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

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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）

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抄録：大阪市長居公園の地下の更新統から多くの昆虫化石が産出した．*Plateumaris sericea* キヌツヤミズクサハムシ(スゲハムシ)，*Donacia flemora* クロガネネクイハムシ，*Donacia splendens hiurai* ヒラタネクイハムシ本州亜種の3種のネクイハムシ亜科を含む昆虫が同定された．クロガネネクイハムシとヒラタネクイハムシの共産は，冷温帯の古気候を示している．産出層準は，最終間氷期の海成層であるMa12の下位にあり，最終間氷期前の寒冷期に相当する．

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 flemora* and *Donacia splendens hiurai* are recognized. Occurrence of *D. flemora* 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

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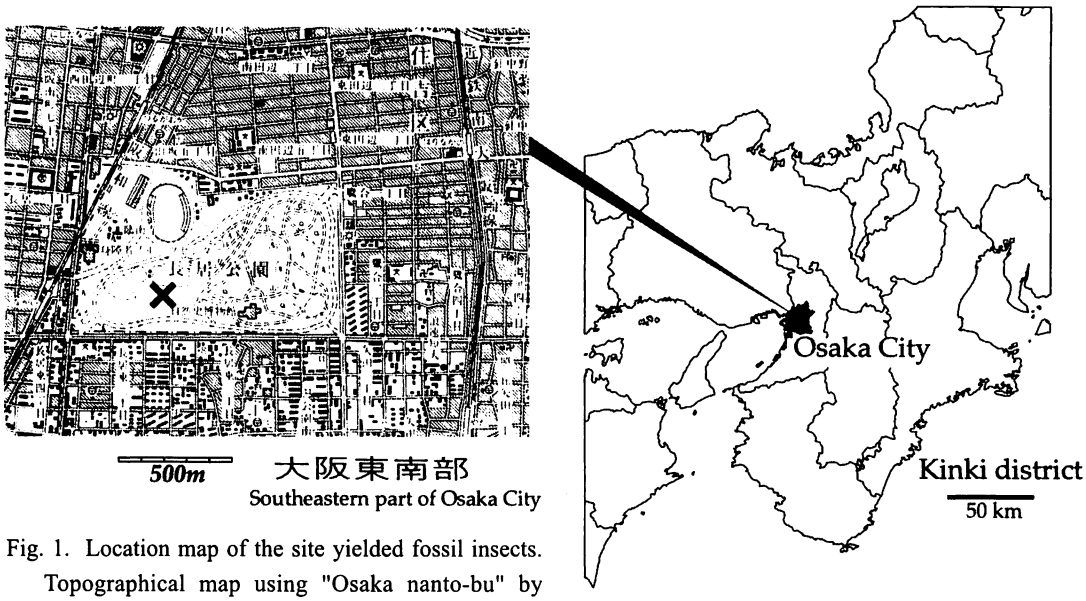

Fig. 1. Location map of the site yielded fossil insects. Topographical map using "Osaka nanto-bu" by Geographical Survey of Japan.

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

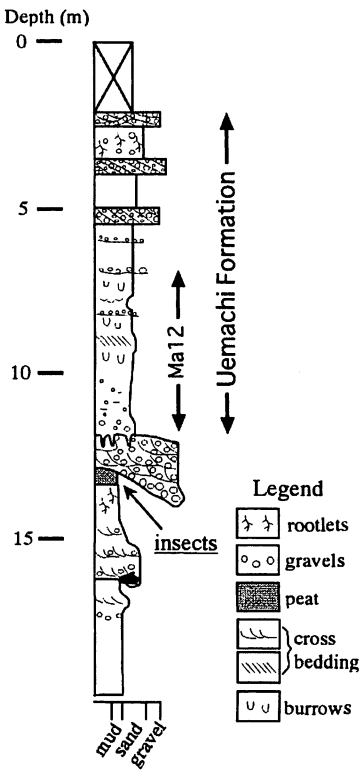

Fig. 2. Schematic log in underground of Nagai Park.

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 donaciine 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 quadrate; 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 striole; sutural interval entirely rugose, narrowed subapically, 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 striole; 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.

COLEOPTERA	
Carabidae	
• Oodini sp.	1
• gen. et sp. indet	27
Hydrophilidae	
• gen. et sp. indet	1
Staphylinidae	
• gen. et sp. indet	2
Chrysomelidae	
• *Plateumaris sericea*	1
• *Plateumaris* sp.	12
• *Donacia flemora*	2
• *Donacia splendens*	11
• Donaciinae gen. et sp. indet	29
Curculionidae	
• gen. et sp. indet	1
Other Coleoptera	
• fam., gen. et sp. indet	19
LEPIDOPTERA	
• fam., gen. et sp. indet (pupa)	8

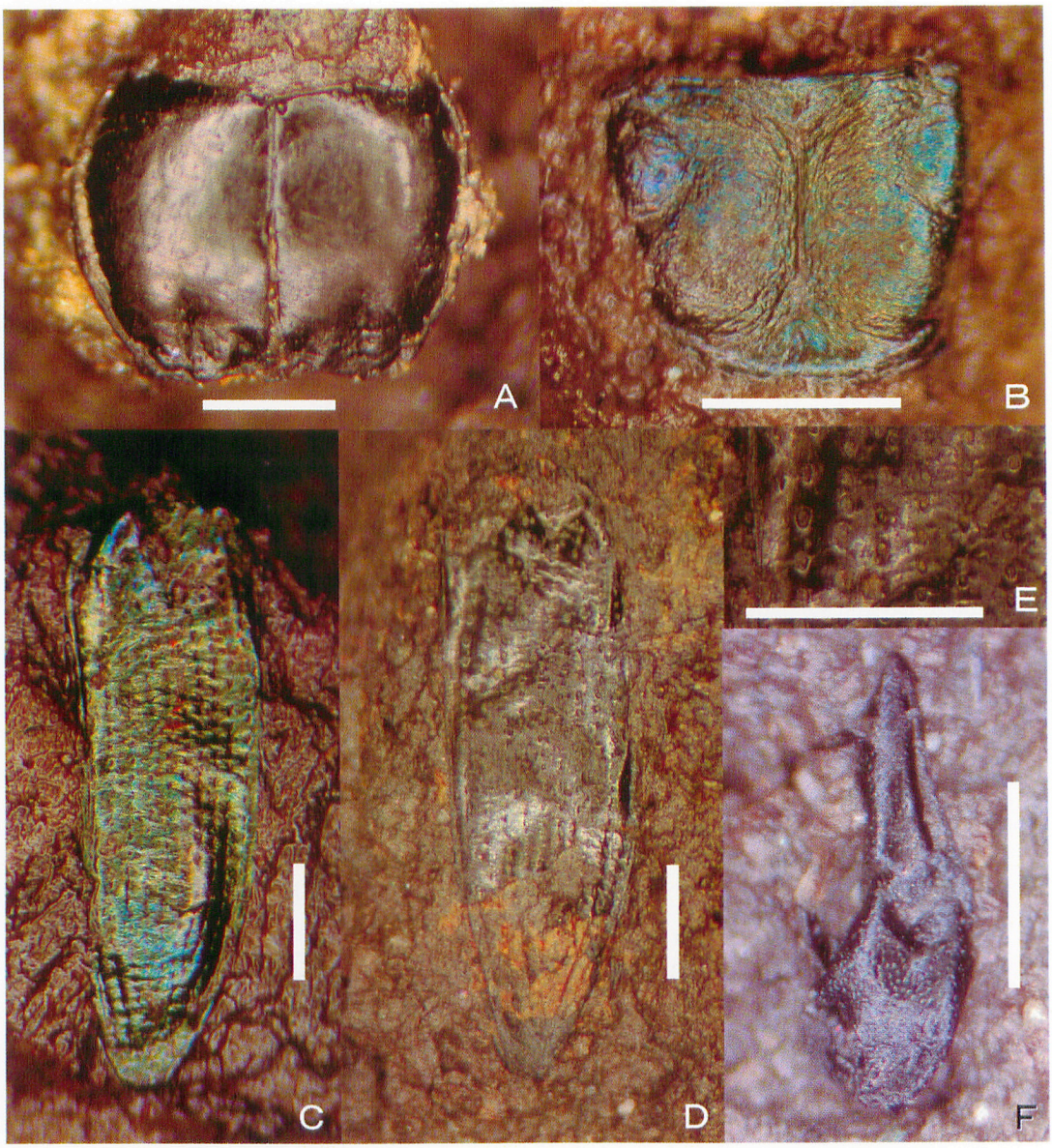

Fig. 3. A, Carabidae, pronotum. B-C, *Plateumaris sericea* (C, pronotum; D, left elytron). D-F, *Donacia flemora* (D, right elytron; E, basal disc of elytron; F, metafemur). Scale bar = 1.0 mm.

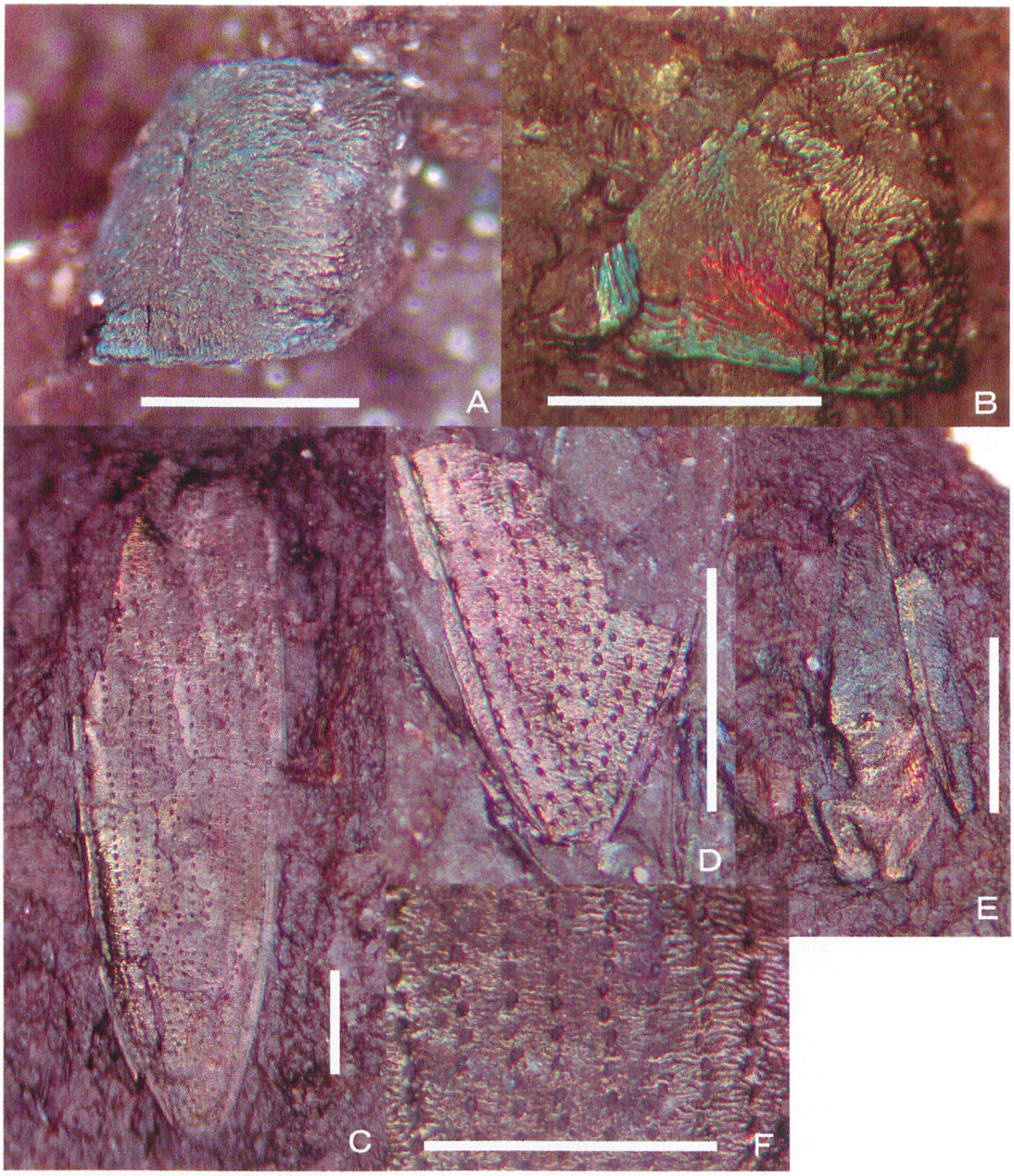

Fig. 4. A-F, *Donacia splendens hiurai* (A-B, pronotum; C, left elytron; D, apex of right elytron; E, metafemur; F, middle part of elytral disc). Scale bar = 1.0 mm.

***Donacia splendens hiurai* Kimoto**

(Figs. 4, 5)

Description: Coloration of pronotum, elytron and femur entirely coppery or metallic green. Pronotal outline more or less quadrate; 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 striole; 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.

Fig. 5. Male genitalia of *Donacia splendens hiurai*. ef: endophallus. Scale bar = 1.0 mm.

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 versicaria*. *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 versicaria*, *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*.

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