛種의 發生

김익수* · 최 윤** · 심재환***

전북대학교 자연과학대학 생물학과
*군산대학교 해양개발학과
**서강실업전문대학

1988년 6월에서 8월 사이에 중남 보령군 웅천면 웅천천에서 어류상을 조사하던 중 돌고기 *Pungtungia herzi*와 감돌고기 *Pseudopungtungia nigra* 사이의 屬間 雛種이라 의심되는 개체를 채집하였다. 形態形質과 計測形質의 비교조사 결과, 두 屬間의 key character인 지느리미 반분의 pigmentation, 그리고 입의 모양과 위치등에서 중간형질 (intermediary)을 보여주고 있어서 본 개체는 두 屬間의 自然雛種이라 생각되었다.