

## THE IDENTITY OF *ARENARIA GOTHICA* AUCT. ANGL.

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*Arenaria gothica* Fr. is commonly distinguished from the complex of the perennial *A. ciliata* L. *sensu lato* on the basis of its life form. Being relatively short lived in nature, with a single or occasionally two flowering seasons, the plant is as a rule very floriferous and vegetative summer shoots are rare. So defined, it is limited in its distribution to a small area in the Swiss Jura, the Swedish island of Gotland and mainland province of Västergötland, and upper Ribblesdale in Mid-west Yorkshire, v.c. 64. This curious distribution has often aroused comment from phytogeographers who usually cite it as an extreme case of Quaternary dissection of a once continuous distribution. This is the suggested explanation put forward for example by Albertson (1946).

However, a recent comparative study of material from these three areas indicates that the taxon is not as coherent as has been supposed. The importance of critical studies of taxa used in phytogeographical arguments should be evident and has been urged most forcibly in a recent paper by A. & D. Löve (1958), concerning the amphi-atlantic plants.

The following is a preliminary account of the chief conclusions concerning *A. gothica* and the consequent taxonomic changes arising from this study. A more detailed account of the complex will be published later.

*A. gothica*, described from Gotland by Wahlenberg as *A. ciliata*  $\beta$  *multicaulis*, was raised to specific rank by Fries (1839). The plants of the Jura, referred to by Grenier and Godron (1848) as *A. ciliata*  $\beta$  *fugax*, were later judged by Grenier (1869) to be conspecific with *A. gothica* Fr. The Yorkshire plant was not discovered until 1889. Two varieties of the species were recognised by Rouy & Foucaud (1896),  $\alpha$  *gothica* Rouy & Fouc. and  $\beta$  *jurana* (Genty) Rouy & Fouc. These were referred to respectively by Williams (1898) as  $\alpha$  *typica* and  $\beta$  *fugax*, the former name being applied to the two northern populations and the latter to the more robust plants of the Jura. This distinction is seldom made in modern floras and no taxonomic distinction appears to have been made between the British and Swedish plants.

Herbarium material has been examined from all the three areas and Swedish and British plants have been studied both in the field and in cultivation. Unfortunately the latter has proved impossible for the Jura plants, which are in danger of extinction. The most important morphological differences detected in this study are presented in Table 1, together for comparison with data for the perennial species *A. norvegica* Gunn. based on material from throughout its range.

Seeds of the Jura plants proved to be significantly larger than those of the Swedish or British ones ( $p$  being less than 0.1%) though all fell within the range of *A. norvegica*.

From Table 1 it will be evident that with respect to these characters the affinities of the British *A. gothica* lie with *A. norvegica* rather than with the Swedish or Jura plants which it resembles in life form and ecology. The first three are however quite distinct in cultivation.

This conclusion, based on morphology, is supported by evidence from cytology and hybridisation. The Swedish plants have a diploid number  $2n = 100$  (Horn, in A. & D. Löve, 1948; Blackburn *in litt.*; Halliday, 1958), whilst both the British plants and

TABLE 1.

Morphological Comparison of *A. gothica* and *A. norvegica*.

All measurements in mm.: those within the brackets indicate the extreme range; those outside, the normal.

	<i>A. gothica sens. lat.</i>			<i>A. norvegica</i>
	Jura	Sweden	Britain	
Height	(50) 80 – 120 (150)	60 – 100 (130)	30 – 50	30 – 60
Leaves				
Length	4 – 5.5 (7)	(3.5) 4 – 5 (6)	4.5 – 5 (6)	3 – 4.5 (6)
Breadth	(1.25) 1.5 – 2 (2.5)	(1.25) 1.5 – 2 (2.5)	1 – 1.5	1 – 1.5 (1.75)
Length/Breadth	2.7 – 2.75	2.5 – 2.7	3.6 – 4	3
Ciliation*	$\frac{1}{3}$ – $\frac{1}{2}$	$\frac{1}{2}$ –	0 – $\frac{1}{3}$ ( $\frac{1}{2}$ )	0 – $\frac{1}{3}$
Number of flowers per cyme	(1) 3 – 6 (8)	(1) 2 – 3 (5)	1 – 2 (4)	1 – 2 (3)
Outer sepals				
marginal cilia*	– $\frac{1}{2}$	– $\frac{1}{2}$	– $\frac{1}{3}$	0 ( $\frac{1}{2}$ )
cilia on back	rare	very common	never present	never present
Petal length	4 – 5.5	4 – 4.5†	(5) 5.25 – 5.5†	4 – 4.5
Flower diameter‡	—	7 – 9	11 – 12	9 – 10

\*. The extent to which the marginal cilia extend from the base towards the apex.

†. Measured on living cultivated material.

‡. Measured in field and on cultivated material.

*A. norvegica* have  $2n = 80$  (Blackburn & Morton, 1957; Halliday, 1958). At the present time, no chromosome numbers have been determined for the Jura plants or any central European *A. ciliata*. Hybridisation experiments reflect this cytological difference. No barriers to gene exchange appear to exist in cultivation between *A. norvegica* and British *A. gothica*, the  $F_1$ ,  $F_2$  and  $F_1$  backcrosses being as fertile as the parents, whereas in crosses involving either of these and Swedish material, meiotic irregularities occur in the  $F_1$  and are associated with reduced seed-formation. This low fertility persists in the  $F_2$  and in backcrosses to the parent with  $2n = 80$  but is increased somewhat on backcrossing to the Swedish parent.

On this evidence, two ecospecies are involved, one including *A. norvegica* and British *A. gothica* and the other the Swedish *A. gothica*. There are therefore strong morphological and genetical grounds for removing the British taxon from *A. gothica* and according it either specific rank or treating it as a subspecies of *A. norvegica*. The former possibility is rejected, not only on cytogenetical grounds, but partly because of the practical difficulty in distinguishing young plants of *A. norvegica* from British *A. gothica*. It is accordingly proposed to give the British *A. gothica* subspecific rank.

*A. norvegica* was described by Gunnerus (1772) but, since he makes no reference to its perennial habit, the original description could cover the British plant. There are however in this a number of inadequate statements as for example “folia . . . enervia, ubique nuda (ne basi quidem ciliata) nitentia.” Therefore descriptions of the two subspecies together with an emended species description are given below.

ARENARIA NORVEGICA Gunn., 1772, *Flora Norvegica*, 2, 144.

An annual, biennial or perennial herb; 3–7 cm. high; leaves obovate, glabrous or ciliate to less than half way, obscurely nerved. Cymes terminal, 1–2 (–4)-flowered. Pedicels

almost glabrous, slender, 4–13 mm. Sepals ovate, 3–4 mm. long, acute with a hyaline margin, usually 3-nerved, but the lateral nerves often obscure, glabrous or with a few cilia confined to the basal margin. Petals white, 4–5.5 mm. long, exceeding the sepals. Ripe capsule equal to or slightly exceeding the calyx. Seeds black with low broad tubercles, 0.8–1.0 mm. in length.  $2n = 80$ .

Subsp. *NORVEGICA*

Herba perennis, caulibus densis procumbentibus, internodiis inferioribus abbreviatis, caulibus floriferis erectis. Folia semi-succulenta, viridia opaca, 3–4.5 (–6) × 1–1.5 (–1.75) mm. Pedunculi terminales (4–) 5–9 (–13) mm. Sepala glabra, vel rarissime ciliis paucis ad basim marginis obsita. Petala 4–4.5 mm. Flores 9–10 mm. diametro. Styli 3–5; dentes capsularum 6–10. Semina 0.8–1.0 mm. Florens 6–9.

Norvegia, Suecia, Scotia, Islandia.

A perennial herb with dense procumbent shoots, short basal internodes, and erect flowering stems. Leaves somewhat succulent, dark green, 3–4.5 (–6) × 1–1.5 (–1.75) mm. Terminal peduncles (4–) 5–9 (–13) mm. Sepals glabrous, or very rarely with a few cilia at the basal margin. Petals 4–4.5 mm. Flowers 9–10 mm. in diameter. Styles 3–5; capsule teeth 6–10. Seeds 0.8–1.0 mm. Flowering 6–9.

Norway, Sweden, Scotland, Iceland.

Subsp. *anglica* Halliday, subsp. nov. *A. gothica* α *gothica* Rouy & Fouc., 1896, *Flore de France*, **3**, 248, *pro parte*. *A. gothica* α *typica* F. N. Williams, 1898, *Journ. Linn. Soc., Bot.*, **33**, 420, *pro parte*.

Herba annua hiberna vel biennis, caulibus floriferis erectis et caulibus sterilibus aestivalibus paucis. Habitus laxior quam in subsp. *norvegica*. Folia pallide viridia, 4.5–5 (–6) × 1–1.5 mm. Pedunculi terminales (4–) 6–13 mm. Sepala exteriora paucis ciliis ad basim marginis obsita vel rarissime glaberrima. Petala 5–5.5 mm. Fores 11–12 mm. diametro. Styli 3; dentes capsularum 6. Semina 0.85 mm. Florens 5l–10.

Anglia.

Holotypus in Herb. Univ. Cantab.: J. F. Pickard, June 6th, 1905 “between Selside and Ingleborough, near Horton-in-Ribblesdale, Mid-west Yorks.”

A winter annual or biennial herb with erect flowering stems and few sterile summer shoots. Of a laxer habit than subsp. *norvegica*. Leaves light green, 4.5–5 (–6) × 1–1.5 mm. Terminal peduncles (4–) 6–13 mm. Outer sepals with a few cilia at the basal margin or very rarely entirely glabrous. Petals 5–5.5 mm. Flowers 11–12 mm. in diameter. Styles 3; capsule teeth 6. Seeds 0.85 mm. Flowering 5–10.

England.

While it seems probable that the Jura plant will prove to be equally distinct from the Swedish and more closely allied to the central European *A. ciliata*, until experimental evidence of this is obtained it seems desirable to retain it for the present in *A. gothica*. The bearing of these and unpublished results on the origin and history of the British taxa is a subject that it is hoped to raise in a later paper.

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## REFERENCES

- ALBERTSON, N., 1946, *Österplana* hed, *Acta Phytogeog. Suec.*, **20**, 151-158, 259-260.
- BLACKBURN, K. B. & MORTON, J. K., 1957, The Incidence of Polyploidy in the Caryophyllaceae of Britain and Portugal, *New Phytol.*, **56**, 334.
- FRIES, E., 1839, *Novitiarum Florae Suecicae, Mantissa altera*, 33.
- GRENIER, C., 1869, *Bull. Soc. Bot. France*, **16**, p. lxi.
- GRENIER, C. & GODRON, D. A., 1848, *Flore de France*, **1**, 259.
- GUNNERUS, J. E., 1772, *Flora Norvegica*, **2**, 144.
- HALLIDAY, G., 1958, *Proc. Bot. Soc. British Isles*, **3**, 90.
- LÖVE, A. & D., 1948, *Chromosome Numbers of Northern Plant Species*; Reykjavik.
- , 1958, The American Element in the Flora of the British Isles, *Botaniska Notiser*, **3**, 376.
- ROUY, G. & FOUCAUD, J., 1896, *Flore de France*, **3**, 248.
- WILLIAMS, F. N., 1898, A Revision of the Genus *Arenaria*, *Journ. Linn. Soc., Bot.*, **33**, 420.