

In the male caste of these three species (Plate 1, figs. 4-6), the rugosity is obsolescent (Plate 2, figs. 12-20) but the de-sclerotization of wing venation (Plate 2, figs. 3-5) shows the same sequential tendency,  $o \rightarrow f \rightarrow s$ . The wing venation of queens (Plate 2, figs. 1, 2) was compared for *osimensis* and *famelica*. These were also observed to exhibit the same differences as those of the males, in the increased de-sclerotization in the venation of *famelica*.

Relation  $o \infty f // s$  is observed in the following three characters: The number of prominent lines of the frontal area in both worker and queen, the shape of the frontal edge of the clypeus in queen (Plate 2, figs. 6-8), and length of the legs both worker and queen (Plate 1, figs. 1-3, 7, 9, 11). In *osimensis* and *famelica*, one prominent line runs through the frontal area of both worker and queen, but no line occurs in the worker and three in the queen of *smythiesi*. The same relation is also found in the length of the legs. The former two species have very long legs but the last species has very short legs in both worker and queen. The form of the legs in *smythiesi* seems to be similar to that of members of *Myrmica*.

Relation  $o // f \infty s$  is observed on the shape of the epinotum in male (Plate 2, figs. 18-20): *osimensis* is completely different from the remaining two species, in having a shape of long box epinotum without any projection of epinotal spine and of metapleural gland. The same relation is observed on the puncturation of the petiole and postpetiole of workers, which are smooth and shining in *osimensis* but are densely punctate in the remaining two species.

A relation  $o \infty s // f$  is shown by the puncturation of the gastric surface of the queen caste (Plate 1, figs. 1-3), which is smooth and shining in *osimensis* and *famelica* but (only the queen of *famelica*) is punctate shallowly over the whole surface of abdomen, although the workers of *famelica* have smooth abdomens. The same relation is observed with the body size and leg length of the male caste (Plate 1, figs. 4-6), in which the male of *famelica* are larger than the males of the other two species.

## 2. Distribution patterns

*A. osimensis*: This species is subtropical, being distributed only in southern Japan. The nests are mostly found in rocky places along the coast of the Pacific Oceans, where the climate is warm even in winter. The nests are made in slits of rocks. This type of nesting behavior, characteristically found in tropical, is primitive as compared with that of highly socialized temperate species. The northernmost spot along the coast of the Pacific Ocean where specimens were collected was Otsu, Ibaragi Pref.; and specimens from the southernmost part of Japan was collected from Amami-Oshima. On the other hand, not a single specimen has ever been collected from the coast of the Japan Sea and from the coastal regions of Sanriku and Hokkaido (Fig. 1). As far as observed, it may be said that this species occurs only up to the southern coast of Kanto District in Japan. This northern limit of distribution agrees well with the isothermal line of  $-3.5^{\circ}\text{C}$  (mean minimum temperature of the year). This distribution pattern is characteristic of many tropical species as mentioned by Imai (1969).

*A. famelica*: The northernmost distribution was recorded at Mt. Daisetsu of