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Effects of mesophyll water potential on photosynthesis in Gramineae plants: With special reference to phylogeny of subfamilies

We selected several species from six Gramineae subfamilies and examined relationships between the photosynthetic rate and mesophyll water potential (Ψ_L). We used the oxygen electrode method originally devised by Ishii et al. and modified by Ishihara et al. Namely, we used a liquid-phase oxygen electrode and measured the O₂ evolution rate [CB note: (Ishii *et al.*, 1977; Xu *et al.*, 1990)].

Fig.2 shows the data averaged for each of 6 subfamilies. The rate of oxygen evolution generally decreased with the decrease in Ψ_L , the decreasing patterns would be different depending on the subfamilies. In Fig.1, the data are shown for each of the subfamilies.

Bambusoideae, Oryzoideae and Arundinoideae were resistant to low water potential, and followed by Festucoideae. These are C₃ species and the order (IT:

in the text) represents the evolutionary sequence of emergence (IT: Bambusoideae is oldest). For C4 species, Panicoideae species were more susceptible than the Eragrostoideae C4 species. Panicoideae C3 species were intermediate of these C4 species. It appears that C3 species are generally more resistant than C4 species.

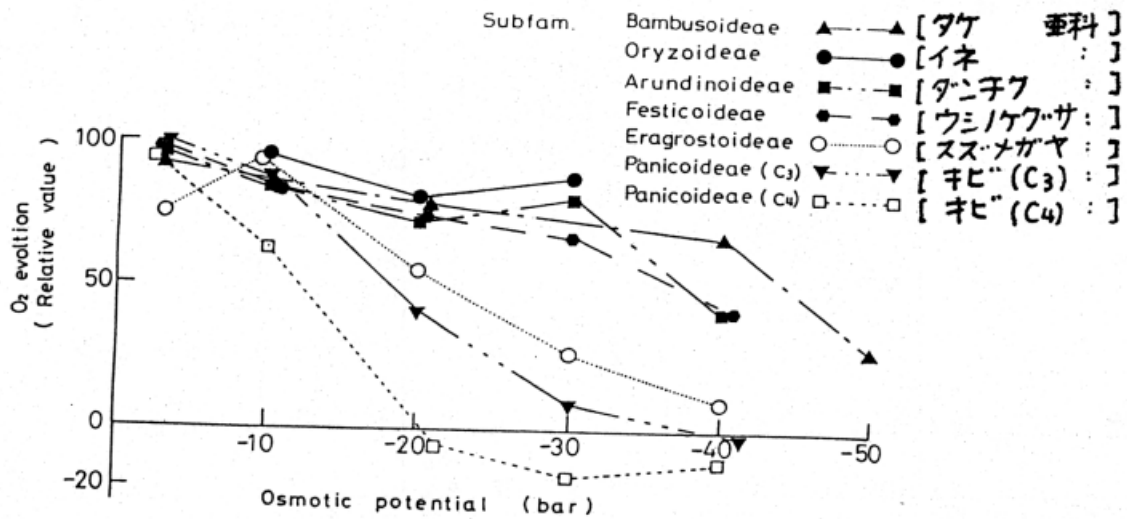


Fig.1 Relation between O₂ evolution from the leaf sections and the osmotic potential of the buffer solution (averages of each subfamily)

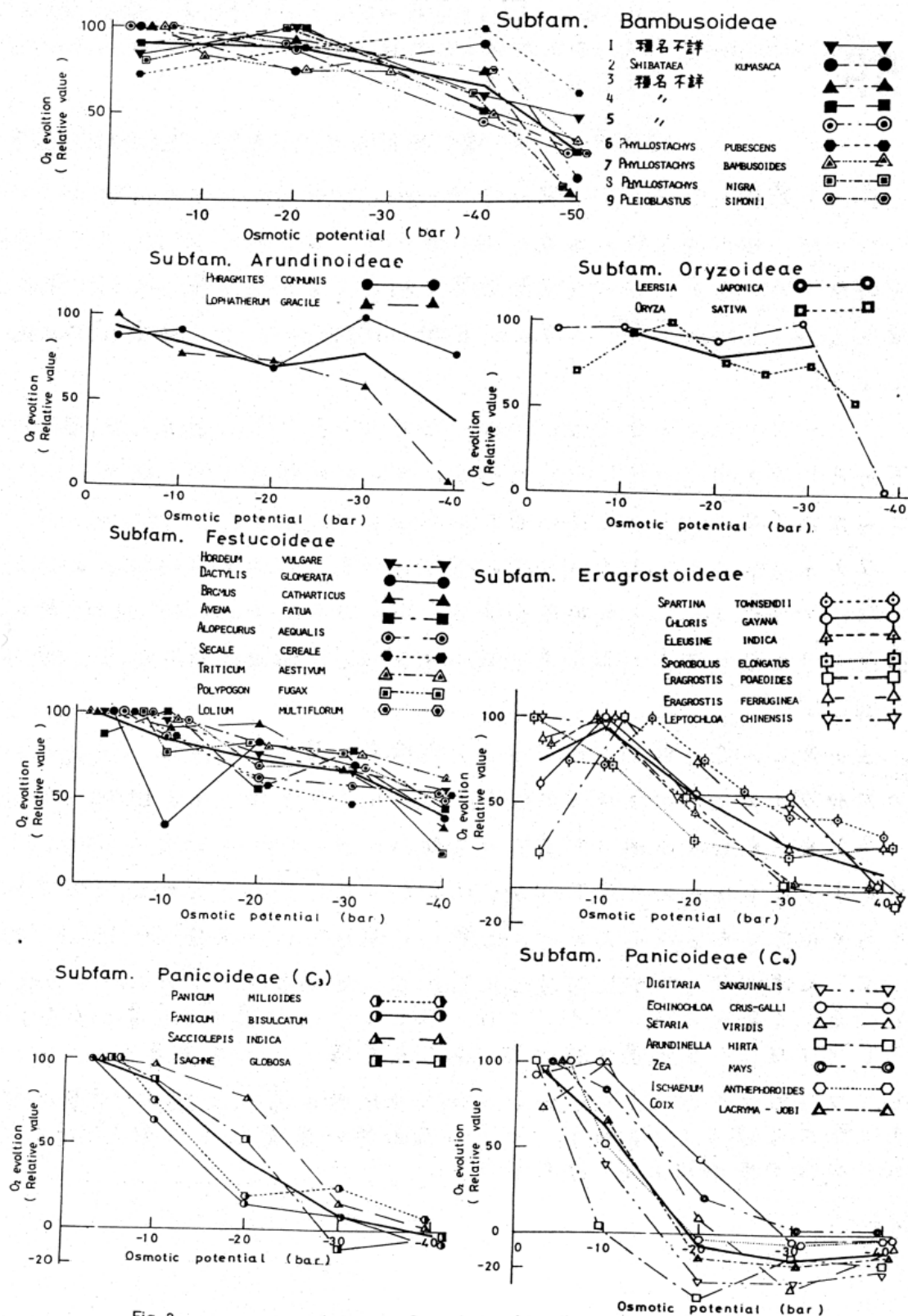


Fig. 2 Relation between O_2 evolution from the leaf sections and the osmotic potential of the buffer solution. (species of each subfamily) Each thick line indicates averages.

Ishii R, Yamagishi T, Murata Y. 1977. On a method for measuring photosynthesis and respiration of leaf slices with an oxygen electrode. *Japanese Journal of Crop Science* **46**(1): 53-57.

Xu H-l, ISHII R, YAMAGISHI T, KUMURA A. 1990. Effects of Water Deficit on Photosynthesis in Wheat Plants: III. Effect on non-stomatal mediated photosynthesis and RuBP carboxylase content in different plant parts. *Japanese Journal of Crop Science* **59**(1): 153-157.