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Seasonality of Supralittoral Hydrophilid Beetles, *Cercyon* (*Cercyon*) spp. (Coleoptera, Hydrophilidae) in Zenibako, Hokkaido, Japan

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Abstract Seasonal changes in abundance for supralittoral *Cercyon* (*Cercyon*) spp. are investigated from May to October 2010, in Zenibako Beach, Hokkaido, Japan. Four hundred fifty individuals of five species, *Cercyon* (*Cercyon*) *algarum* Sharp, 1873, *C.* (*C.*) *setulosus* Sharp, 1884, *C.* (*C.*) *dux* Sharp, 1873, *C.* (*C.*) *numerosus* Shatrovskiy, 1989 and *C.* (*C.*) *aptus* Sharp, 1873 were collected in total. All species except *C. aptus* showed two peaks in June–July and July–September. Sex ratios are calculated for *C. dux* and *C. numerosus*, and did not show deviation from 1 : 1 for either species.
Key words: Supralittoral beetle, Macroalgal wrack, Seasonality, Abundance, Sex ratio.

Introduction

Supralittoral hydrophilid, *Cercyon* (*Cercyon*) spp. are a major beetle group inhabiting macroalgal wrack cast on supralittoral zones of sand, cobble, and shingle beaches (Ôhara & Jia, 2006; Satô, 1981, 1989; Sharp, 1873; Shatrovskiy, 1989, 1992; Smetana, 1988). The larvae prey on dipteran larvae (Phillips & Arthur, 1994), and adults forage decomposing seaweed and sea grass (Kobayashi, 2009; Kobayashi & Ôhara, 2017).

Since multiple *Cercyon* spp. usually coexist in a single habitat (cf. Ôhara, 2008), clarifying species-specific traits is important to understand maintenance mechanisms of their populations. However,

Fig. 1. Study site at Zenibako, Hokkaido, Japan.

there are few studies concerning their life history (but see Hodge & Williams, 2007 for *C. littoralis* in Britain Island). Thus, we investigated the seasonality of five coexisting species: *Cercyon* (*Cercyon*) *algarum* Sharp, 1873, *C.* (*C.*) *aptus* Sharp, 1873, *C.* (*C.*) *dux* Sharp, 1873, *C.* (*C.*) *setulosus* Sharp, 1884 and *C.* (*C.*) *numerosus* Shatrovskiy, 1989.

Material and Methods

We conducted our study at a cobble beach of 50 m in length near Zenibako Japanese Railway Company Station in Otaru, Hokkaido, Japan (43°08'38"N, 141°09'43"E, Fig. 1). Sampling was conducted from 2nd May to 30th Oct., 2010 in two week intervals, and with one week intervals in July and August when their densities greatly fluctuated.

Samples were manually picked up with forceps from a handful of decomposing algae after sifting and/or soaking in water. This procedure was repeated for 30 or 60 minutes a day by one or two person(s). All samples were fixed with 70 % ethanol, then identified to species level in laboratory. Specimens were stored in SEHU (Systematic Entomology, The Hokkaido University Museum), and their records are registered in a data set of the Global Biodiversity Information Facility (Ôhara, 2016).

The density of each species for each sampling day was calculated as the number of individuals per person per hour. The sex ratio for each species (*C. dux* and *C. numerosus*) and/or sampling date in which more than ten individuals were collected were tested by a two-sided binomial test.

Results and Discussion

We collected 450 individuals of five *Cercyon* species in total. The most abundant species was *C. setulosus* (178 individuals), followed by *C. algarum* (106), *C. dux* (90), *C. numerosus* (67) and *C. aptus* (9). *Cercyon aptus* had the lowest abundance which is concordant with past studies in which this species is prone to be more abundant in sandy beaches than in other types of coastal habitats (Ôhara, 2008).

All species except *C. aptus* showed two peaks in June–July and July–September with a disappearance in July (Fig. 2). *Cercyon aptus* showed a similar, but partly different seasonal pattern than described above because of its insufficient sample size. There was sufficient amount of wrack to conduct sampling except on three days (24th July, 16th October and 30th October) when macroalgal wrack disappeared. Thus, the graphs shown in Fig. 2 roughly reflect the seasonal changing patterns of *Cercyon* adults.

The numbers of male and female individuals throughout the study period for *C. dux* and *C. numerosus* was 46 and 43, and 31 and 36, respectively. It suggests that sex ratios in both species were not statistically different from 1 : 1 (*C. dux*: $p = 0.313$, *C. numerosus*: $p = 0.416$, two-sided binomial tests). Furthermore, the sex ratio for *C. dux* on 1st Aug. was 14 : 13 ($p = 1.000$), for *C. numerosus* on 26th Jun. was 12 : 5 ($p = 0.143$), for *C. numerosus* on 21st Aug. was 10 : 16 ($p = 0.327$). These ratios were not different from 1 : 1 (Fig. 3), suggesting that there was no difference in adult behavior such as timing of emergence or process of dispersion, between male and female.

We cannot distinguish whether these species are univoltine or bivoltine. It is necessary to investigate seasonality of larvae and developmental stages of reproductive organs in adult individuals.

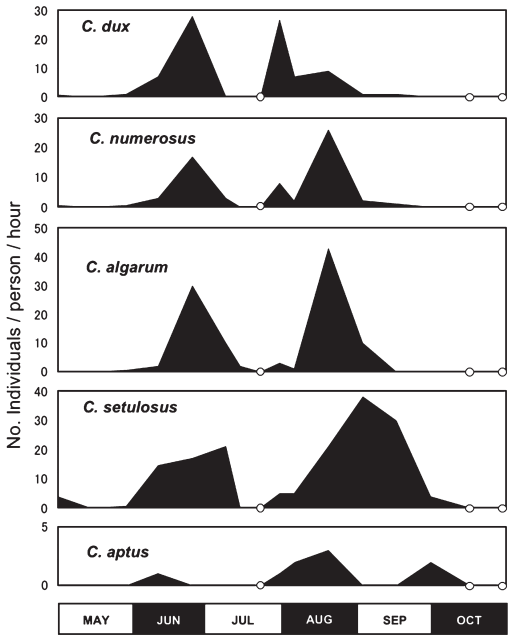

Fig. 2. Seasonality of five *Cercyon* spp. Notice that the scale of vertical axis for *C. aptus* is different from the others.

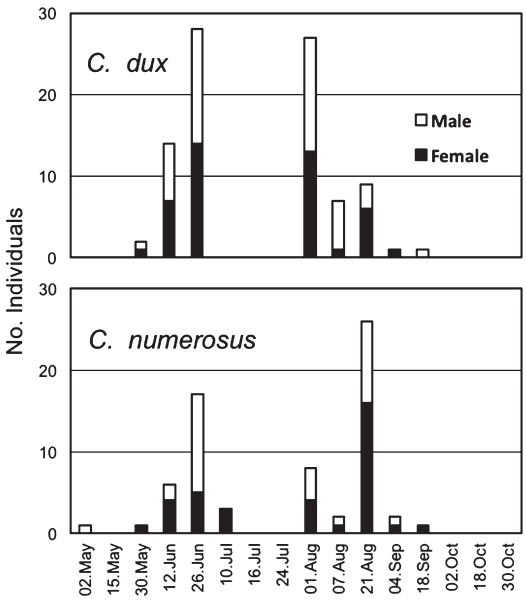

Fig. 3. Seasonality of the number of male and female individuals for *Cercyon dux* and *C. numerosus*.

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要　　約

稲荷尚記・小林憲生・大原昌宏：北海道銭函海岸における海浜性ガムシ科甲虫ケシガムシ属 *Cercyon* (*Cercyon*) の季節消長（鞘翅目ガムシ科）．――――北海道の銭函海岸において 2010 年 5〜10 月に海浜性ケシガムシ属 *Cercyon* (*Cercyon*) の季節消長を調査した結果，ヒメケシガムシ *C*. (*C*.) *algarum* Sharp, 1873, ナガケシガムシ *C*. (*C*.) *setulosus* Sharp, 1884, フチトリケシガムシ *C*. (*C*.) *dux* Sharp, 1873, エゾケシガムシ *C*. (*C*.) *numerosus* Shatrovskiy, 1989 , コケシガムシ *C*. (*C*.) *aptus* Sharp, 1873 の合計 5 種 450 個体が採集された．個体数の少なかった *C*. (*C*.) *aptus* を除いて，いずれの種も 6〜7 月と 7〜9 月に合計 2 回の個体数ピークを示した．また，フチトリケシガムシとエゾケシガムシについては性比を調べた結果，いずれの種も 1 : 1 と異ならなかった．

References

Hodge, S., & A. Williams, 2007. Coleoptera found in wrack beds and strandlines around the Kent Coast. *British Journal of Entomology and Natural History*, **20**: 61–70.

Kobayashi, N., 2009. Food plants of a supralittoral hydrophilid beetle, *Cercyon* (*Cercyon*) *dux* (Coleoptera, Hydrophilidae). *Elytra*, *Tokyo*, **37**: 272–274.

Kobayashi, N., & M. Ôhara. 2017. Preliminary report of host plants of a supralittoral beetle, *Cercyon* (*Cercyon*) *tolfino* (Coleoptera, Hydrophilidae) in Canada. *Elytra*, *Tokyo*, (n. ser.), **7**: 21–23.

Ôhara, M., 2008. New records of the supralittoral species of the genus *Cercyon* (Coleoptera, Hydrophilidae) from the peripheral islands off Hokkaido, Japan. *Elytra*, *Tokyo*, **36**: 343–348.

Ôhara, M., 2016. Hokkaido University Coleoptera Collection. National Institute of Genetics, ROIS. Occurrence Dataset [online] Available from: https://doi.org/10.15468/xejzxw [accessed on 6th May 2018].

Ôhara, M., & F. Jia, 2006. Terrestrial hydrophilid beetles of the Kuril Archipelago (Coleoptera, Hydrophilidae). *Biodiversity and biogeography of the Kuril Islands* and Sakhalin, **2**: 129–150.

Phillips, D. S., & W. Arthur, 1994. Observations on the distribution of seaweed fly larvae and other invertebrates within a wrack bed. *The Entomologist*, **113**: 154–163.

Satô, M., 1981. Hydrophilidae. Pp. 208–217 [incl. pls. 38–39]. *In* Uéno, S.-I., Y. Kurosawa & M. Satô (eds.), *The Coleoptera of Japan in Color*, **2**. 514 pp. Hoikusha, Osaka. (In Japanese with English book title.)

Satô, M., 1989. Hydrophilidae. Pp. 242–246. *In* Entomological Laboratory, Faculty of Agriculture, Kyushu University & Japan Wildlife Research Center (eds.), *A Check List of Japanese Insects*, 1. 540 pp. Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka (In Japanese.)

Shatrovskiy [as "Shatrovskij"], A. G., 1989. Hydraenidae, Hydrophilidae. Pp. 260–293. *In* Ler, P. A. (ed.), *Opredelitel* '*nasekomykh Dal'nego Vostoka SSSR v shesti tomakh*, **3**. *Zhestkokrylye*, *ili zhuki* (part 1). 572 pp. Nauka, Leningrad.

Shatrovskiy [as "Shatrovskij"], A. G., 1992. Novye i maloizvestnye vodolyubovye (Coleoptera, Hydrophiloidea) iz yuzhnogo Primor'ya i sopredel'iykh territorii. (New and little known Hydrophiloidea) from south Primorye territory and adjacent regions). *Entomologicheskoe*. *Obozrerine*, **71**: 359–371.

Sharp, D., 1873. The water beetles of Japan. *Transactions of the Entomological Society of London*, **1873**: 46–67.

Sharp, D., 1884. The water-beetles of Japan. *Transactions of the Entomological Society of London*, **1884**: 439–464.

Smetana, A., 1988. Review of the family Hydrophilidae of Canada and Alaska (Coleoptera). *Memoirs of the Entomological Society of Canada*, (142): 1–316.

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