SYNECOLOGICAL STUDY ON INTERTIDAL COMMUNITIES II. ON THE INTERRELATION BETWEEN THE HIJIKIA FUSIFORME ZONE AND THE MYTILUS EDULIS ZONE

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SYNECOLOGICAL STUDY ON INTERTIDAL COMMUNITIES
II. ON THE INTERRELATION BETWEEN THE *HIJIKIA FUSIFORME* ZONE AND THE *MYTILUS EDULIS* ZONE[1)]

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(With one figure)

In the previous paper, it was clarified that the distribution of *C. challengeri* and some others was modified by the covering of *M. edulis* and thus the covering phenomenon is one of the important factors determining the intertidal zonation (Hoshiai 1958).

In the present paper, further investigation was made to ascertain the said importance of the covering phenomenon in the intertidal rocky communities.

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METHOD

On the open coast of Matsushima Bay, the zonation of sedentary organisms, which was formed on the vertical rock face, was observed. In the present study, one station (TN) was selected on the tuff cliff and two stations (GN and GS) were on the vertical surface of each of two granite rocks. The belt transect method was used and a 10 cm wide belt was vertically set on the rock face, which was divided into 10 cm squares. The individual number of the animals in each square was counted and the vertical distribution of plants was studied.

OBSERVATIONS AND DISCUSSION

These rocks stand close to one another and, TN and GN face to the north and GS to the south. As to the nature of the rock face, the tuff cliff is rougher and more fragile than the granite rock.

Chthamalus challengeri Hoek, *Ostrea gigas* Thunberg, *Septifer virgatus* (Wiegmann), *Mytilus edulis* Linné and the brown algae, *Hijikia fusiforme* (Harvey)

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Okamura, are found commonly on the intertidal rock surface in this vicinity. The distribution patterns of these species in the present three stations are shown in Fig. 1. As is shown in Fig. 1, the *C. challengeri* zone, the *H. fusiforme* zone and the *M. edulis* zone are found in TN from the upper part to the lower part. But, in GN and GS, the *M. edulis* zone is arranged directly below the *C. challengeri* zone and moreover *C. challengeri* is more plentiful than in TN, and the small spats of *O. gigas* are scattered in the *C. challengeri* zone. At the upper part of GN and GS *S. virgatus* is more plentiful in number than that in TN. Above all, the remarkable difference obtained from comparison of three rock faces is that on the tuff cliff face the *H. fusiforme* zone lies between the *C. challengeri* zone and the *M. edulis* zone, but that it is absent from the granite rock face.

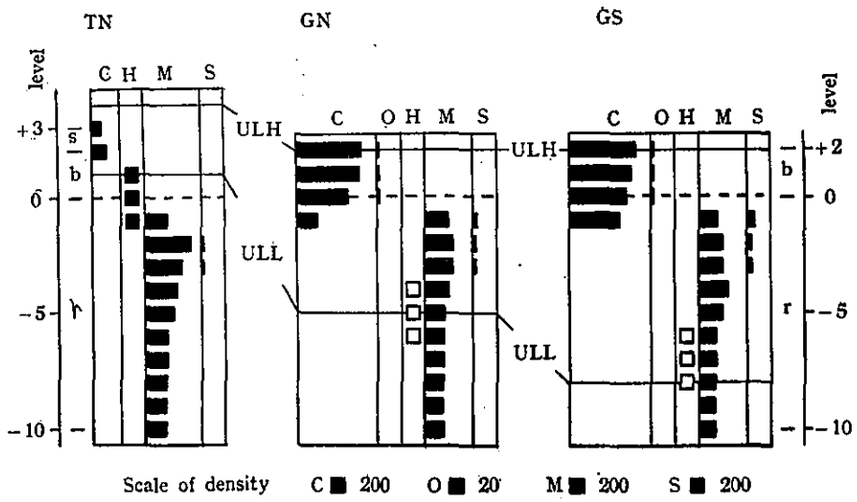

Fig. 1. The vertical distribution of the organisms is illustrated. The open symbols show the covered *H. fusiforme*.

The abbreviations used in the figure are the following:
C – *C. challengeri*, O – *O. gigas*, M – *M. edulis*, S – *S. virgatus*, H – *H. fusiforme*.
s — splash part, b — breaker part, r — brushing water part.
ULH — the upper limit of the wet part of the rock face at high spring tide.
ULL — the upper limit of the wet part of the rock face at low spring tide.

In order to know the relation between the distribution of the prominent species and the environmental conditions, the wave exposure condition and the damp condition of the surface were observed.

At high spring tide, when waves sweep over the cliff face, the narrow splash part, the breaker part and the brushing water part are distinguished. On the granite rock it was observed that the splash part does not appear and thus the breaker washes the top of the rock, but the wave action is generally similar to that at the cliff.

At low spring tide, the surface of each station is entirely exposed in the air.

As it was noted that the damp condition of the rock face seemed to be influenced by the inhabitants, the degree of the desiccation on the denuded rock face was also observed.

As is shown in Fig. 1, at high spring tide, the upper limit of the wet part of the rock face in TN is 20 cm higher than the top of the rock in GN and GS, and also at low spring tide it is at −1 level in TN, at −5 level in GN and −8 level in GS.

According to the present observation, *C. challengeri* distributes at the splash part and the breaker part. The *M. edulis* zone is formed in the brushing water part and therefore seems to have no relation to the damp condition. But, the relation of *H. fusiforme* to the wave action is not so simple as in the case of the above two species. The *H. fusiforme* zone which appears only in TN, is formed in the breaker part where the rock surface does not dry up from the high tide to the next one. From such appearance, it is considered as if the presence of *H. fusiforme* depends upon the nature of the substratum.

However, it is necessary to note that *M. edulis* covers the other animals (Hoshiai 1958) and that Lewis (1954) pointed out the exclusive interrelation existing between *M. edulis* and the *Himanthalia* belt. In addition, it is interesting to know that at the lower part of the *H. fusiforme* zone in TN, *M. edulis* attaches to the thalli of *H. fusiforme*. Thus, it was tried to examine the relation between *H. fusiforme* and *M. edulis*. For this purpose the shells of *M. edulis* were carefully taken away from the substrata. It is the result of this deprivation that the *H. fusiforme* zone was found beneath the *M. edulis* zone. Accordingly, it becomes clear that both tuff rock face and granite one are suitable for the settlement of *H. fusiforme*. Fig. 1 shows that the *H. fusiforme* zone is formed near the upper limit of the wet part of the rock face during the low spring tide. In the case of the granite rock, the *H. fusiforme* zone is formed within the vertical range of the *M. edulis* zone and successively it is concealed with *M. edulis*. On the other hand, on the tuff cliff it is formed above the upper limit of the *M. edulis* zone and therefore it is saved from the coverage of *M. edulis*. Thus, it is concluded that the distribution of *H. fusiforme* may be primarily controlled by the damp condition and secondarily influenced by the coverage of *M. edulis*.

SUMMARY

On the exposed coast where both *H. fusiforme* and *M. edulis* form respectively characteristic zones, the *H. fusiforme* zone is formed near the upper limit of the wet part of the rock face at the low spring tide and *M. edulis* forms its zone on the brushing water part.

When the *H. fusiforme* zone and the *M. edulis* zone overlap each other, the former is covered by the latter and thus the *H. fusiforme* zone disappears from the rock face. *H. fusiforme* which attached itself to the outside of the *M. edulis* zone, survives and forms the neat belt. It is therefore generally recognized that the covering action seen among intertidal organisms has an influence on the forming of the zonation.

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