Jpn. J. Ent., **61** (3): 511–514. September 25, 1993

Ergatoid Queens of Slave-making Ant *Polyergus samurai* YANO (Hymenoptera, Formicidae)

Mamoru TERAYAMA

Biological Laboratory, Toho Institute of Education, Wakaba-cho 1–41–1, Chofu, Tokyo, 182 Japan,

Takeshi YAMAGUCHI

Department of Ecological Science, Natural History Museum and Institute, Chiba, Aoba-cho 955–2, Chuou-ku, Chiba, 280 Japan

and

Eisuke HASEGAWA

Department of Biology, Faculty of Science, Tokyo Metropolitan University, Minamiohsawa 1–1, Hachioji, Tokyo, 192–03 Japan

Abstract Ergatoid queens of *Polyergus samurai* YANO, 1911, are firstly described. This caste is easily distinguishable from the normal queens by the workerlike trunk, and from the workers by the large head and gaster, convex mesonotum, and developed ovaries. The developed reproductive organs suggest that the ergatoid queens can produce female offsprings. The ground activities of the caste were also observed in the field.

Key words: *Polyergus samurai*; Formicidae; Hymenoptera; ergatoid queen.

Introduction

The slave-making ant genus *Polyergus*, belonging to the subfamily Formicinae, is represented by 5 species distributed in the Holarctic Region. In Japan, a single species, *Polyergus samurai* YANO, 1911, is distributed from Hokkaido to Kyushu and nests in the ground of grasslands or barelands. In this genus, wingless ergatoid queens have been known to occur in European *P. rufescens* and North American *P. lucidus* (STITZ, 1939; HEINZE & BUSCHINGER, 1987; KWAIT & TOPOFF, 1984). However, almost nothing has been known for the ecological role of these ergatoid queens. In addition, there has been no report for the ergatoid queens of *P. samurai*.

Recently, we found ergatoid queens of *P. samurai* in the Ecology Park of the Natural History Museum and Institute, Chiba, Japan. In this report, we provide a description of the morphology and some ecological information of the ergatoid queens of *P. samurai*.

Materials and Methods

In the Ecology Park of the Natural History Museum and Institute, Chiba, 12 colonies of *P. samurai* were covered with a light-brown tile plate (20×15 cm) in late May, 1992. All colonies made a large chamber under the plate and slave-workers carried brood into the chamber. The condition of the nests under the plate was checked once a week until October, 1992.

Four ergatoid queens were collected from 2 colonies and were examined for the morphology under a binocular microscope.

Results and Discussion

Description of ergatoid queen

Head length 1.93–1.95 mm, head width 1.90–2.00 mm, scape length 1.25–1.35 mm, cephalic index 99–103, scape index 63–74, WEBER's length of trunk 2.95–3.05 mm, dorsal pronotal length 1.25–1.30 mm, petiolar scale length 0.55–0.65 mm, petiolar scale height 0.95–1.00 mm, dorsal petiolar scale width 1.10–1.20 mm, total body length 7.5–8.0 mm. (Four individuals were measured.)

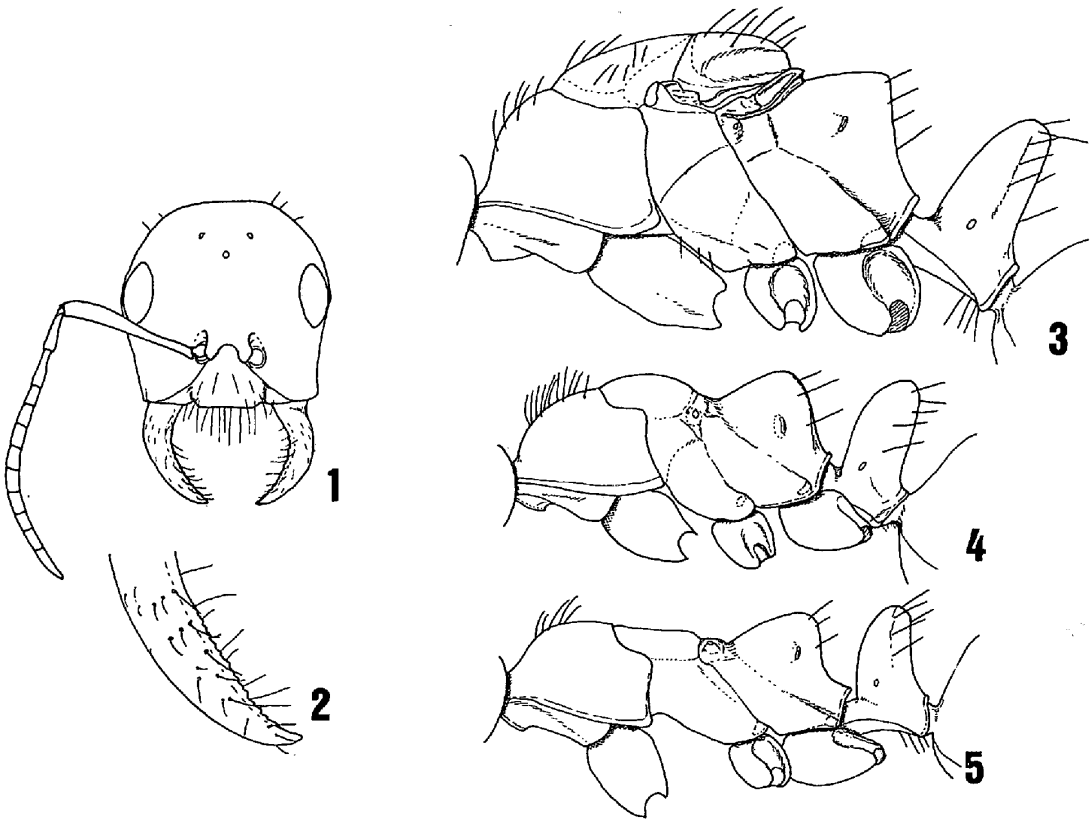
Head almost as long as wide with convex occipital border in frontal view (Fig. 1). Mandibles long and slender, sickle-shaped with an acute apical tooth; anterior 2/3 of masticatory margin with a series of minute denticles (Fig. 2). Clypeus truncated anteriorly. Antennae with 12 segments; 2nd segments 3.2× as long as broad; 3rd segments 2.8× as long as broad; first 5 funicular segments in a ratio of about 16: 14: 9: 8.5: 8 in length. Compound eyes 0.48–0.53 mm in maximum diameter. Ocelli small, anteromedian ocellus 0.07–0.08 mm in diameter; front angle of ocellar triangle obtuse. Maxillary palpi with 4 segments, labial with 3 segments.

Trunk compact, 1.5–1.6× as long as head length. Dorsal outline of mesonotum convex in lateral view. Propodeum strongly raised posteriorly. Promesonotal suture distinct, mesonotal-mesepisternal and mesepisternal-metanotal sutures indistinct. Wings and tegulae absent. Petiolar scale large, with gently convex anterior border and almost straight posterior border; in front view, dorsal border convex with shallow median notch.

First gastric tergite 2.6–2.7 mm in dorsal width.

Long standing hairs present on the clypeus, masticatory margin of mandibles, posterolateral corners of occiput, dorsum of pronotum, posterolateral corners of propodeum, and petiole. Color black.

Material examined. 2 ergatoid queens, 15–VII–1992, Aoba-cho, Chiba-shi, Japan, E. HASEGAWA & T. YAMAGUCHI leg.; 2 ergatoid queens, 19–VII–1992, otherwise same data.



Figs. 1–5. *Polyergus samurai* YANO, 1911 (normal queen, ergatoid queen, and worker). —— 1, Ergatoid queen, head; 2, ergatoid queen, anterior 2/3 of mandible; 3, normal queen, trunk and petiole; 4, ergatoid queen, trunk and petiole; 5, worker, trunk and petiole.

Comparisons with normal queens and workers

The ergatoid queens are easily distinguishable from the normal queens by the workerlike trunk, and from the workers by the large head and gaster which are almost as large as those of normal queens, convex mesonotum, and developed ovaries. The shape of trunks of normal queen, ergatoid queen, and worker are shown in Figs. 3–5.

Of the 5 colonies which produced new alate queens, 4 colonies contained several (2–3) ergatoid queens in each nest. Dissections revealed that the number of ovarioles in an ovary was not different between alate queens and ergatoid queens (for alate queens: 23.5 ± 1.91, n=4, N=2; for ergatoid queens: 24.3 ± 0.96, n=4, N=2. Mean$\pm$S.D., n: number of examined ovaries; N: number of examined individuals). In addition, both forms possessed a well developed spermatheca. Thus, the ergatoid queens can produce female offsprings. KWAIT and TOPOFF (1984) reported that one of the 6 ergatoid queens found in a colony of *P. lucidus* laid eggs in laboratory. In addition, most *P. samurai* colonies in the Ecology Park produced several ergatoid queens. There is a possibility that the ergatoid queens of *P. samurai* have

some adaptive functions in colonies.

Ground activities in the field

On two occasions in 1992, E. H. and T. Y. observed above ground activities of ergatoid queens. On 19 July, an ergatoid queen was found on a glass brade near a nest entrance of a *Polyergus* colony. We dissected this individual and found that she was not inseminated. On 7 August, another ergatoid queen was found entering a *Polyergus* nest. This individual returned to the nest following a raiding trip of this colony although her going behavior was not directly observed. Whether this individual participated in the raiding or not was not confirmed because she had no booty. In the genus *Polyergus*, a nest founding behavior that dealate queens follow a raiding swarm and intrude into the target nest with raiding workers has been reported (MORI *et al.*, 1991; KWAIT & TOPOFF, 1984). TOPOFF and GREENBERG (1988) found that alate queens of *P. breviceps* mate with males in raiding swarms. In *P. lucidus*, MARLIN (1971) observed multiple mating of alate queens on the ground. Thus, the observed behaviors of the ergatoid queens may be reproductive activities. Detailed studies on behaviors of the ergatoid queens are needed to elucidate ecological roles of this caste.

References

HEINZE, J., & A. BUSCHINGER, 1987. Queen polymorphism in a non-parasitic *Leptothorax* species (Hymenoptera, Formicidae). *Insectes soc.*, **34**: 28–43.

KWAIT, E. C., & H. TOPOFF, 1984. Raid organization and behavioral development in the slave-making ant *Polyergus lucidus* MAYR. *Insectes soc.*, **31**: 361–374.

MARLIN, J. C., 1971. The mating, nesting and ant enemies of *Polyergus lucidus* MAYR (Hymenoptera: Formicidae). *Am. Midl. Nat.*, **86**: 181–189.

MORI, A., D. A. GRASSO & F. LE MOLI, 1991. Eco-ethological study on raiding behaviour of the European amazon ant, *Polyergus rufescence* LATR. (Hymenoptera: Formicidae). *Ethology*, **88**: 46–62.

STITZ, H., 1939. Ameisen oder Formicidae. *In* DAHL, F., (ed.), *Die Tierwelt Deutschlands*, No. 37. 428 pp. G. FISCHER Verlag, Jena. (Indirectly cited.)

TOPOFF, H., & L. GREENBERG, 1988. Mating behaviour of socially-parasitic ant *Polyergus breviceps*: the role of the mandibular glands. *Psyche*, **95**: 81–87.

(Received February 16, 1993; Accepted June 17, 1993)