THE SUBSPECIES OF AICHRYSON PACHYCAULON BOLLE (CRASSULACEAE) AND THEIR PROBABLE ORIGIN.

DAVID BRAMWELL

Jardín Botánico Canario "Viera y Clavijo" del Excmo. Cabildo Insular de Gran Canaria

RESUMEN

Son estudiadas las diferentes razas de cromosomas incluidas en *Aichryson pachycaulon* y se tiene en cuenta la variación inter-isla en el tamaño de las flores y caracter de las hojas. Se propone que estas razas deberían ser reconocidas como subespecies. Se considera su posible origen.

SUMMARY

The various chromosome races included in *Aichryson pachycaulon* are studied, account is taken of interialand variation in flower-size and leaf-characters and it is proposed that these races should be recognized as subspecies, consideration is given to their possible origin.

CONTENTS

INTRODUCTION

Aichryson Webb & Berth. Crassulaceae) is a small Macaronesian/North African genus of about 12 species allied to *Aeonium* in the subfamily *Sempervivoideae* (Bramwell, 1969) but which bridges, to some extent the gap between the *Sempervivum* group and *Sedum* (Crassulaceae-*Sedoideae*).

Within *Aichryson* two chromosome base-numbers are known, x=15 in the majority of species and x=17 in *A. punctatum* (Chr.

Sm.) Webb & Berth. Uhl (1961) also reports n=32 (x=16) from some forms of *A. pachycaulon* Bolle from the islands of La Palma and Tenerife.

A. pachycaulon is a robust local species of wet places in the Canary Islands and has been reported from Fuerteventura, Tenerife, La Palma and, recently, Gran Canaria. A closely related taxon *A. gonzalez-hernandezii* Kunkel has been reported as an endemic of the central region of La Gomera. Over a number of years samples of populations of *A. pachycaulon* from the five islands mentioned above have been cultivated in uniform conditions and studied cytologically in order to evaluate the observed morphological and cytological differences between plants from the different islands.

MATERIALS AND METHODS

Living plants or seeds from populations of *A. pachycaulon* from Tenerife, La Palma, Gran Canaria and Fuerteventura and of *A. gonzalez-hernandezii* from La Gomera were collected in the field from 1964-1975 and have been maintained in cultivation over a number of years. For chromosome preparations buds were fixed using modified Carnoy's solution, hydrolysed in 1:1 conc. HCL/ Abs. Alcohol for 2-3 minutes and squashed in aceitc orcein.

CHROMOSOME NUMBERS

The very small punctiform chromosomes found in *Aichryson* Fig. 1 make analysis of meiotic behaviour extremely difficult and the only reliable information obtainable from cytological studies of the genus is the chromosome number.

Within the *A. pachycaulon* group of taxa the following chromosome numbers have been determined:

Tenerife:	Above Taganana	n=32	uhl, 1961
Tenerife:	Vueltas de Taganana	n=32	Bramwell,unpubl.
La Palma:	Cubo de La Galga	n=32	uhl, 1961
La Palma:	Cubo de La Galga	n=30+1	uhl, 1961
La Palma:	Barranco del Río	n=32	Bramwell,unpubl.
La Gomera:	Monte above Hermigua	n=34	Bramwell,unpubl.
La Gomera:	Degollada del Tanque	n=34	Bramwell,unpubl.
Fuerteventura:	Pico de la Zarza	n=34	Bramwell,unpubl.
Gran Canaria:	Presa de los Pérez	n=34	Bramwell,unpubl.
		n=17	Bramwell,unpubl.

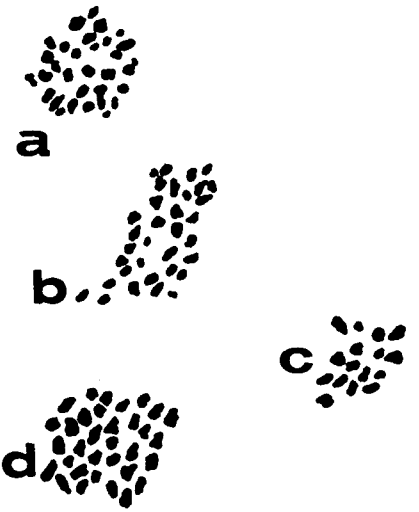

Figure 1. Meiotic chromosomes from *A. pachycaulon* sl: A. n=32, La Palma, Bco. del Río; B. n=34, Gomera above Hermigua; C. n=32+1, single plant from same locality as B; d. Artificial hybrid of *A. punctatum* x *A. laxum*, pollen fertility 10%, seed-set nil, n=16—17.

This range of variation in chromosome numbers has not been found in any other *Aichryson* species and, as Uhl (1961) indicates, means that at least some populations of the polyploid *A. pachycaulon* may be of amphidiploid origin whilst others would seem to be autopolyploid.

MORPHOLOGICAL VARIATION

Within the *A. pachycaulon* group of taxa there is a considerable degree of variation in what might be described as "trivial" morphological characters. Populations from Pico de la Zarza, Fuerteventura, are erect in habit with erect leaves whereas those from Tenerife, La Palma, Gomera and Gran Canaria tend to be more sprawling in habit with divaricate branches and patent leaves, (Praeger, (1932 o.k.). The Gomera plants tend to have larger flowers than the others and the La Palma Barranco del Río population has very small flowers (Figure 2).

All populations examined have crenate leaf-margins though in the Fuerteventura plants most leaves have very weakly crenate to subentire edges. Only the plants from Gran Canaria have the black marginal glands typical of some of the diploid species such as *A. punctatum*. On the other hand all populations are generally glabrous and much larger than the diploid relatives.

DISCUSSION

The populations of giant, glabrous individuals which can be included in the *A. pachycaulon* group are polyploid (with the exception of Gran Canaria where some diploid individuals also occur) and are morphologically generally similar to each other. They appear to have replaced diploids in wet habitats. Cytologically, however, there is evidene for the independent origin of each distinct island population by autopolyploidy or hybridization followed by allopolyploidy.

The diploid parent of the n = 34 taxa from La Gomera, Fuerteventura and Gran Canaria is probably *A. punctatum* (n = 17) and this is almost certainly also one of the progenitors of the *N*=32 populations (n=17 X n=15) from Tenerife and La Palma. The n = 15 parent for the Tenerife and La Palma populations could, however, be one of several species, *A. laxum* (Haw.) Bramwell, *A. parlatorei* Bolle, *A. palmense* Webb etc. and as these are all morphologically similar it is difficult to acertain the n=15 parent.

The taxonomic problem presented by the *A. pachycaulon* group is an interesting one as most of the distinct island populations have at some time in their history been considered as separate species, Tenerife populations as *A. immaculatum* Webb, La Palma as *A. parviflorum* Bolle, La Gomera as *A. gonzalez-hernandezii* Kunkel, Fuerteventura as *A. pachycaulon* Bolle and Gran Canaria as *A. punctatum* s.l. They can all be considered to be elements of a single species with a polytopic origin ie. forms, varieties or subspeies of *A. pachucaulon* which would simply be a convenient polyploid grade group of morphologically similar individuals without direct cladistic affinity. Alternatively, despite the morphological similarity, each island population could be considered as an independently originating, phylogenetically, distinct species differing from its nearest relatives by a series of minor morphological characters of habit, flower size, and leaf-margins. As pointed out by Davis & Heywood (1963) "it is the view of many taxonomists that, if a taxon can be shown to be of polytopic origin, it should be split into two or more taxa". On the other hand these authors suggest that "there seems every justification for classifying cases of suspected polytopism on the basis of their overall resemblance". In the present case the overlap in floral (Figure 21) and leaf-margin characters does not allow a clear separation of the individual island taxa and, therefore, "the convenient grade group" *A. pachycaulon sensu lato* has been accepted to cover the whole complex and the

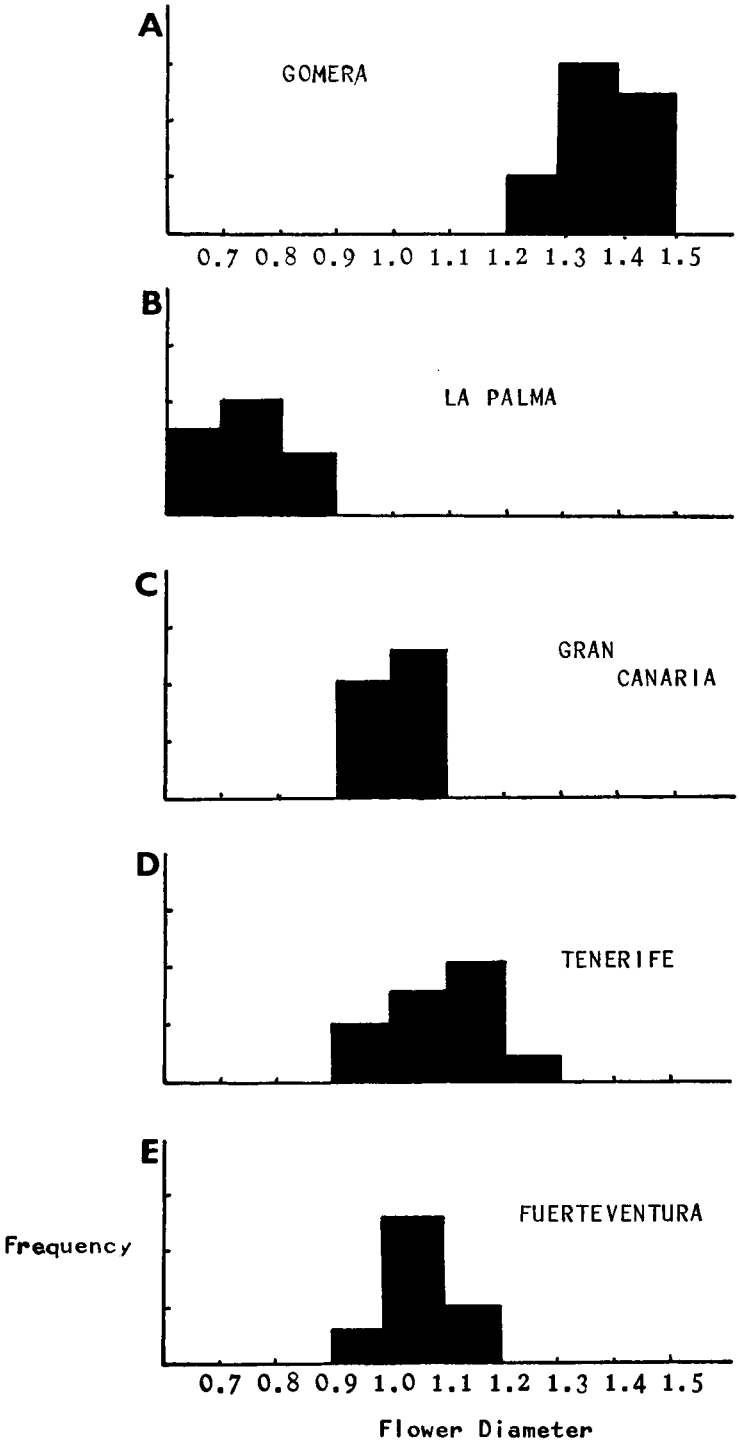

Figure 2. Flower diameters in cm. in *A. pachycaulon* s.l. populations from various islands.

various island local taxa are considered to be subspecies of this species.

Synopsis of subspecies of *A. pachycaulon*

A. pachycaulon Bolle, Bonplandia 7: 244 (1859)

Syn. *Sempervivum pachycaulon* (Bolle) Christ, *Bot. Jahrb* 9: 161 (1888) *A. punctatum* (Chr.Sm.) Webb & Berth. var. *pachycaulon* (Bolle) Praeger *Proc. Roy Irish Acad.* 28: 9 (1928).

Annual, biennial or triennial herbs up to 65 cm, glabrous. Stems thick leaves mor os less rhomboidal or trapeziform, the margins entire, subentire or crenate, rarely with black marginal glands. Inflorescences dense or lax, the bracts entire. Flowers pale to golden yellow, 6-15 mm in diameter.

Key to subspecies:

1. leaf-margins normally without black glands.
   2. Habit and leaves erect (Fuerteventura) ..... 1. subsp. *pachycaulon*
   2. Habit lax, leaves more or less patent
      3. Flowers small, less than 9 mm (La Palma) 2. subsp. *parviflorum*
      3. Flowers 9-15 mm across
         4. Flowers 9-11.5 mm, habit divaricate to suberect, leaf - margins subentire (Tenerife) ..... 3. subsp. *immaculatum*
         4. Flowers 12-15 mm, habit sprawling leaf-margins crenate (La Gomera) ..... 4. subsp. *gonzalez-hernandezii*
1. Leaf-margins punctate, with black glands (Gran Canaria) 5. subsp. *praetermissum*

1. subsp. *pachycaulon*

Biennial-triennial herb, stems and leaves erect; leaf-margins

subentire; flowers pale yellow, about 9-12 mm in diam.
Fuerteventura: Pico de la Zarza, on moist cliffs 600-700 m.

2. subsp. *parviflorum* (Bolle) comb. et stat. nov.
Aichryson parviflorum Bolle, *Bonplandia* 7: 243 (1859)
Biennial herb, stems divaricate - suberect or sprawling, leaf-margins crenate without black glands; flowers less than 9 mm in diam.
La Palma: N.W. region, Bco. del Río etc. in laurel forest barrancos.

3. subsp. *immaculatum* (Webb ex Christ) comb. et stat. nov.
Aichryson immaculatum Webb ex Christ, *Bot. Jahrb.* 9: 108 (1888).
Biennial to triennial herb, stems divaricate, leaves more or less patent, the margins remotely crenate without black glands; flowers pale yellow, 9-11.5 cm in diam.
Tenerife: Anaga Range, Vueltas de Taganana; Agua García, Madre del Agua. Wet places in Laurel forests.

4. subsp. *gonzalez-hermandezii* (Kunkel) comb. et stat nov.
Aichryson gonzalezhernandezii Kunkel *Cuad. Bot. Canar.* 25:34 (1975).
Tall, sprawling biennial to triennial herb up to 60 cm. leaves patent long-petiolate, the margins crenulate, flowers golden yellow, 12-15 mm in diam.
La Gomera: Forests above Hermigua, El Bailadero, Degollada del Estanque 800-100 m. in damp places, borders of streamlets etc.

5. subsp. *praetermissum* subsp. nov.
Herba biennis usque ad 50 cm; folia crenulata, margin nigro-punctata; flowers ca 1 cm diametro.
Holotypus: Gran Canaria: side of spring below humid cliffs, Presa de los Pérez 700 m. *Bramwell.* 1976 (JVC).
Gran Canaria: N.W. central region between Tamadaba and Juncalillo, sides of springs, on humid rocks, 700-800 m.

REFERENCES

BRAMWELL, D., 1969: Notes on the taxonomy and nomenclature of the genus Aichryson *Bol. Inst. Nav. Inv. Agron.* 59: 203-213.
DAVIS, P.H. & HEYWOOD, V.H., 1963: Principles of Angiosperm Taxonomy. Edinburgh.
PRAEGER, R.L., 1932: An Account of the *Sempervivum* Group. RHS. London.
UHL C., 1961: The Chromosomes of the Sempervivoideae (Crassulaceae) *Am. Journ. Bot.* 48: 114-123.