Rapid Communication

First report of the Black-headed python (*Aspidites melanocephalus* Krefft, 1864) found in the wild in the Republic of Korea

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Abstract

As the pet industry continues to grow worldwide, reptile species have become increasingly popular, which has increased the trade of these species. However, as various species are bred, some are discovered in the wild after being lost or abandoned, which can result in ecosystem disturbances. Accordingly, in this study, we report a black-headed python (*Aspidites melanocephalus*) that was found in the wild for the first time, in the Republic of Korea. At the time of discovery, the deceased python was ascertained to be roadkill, and it appeared to have been killed a few days prior to discovery. The reptile was identified as a black-headed python through its appearance (head color, body stripes, etc.) and DNA analysis. It is suspected that the snake was a lost or abandoned pet. The occurrence of exotic reptiles in the wild may disturb Korean ecosystems. Thus, it is necessary to evaluate the current status of potentially exotic reptiles and improve the management of abandoned animals, especially reptiles.

Key words: invasive reptiles, pet, snake, lost or abandoned, abandoned animal management system

Introduction

The introduction of invasive species is one of the most important factors that reduce biodiversity. (Walker and Stenffen 1997; Fuller 2014). Global establishment of invasive species has become widespread due to new trade routes and commerce (Meyerson and Mooney 2007). In 2020, the Convention on Biological Diversity (CBD) prioritized invasive species management as a collaborative effort worldwide for the conservation of biodiversity.

Currently, the pet industry is growing worldwide, with some species increasingly being traded (Sung and Fong 2018). However, these exotic pets are sometimes abandoned or released. Abandoned, non-native pets found in the wild are classified as invasive species; these species disturb local ecosystems (Singh 2005; Shine 2010; McClure et al. 2018). Problems related to invasive species have arisen, including the spread of disease (Mack et al. 2000), competition with native species (Hoskin 2011), and severe direct or indirect impact on ecosystems (Wiles et al. 2003; Dorcas et al.)
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2012; Willson 2017). Addressing these problems often incurs a considerable economic cost (Huxel 1999; Pimentel et al. 2005; Lovell et al. 2006; Shine 2010).

Reptiles are popular in the pet industry, and their illegal trade is increasing as various species are bred (Sung and Fong 2018; Marshall et al. 2020). An investigation into amphibian and reptile trade on online pet shops in the Republic of Korea in January 2019 revealed that 677 exotic amphibians and reptiles were being traded. Among them, 433 species belonged to the order Squamata (Koo et al. 2020a). Exotic reptiles known to occur in the wild in the Republic of Korea include the common snapping turtle (Chelydra serpentina; Koo et al. 2020b), alligator snapping turtle (Macrochelys temminckii; Koo et al. 2021), western painted turtle (Chrysemys picta bellii; Park et al. 2020), savannah monitor (Varanus exanthematicus; Kim 2016), green iguana (Iguana iguana; Ha 2016), and ball python (Python regius; Lee and Choi 2020). These species are listed on the online trading lists for pet shops (Koo et al. 2020a).

Therefore, to highlight concerns about the abandonment of traded invasive pets, we report the first case of a black-headed python (Aspidites melanocephalus; Krefft 1864) in the wild (Figure 1), found in the Republic of Korea.

Materials and methods

On 22 December 2019, we received a report of a large snake carcass from a citizen (Mi kyung, Kim) in Buam-dong, Seoul, Republic of Korea (37°35′50.42″N; 126°58′12.10″E, altitude 191 m, Figure 2). The snake was found close to a two-way road in a grassland near the southern ridge of Mt. Bukak, and a forested area, which includes agricultural land and houses concentrated in the west (Figure 2B).

At the time of the discovery, the deceased python was determined to be roadkill, and it appeared to have died a few days before discovery. The damaged
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Figure 2. (A) Satellite photo of the black-headed python location in the Republic of Korea (red point). It is close to a forested area with agricultural land. Houses are concentrated in the west. (B) Foreground photo of the discovery site. The deceased python was placed on the rock (white arrow). Photo by Choong Ho, Ham.

Figure 3. (A) The state of the black-headed python at the time of discovery. (B) The snake was approximately 140 cm along each half when folded in half (total length 280 cm). (C) The “jet black” head. (D) The dark striped body. C and D are characteristic of the black-headed python (Cogger 2014).

body had been folded in half on a rock by the grassland along the road (Figure 3A). The total length was measured and estimated to be approximately 280 cm using an unbroken line from head to tail (Figure 3B). We determined
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Table 1. Primers used for DNA amplification.

<table>
<thead>
<tr>
<th>Marker</th>
<th>Primer names</th>
<th>Primer sequences (5'→3')</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control region</td>
<td>Am-F1</td>
<td>ACCACACCTTCCCCAACC</td>
</tr>
<tr>
<td></td>
<td>Am-R1</td>
<td>GCATATATGGTAGTCAGATGAAAG</td>
</tr>
</tbody>
</table>

Table 2. BlastN search results for Am-F1/R1 PCR products. Based on Blast analysis, the species whose sequence had high homology compared with the analyzed sample are described, as well as sequence identity and accession numbers annotated by NCBI.

<table>
<thead>
<tr>
<th>Description</th>
<th>Identity (%)</th>
<th>Accession number</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aspidites melanocephalus</em> isolate ABTC68246 control region, partial sequence; mitochondrial</td>
<td>97.78</td>
<td>EF545085.1</td>
</tr>
<tr>
<td><em>Aspidites ramsayi</em> isolate ABTC55474 control region, partial sequence; mitochondrial</td>
<td>95.41</td>
<td>EF545086.1</td>
</tr>
</tbody>
</table>

the snake to be a black-headed python based on the overall body length, jet black color of the head and dark transverse stripes over a sandy background on the body (Cogger 2014; Figure 3C, D).

To further confirm the identification, we conducted DNA analysis for species identification. The tail tip was sampled using sterilized scissors (~ 1 cm) and transferred into a sterilized tube without solution. The remainder of the snake was donated and stored at the National Institute of Ecology (Invasive Species Research Team).

The sample was processed by Biomedic Co, Ltd (Gyeonggi-do, Republic of Korea). Genomic DNA was extracted from the tail tissue sample using a Biomedic Plant gDNA extraction kit (Biomedic Co., Ltd.), followed by amplification. The primers targeted the control region in the mitochondrial genome (Table 1). The control region sequence is universally used for phylogenetic analysis (Lee et al. 2006; Zhang et al. 2009). The amplified DNA sequences were compared with the reference sequences uploaded on GenBank through the BlastN algorithm provided by the National Center for Biotechnology Information (NCBI, USA). The results showed that the sample had high homology with the black-headed python (97.78% for the control region; Table 2). Therefore, we concluded the snake was a black-headed python.

**Discussion**

The black-headed python is a large reptile native to north Australia, growing up to mean and maximum lengths of 1.5 and 2.5 m, respectively. The head and neck are black, and the whole body has a pattern of dark bands on a lighter background (Cogger 2014). According to current Global Biodiversity Information Facility (GBIF) records, there are no reports of wild black-headed python detections beyond its native distribution. Thus, this observation is of great significance. In Asia, the black-headed python is exceedingly rare (Shea et al. 2017). This species has been part of the Australian pet trade and the European and American pet industries and was identified in a reptile pet shop in Japan in 2007 (Shea et al. 2017). In a Republic of Korea online pet shop, a black-headed python was traded for approximately 2,010 USD (Koo et al. 2020a). Given it was found in winter close to a road, we believe the black-headed python identified in this study
is an escaped or abandoned pet, and that it was road-killed while attempting to find a hibernation site or food.

The black-headed python is a tropical species that is occasionally found in the subtropics, and its primary habitats are seasonally dry tropical and subtropical woodlands, and occasionally humid coastal forests (Cogger 2014; Shea et al. 2017). It is not found in the temperate regions of Australia. The Republic of Korea is in the temperate climatic zone. As such, the possibility of the black-headed python adapting to the local environment and producing a viable population is low. However, the Chinese striped-neck turtle (*Mauremys sinensis*), an invasive species in Europe, has been confirmed hibernating in Europe regardless of its original habitat being a tropical climate (Jablonski et al. 2018). Similarly, the imported red fire ant (*Solenopsis invicta*), which is native to subtropical South America, has become an established invasive species in the Republic of Korea where there is concern about the possibility of it adapting to the wild (Lyu and Lee 2017; Sung et al. 2018). In the context of climate change, it is wise to consider the possibility of adaptation of black-headed pythons to wildlife ecosystems in the Republic of Korea. In addition, this species is several times larger than the size of native local reptiles, and the majority of its diet (92%) is reptiles (Shine 1995). So, smaller native reptiles are more likely to be predated, and particularly endangered species (such as Korean ratsnake, *Elaphe schrenckii*) may be at greater risk. Thus, there is an urgent need to introduce an abandoned animal management system (e.g., a companion animal registration system) to manage unwanted exotic reptiles in the Republic of Korea.

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**Authors’ contribution**

CHH, SMP, JEL contributed to the design and implementation of this study. JP and DHL performed the experiments for DNA analysis. HCS did all parts of this study.

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