Morphological and behavioral traits of a wild hybrid Eurasian Wigeon x Falcated Duck male found at Hyo-ko Waterfowl Park, Niigata, Japan

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Abstract In the course of our fieldwork study at Hyo-ko Waterfowl Park, a local preserve in Niigata Prefecture, Japan, we found a male presumed wild hybrid between a Eurasian Wigeon Anas penelope and a Falcated Duck A. falcata in 2007; another or possibly the same individual was found again in 2009. The bird shared morphological traits with both species, although it was biased toward the Falcated Duck. Occasionally, the bird joined courting parties of Eurasian Wigeon, followed Wigeon females or competed with Wigeon males, and also showed courtship displays, e.g. Grunt-whistle, Head-up-tail-up, and Burping call, all of which were more like those of the Falcated Duck than those of the Eurasian Wigeon. Thus, the hybrid bird was sexually active to a considerable extent, but it remains unknown whether or not it actually formed a pair bond with a female of either parent species.

Key words Courtship display, Eurasian Wigeon, Falcated Duck, Hybrid, Morphological and behavioral traits

Hybrids occur frequently in captivity, where the choice of potential mates is limited. In general, the availability of mates, imprinting, and disturbed habitats are considered to be the causes of hybridization in the wild (McCarthy 2006). Among the dabbling ducks (Anas spp.), hybridization in the wild is common; e.g. hybrids of the Eurasian Wigeon Anas penelope with the Mallard A. platyrhynchos, Garganey A. querquedula, Chiloe Wigeon A. sibilatrix, Gadwall A. strepera, European Pochard Aythya ferina, Tufted Duck Ay. fuligula, Common Scoter Melanitta nigra, and Red-crested Pochard Netta rufina have previously been documented (Kuroda 1960; Johnsgard 1960, 1965; Randler 2001; McCarthy 2006). Also, hybrids of the Falcated Duck A. falcata with Anas spp, including Eurasian Wigeon and with Shelducks Tadorna spp. (Johnsgard 1960, 1965; McCarthy 2006) have been described, as well. It is generally known that hybridization causes sterility and reduces the survival of the hybrid and its offspring. Nevertheless, the dabbling ducks show remarkable interspecific hybrid fertility (Johnsgard 1960; McCarthy 2006). In this context, knowledge about the morphology, degree of sterility/fertility, and sexual behavior of hybrid ducks (Johnsgard 1960, 1965; McCarthy 2006), together with genetic (Steklenev & Marinchuk 1977; Numachi et al. 1983), cytogenetic (Yamashina 1949), and molecular data (Avise 1986; Lin et al. 1990; Muñoz-Fuentes et al. 2007), has contributed to our understanding of the reproductive and evolutionary biology of the waterfowl.

In the course of our field study including bird banding at Hyo-ko Waterfowl Park, a local preserve in Niigata Prefecture, Japan, we came across a male (or males) of a presumed hybrid between Eurasian Wigeon and Falcated Duck, not Eurasian Teal Anas crecca as evidently shown later. Concerning the hybrids of this type, previous papers have briefly reported on their occurrence and/or external features (Kuroda 1980; McCarthy 2006), but almost no information is available concerning their behaviors and degree of sterility/fertility.

In order to contribute to avian reproduction and evolutionary biology through field study of hybrid waterfowl, this paper describes the external features
and sexual behavior of this hybrid found in flocks of Eurasian Wigeon on their wintering grounds; because very little is known about relevant aspects of these subjects, in particular, the behavioral aspects of the possible mating process in hybrids (Chiba et al. 2006).

STUDY SITES AND METHODS

1) Study sites
Field observations were conducted at three sites: Hyo-ko Waterfowl Park (30.4 ha area including water surface, 37°50′N, 139°14′E) in Agano City, Bentengata Pond (9 ha, 37°56′N, 139°15′E) in Seiro Town, and the middle reaches of the Shinano River (37°28′N, 138°46′E) in Nagaoka City, Niigata Prefecture, Japan. These sites are well-known local preserves or wintering grounds for waterfowl in Japan, where the Tundra Swan Cygnus columbianus, Mallard, Northern Pintail A. acuta, Eurasian Wigeon, Eurasian Teal, European Pochard, and Tufted Duck are commonly seen; whereas the Falcated Duck is rather uncommon in Hyo-ko Waterfowl Park or Bentengata Pond, it is regularly seen on the Shinano River.

2) Field observations
During the wintering periods from November to January in 2007–2009 years, we used binoculars (8×) and spotting (20×) telescopes to observe the external features and social behavior of the hybrid Eurasian Wigeon×Falcated Duck male, and compared them with those of the Eurasian Wigeon and Falcated Duck. A digital camera (Eos 30D, Canon, Tokyo) equipped with a 100-400 mm zoom lens and a handy video camera (TVR240K, Sony, Tokyo) were also used to take photographs and video images, which were analyzed in combination with field notes. Selected video images were converted into a series of still pictures for detailed analysis of behaviors. We monitored the sexual and social behaviors of the hybrid, classified them into several known types, mainly according to Johnsgard (1965). Field observation was carried out for a total of 23.5 hrs during 21 days over two winters, 2007/2008 and 2009; and the frequency of the hybrid’s major displays (number of times / hr) was examined. For this purpose, the number of times that each display was observed was counted during a seven day period from 25 November to 16 December 2009 (total 7.8 hrs); and the value was divided by the total observation time (Table 1).

RESULTS

1) Morphological traits
On 14 November 2007, we found a strange dabbling duck, a presumed hybrid Eurasian Wigeon×Falcated Duck male, at Hyo-ko Waterfowl Park. Two years later, on 13 November 2009, a similar, or perhaps the same individual, was seen again in the same area. The focal bird closely resembled a male Falcated Duck in terms of its breeding plumage, but also had some characteristics of a male Eurasian Wigeon (Fig. 1). These features accord well with a brief description of hybrids of the same type reported previously (Kuroda 1980), although buff triangles are evident in the undertail-coverts of the present hybrid bird (Fig. 1E). No morphological traits of male

<table>
<thead>
<tr>
<th>Male courtship displays</th>
<th>Falcated Ducka)</th>
<th>Eurasian Wigeona)</th>
<th>Hybridb)</th>
<th>Frequencyc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory shake</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>n.c.</td>
</tr>
<tr>
<td>Chin-up call (notes)</td>
<td>(lililili)</td>
<td>(whew or wá-chew)</td>
<td>(unknown)</td>
<td>6.3</td>
</tr>
<tr>
<td>Burping call (notes)b)</td>
<td>(rruh-urr)</td>
<td>–</td>
<td>(unknown)</td>
<td>8.5</td>
</tr>
<tr>
<td>Grunt-whistlec)</td>
<td>+</td>
<td>±</td>
<td>+</td>
<td>1.2</td>
</tr>
<tr>
<td>Head-up-tail-upd)</td>
<td>+</td>
<td>–</td>
<td>+</td>
<td>2.3</td>
</tr>
<tr>
<td>Turn-the-back-of-the head</td>
<td>+</td>
<td>+</td>
<td>unknown</td>
<td></td>
</tr>
<tr>
<td>Lead “Inciting” females</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>n.c.</td>
</tr>
<tr>
<td>Preen-behind-the-wing to female</td>
<td>+</td>
<td>+</td>
<td>unknown</td>
<td></td>
</tr>
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</table>

+ present, –: absent, ±: not normally found but might occur very rarely
b) main difference in courtship displays between Falcated Duck and Eurasian Wigeon; a) cited from Lorenz and von de Wall (1960) and Johnsgard (1965) with a slight modification based on our field observations; b) present data; c) frequency (number of times/hr) of each display during seven days from 25 November to 16 December 2009 (total 7.8 hrs). n.c.: not counted
Eurasian Teal were found in this bird (Fig. 2). Moreover, in size, the focal bird was nearly the same size or larger than a male Eurasian Wigeon, which is considerably larger than a male Eurasian Teal. Thus, it is reasonable to identify the focal bird as male Eurasian Wigeon/H11003 Falcated Duck. By the middle of November 2007, its plumage was largely in breeding condition, with the exception of some brown feathers on its flanks and breast, which were in the eclipse stage; the tertials continued to elongate until early January 2008 (Figs. 3A–C). When the bird was (re)found in 2009, it was already in full breeding plumage.

2) Behavioral traits

In 2007, the hybrid was found in a flock of Eurasian Wigeon and showed considerable site-fidelity within the Hyo-ko Waterfowl Park. During its stay from 14 November 2007 to 12 January 2008, it tended to be solitary, but occasionally joined flocks when they rested on the surface or foraged for food at the shore (Figs. 3D, E). We did not observe it joining courting parties of Eurasian Wigeon, but occasionally we observed agonistic behavior (pecking and threatening with a bill-tilting posture) toward Eurasian Wigeon and other waterfowl. The bird seen in 2009 also showed similar site-fidelity, but in contrast to our 2007/2008 observations it was socially active. It was found in a flock of Eurasian Wigeon, was accustomed to artificial feeding, and sometimes showed agonistic behavior toward the wigeon and other dabbling ducks (Figs. 3F, G). The hybrid uttered calls frequently (Fig. 4), joined Eurasian Wigeon courting parties (Figs. 5A–C), and showed courtship displays similar, in some aspects, to those of the Falcated Duck (Figs. 5C, D1–4, E1–5). Such sexual activity by the hybrid may have represented compensational behavior at a site where proper subjects for mating, i.e. female Falcated Duck were not available. In contrast to the moderately loud whistled call of male Eurasian Wigeon, i.e. a one-syllable whew or two-syllable wá-chew, the call of the focal hybrid was difficult to hear and to record against the noisy background of a
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Fig. 2. External features of male presumed hybrid Eurasian Wigeon × Falcated Duck (A) and Eurasian Teal (B) for comparison. Some of the morphological traits characteristic of Eurasian Teal, e.g. black bill, whitish lines of the face, buff breast with dusky spots, distinct white scapular line, and brownish gray tertials, are not found in the hybrid. Scale bar = 5 cm

Fig. 3. A–C: Plumage changes in the hybrid seen in the early winter, 2007. Elongating tertials (indicated by thick arrows) and feathers in the eclipse stage (indicated by thin arrows) are also shown. D and E: Foraging activity of a flock of Eurasian Wigeon with the hybrid male (arrow). F and G: Agonistic behavior of the hybrid toward Eurasian Wigeon (right in “F”) and Northern Pintail (right in “G”).
Fig. 4. Comparison of calling postures of the hybrid male (A\(_{1,3}\) and B\(_{1,3}\)) and Eurasian Wigeon male (C\(_{1,3}\)). A: Burping call postures. B and C: Chin-up call postures. Movements of the bill and head at the moment of calling are shown in a series of pictures, A\(_{1,3}\), B\(_{1,3}\), and C\(_{1,3}\) (1-3 frames taken at about 0.3-second intervals).

Fig. 5. A–C: Courting activities in a flock of Eurasian Wigeons. Courtship display (A and C) and agonistic behavior (B) of Eurasian Wigeon × Falcated Duck hybrid male (indicated by asterisk) are shown. The arrows in “B” and “C” indicate a female wigeon giving an “Inciting” display toward a presumptive mate. D\(_{1,4}\), E\(_{1,5}\). A series of pictures showing the “Grunt-whistle” displays of the hybrid and a Falcated Duck male, respectively.
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waterfowl gathering. However, careful observation of the bird’s bill movements and postures suggests that it uttered at least two types of calls. One posture was comparable to that of the “neck-stretching burp” of the Falcated Duck and Gadwall (Figs. 4A₁₋₄; C₁₋₄). The other, to that of the “chin-up call” of the Eurasian Wigeon, though the degree of chin-up movement of the hybrid was not so strong as that of a Eurasian Wigeon (Figs. 4B₁₋₃, C₁₋₃). Within courting parties of Eurasian Wigeon, the hybrid behaved actively, as if it was a bachelor wigeon. It followed wigeon female(s) with or without a favored male (or presumptive mate) and sometimes showed agonistic competitive behaviors toward rival males (Figs. 5A, B). Such behaviors of the males and the hybrid sometimes induced “inciting display (females’ initiative in choosing their mates toward the preferred male)” in a female with a presumptive mate (Figs. 5B, C). Importantly, the courtship displays of the hybrid differed from those of male Eurasian Wigeon but rather resembled those a male Falcated Duck; i.e. one of these displays was comparable to the “Head-up-tail-up” display, which was characterized by crest erection and body lifting while calling (Fig. 5C). The other was similar to the “Grunt-whistle” (Figs. 5D₁₋₄), which is common to the Falcated Duck and other dabbling ducks, but which is thought to have been subsequently lost or is presumed to occur only very rarely in wigeon (Table 1, Johnsgard 1965). In detail, the “Grunt-whistle” of the hybrid was not as spectacular as that of the Falcated Duck (Figs. 5D₁₋₄, E₁₋₄), as the head- and tail-lifting movements of the hybrid were not so vigorous (Figs. 5D₁₋₄, D₁₋₄). Moreover, the quick bow at the beginning (Fig. 5E₂) and the head/neck-throw at the end (Fig. 5E₃) of the Falcated Duck’s display were absent in the hybrid. The sexual behaviors frequency of major courtship displays of the hybrid and its presumptive parent species were compared (see Table 1).

Unfortunately, it is not known whether or not the hybrid successfully formed a pair bond with a female wigeon, because it disappeared from the study area in the middle of December, 2009 and did not return.

**DISCUSSION**

The strange waterfowl we found at Hyo-ko is identifiable as a male Eurasian Wigeon × Falcated Duck hybrid male with the morphological and behavior traits biased toward the Falcated Duck. In respect of social and sexual behaviors, the bird was considerably active in flocks of Eurasian Wigeon, but successful pair formation was not confirmed. These findings together with our previous data (Chiba et al. 2006) may contribute to ethological evaluation of sexual isolation between taxonomically valid species, because the degree of sterility/fertility varies among hybrid waterfowl (Yamashina 1949; Johnsgard 1960; McCarthy 2006).

Relatively little information is available regarding the occurrence of hybrids between Eurasian Wigeon and Falcated Duck in the wild, and what is available refers only to their locality, date, sex, and morphological traits (Kuroda 1939, 1980; Johnsgard 1960; McCarthy 2006). According to McCarthy (2006), most of the focal hybrids are males. Kuroda (1980) also reported that nine examples recorded in Japan were all males. In general, female hybrids are extremely hard to detect (McCarthy 2006) and so are typically overlooked. This bias toward recording male hybrids and not female hybrids arises because most male waterfowl have conspicuous and readily identified plumage features, whereas the females are cryptic and inconspicuous with few identifiable plumage characters. Also, this sexual bias may be consistent with Haldane’s rule. With regards to the topographic distribution of wild hybrid Eurasian Wigeon × Falcated Duck, the literature suggests that they tend to occur within a restricted region, i.e. East Siberia and the Far East (McCarthy 2006), where the breeding ranges of the two species overlap (Johnsgard 1978). It is reasonable to assume that in this region, the hybrid zone (McCarthy 2006), males and females of different species can interface and the opportunity for hybridization occurs. An overlap of wintering ranges seems to be significant for the initial stage of hybridization, because most waterfowl initiate pair bonding on their wintering grounds, where temporal sympatry may be a possible context for hybridization.

In terms of morphology and behavior, the hybrid studied shared traits with both parental species, but as a whole was biased toward the Falcated Duck. This hybrid appeared to be socially active, occasionally joined flocks of Eurasian Wigeon, and was sexually active showing Falcated Duck-like displays when in the courting parties. We cannot explain exactly why and how this complicated situation in morphological and behavioral traits was brought about, although similar phenomena have occasionally been seen in other hybrids, e.g. our previous study on hybrid male Baikal Teal × the Northern Pintail (Chiba et al. 2006).
Among waterfowl during courting, males display directly to females, and females chooses from among the courting males (Weidmann 1956; Weidmann & Darley 1971). Pairing may then occur. Pair bonding is characteristic of mating systems in all tribes of Anatidae (Delacour & Mayr 1945; Kear 1970); and strong pair formation (e.g. by attentiveness of the male partner) is important for fertile egg production and incubation by the female, as for example in the case of Canvasback Aythya valisineria (Bluhm 1983). In this context, the hybrid male may have handicaps in terms of reproductive performance. At the initial stage of pair formation, the courtship displays of the hybrid male may not attract the interest of female wigeon, because its behavior obviously differed from that of pure male wigeon, probably resulting in failure of pair formation. Unusual external features of the hybrid male may have similar effects. However, the concern of such morphological traits in pair formation was not verified in the present study. Our previous study on a wild hybrid male Baikal Teal×Northern Pintail male may represent positive data for pair formation between a hybrid male and a normal pintail female, but their pair bond was unsuccessful. The failure may be ascribed to a size handicap in the hybrid male; i.e. the smaller hybrid appeared to be at a disadvantage as a mate guard, when competing with larger pintail males and ultimately losing its pair bond (Chiba et al. 2006). Female choice in waterfowl was studied experimentally in Northern Pintail in an outdoor facility (Sorenson & Derrickson 1994), and it was demonstrated that (1) females choose males based on a suite of morphological (pure white breast and colorful scapulars) and behavioral (more courting and more attentiveness) characteristics, (2) male dominance relationships do not constrain active female choice, (3) a male’s position in a dominance hierarchy is largely a result, rather than a cause, of female choice, and (4) female choice plays a more significant role than male-male competition in the evolution of several secondary sexual traits in male Northern Pintail. Currently, no such data are available for the Falcated Duck and Eurasian Wigeon.

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