

## NOTES

OBSERVATIONS ON THE MORPHOLOGY AND GEOGRAPHIC RANGE OF *ANTENNARIA DIOICA* (L.) GAERTN. (ASTERACEAE: GNAPHALIEAE).—Randall J. Bayer, CSIRO, Plant Industry, Australian National Herbarium, GPO Box 1600, Canberra, ACT, 2601, Australia.

*ANTENNARIA DIOICA* (L.) Gaertn. (Asteraceae: Gnaphalieae) is widely distributed across Eurasia from the British Isles to Japan and its range extends east into North America only in the western most Aleutian Islands (Bayer, 1993; Bayer and Stebbins, 1993). It is characterized by having glabrous adaxial leaf surfaces and phyllaries with pink or white laminae. The circumscription of *A. dioica* in North America has long been a topic of debate, as *A. marginata* (syn. = *A. dioica* var. *marginata* (Greene) Jeps.) of the southwestern United States bears a remarkable similarity to *A. dioica*. The two species differ in that *A. dioica* has the upper flowering stems lacking glandular hairs and the stolon surface is pubescent, but not densely woolly, whereas in *A. marginata* the upper flowering stem is usually beset with purple glandular hairs and the stolon surface is densely woolly obscuring the surface of the stolon. The species are also strongly allopatric, therefore it seems best to recognize the two as distinct species (Bayer and Stebbins, 1993). No other species in North America is so similar to *A. dioica* as to pose a difficulty in determination.

Recently, Chmielewski (1998) reported a large range extension for *A. dioica* from the Aleutian Islands to the Sierra Nevada, a distance of ca. 5,000 km. *Antennaria dioica* (*sensu* Bayer and Stebbins, 1993) has not previously been reported for California (Stebbins and Bayer, 1993). After examining the herbarium specimen upon which the range extension is based (California, Sierra Nevada, "Among granite fell-fields & scattered *Pinus alba-aulis* near Margaret Lakes, east of Bishop Pass, no. Inyo Co. Elev. 10,800 ft., 7-19-62, Betty H. Johnson #692," CAS 898202!), I came to the conclusion that this collection represents atypical individuals of *A. media* Greene (= *A. alpina* var. *media* (Greene) Jeps.).

Chmielewski (1998) states that "The single collection of *Antennaria dioica* that is the basis of this report consists of three staminate shoots . . .", however, also on the sheet are seven other staminate flowering stalks and their associated basal leaves and stolons.

These seven specimens are part of the same collection and in my view represent typical staminate plants of *Antennaria dioica*. They have strongly pubescent basal leaves, narrowly spatulate basal

leaves, flagless<sup>1</sup> upper cauline leaves, and the papery laminae of the phyllaries are olivaceous to brown or black in color. The fact that the leaves of all ten flowering stalks mounted on the herbarium sheet lack flags distinguishes them from *A. alpina* (L.) Gaertn., which possesses prominent flags. The length of the staminate florets is greater than 3.5 mm, which separates these specimens from the closely related diploid species, *A. pulchella*. E. Greene, which has florets shorter than 3.0 mm (Bayer 1990). The observation that the adaxial surfaces of the leaves are pubescent and the capituli are relatively small and the laminae of the phyllaries are dark colored, distinguishes them from *A. marginata*, E. Greene which has leaves that are glabrous adaxially and has relatively large heads with white tipped phyllaries.

The three specimens (Fig. 1, arrows), referred to as *A. dioica* by Chmielewski (1998), appear to be those with pink flecking in the lamina of some of the phyllaries, although the entire sheet, i.e., all ten specimens, is annotated as *A. dioica* by Chmielewski (Fig. 1). A fourth specimen with pink flecking in the lamina is in a fragment folder on the sheet. It appears that all of these specimens came from the same clone, as their leaves, stem height, phyllary color, and stage of maturity seem to be identical (Fig. 1, arrows). I would determine these three (four counting the specimen in the fragment folder) specimens as either *A. media* or later generation hybrids between *A. media* and *A. rosea* Greene, not *A. dioica*.

The basal leaves of the specimens are heavily pubescent on both the abaxial and adaxial surfaces and resemble the other eight specimens of *A. media* on the sheet. *Antennaria dioica* usually has glabrous adaxial leaf surface, less often are these surfaces subglabrous (Tutin et al. 1976; Hultén 1968; Bayer and Stebbins 1993). As for the phyllary color, my examination of the material leads me to conclude that these three staminate plants do not bear "pink bracted involucre" (c.f. Chmielewski 1998). The base of the papery lamina is olivaceous-black, the tips of some are white, whereas others are reddish-pink or white with reddish-pink flecks. The entire involucre of these three plants gives the impression of being white spotted with reddish-pink. Typical *A. dioica* has heads in which laminae are entirely white, pink or rose. Phyllary color in *A. dioica* is a sex-linked trait; the laminae of the staminate plants usually being white, whereas those of

<sup>1</sup> Flags are flat, linear, scarious, tips that are similar to the tips of the phyllaries not to be confused with ordinary subulate or blunt leaf tips that are essentially green and herbaceous.



FIG. 1. Partial view of herbarium sheet (CAS #898202) showing staminate plants of *Antennaria media*; reputed specimens of *A. dioica* indicated with arrows. Scale as indicated on figure.

the *pistillate* plants are normally pink or rose (von Ubisch 1930), therefore the situation we see in these specimens is the opposite of the usual phyllary color in staminate *A. dioica*. Typical *A. dioica* do not usually have a large dark olivaceous or black spot at the juncture of the base of the phyllary and the papery lamina, as do the three (four) specimens in question. I believe that the pink flecking in these specimens is simply the expression of a rare character, not normally seen in *A. media*. The same rose flecking is also seen in the phyllaries of some specimens of *A. umbrinella* Rydb. (see discussion under *A. umbrinella* in Bayer and Stebbins 1993), whose laminae are normally light to dark brown. I also have made the same observation in *A. anaphaloides* Rydb and *A. pulcherrima* (Hook.) Greene (Bayer personal observation). It is also possible that the specimens in question represent later generation backcross hybrids between *A. media* and *A. rosea*, *E. Greene*, the pink or red phyllary character being a typical trait of *A. rosea* subsp. *rosea*.

The protoplasts of pollen grains from a typical Scandanavian *A. dioica* (taken from CANB 11884 and stained with Alexander's stain (Alexander 1980)) are an average of 21.3  $\mu$  in diameter and 87.5% of the grains stained viable. The dark-phyllaried typical *A. media* specimens on the sheet, i.e., those without the pinkish flecking in the phyllaries, are an average of 27.2  $\mu$  in diameter with 90% viability. The size difference in the protoplasts is typical of diploid (*A. dioica*) vs. tetraploid (*A. media*) pollen (Bayer unpublished). If the three specimens in question were *A. dioica* one would expect the pollen to be around 21  $\mu$  in diameter and to be reasonably viable, thus distinguishing them from the other plants on the sheet. Unfortunately, they are sterile, the anthers are empty, not producing any identifiable pollen even though the flowering stalks are of mature height and the phyllaries are mature. This is highly supportive of the idea that these plants may represent hybrids between *A. media* and *A. rosea*, which grow in sympatry throughout the Sierra Nevada.

In summary, I believe the three specimens (four including the one in the fragment folder) in question on CAS 898202 (*Johnson #692*) to be somewhat atypical staminate plants of *A. media* with

some pinkish or rose flecking in the laminae of the phyllaries. The reddish-pink phyllary color may be due to introgressive hybridization between *A. media* and *A. rosea*. I maintain that the distribution of *A. dioica* is mainly Eurasian, with a few populations in the Aleutian Islands of Alaska. Therefore, *Antennaria dioica* is not a part of the flora of California, and the only North American populations are in the Aleutian Islands.

#### ACKNOWLEDGMENTS

I thank the curator of CAS for loan of the herbarium specimen and to Laurie Adams, Greg Chandler, Lyn Craven, Don Les, Rogier de Kok, and Michael Trebby for critical reviews of this manuscript. I am grateful to Neil Bagnall for measuring and scoring pollen grains for this study.

#### LITERATURE CITED

- ALEXANDER, M. P. 1980. A versatile stain for pollen, fungi, yeast and bacteria. *Stain Technology* 55:13-18.
- BAYER, R. J. 1990. A systematic study of *Antennaria media*, *A. pulchella*, and *A. scabra* (Asteraceae: Inuleae) of the Sierra Nevada and Inyo Mountains. *Madroño* 37:171-183.
- . 1993. A taxonomic revision of the genus *Antennaria* (Asteraceae: Inuleae: Gnaphaliinae) of Alaska and Yukon Territory, northwestern North America. *Arctic and Alpine Research* 25:150-159.
- AND G. L. STEBBINS. 1993. A synopsis with keys for the genus *Antennaria* (Asteraceae: Inuleae: Gnaphaliinae) for North America. *Canadian Journal of Botany* 71:1589-1604.
- CHMIELEWSKI, J. G. 1998. *Antennaria dioica* (Asteraceae: Inuleae): Addition to the vascular flora of California. *Madroño* 45:271-272.
- HULTÉN, E. 1968. *Flora of Alaska and neighboring territories: A manual of the vascular plants*. Stanford University Press, Stanford, CA.
- STEBBINS, G. L. AND R. J. BAYER. 1993. *Antennaria*. in J. Hickman (ed.), *The Jepson Manual of Higher Plants of California*. University of California Press, Berkeley.
- TUTIN, T. G., V. H. HEYWOOD, N. A. BURGESS, D. M. MOORE, D. H. VALENTINE, S. M. WALTERS, AND D. A. WEBB. 1976. *Flora Europaea*, Vol. 4. Plantaginaceae to Compositae (and Rubiaceae). Cambridge University Press, Melbourne.
- VON UBISCH, G. 1930. Geschlechtsverteilung und sekundäre Geschlechtsmerkmale bei *Antennaria dioica* (Gaertn.). *Biol. Zbl.* 50:532-540.