

## Is *Opisthorchis viverrini* an avian liver fluke?

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### Abstract

Recently, in the *Journal of Helminthology* (May 2013), Dao *et al.* reported that *Opisthorchis viverrini*-like flukes were found in the bile duct of domestic ducks in Vietnam. They stated that this is the first record of *Opisthorchis* sp. in birds in Vietnam. However, three *Opisthorchis* species – *O. cheelis*, *O. longissimus* and *O. parageminus* – in birds in Vietnam were described by Le in 2000. Amongst these, *O. parageminus* was first reported, by Oshmarin in 1970, as a new *Opisthorchis* species found in domestic ducks (*Anas platyrhynchos*) in Vietnam. Morphologically *O. viverrini*-like flukes described by Dao *et al.* are much more similar to *O. parageminus* than to *O. viverrini*. The phylogenetic trees of internal transcribed spacer 2 (ITS2) and cytochrome oxidase 1 (CO1) gene sequences also showed that the *O. viverrini*-like liver flukes from domestic ducks were closer to *O. lobatus* than to *O. viverrini*. Therefore, *O. viverrini*-like liver flukes reported by Dao *et al.* (2013) are most likely to be *O. parageminus*.

The genus *Opisthorchis* consists of 53 nominal species, including two species pathogenic to humans – *O. viverrini* and *O. felineus*. Of these, 30 species are recorded as the parasites of birds, and the remaining species are parasites of mammals, reptiles, fish and molluscs (<https://insects.tamu.edu/research/collection/hallan/test/Platyhelminthes/Family/Opisthorchiidae.txt>). Among *Opisthorchis* species, *O. viverrini* is the most well-known species because of its close association with cholangiocarcinoma in humans (Mayer & Fried, 2007; Sripa *et al.*, 2012). Cats, dogs and various fish-eating mammals, including humans, are the definitive hosts of *O. viverrini* (Kaewkes, 2003).

Recently, in the *Journal of Helminthology*, Dao *et al.* (2013) reported *Opisthorchis* adult worms from the bile duct of domestic ducks (*Anas platyrhynchos*) and considered them as *O. viverrini*. The authors stated that *Opisthorchis* worms have never been reported in birds in Vietnam

(Dao *et al.*, 2013). However, the book *Fauna of Vietnam*, volume 8, written by Le (2000), provided full information about three avian species of *Opisthorchis* – *O. cheelis* Lal, 1939, *O. longissimus* (Linstow, 1883) and *O. parageminus* Oshmarin, 1970 – which were reported from birds in Vietnam. Among these, *O. parageminus* was reported first as the new *Opisthorchis* species found in domestic ducks (*A. platyrhynchos*) in Vietnam (Oshmarin, 1970). Since Dao *et al.* (2013) compared the morphology of their specimens with *O. viverrini* obtained from a cat in Vietnam (Le, 2000), the authors should have been aware of the presence of three avian *Opisthorchis* in Vietnam, which appeared in the same genus in the same reference book (Le, 2000).

When morphological and morphometric features of *O. viverrini*-like liver flukes from domestic ducks in Vietnam described by Dao *et al.* (2013) were compared with those of *O. viverrini*, there are at least three differences between them: (1) *O. viverrini* has two deeply lobed testes, diagonally arranged and situated near the posterior extremity, whereas *O. viverrini*-like flukes of Dao *et al.* have two deeply lobed testes, which were much larger

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(two times) than those of *O. viverrini* and tandemly arranged near the posterior extremity; (2) the vitellaria of *O. viverrini* possess numerous follicles dispersed as several columnar groups in the lateral fields between ventral sucker and testes, whereas *O. viverrini*-like flukes of Dao *et al.* also have numerous follicles dispersed as several columnar groups in the lateral fields, which are longer than those of *O. viverrini*, close to or extending anteriorly to the ventral sucker; and (3) the excretory bladder of *O. viverrini* is a long, S-shaped sac-like tube running between the two testes, whereas that of *O. viverrini*-like flukes by Dao *et al.* possess a thin, straight tube-like excretory bladder located behind the testes. The morphological characteristics of *O. viverrini*-like liver flukes from ducks by Dao *et al.* (2013) are more compatible with those of *O. parageminus*, which have also been collected from ducks from Vietnam (Oshmarin, 1970; Le, 2000).

Moreover, in the phylogenetic trees of internal transcribed spacer 2 (ITS2) and cytochrome oxidase 1 (CO1) gene sequences provided by Dao *et al.* (2013), the *O. viverrini*-like liver flukes from domestic ducks were closer to *O. lobatus*, which is an avian *Opisthorchis* (Thaenkham *et al.*, 2011), but were separated from *O. viverrini* by the presence of *O. lobatus* in both trees. Since Dao *et al.* (2013) considered the specimens from ducks as *O. viverrini* in these phylogenetic trees, *O. lobatus* should also be included as the intra-species variant in the *O. viverrini* clade. It is regretful that the GenBank accession numbers for the ITS2 and CO1 sequence data of *O. viverrini*-like liver flukes of Dao *et al.* (2013) are not available in the literature or in the DNA database. Access to the GenBank accession numbers of the ITS2 and CO1 sequence data of the isolates in question would also have been desirable.

To our knowledge, *O. viverrini* has never been found in birds. Since *O. viverrini* is a carcinogenic liver fluke, extreme caution is required to study its distribution in the intermediate and definitive hosts, especially in avian hosts such as ducks, or its geographical distribution. Whether *O. viverrini* can really parasitize domestic ducks

could be confirmed by experimental infection of ducks with *O. viverrini* metacercariae from fish.

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### Conflict of interest

None.

### References

- Dao, T.H., Nguyen, T.G., Victor, B., Gabriel, S. & Dorny, P. (2013) *Opisthorchis viverrini*-like fluke in birds from Vietnam: morphological variability and rDNA/mtDNA sequence confirmation. *Journal of Helminthology* doi:10.1017/S0022149X13000400.
- Kaewkes, S. (2003) Taxonomy and biology of liver flukes. *Acta Tropica* **88**, 177–186.
- Le, N.T. (2000) *Fauna of Vietnam*. pp. 236–246. Hanoi, Science and Techniques Publishing House.
- Mayer, D.A. & Fried, B. (2007) The role of helminth infections in carcinogenesis. *Advances in Parasitology* **65**, 239–296.
- Oshmarin, P.G. (1970) Trematodes of domesticated and wild birds in the Democratic Republic of Vietnam. pp. 5–126 in Oshmarin, P.G., Mamaev, Y.L. & Lebedev, B.I. (Eds) *Helminths of animals of Southeast Asia*. Moscow, Nauka (in Russian).
- Sripa, B., Brindley, P.J., Mulvenna, J., Laha, T., Smout, M.J., Mairiang, E., Bethony, J.M. & Loukas, A. (2012) The tumorigenic liver fluke *Opisthorchis viverrini* – multiple pathways to cancer. *Trends in Parasitology* **28**, 395–407.
- Thaenkham, U., Nuamtanong, S., Vonghachack, Y., Yoonuan, T., Sanguankiat, S., Dekumyoy, P., Prommasack, B., Kobayashi, J. & Waikagul, J. (2011) Discovery of *Opisthorchis lobatus* (Trematoda: Opisthorchiidae): a new record of small liver flukes in the Greater Mekong Sub-region. *Journal of Parasitology* **97**, 1152–1158.