



Chrysomya bezziana: a case report in a dog from Southern China and review of the Chinese literature

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Abstract

Chrysomya bezziana is an obligate, myiasis-causing fly in humans and warm-blooded animals throughout the tropical and subtropical Old World. We report a case of cutaneous myiasis due to *C. bezziana* in a dog from Guangxi province in China. A total of 35 maggots were removed from the lesions. Direct sequencing of the mitochondrial cytochrome b gene showed that the specimen belonged to haplotype CB_bezz02, which was previously reported in Malaysia and the Gulf region. This paper also reviews reported cases of screwworm myiasis from humans and animals in China. Geographical records indicate that the distribution of *C. bezziana* is expanding, suggesting that an integrated pest management control should be taken into consideration in China.

Keywords *Chrysomya bezziana* · Myiasis · Cytochrome b · Dog · China

Introduction

The Old World screwworm fly, *Chrysomya bezziana*, belongs to the order Diptera and family Calliphoridae. This obligate, myiasis-causing fly is widely distributed in tropical and subtropical areas in Africa, Arabian Peninsula, Indian subcontinent, Southeast Asia, and Papua New Guinea (Spradbery and Evans 1994). Female screwworm flies lay up to 200 eggs at a time in the vicinity of the wounds or body orifices in humans or warm-blooded animals. The larvae can invade the host tissues and live as parasites for about a week. The presence of *C. bezziana* larvae is responsible for inappetence, maiming, infertility, or even death (Humphrey et al. 1980). Due to its parasitic mode of life, *C. bezziana* can be a serious pest in livestock and a significant public health risk. Here, we report on a case of cutaneous myiasis due to *C. bezziana* in a dog

from Guangxi province in China. This represents the first case of haplotype CB_bezz02 ever recorded in China. The paper also reviews cases previously reported in the literature of screwworm myiasis in humans and animals in China, adding new geographical records to the known distribution of the parasite.

Materials and methods

A 3-year-old male German shepherd dog was presented with inappetence and a foul smelling wound on the lower back. At the time of examination, a few moving maggots were observed in the open wound. The dog was alert with no systemic signs of illness. The owner confirmed that the dog had been living downtown and had never been out of the area. Before providing any specific treatment, hairs in the affected area were clipped. Mechanical removal of the maggots was performed carefully after the administration of a local anesthetic. All maggots were extracted, and the wound was flushed with diluted hibitane solution. Ivermectin at 1% was administered by dropping the solution directly on the wound, to prevent reoccurrence in case remaining larvae were still present. The dog was sent home on a 7-day treatment of oral cephalexin (15 mg/kg). The larvae were preserved in 75% alcohol and sent to the Department of Parasitology (Faculty of Science

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Technology and Veterinary Medicine, Guangxi University) for further identification.

The collected maggots were individually examined under a stereomicroscope. The posterior spiracle was cut and examined using a Motic BA400 microscope. Identification was made according to the morphological keys (Spradbery 1991). To confirm the identification, a molecular analysis was performed. Genomic DNA was extracted from the muscle tissue of an individual specimen using the DNeasy Blood & Tissue Kit and Animal Tissues (Spin-Column) protocol from QIAGEN (Hilden, Germany), and stored at -20°C until use. A 716-bp fragment of mitochondrial cytochrome b was amplified using the primers CB1-SE (5'-3'TATGTACTACCATG AGGACAAATATC) and PDR-WR04 (5'-3'ATTTCACG CTCATTA ACT) (Ready et al. 2009). Thermocycler conditions were those reported by Wardhana et al. 2012.

The PCR-amplified products were purified and directly sequenced in both directions. Sequences on both DNA strands were edited using the program EditSeq 7.1 and aligned with ClustalX.

Results

A total of 35 maggots were collected from the wound. All maggots were morphologically identified as *C. bezziana* according to the following microscopic taxonomic attributes: posterior spiracle with peritreme open; tracheal trunks not heavily pigmented; posterior margin of segment 11 with dorsal spines; thornlike body spines; and anterior spiracle with five papillae (Fig. 1). The sequence was submitted to GenBank under accession number MH986668. The Blast search revealed that the sequence was identical to *C. bezziana*, registered as haplotype CB_bezz02 (JQ655238). This haplotype has been previously reported in Malaysia and the Gulf region (Ready et al. 2009).

Discussion

In reviewing the literature for cases of *C. bezziana* infestation, we found eight publications from Mainland China, all of them written only in Chinese. The provinces of all confirmed screw-worm myiasis cases are shown in Fig. 2. Between 1959 and 1979, eight cases of human myiasis caused by *C. bezziana* were reported in Guangxi province (Ye 1985). Since then, sporadic human and livestock cases were reported in Fujian, Jiangxi, Guizhou, and Hunan provinces (Hu et al. 1983; Wu et al. 2008; Lan and Zhong 2001; Wang et al. 1992; Liao 2015; Qiu et al. 2015). Recently, one case of oral myiasis due to *C. bezziana* was reported in a man as far north as Hebei province, with the patient indicating that he had not traveled to any other place in the previous 2 months (Nuo et al. 2017). More detailed human and animal infestations were reported in Hong Kong (Chemonges-Nielsen 2003; Chan et al. 2005; Kwong et al. 2007). Climate modeling (CLIMAX) indicated that the distribution of *C. bezziana* was confined to the southern part of China with the northernmost limit in Fujian province (Sutherst et al. 1989). The distribution of the fly might have expanded with climate change, growing trade, and travel activity, even as far north as Hebei Province. Epidemiological data on human and animal myiasis are scant in China. Recently, a review on 291 cases of human myiasis during the 2003–2013 period reported that cutaneous myiasis is mainly caused by *Hypoderma* spp. infestation (Cao et al. 2015). However, these flies are only present in the northern and western parts of China, while the myiasis due to *C. bezziana* dominated in the south.

Myiasis has been reported mostly in rural areas (Kwong et al. 2007). In our reported case, the infested dog had been living in the city's downtown. The inhabitation of the fly in the downtown poses great threat to urban residents and animals, especially to aged people who cannot take care of their own hygiene and to stray animals (Chan et al. 2005). A combination of clinical (e.g., open wounds, peripheral vascular



Fig. 1 **a** Anterior part of a larva of *C. bezziana*, with two mouth hooks and thornlike spines. **b** Five papillae in the anterior spiracles. **c** Posterior spiracle with peritreme open

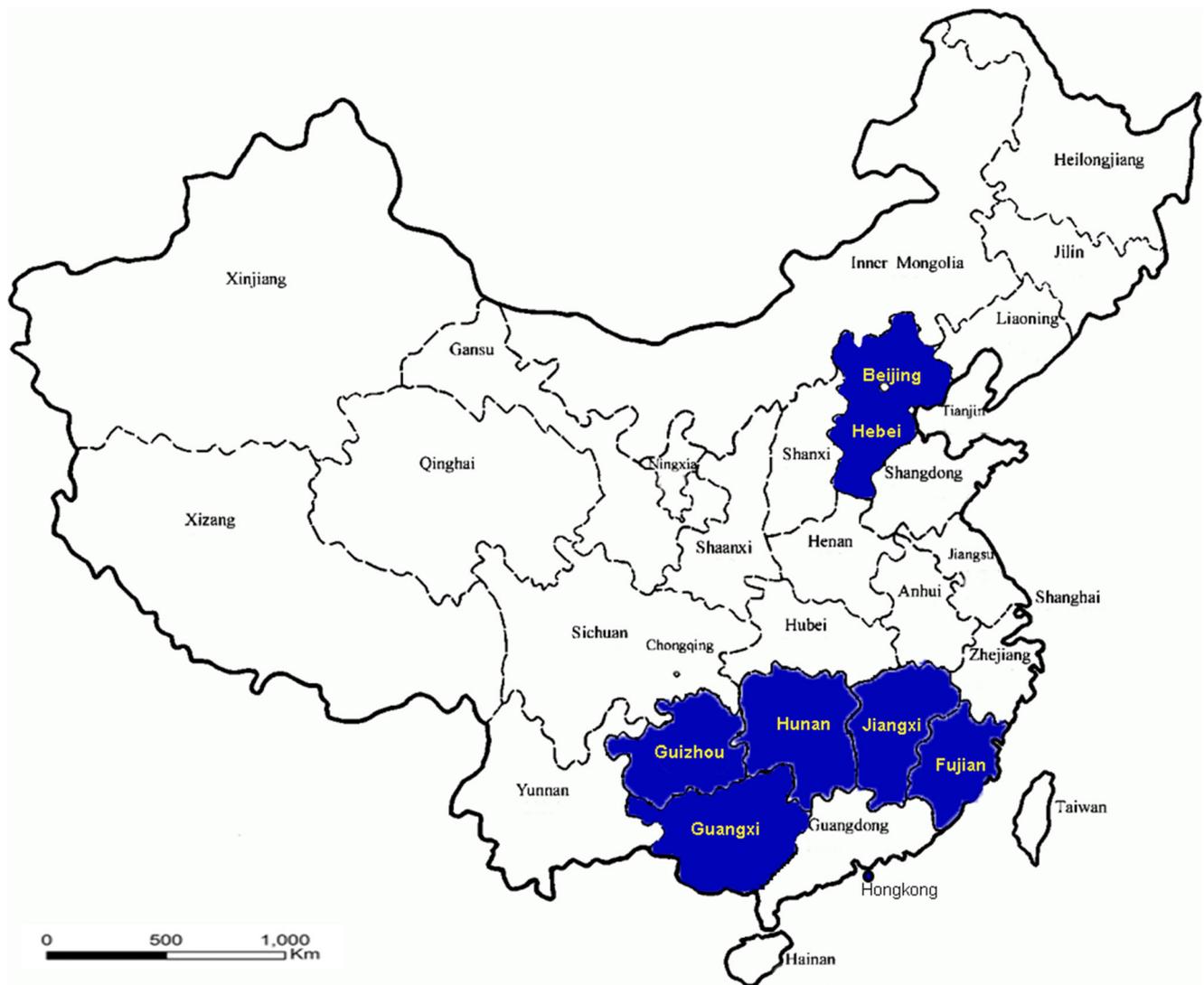


Fig. 2 Geographical distribution of *C. bezziana* in China (in blue). Guangxi: eight cases in humans between 1959 and 1979; Fujian: one case in humans in 1981 and 21 cases in cattle in 2001; Guizhou: 513

cases in cattle and sheep between 1987 and 1991; Jiangxi: one case in humans in 2007 and three cases in pigs in 2011; Hunan: one case in humans in 1981 and 21 cases in cattle in 2001; Guizhou: 513

disease, diabetes, physical and mental disability, and advanced age) and social (e.g., homelessness, alcoholism, poor hygiene, and bad housing conditions) factors in humans, and open wounds due to fighting or the bite of ticks in animals, can be predisposing factors for screwworm myiasis (Hall et al. 2015).

Screwworms cause significant losses in livestock, as a combination of treatment costs, losses in fur or wool quality, loss in production of milk or meat, debilitation, and even death (Han et al. 2017). Chemotherapy with ivermectin is an efficacious treatment for myiasis (Wardhaugh et al. 2001). As topical treatment, 1% ivermectin killed all screwworm larvae within 24 h (Victoria et al. 1999). Injectable ivermectin (200 mg/kg) provides a long-term prevention effect (Wardhaugh et al. 2001). Additional drugs are available for the treatment of animal cases of myiasis. Recently, nitenpyram, spinosad,

and afoxolaner treatments were effective against screwworm infestation in dogs (Han et al. 2018).

Molecular analysis showed that the specimen belonged to the CB_bezz02 haplotype, which had been previously reported in Malaysia and the Gulf region, while the predominant haplotype found in Hong Kong was CB_bezz01 (Ready et al. 2009). These two haplotypes are closely related. Our result is consistent with the finding by Ready et al. (2009) that very limited mtDNA diversity occurs in mainland Asia.

Conclusion

Cutaneous myiasis caused by *C. bezziana* has been previously reported in humans and livestock in Guangxi, Fujian, Jiangxi,

Guizhou, Hunan, and Hebei provinces, but, to the best of the authors' knowledge, this is the first description in a companion animal in Mainland China. In view of the increased threat of the expanding myiasis invasion in China, implementing an integrated pest management control for this parasite should be taken into consideration.

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Compliance with ethical standards

Conflicts of interest The authors declare that they have no conflicts of interests.

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