

MORPHOLOGY AND DISTRIBUTION OF *AMMANNIA AURICULATA* WILLD. IN PADDY FIELDS OF SOUTHERN JAPAN

S. Nakayama¹ and H. Morita

Kyusyu National Agricultural Experiment Station, Chikugi, Fukuoka, 833, Japan

¹ Present address: National Agriculture Research Centre, Kannondai, Tsukuba, 305, Japan

Summary. *Ammannia auriculata* was detected as a new troublesome weed in paddy fields in Kyusyu islands beside two common species, *A. multiflora* and *A. coccinea*. The distribution range of *A. auriculata* was approximately similar to *A. coccinea* which naturalised in the 1950s. Morphological differences in peduncle, pedicel, seed and cotyledon were effective to distinguish *A. auriculata* from others.

INTRODUCTION

In recent years, *Ammannia* species have infested paddy fields of southern Japan, in spite of the application of newly developed herbicides. *Ammannia multiflora* Roxb. and *A. coccinea* Rottb., a naturalised species, had been known as common *Ammannia* species in Japan. Recently, we found out that another naturalised species, *A. auriculata* Willd. had been incorrectly identified as *A. coccinea* in paddy fields in Kyusyu islands, located at southern Japan (3). *A. auriculata* was first recorded in Japan by Hatsushima (2) in 1978. *A. auriculata* has been incorrectly identified as *A. coccinea* because of their morphological resemblance. Distribution and morphological differences of *A. auriculata* were investigated and compared with 2 other *Ammannia* weeds.

METHODS

Distribution in Kyusyu islands. The district of an agricultural extension office was taken for the surveying unit and 58 of 106 units were surveyed in this study. The occurrence of *A. auriculata* and *A. coccinea* were surveyed in fallow paddy fields or paddy rice fields with no autumn ploughing in the units. The survey was carried out from January to March and from November to December in 1992.

Morphological characteristics. To investigate morphology of mature plants of *A. auriculata*, *A. coccinea* and *A. multiflora*, specimens collected from paddy fields in Kyusyu and the Nile delta of Egypt, and fresh plants growing in Kyusyu National Agricultural Experiment Station, were examined.

Seeds of three *Ammannia* species were collected from mature plants growing in paddy fields in the Experiment Station in late autumn to early winter in 1991. They were dried and kept in a desiccator at room temperature.

Seed surface was observed with a scanning electron microscope (HITACHI 450-LB). Size of twenty seeds was measured with a micrometer under a stereoscopic microscope. Fifty seeds were weighted with five replications. To investigate morphology of seedlings, seeds of the three species were seeded on watered paddy soil in plastic cases (18x13 cm, depth 6 cm) at a spacing of 1.5x1.5 cm. Nutrients were applied at rates of 30-30 g a.i. ha N-P₂O₅-K₂O in a compound fertiliser. The cases were incubated in a growth chamber at 30°C, 14 h light at 18,000 lux. Cotyledons were observed under a stereoscopic microscope periodically.

RESULTS AND DISCUSSION

Distribution in Kyusyu islands. The results of the survey on the occurrence of *A. auriculata* and *A. coccinea* are shown in Table 1. *A. auriculata* was observed in 31 of 58 surveying units while *A. coccinea* was observed in 24 (Table 1). *A. auriculata* has widely infested Kyusyu already, at a higher frequency than *A. coccinea* which become naturalised in Kyusyu in the 1950s (1).

Table 1. Frequency in occurrence of *A. auriculata* and *A. coccinea* in districts of agricultural extension offices in Kyusyu islands

	Investigated (A)	Observed (B)	Frequency (B/A)
<i>A. auriculata</i>	58	31	0.53
<i>A. coccinea</i>	58	24	0.41

In the survey, *A. auriculata* and *A. coccinea* were often observed in the same field. Considering this phenomena and the morphological resemblance, there is a possibility that *A. auriculata* will be observed in regions infested with *A. coccinea* beside Kyusyu islands. Therefore, infestation with *A. auriculata* should be noticed in such regions.

Morphological characteristics. The morphological characteristics of three *Ammannia* species are summarised in Table 2. In mature plants, *A. auriculata* could be easily distinguished from *A. multiflora* by the remarkable pinkish-purple or purple petals and larger diameter capsules. Since *A. auriculata* and *A. coccinea* resembled each other in shape and colour of petals and size of capsules. The length of peduncles and pedicels were the most reliable indicators for distinguishing *A. auriculata* from *A. coccinea*.

The seed surface was comparatively smooth in *A. auriculata*, while it was rough in the other two species. This difference can be seen with the naked eye as a practised observer. Since the most remarkable characteristic in seeds of *A. auriculata* was its surface, it is considered the most useful and reliable key for distinguishing seed of *A. auriculata* from others.

Since cotyledons of *Ammannia* species change in size and shape with extension, to distinguish species the shape of cotyledons should be compared at the same stage. Cotyledons of *A. auriculata* had remarkable processes on their edge until the middle phase of extension, while cotyledons of the other two species lost these processes soon after germination. The processes on cotyledons of *A. auriculata* were the most reliable characteristics for distinguishing the *Ammannia* species in the cotyledon stage.

The results of this study can be used as helpful information in ecological study on *Ammannia* species.

Weed morphology and distribution

Table 2. Key to differentiating three weed species of *Ammannia* in Kyusyu islands

	<i>A. auriculata</i>	<i>A. coccinea</i>	<i>A. multiflora</i>
Mature plants			
Basal part of leaf on flowering stem	auriculate, amplexicaul to winged stem	auriculate, amplexicaul to winged stem	truncate or auriculate slightly to ridged stem
Petals	4 petals, 2-3 mm long, pinkish-purple or purple	4 petals, 2-3 mm long, pinkish-purple or purple	4 petals, 0.5 mm long, minute
Peduncles	3-10 mm	0-2 mm	0-3 mm
Pedicels	2-5 mm	0-1 mm	0-1 mm
Mature capsules	2-3.5 mm in diameter, exceeding floral tube	3-4 mm in diameter, exceeding floral tube slightly	2-2.5 mm in diameter, exceeding floral tube by >50%
Seeds			
Colour	lustrous light brown	yellowish brown	reddish brown
Length (mm)	0.44 (0.042)*	0.47 (0.031)	0.38 (0.030)
Width (mm)	0.41 (0.048)	0.39 (0.036)	0.30 (0.028)
Thousand seed weight (mg)	19.3 (0.17)	21.2 (0.28)	12.3 (0.21)
Surface	comparatively smooth	rough	rough
Cotyledon			
Basal part	cuneate in early stage, ovate later	ovate	cuneate in early stage, ovate later
Processes on edge	remarkable till middle phase	indistinct	indistinct

* Standard deviations for length, width and weight of seeds showed in parenthesis.

REFERENCES

1. Hara, H. 1954. Jpn Bot. 29, 152 (in Japanese).
2. Hatsushima, S. 1978. In: Enumeration of Vascular Plants in Kagoshima Prefecture. (eds The Botanical Society of Kagoshima). pp 78 (in Japanese).
3. Morita, H. and Nakayama, S. 1992. Weed Res. Japan 37, 74-77 (in Japanese).