Pleistocene fossil insects from the underground of Nagai Park, Osaka City, western Japan, with description of three donaciine leaf beetles (Coleoptera: Chrysomelidae)

Masakazu Hayashi*, Shigehiko Shiyake**, Yorio Miyatake*** and Daisuke Iwai****

抄録：大阪市長居公園の地下の更新統から産出した昆虫化石、特にネクイハムシ類3種について（鞘翅目：ハムシ科）

林 成多*・初宿成彦**・宮武頼夫***・岩井大輔****

Abstract: The Pleistocene strata in the underground of Nagai Park, Osaka City, yield abundant fossil insects. The fossil assemblage includes five families of Coleoptera and indetermined pupa of Lepidoptera. Among them three donaciine leaf beetles, Plateumaris sericea, Donacia fleemora and Donacia splendens hiurai are recognized. Occurrence of D. fleemora and D. splendens indicates the cool temperate paleoclimate. The stratigraphic position of the fossils is lower than the last interglacial marine bed, Ma 12, and correlated to the cool period before the last interglacial age.

Key Words: Donaciinae; fossil insects; paleoenvironment; Middle Pleistocene

Contributions from the Osaka Museum of Natural History, No. 382 (Accepted March 31, 2003)
* Hoshizaki Green Foundation, 1659-5 Okinoshima, Sono-cho, Hirata, Shimane 691-0076, Japan
E-mail: hgf-haya@green-for.jp
** Osaka Museum of Natural History, 1-23 Nagai Park, Higashi-Sumiyoshi-ku, Osaka 556-0034, Japan
E-mail: shiyake@mus-nh.city.osaka.jp
*** 220-1-609 Shinga-cho, Kashihara 634-0006, Japan
E-mail: yk-miya@nifty.com
**** 1-157-202 Miinashi, Omiya-ku, Saitama 331-0052, Japan
E-mail: d_iwai@ecosys.or.jp
Uemachi Daichi is the Pleistocene terrace in Osaka Plain, Osaka Prefecture, western Japan. Nagai Park with the Osaka Museum of Natural History is situated on the southern part of the terrace. In 2000, artificial exposure with the Middle to Late Pleistocene strata was dug by public works in the underground of the park of which depth is about 20 m. The Pleistocene strata include peaty bed that yield abundant plant remains and fossil insects. In this paper, we are going to report those fossil insects and discuss their paleoenvironmental significance.

This study followed the observation method of Hayashi (1999). All fossil specimens are preserved in the Osaka Museum of Natural History (OMNH).

**Locality and geological setting**

The location of fossil site in Nagai Park is shown in Fig. 1. Ishii and Nakajo (2000) reported the stratigraphy of the Pleistocene strata in the site where two stratigraphical units were recognized: the lower unit being probably high terrace deposit in Osaka Plain and the upper unit being the Uemachi Formation. The fossil insects were obtained from a peat bed of the lower unit (Fig. 2). The depth of the bed is about 13 m. The
Uemachi Formation contains the last interglacial marine bed, "Ma 12" (Ishii and Nakajo, 2000). As the age of Ma 12 is ca. 13 ka (Itihara, 1993), the fossil age is assigned to the latest Middle Pleistocene.

**Fossil insects from Nagai Park**

The fossil assemblage mainly includes Coleoptera fragments but contains Lepidoptera pupa as well. A list of them is shown in Table 1. Three donacine beetles, *Plateumaris sericea*, *Donacia flemora* and *Donacia splendens hiurai* are recognized.

**Order Coleoptera**

**Family Chrysomelidae**

*Plateumaris sericea* (Linnaeus)

(Figs. 3B, 3C)

**Description:** Coloration of pronotum and elytron entirely metallic green. Pronotal outline more or less quadrated; anterolateral calli prominent, callosal sulci deep; disc coarsely punctate with transverse deep rugae; basal sulcus prominent with rugae and punctures densely; median line deep, continuous. Elytron subparallel-sided from base to middle, gradually narrowed toward apex with 10 complete punctate striae and a scutellar striae; sutural interval entirely smooth, narrowed apically, inner and outer beads convergent, and explanate sutural margin exposing; other intervals with transverse rugae between them, getting finer and denser apically; apex more or less truncate, outer apical angle rounded, inner apical angle nearly right.

**Measurements:** Pronotum, length 1.5 mm (n=1); elytron, length 5.0 mm, width 1.5 mm (n=1).

**Materials:** Two specimens.

*Donacia flemora* Goecke

(Figs. 3D, 3E)

**Description:** Coloration of elytron and femur entirely metallic black. Elytron subparallel-sided from base to middle, gradually narrowed toward apex with 10 complete punctate striae and a scutellar striae; sutural interval entirely smooth, narrowed apically; other intervals with transverse rugae sparsely; apex truncate. Metafemur entirely punctate with a prominent blade-like tooth.

**Measurements:** elytron, length 5.2 mm, width 1.6 mm (n=1); metafemur, length 2.1 mm (n=1).

**Materials:** Two specimens.

**Notes:** This occurrence is the first fossil record of this species from the Pleistocene in Honshū.

**Table 1. A list of fossil insects from Nagai Park.**

<table>
<thead>
<tr>
<th>Order</th>
<th>Family</th>
<th>Genus/Species</th>
<th>Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLEOPTERA</td>
<td>Carabidae</td>
<td>Oodini sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>gen. et sp. indet</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Hydrophilidae</td>
<td>gen. et sp. indet</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Staphylinidae</td>
<td>gen. et sp. indet</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chrysomelidae</td>
<td><em>Plateumaris sericea</em></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Plateumaris sp.</em></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Donacia flemora</em></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Donacia splendens</em></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Donaciinae gen. et sp. indet</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Curculionidae</td>
<td>gen. et sp. indet</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Other Coleoptera</td>
<td>fam., gen. et sp. indet</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LEPIDOPTERA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fam., gen. et sp. indet (pupa)</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 3. A, Carabidae, pronotum. B-C, Plateumaris sericea (C, pronotum; D, left elytron). D-F, Donacia flemora (D, right elytron; E, basal disc of elytron; F, metafemur). Scale bar = 1.0 mm.
Fig. 4. A-F, Donacia splendens hiurai (A-B, pronotum; C, left elytron; D, apex of right elytron; E, metafemur; F, middle part of elytra). Scale bar = 1.0 mm.
Donacia splendens hiurai Kimoto
(Figs. 4, 5)

Description: Coloration of pronotum, elytron and femur entirely coppery or metallic green. Pronotal outline more or less quadrato; median line deep; callosal sulcus present, but shallow; disc coarsely punctured with transverse rugae; discal puncture oval, more or less oblong; basal sulcus shallow. Elytron subparallel-sided from base to middle, gradually narrowed toward apex, with ten complete punctate striae and a scutellar striae; strial punctures nearly vertical oval; all intervals shiny, rugulose, punctulate; sutural interval gradually narrowing to apex; other intervals with transverse rugae between them; apex truncate, outer and inner apical angles nearly right. Metafemur punctate. Median lobe of male genitalia with endophallus; apex of median lobe gradually narrowed without median lip and subapical emarginate; median process of endophallus L-shaped.

Measurements: pronotum, length 1.3-1.4 mm (n=2); elytron, length 6.6 mm, width 2.2 mm (n=1); metafemur, length 2.4 mm (n=1).

Materials: Five specimens.

Notes: The fossil specimens are identified with Donacia splendens hiurai Kimoto based on L-shaped median process of endophallus. Donacia hiurai Kimoto from Honshu has been treated as a subspecies of Donacia splendens Jacobson since Hayashi (2000).

Discussion and conclusions
The three donaciine species are useful for paleoenvironmental reconstruction of the paleovegetation and climate of the fossil bed. Distributional and ecological informations of Japanese donaciines are mainly based on Fossil Insect Research Group for Nojiri-ko Excavation (1985). Plateumaris sericea is a transpalearctic species whose climatic distribution ranges from upper warm to cold temperate zones. Adults of P. sericea feed on Carex spp., Scirpus spp., Iris spp., Menyanthes trifoliata etc. Donacia flemora is known from Japan (Honshu), Korea, East Siberia and NE China. Its climatic distribution range is in the cool temperate zone. Adults of D. flemora eat leaves of Carex versicolor. Donacia splendens is known from Japan (Hokkaido and Honshu), Sakhalin and East Siberia (Hayashi, 2000). Its climatic distribution ranges from the cool to cold temperate zones. Adults of D. splendens feed on Carex versicolor, C. thunbergii, C. olivacea confertiflora, C. ampliata dispalata, and C. idzuroei.

Paleoenvironmental reconstruction based on distributional and ecological informations of recent species is as follows: the fossil biota shows the presence of marsh with sedge of Carex and therefore the peat bed was probably derived from sedge remains; paleoclimate is considered to be
the cool temperate zone that is cooler than the present time based on recent climatic ranges of *D. splendens* and *D. flemora*.

**Acknowledgements**

The authors would like to thank the Osaka-City Road Corporation, Osaka Municipal Waterworks Bureau and Recreation & Tourism Bureau, City of Osaka for permission to observe construction sites of underground parking and pump station in Nagai Park. Our hearty thanks are also due to Dr. Takeshi Nakajo & Ms. Yoko Ishii (Osaka Museum of Natural History), Dr. Naotoshi Kuhara, and the members of the Fossil Insect Research Group for Noji-ko Excavation, Mr. Itaru Kanazawa, Mr. Fumiaki Muguruma, Ms. Kyoko Muguruma, Ms. Atsuko Nagai, Mr. Tamihisa Ota, for their help in sampling materials.

**Literature cited**


