Elytra, *Tokyo*, New Series, **8** (2): 235–237
December 25, 2018

Male-Male Combat in a Sexually Dimorphic Weevil, *Gasterocercus longipes* Kôno, 1932 (Coleoptera, Curculionidae, Cryptorhynchinae)

Kazuo Yamazaki

Osaka Institute of Public Health, 8–34 Tojo-chô, Tennôji, Osaka, 543–0026 Japan
E-mail: kazuo-yamazaki@iph.osaka.jp

Males belonging to many beetle species worldwide bear sexually dimorphic morphological traits that are often used for fighting against rival males (Eberhard, 1979; Emlen *et al*., 2005; Yamazaki, 2009). For example, males belonging to many stag and rhinoceros beetle species duel using exaggerated mandibles and horns, respectively, to gain access to females, and they may fight with other insect species to monopolize food resources (Eberhard, 1979, 1980; Karino *et al*., 2005; Emlen, 2015). In general, males with larger weapons are found to be more successful in battle (Brown, 1980; Karino *et al*., 2005, Yamazaki, 2009; Emlen, 2015). Because these weapons are sexually selected traits, these beetle species have long contributed to advancement of the sexual selection theory in behavioral ecology. However, despite the abundance of beetle species with weapons in males, the use of these weapons has been reported in only a small subset.

Gasterocercus longipes Kôno, 1932 is a common species found on rotten wood in Japan (Honshu, Shikoku, and Kyushu), Korea, and China; this species is characterized by long forelegs in males (Morimoto, 1984; Alonso-Zarazaga *et al*., 2017). Although the long forelegs are surmised to be used as weapons (Lyal, 2013), their use in intersexual competition has not been formerly reported. Male-male combat in this weevil has been documented in the form of photos and videos by such as Fukuda (2004) and Miyairi (2017). The present paper aims to formally describe battles between *G. longipes* males and elaborate on the use of their forelegs in these battles.

Field observations were carried out in Hiraoka Park, Higashi-Osaka City, Osaka Prefecture, central Japan (34°40’N, 135°39’E, ca. 140 m above sea level) on 21 May, 2017. A dead tree belonging to *Albizia julibrissin* Durazz. (Fabaceae) (ca. 10 m tall, ca. 50 cm diameter at the ground level), which bore bracket fungi, was located at the study site. About 15 *G. longipes* adults were present on the wood of the dead tree, 0–50 cm above the

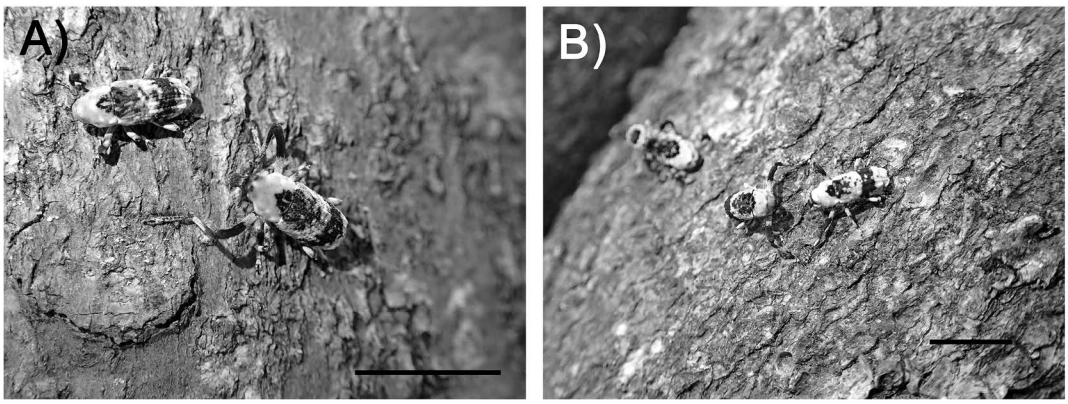

Fig. 1. Intraspecific interactions in *Gasterocercus longipes*. —— A, A male guarding a female that was digging an oviposition hole in the wood; B, male-male combat (center) and a pair in copulation (at the back to the left).

ground. The behavior of these weevil adults was observed from 14:40 to15:00 and 16:25 to16:40.

Four females were observed digging holes in the wood with their rostra, which may have been used for oviposition, and each of them was observed being guarded by a male (Fig. 1A). Several solitary males and females were also present on the wood. Male-male combat was observed several times (Fig. 1B). When two males encountered each other, they struck their opponent alternately with their right and left forelegs and pushed with their heads. The scuffling combat resembled sumo wrestling. An example is shown in the digital video by YAMAZAKI (2018). In this video, three males fought one another to obtain a female that was digging an oviposition hole. A smaller male lost the female that he pursued, and a larger male winner eventually positioned itself just behind the female.

The large forelegs of males belonging to *G. longipes* can be viewed as a sexually selected weapon because they are used to fight rival males for access to females. Exaggerated forelegs are known to be used for male-male combat in other weevils (e.g., *Macromerus bicinctus* (CHAMPION, 1905) in WCISLO & EBERHARD (1989); *Staminodeus vectoris* FRANZ, 2001 in FRANZ (2003)). Moreover, combat in the presence of females digging oviposition holes has been reported for other weevils (e.g., *Rhinostomus barbirostris* (FABRICIUS, 1775) in EBERHARD, 1983; *M. bicinctus* in WCISLO & EBERHARD (1989); *Parisoschoenus expositus* (CHAMPION, 1908) in EBERHARD & GARCIA-C. (2000)). However, as the present study was limited in scope, more detailed experiments are needed to elaborate on the mechanism and consequences of male-male combat in this weevil. The process of scuffling using forelegs to expel the opponents and whether larger leg size is advantageous in battle are intriguing subjects for research. *Gasterocercus longipes* may thus be a promising species in the study of sexual selection.

References

ALONSO-ZARAZAGA, M. A., H. BARRIOS, R. BOROVEC, P. BOUCHARD, R. CALDARA, E. COLONNELLI, L. GÜLTEKIN, P. HLAVÁČ, B. KOROTYAEV, C. H. C. LYAL, A. MACHADO, M. MEREGALLI, H. PIEROTTI, L. REN, M. SÁNCHEZ-RUIZ, A. SFORZI, H. SILFVERBERG, J. SKUHROVEC, M. TRÝZNA, A. J. VELÁZQUEZ DE CASTRO & N. N. YUNAKOV, 2017. Cooperative Catalogue of Palaearctic Coleoptera Curculionoidea [online]. *Monografías Electrónicas S. E. A.*, **8**. 729 pp. Sociedad Entomológica Aragonesa, Zaragoza. Available from: http://sea-entomologia.org/PDF/MeSEA_8_Catalogue_Palaeartic_Curculionoidea.pdf [accessed on 17 October 2018].

BROWN, L., 1980. Aggression and mating success in males of the forked fungus beetle, *Bolitotherus cornutus* (PANZER) (Coleoptera: Tenebrionidae). *Proceedings of the Entomological Society of Washington*, **82**: 430–434.

EBERHARD, W. G., 1979. The function of horns in *Podischnus agenor* (Dynastinae) and other beetles. Pp. 231–258. *In* BLUM, M. S., & N. A. BLUM (eds.), *Sexual Selection and Reproductive Competition in Insects*. 476 pp. Academic Press, San Francisco, CA.

EBERHARD, W. G., 1980. Horned beetles. *Scientific American*, **242**: 124–131.

EBERHARD, W. G., 1983. Behavior of adult bottle brush weevils (*Rhinostomus barbirostris*) (Coleoptera: Curculionidae). *Revista de Biologia Tropical*, **31**: 233–244.

EBERHARD, W. G., & J. M. GARCIA-C., 2000. Ritual jousting by horned *Parisoschoenus expositus* weevils (Coleoptera, Curculionidae, Baridinae). *Psyche*, **103**: 55–84.

EMLEN, D. J., 2015. Animal Weapons: The Evolution of Battle. 288 pp. Henry Holt & Co., New York.

EMLEN, D. J., J. MARANGELO, B. BALL & C. W. CUNNINGHAM, 2005. Diversity in the weapons of sexual selection: horn evolution in the beetle genus *Onthophagus* (Coleoptera, Scarabaeidae). *Evolution*, **59**: 1060–1084.

FRANZ, N. M., 2003. Mating behaviour of *Staminodeus vectoris* (Coleoptera: Curculionidae), and the value of systematics in behavioural studies. *Journal of Natural History*, **37**: 1727–1750.

FUKUDA, O., 2004. *Gasterocercus longipes*. Insect Photo Collection [online]. Available from: http://www.g-hopper.ne.jp/free/fukuda/photo_zukan/kochu/pz_ashinag aonizomushi-01.htm [accessed on 5 July 2018]. (In Japanese.)

KARINO, K., H. NIIYAMA & M. CHIBA, 2005. Horn length is the determining factor in the outcomes of escalated fights among male Japanese horned beetles, *Allomyrina dichotoma* L. (Coleoptera: Scarabaeidae). *Journal of Insect Behavior*, **18**: 805–815.

LYAL, C. H. C., 2013. Molytinae SCHOENHERR, 1823. Pp. 529–570. *In* LESCHEN, R. A. B., & R. G. BEUTEL (eds.), *Coleoptera, Beetles*, **3**: *Morphology and Systematics* (*Phytophaga*). *In* KRISTENSEN, N. P., & R. G. BEUTEL (eds.), *Handbook of Zoology*, *Arthropoda*: *Insecta*. 565 pp. De Gruyter, Berlin.

MIYAIRI, K., 2017. *Gasterocercus longipes*. Weevils [online]. Available from: http://yasou.jp/Site_7_zoomushi/ashinagaonizoumushi.html [accessed on 5 July 2018]. (In Japanese.)

Morimoto, K., 1984. *Gasterocercus longipes* Kôno. Pp. 339, pl. 67–fig. 2. *In* Hayashi, M., K. Morimoto & S. Kimoto (eds.), *The Coleoptera of Japan in Color*, **4**. 438 pp. Hoikusha, Osaka. (In Japanese, with English book title.)

Wcislo, W. T., & W. G. Eberhard, 1989. Club fights in the weevil *Macromerus bicinctus* (Coleoptera: Curculionidae). *Journal of the Kansas Entomological Society*, **62**: 421–429.

Yamazaki, K., 2009. Intraspecific behavioral interactions in *Toxicum funginum* Lewis, 1894 (Coleoptera: Tenebrionidae): dueling males and resistant females. *Coleopterists Bulletin*, **63**: 509–512.

Yamazaki, K., 2018. Combat between males in *Gasterocercus longipes*. Available from: https://youtube.com/watch?v=5aTIOPV6TYM [uploaded on 12 August, 2018].

Manuscript received 9 September 2018;
revised and accepted 17 October 2018.