# DIFFERENCES IN MORPHOLOGY AND SUSCEPTIBILITY TO HERBICIDES BETWEEN SEEDLINGS OF *BECKMANNIA SYZIGACHNE* AND *ALOPECURUS AEQUALIS* VAR. *AMURENSIS* IN WHEAT AND BARLEY CROPPING OF SOUTHERN JAPAN

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*Summary.* Seedlings of *B. syzigachne* and *A. aequalis* var. *amurensis* are difficult to distinguish because of morphological resemblance in their early growth stage in drained paddy fields for wheat and barley in southern Japan. Separating the two species is needed for the correct evaluation for efficiency of herbicides, since they differ in susceptibility to the preemergence application of trifluralin or benthiocarb + prometryn. Difference in color of roots was the most effective indicator to distinguish them.

## INTRODUCTION

American sloughgrass, *Beckmannia syzigachne* Steud., has become a noxious gramineous weed in drained paddy fields for winter cropping of wheat, *Triticum aestivum* L., and barley, *Hordeum vulgare* L., in Kyusyu, southern Japan (2,4). Area affected by American sloughgrass was estimated as 30.9 percent against 58,544 ha of planted area in 1992, while short-awned foxtail, *Alopecurus aequalis* Sobol. var. *amurensis* (Komar.) Ohwi, affected 85.4 percent of the area. Close resemblance in the morphology of their young seedlings prevents the correct evaluation on the herbicidal efficiency to the two gramineous weeds. Therefore, distinguishable characteristics and susceptibility to some soil applied herbicides in American sloughgrass were investigated in comparison with short-awned foxtail.

## METHODS

Differences in size of leaf blade. Seeds of American sloughgrass and short-awned foxtail were sown in a 5 cm of depth of sterilized light clay soil in the cement pots of 75 L, on 10 December 1990. Seedlings were grown under 4 different soil moisture rates. Size of leaf blade were measured on 73 days after seeding.

Morphological differences in seedlings and response to herbicides. In cement pot of 75 L filled with light clay soil, seeds of American sloughgrass and short-awned foxtail were sown into the surface soil with other species such as catchweed bedstraw, *Galium sprium L.* var. *echinospermon* Hayak, and so on. Seeds were stored under the ground in 80 cm for dormancy break during 50 days before seeding.

Wheat two-rowed and naked barley were sown in each one row in a pot. Details of the treatment of soil-applied herbicides are given in Table 1. Morphological characters were observed with the seedlings in 2 to 6 leaf stages collected from untreated plot at the end of March of both years. Herbicidal efficiency was evaluated through sampling the survived weeds at 122 days and 114 days after application in 1988 and 1989, respectively.

Table 1. Experimental design for herbicidal efficiency to *Beckmannia syzigachne* and *Alopecurus aequalis* var. *amurensis*.

| Year | Seeding date | Plot no. | Herbicide | | | |
|---|---|---|---|---|---|---|
| | | | Name | Formulation | Rate (kg ai/ha) | Application date |
| 1988 | 17 Nov. | 1 | benthiocarb + prometryn | emulsifier concentrate | 4+0.4 | 18 Nov. |
| | | 2 | benthiocarb + prometryn | granules | 4+0.4 | |
| | | 3 | trifluralin | emulsifier concentrate | 1.35 | |
| 1989 | 24 Nov. | 1 | benthiocarb + prometryn | granules | 4+0.4 | 26 Nov. |
| | | 2 | trifluralin | granules | 1.13 | |

## RESULTS AND DISCUSSION

Difference in leaf size. Length and width of leaf blade of the first, second and third leaves were given in Table 2. They were not affected by soil moisture rate in American sloughgrass, while the length of leaf blade of short-awned foxtail was inhibited under higher soil moisture rate. Width of leaf blade of American sloughgrass was significantly broader than that of short-awned foxtail in the second and third leaves, however they did not differ in length.

Table 2. Length (L) and width (W) of leaf blade (LB) of seedlings of *Beckmannia syzigachne* and *Alopecurus aequalis* var. *amurensis* under different soil moisture rates

| Soil moisture rate[B] | *B. syzigachne*[A] | | | | | | *A. aequalis* var. *amurensis*[A] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1st LB | | 2nd LB | | 3rd LB | | 1st LB | | 2nd LB | | 3rd LB | |
| | L | W | L | W | L | W | L | W | L | W | L | W |
| 36.4% | 24.9 | 0.8 | 26.0a | 1.2 | 35.8a | 2.2 | 19.9 | 0.7 | 29.9a | 1.0 | 38.7a | 1.7 |
| 37.1% | 24.1 | 0.8 | 23.5a | 1.3 | 41.0a | 2.3 | 19.1 | 0.7 | 28.1a | 1.0 | 38.0a | 1.7 |
| 46.7% | 21.5 | 0.8 | 29.3a | 1.1 | 38.1a | 2.1 | 21.4 | 0.7 | 30.0a | 1.0 | 36.4a | 1.8 |
| 51.7% | 20.5 | 0.8 | 26.8a | 1.2 | 39.1a | 2.2 | 16.6 | 0.7 | 21.3b | 1.0 | 29.8b | 1.6 |

[A] Figures are mean value (mm) of 4 to 24 leaves for *B. syzigachne* and 17 to 31 leaves for *A. aequalis* var. *amurensis*. Same alphabet means no significant difference at 5% level by T-test.

[B] Mean of 3 measurements from January to February.

It is considered that the differences in width of leaf blade are too inconspicuous to adapt as a practical method for distinction of seedlings of both species.

Morphological differences in seedlings. Differences in some characters to distinguish the seedlings of american sloughgrass from short-awned foxtail were given in Table 3. Spikelet and husks at the base were effective for distinction if they remained. Young panicle in leaf sheath was also effective after initiated. The root color of American sloughgrass was white, while that of short-awned foxtail was pale reddish brown.

Table 3. Morphological differences in seedlings of *Beckmannia syzigachne* and *Alopecurus aequalis* var. *amurensis* in two- to six-leaf stage at end of March

| Characters | *B. syzigachne* | *A.aequalis* var. *amurensis* |
|---|---|---|
| Spikelet and husks remained at end of mesocoytyle | glumes are swollen, floret is awnless | glumes are sharply flat and hairly, floret awned |
| Tip of ligule | minutely pointed | sharply pointed |
| Quality of leaf blade | minutely rough on surface | minutely rough only on margines |
| Young panicle in sheath | rachis-branch is obvious | rachis-branch is invisible |
| Root colour | white | pale reddish brown |

Difference in root color is recognized as the most effective character among these for distinction, because it can be adaptable to the seedlings without spikelet and husks removed at sampling-time and before panicle initiation. The difference in root color was observed more clearly when half dried.

Response to preemergence application of soil-applied herbicides. Effects of preemergence treatment of soil-applied herbicides were given in Table 4. Through the herbicides treated and year, number of plants survived was greater in American sloughgrass than in short-awned foxtail with the difference in 4 to 40 percent of control. When herbicidal efficiency was evaluated without separating two species, it was resulted in overestimate for American sloughgrass, and in underestimate for short-awned foxtail.

Table 4. Effects of preemergence treatment of soil-applied herbicides to *Beckmannia syzigachne* and *Alopecurus aequalis* var. *amurensis* at 122 and 114 days after treatment as percent of untreated control

| Year | Plot no.[A] | *B. syzigachne* | | *A. aequalis* var. *amurensis* | | *B. syzigachne* + *A. aequalis* | |
|---|---|---|---|---|---|---|---|
| | | No. of plants | Air-dry weight | No. of plants | Air-dry weight | No. of plants | Air-dry weight |
| 1988 | 1 | 33.0 | - | 5.8 | - | 20.7 | - |
| | 2 | 54.0 | - | 14.0 | - | 36.0 | - |
| | 3 | 5.8 | - | 1.2 | - | 3.9 | - |
| Untreated control[B] | | 575 | - | 478 | - | 1050 | - |
| 1989 | 1 | 38.9 | 40.7 | 8.7 | 8.5 | 18.6 | 17.9 |
| | 2 | 19.5 | 35.5 | 13.6 | 22.6 | 15.5 | 26.4 |
| Untreated control[B] | | 1656 | 18.6 | 3384 | 45.8 | 5040 | 64.4 |

[A] Refer Table 1.
[B] Number and g per $m^2$, mean of 2 replicates.

Characteristics in the emergence and seed germination of American sloughgrass have been reported (1). However, there was no effective method to identify the young seedlings of American sloughgrass (2,4), while mature plants could be distinguished without trouble from short-awned foxtail (3). In the experiments for evaluation of herbicidal efficiency to American sloughgrass and short-awned foxtail, following procedure has been adopted in order to decide the composition of the two species in sampled weeds. Individual seedling in border, which was marked before sampling time in middle March, was identified after its heading on few weeks after the time (4). The results of this study provide the simple and accurate method to separate the seedlings of American sloughgrass and short-awned foxtail. Difference in the response to some herbicides between the two species suggests a probable factor encouraging the infestation of American sloughgrass in winter cropping of wheat and barley in southern Japan.

## REFERENCES

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