Clump structures of two sedge species induced by soil moisture regime in an ephemeral wetland

Takashi ASAEDA* • Md H. RASHID

Department of Environmental Science & Technology • Saitama University, JAPAN

9th INTECOL INTERNATIONAL WETLANDS CONFERENCE

Saitama University 埼玉大学

ABSTRACT

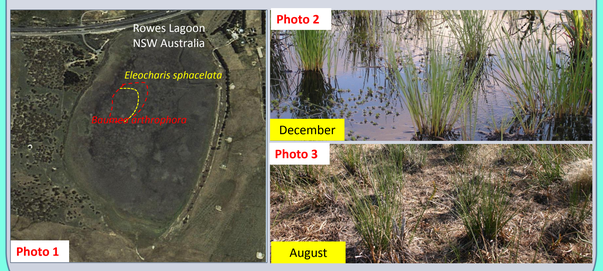
A study was conducted to explore the inter-specific plant mutualism driven by moisture deficit at Rowes lagoon in NSW Australia. *Eleocharis sphacelata* and *Baumea arthrophylla* produced pure and mixed clumps in a soil moisture gradient. Observation of their clump structure and soil condition in both types of patches revealed that these plants shows a mutualism phenomenon in respect of clump formation driven by a acute soil moisture deficit. Formation of mixed clumps provide these species with better moisture preservation capacity in litter, soil and underground rhizome and roots.

INTRODUCTION

Inter-specific interactions among aquatic plant species are an important determinant of community structures, composition and dynamics of a particular ecosystem. In ephemeral wetlands with distinct wet and dry seasons, soil moisture often becomes a deficit factor during dry season. It may affect the community structure to produce the positive interaction among species. In this study, interactions among two sedge species induced by moisture deficit and clump structure of the species were studied in an ephemeral wetland.

MATERIALS & METHODS

- The study was conducted at at Rowes lagoon in NSW Australia from 2003 through 2004.
- The lagoon was mostly flat and inundated up to ca. 10 cm depth for about four months during winter to spring.
- Although most of the area was inhabited exclusively by *Eleocharis sphacelata*, the lowest part of the lagoon was occupied mainly with *Baumea arthrophylla* (Photo 1-3).
- In the transitional zone, both *E. sphacelata* and *B. arthrophylla* grew together. clumps of both species grew separately or as mixed clumps.
- Sampling was carried out at monthly to bi-monthly intervals during 2003 through 2004.
- Number of clumps of both species and their sizes were recorded separately for pure clumps, and for mixed clumps from quadrats of 50 m × 30 m.
- Aboveground and belowground plant tissues and litter were collected from the quadrats and sorted species-wise.
- Dry weights were obtained for the collected samples.



- Shoots of *B. arthrophylla* retained moisture by swelling after they died, increasing their diameter to more than twice than that of the living shoots, thus shoot diameters were measured with respect to the status of the shoots.
- Soil samples were taken in between the clumps where soil surface was exposed, around the outer edge of an individual clump, and in the center of an individual clump.

RESULTS

- *B. arthrophylla* formed clumps composed of densely aggregated shoots around the center, whereas *E. sphacelata* clumps consisted of widely distributed shoots in the clump area (Photo 4-6).

Photo 4: Pure *E. sphacelata* clumps

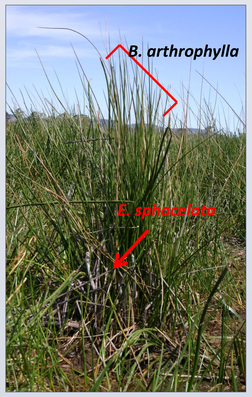


Photo 5: Mixed clumps

Photo 6: Pure *B. arthrophylla* clumps

- In either *E. sphacelata* or *B. arthrophylla* dominated zones, small ramets with several shoots of the other species occurred occasionally, while in the transitional zone, each species formed clumps independently or formed mixed clumps at the same spot with the other species. (Fig. 1).
- The occurrence ratio of mixed clumps was significantly higher than the individual clumps of each species.
- When shoots of one species grew in the clump of the other species, they grew mostly around the center of the clump area rather than along the circumference.
- The shoot diameter of *B. arthrophylla* enhanced by more than twice in several months after they died, and continued to further increase thereafter.

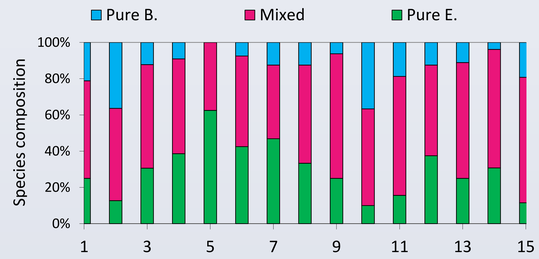


Fig. 1: Composition of *E. sphacelata* and *B. arthrophylla* clumps in a 8m x 8m quadrat

- Due to the stable position of clumps, litter was repeatedly produced over the years at the same spot.
- Standing shoots of *B. arthrophylla* inhibited accumulated litters from dislocating, thereby newly produced litters were mostly accumulated inside the clumps.
- Moisture contents were significantly higher inside the clumps than in the outside, and *B. arthrophylla* contained nearly double amount of moisture inside the clumps and along the outer edge of the root zone, compared to that of *E. sphacelata* (Fig. 2).

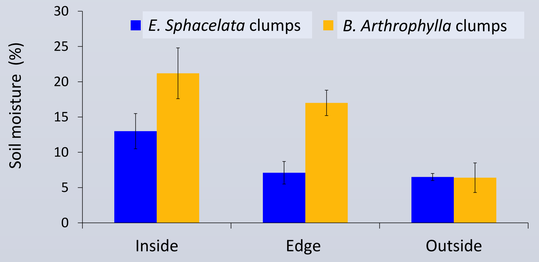


Fig. 2: Moisture content of soil inside, at the edge and outside of clumps

- The shoot diameter of *B. arthrophylla* enhanced by more than twice in several months after they died. In the mixed clumps, roots also overlapped each other.
- Towards the end of drought, high mortality of rhizomes and shoots was observed (Fig. 3), and subsequently the dead rhizomes increased and the contained water was mostly exhausted. Therefore, soil moisture seemed to be deficient during the dry season.

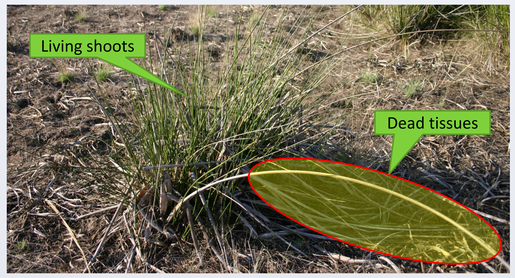


Photo 7: Litter production at the edge of a clump

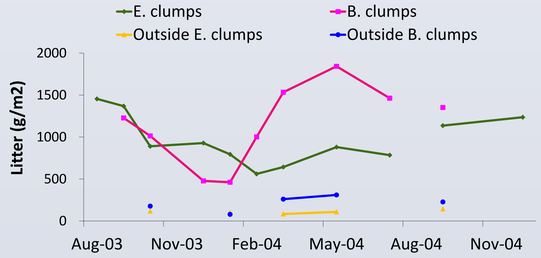


Fig. 3: Production of litters in- and outside of *E. sphacelata* and *B. arthrophylla* clumps

CONCLUSION

- At dry condition with low moisture content in the substrate, plant litters on the ground surface and belowground rhizomes and roots have high potential to preserve moisture.
- The formation of mixed clumps of two species provide them with moisture conserving capacity and thereby they can survive severe drought condition.

CONTACT

Takashi Asaeda
Institute of Environmental Science & Technology, Saitama University
255 Shimo-okubo, Sakura, Saitama, JAPAN
Phone: +81-48-858-3563 Email: asaeda@mail.saitama-u.ac.jp