Gynandromorph of *Culex inatomii* (Diptera: Culicidae) collected at Yonago Waterbirds Sanctuary, Tottori, Japan

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Abstract: Mosquito collection was carried out monthly using dry-ice traps at Yonago Waterbirds Sanctuary, Tottori Prefecture, Japan, and *Culex inatomii* was found to be present at a high density. One gynandromorph specimen of *Cx. inatomii* was collected in July 2017 and the morphology of the head, abdomen, and anterior claws of the foretarsi and midtarsi was examined and the sex was determined. The head and the right midtarsus were identified as female, whereas the abdomen and the left foretarsus and left midtarsus were male. These results indicated that the specimen had the head of a female, the abdomen of a male, and the thorax was divided bilaterally or obliquely. This gynandromorphic finding is the first report for *Cx. inatomii* worldwide.

Key words: gynandromorphy, *Culex inatomii*, Yonago Waterbirds Sanctuary

**INTRODUCTION**

*Culex inatomii* Kamimura and Wada belongs to subgenus *Barraudius*, which is a small subgenus of *Culex* containing only 4 species so far, including *Cx. modestus* Ficalbi one of the potential vectors of West Nile virus in Europe (Becker et al., 2010). This species is distributed in Japan and the east coast of Korea and China (Tanaka et al., 1979; Xu et al., 1993; Ree, 1998; Mizuta et al., 2012). Recently a widespread outbreak of *Cx. inatomii* occurred in the flat area of Miyagi Prefecture for 4 years after the tsunami caused by the Great East Japan Earthquake in 2011 (Tsuda and Kim, 2013; Tsuda et al., 2016).

The larval habitat of *Cx. inatomii* consists of fresh or brackish water bodies present in reed beds at low elevations near the seashore, and major habitats in Japan are restricted to the east coast facing the Pacific Ocean (Kim et al., 2009; Mizuta et al., 2012), except for the Sakata wetland, Niigata Prefecture, which is located on the western side of Japan facing the Japan Sea (Kim and Tsuda, 2012).

Through molecular ecological studies on avian *Plasmodium* parasites, we recognized *Cx. inatomii* as an efficient vector (Kim and Tsuda, 2012, 2015), and the persistence of the transmission cycle of avian *Plasmodium* parasite governed by *Cx. inatomii* has been demonstrated among migrating birds and local wild birds inhabiting coastal wetlands. Yonago Waterbirds Sanctuary, Tottori Prefecture (35°26′28N, 133°1′14E) is a coastal wetland receiving various migrating birds, and we conducted mosquito collection monthly from June to September 2017 to determine whether *Cx. inatomii* was present or not. A large number of *Cx. inatomii* were collected and one gynandromorph specimen was found in July 2017.

The results of morphological observations of the gynandromorph specimen are presented in this paper.

**MATERIALS AND METHODS**

Adult mosquitoes were collected using five CDC-like traps with 1 kg of dry ice at Yonago Waterbirds Sanctuary, Tottori Prefecture on 19 July 2017. The mosquitoes were carried to the Joint Department of Veterinary Medicine, Faculty of Agriculture, Tottori University and the species identified based on morphological keys (Tanaka et al., 1979).

A gynandromorph specimen of *Cx. inatomii* was found and examined morphologically. The head, abdomen, and legs were detached and mounted in Euparal after maceration with KOH. The morphology of the head (antenna and palpus), leg (anterior claw), and abdomen (genitalia) was observed and recorded using a microscope (Nikon Eclipse Ci) with a digital camera (Nikon DS-L3), and the sex was determined. The internal organs were not examined in this study.

In male *Cx. inatomii*, the anterior claws of fore- and midtarsi have a blunt-tipped median tooth (Tanaka et al., 1979), whereas the claws of females are simple and equal. The sexes of foretarsus and midtarsus were determined based on these morphological differences. The specimen was deposited in the Laboratory of Veterinary Parasitology, Joint Department of Veterinary Medicine, Faculty of Agriculture, Tottori University.
Fig. 1. Gynandromorph of *Culex inatomii* collected at Yonago Waterbirds Sanctuary, Tottori Prefecture in July 2017. a: Whole body, b: palpi, c: genitalia.

Fig. 2. The anterior claw of the left foretarsus, a, the left midtarsus, b, and right midtarsus, c, of the gynandromorphic *Culex inatomii* examined in this study. The anterior claw of the left foretarsus and left midtarsus had a blunt-tipped median tooth, indicating it is male, whereas that of the right midtarsus was simple, indicating it is female.
RESULTS AND DISCUSSION

A total of 2,965 mosquitoes were collected on 19 July 2017, and the following six species were identified: Cx. inatomii, Cx. tritaeniornynchus Giles, Cx. pipiens group, Cx. bitaeniorhynchus Giles, Cx. pseudovishnui Coless, and Aedes albopictus (Skuse). Among them Cx. inatomii was dominant, comprising 70% of the total. The result indicated that Yonago Waterbird Sanctuary provided suitable habitats for Cx. inatomii, and the population achieved a high density (415.6/trap/day) in July 2017.

All Cx. inatomii collected in this study were female, except one gynandromorph specimen. The antennae of the gynandromorph specimen were not plumose and palpi were short indicating these were female (Fig. 1a, b). The abdomen had a male genitalia (Fig. 1c). The anterior claw of the left foretarsus (Fig. 2a) and left midtarsus (Fig. 2b) had a blunt-tipped median tooth indicating these parts were also male. The right foretarsus was lost. The anterior claw of the right midtarsus was simple and identified as female (Fig. 2c). In summary the specimen had the head of a female, abdomen of a male indicating the polar gynandromorph and the thorax was divided bilaterally or obliquely.

Gynandromorphs have been reported from 11 Culex species so far in the literature; Cx. tarsalis Coquillet, Cx. nigrripalpus Theobald, Cx. quinquefasciatus Say, Cx. salinarius Coquillet, Cx. tritaeniornynchus, Cx. fuscocephala Theobald, Cx. pseudovishnui, Cx. neavei Theobald, Cx. cinereus Theobald, Cx. pipiens Linnaeus and Cx. theileri Theobald (Mitchell and Hughes, 1969; Meadows, 1966; Seal 1966; Taylor et al., 1966; Aslamkhan and Baker, 1969; Aslamkhan, 1970; Harmston, 1971; Aslamkhan and Reisen, 1979; Jupp, 1998; Mahmoud and Bajwa, 2006; Sánchez-Murillo et al., 2013). This gynandromorphic finding is the first report for Cx. inatomii worldwide. In Japan, gynandromorph specimens have been reported from 4 mosquito species, Armigeres subalbatus (Coquillet), Cx. pipiens form molestus (Coquillet), Cx. tritaeniornynchus. Culex theileri from New York City. A bipolar differentiated gynandromorph of Culex tarsalis Coquillet, from Texas. J. Med. Entomol., 6: 78.

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References


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