Estimation of fine root dynamics in mangrove forest in Okinawa, Japan

Yumi Nishino

Key Words: *Mangrove, Kandelia obovata, fine root production, net primary production, Okinawa*

1. Introduction

Terrestrial ecosystems are closely related with atmospheric circulation including carbon dioxide. Atmospheric carbon is absorbed into plants by its photosynthetic activity and accumulated temporarily in the plant body with its growth. Clear understanding of the carbon dynamics in ecosystems is valuable for land use and forest management. Forest has been attracted attention for the usefulness of the mitigation effect against the climate change as a carbon sink. Fine roots, especially, are important to net primary production (NPP) which is the total amount of accumulated carbon in plants. However, the contribution of roots to NPP in ecosystems has not been considered. Two approaches were applied in this study due to the first attempt for estimating root production, mortality and decomposition with soil core techniques and litter bag experiments in *Kandelia obovata* (S., L.) Yong stand, which is locally endomic mangrove species to southern Japan and the east coast of China.

2. Materials and methods

The present study was carried out in Manko Wetland (26°11′ N and 127°40′ E) in Okinawa main island, Japan, which belongs to subtropical region and is nearly the northern limit of the mangrove habitat. A quadrat (20 m × 20 m) was established in the pure *K. obovata* stand. Ground elevation, soil water EC and pH, soil temperature were measured for site environments. Root production, mortality and decomposition were estimated from the changes in root biomass and necromass, and the decomposition ratio by using ingrowth core experiments and sequential soil core samplings, and root litter bag experiments for the decomposition ratio.

3. Results

Root production, mortality and decomposition of all diameter size classes of coarse (diameter $\varphi \geq 2$ mm), fine ($0.5 \leq \varphi < 2$ mm) and very fine roots ($\varphi < 0.5$ mm) which estimated by using ingrowth core experiments, were 583.0, 556.0 and 298.7 g m^{-2} y^{-1}, and these of only fine and very fine roots, which has generally been defined as 'fine root' and discussed together, were 516.6, 510.4 and 263.0 g m^{-2} y^{-1}, respectively (Fig. 1a). The values of production, mortality and decomposition of three root diameter size classes for sequential soil core samplings were 2259.6, 1825.4 and 1267.9 g m^{-2} y^{-1}, and these of diameter size of less than 2 mm were 1248.1, 1195.1 and 763.0 g m^{-2} y^{-1}, respectively (Fig. 1b). The values of belowground NPP for ingrowth core experiments and sequential soil core samplings were 2.9 and 11.3Mg C ha^{-1} y^{-1}, respectively.

4. Discussion

The estimates of root productivity by ingrowth core experiments tended to be underestimated due to a short period of one experiment. The total NPP including the belowground NPP of *K. obovata* stand (17.8-27.4 Mg C ha^{-1} y^{-1}) was slightly higher than that of other region mangrove forests. This *K. obovata* habitat which located at the inland with less impact of water currents and low salinity might make the proportion of the belowground NPP to the total (15-42.2%) relatively lower than other mangrove forests.

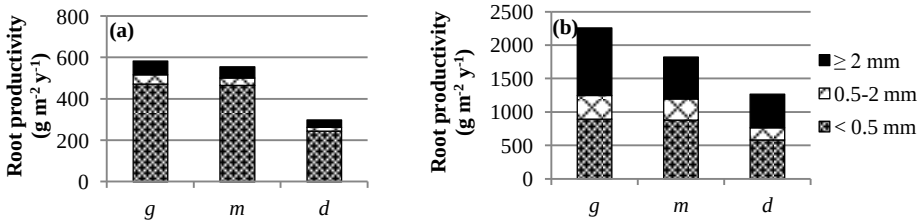

Fig. 1 Root production (*g*), mortality (*m*) and decomposition (*d*) per year for ingrowth core experiments (a) and sequential soil core samplings (b)