BOTANICA MACARONÉSICA

2

OCTUBRE 1976

JARDIN BOTANICO «VIERA y CLAVIJO»

del

EXCMO. CABILDO INSULAR de GRAN CANARIA

EDICIONES DEL EXCMO. CABILDO INSULAR DE GRAN CANARIA
(COMISIONES DE EDUCACION Y CULTURA)

IV

CIENCIAS

(AL CUIDADO DEL JARDIN BOTANICO «VIERA Y CLAVIJO»)
1976

Impreso en Imprenta Pérez Galdós
Buenos Aires, 38
Las Palmas de Gran Canaria
Depósito Legal: G.C. 316 - 1977

BOTANICA
MACARONESICA
2

EXCMO. CABILDO INSULAR DE GRAN CANARIA

BOTANICA MACARONESICA

2

REDACTADA POR

JARDIN BOTANICO «VIERA Y CLAVIJO»

INDICE

BOTANICA MACARONESICA 2 (1976)

ESTUDIOS EN LA FLORA DE MACARONESIA; ALGUNOS NUMEROS DE CROMOSOMAS II

A. E. ALDRIDGE & J. ORTEGA

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

En este trabajo se recogen los números de cromosomas de 19 especies de fanerógamas de la Macaronesia, de las cuales, al parecer, no era conocida su dotación cromosómica haploide o diploide y se confirma la de tres ya anteriormente publicadas. Se discute los niveles de ploidia de algunos géneros.

SUMMARY

Chromosome numbers of 19 species of Macaronesian flowering plants are reported for the first time and the numbers of three species are confirmed. Levels of ploidy in some genera are discussed.

CONTENIDOS

INTRODUCCION

Este estudio se considera una continuación del anteriormente publicado por Bramwell, Pérez de Paz & Ortega (1976) y representa una contribución al Atlas de números de cromosomas de la Flora macaronésica, en preparación en este Centro.

MATERIALES Y METODOS

Las raíces y yemas proceden de plantas cultivadas en el Jardín Botánico "Viera y Clavijo" recolectadas directamente en el campo o de material recogido en las localidades reseñadas que posteriormente se indican, así como recolector y fecha.

Las raíces que en unos casos eran obtenidas de semillas, en otros directamente de las plantas adultas, eran pretratadas en solución saturada de paradiclorobenceno o de 8 - hidroxiquinoleina durante 2-4 horas, fijadas en alcohol-ácido acético (3:1), durante 12-24 horas, hidrolizadas en ácido clorhídrico IN, a 60° durante 4-6 minutos y teñidas con orceina-acética.

El conteo en células madres del polen, se hacía previa fijación en "Carnoy", hidrolisis en clorhídrico concentrado: alcohol absoluto (1:1) durante 3-6 minutos y teñido con orceina acética.

Las preparaciones se mantienen en Euparal, y las plantas se mantienen en el Jardín o en herbario.

OBSERVACIONES Y DISCUSION

Dicotyledoneae

ASCLEPIADACEAE

Sarcostemma daltonii Dcne. ex Webb 2n=22 (Fig. I A).

El material procede del cultivado en el Jardín Botánico "Viera y Clavijo", y fue recolectado en la Isla de San Antaô, del archipiélago de Cabo Verde por E. R. Sventenius. Al parecer, de las 10 especies descritas de este género en el mundo sólo se conoce el número de cromosomas de *Sarcostemma acidum* Voigt. dado por Chopde (1965), que es el mismo que el calculado por primera vez para esta especie endémica de Cabo Verde.

CAMPANULACEAE

Laurentia canariensis DC. n=11 (Fig. 1 B).

Las yemas proceden de las plantas recogidas por E. R. Sventenius en el barranco de Masca, Tenerife.

Es esta la única especie endémica de este género en las Islas Canarias y su número no había sido calculado con anterioridad.

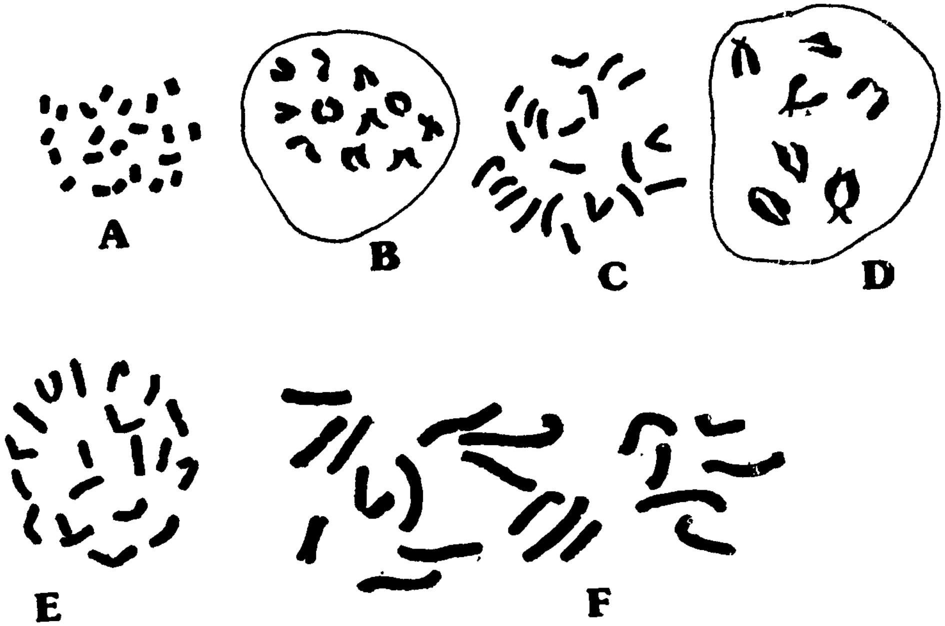


Figura 1 A. *Sarcostemma daltonii,* 2n=22; B. *Laurentia canariensis.* n=11; C. *Helianthemum bystropogophyllum,* 2n=20; *D. Lotus genistoides,* n=7; *E. Helianthemum tholiforme,* 2n=20; F. *Atractylis preauxiana,* 2n=20. No a escala.

CISTACEAE

Helianthemum bystropogophyllum Svent. 2n=20 (Fig. 1 C).

Material recolectado por E.R. Sventenius en Montaña del Horno, Gran Canaria; actualmente se encuentran plantas cultivadas en el Jardín Botánico "Viera y Clavijo" procedentes de esa localidad. Se trata de un endemismo de Gran Canaria descrito por Sventenius (1960).

Helianthemum tholiforme Bramw., Ortg. & Nav. 2n=20 (Fig. 1 E).

De esta planta descrita por Bramwell, Ortega & Navarro (1976), se recolectó material en la localidad citada y a partir de las raíces de los esquejes se comprobó el número de cromosomas.

COMPOSITAE

Tribu Inuleae Cass.

Vieraea laevigata Webb & *Berth.* n=8 (Fig. 2 E)

Material cultivado en el Jardín Botánico "Viera y Clavijo" recolectado por E.R. Sventenius en barranco de Masca, Tenerife.

Esta es la primera comunicación del complemento meiótico de este género monotípico que es un raro endemismo de Tenerife. El número de cromosomas mitótico de 2n=16 ha sido comunicado anteriormente por Bramwell, Humphries, Murray & Owens (1971), Gagnieu, Linder & Voggenreiter (1973) y Borgen (1974).

Tribu Anthemideae Cass.
Tanacetum ferulaceum (Webb & Berth.) Schultz Bip. n=9 (Fig. 2 A).

Material cultivado en el Jardín Botánico "Viera y Clavijo" y recolectado por E.R. Sventenius en Santa Lucía de Tirajana, Gran Canaria.

Esta es la primera comunicación del número de cromosomas de esta especie endémica.

Tanacetum ferulaceum (Webb & Berth.) Schultz Bip. var. *latipinnum* Svent. n=9 (Fig. 2 B).

Material cultivado en el Jardín Botánico "Viera y Clavijo",

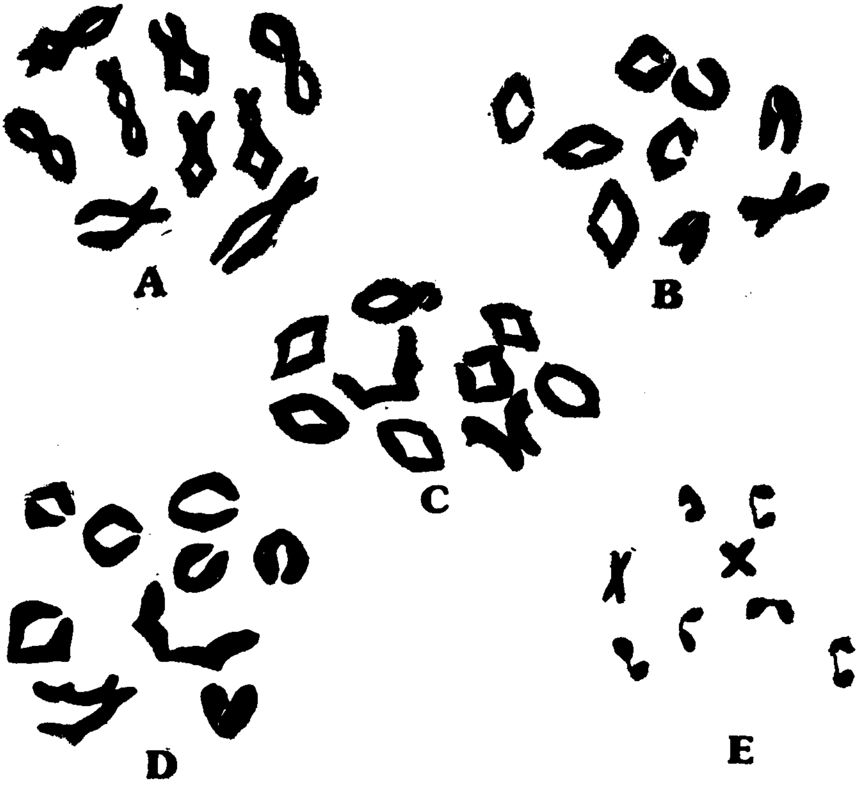


Figura 2. A. *Tanacetum ferulaceum*, n=9; B. *Tanacetum ferulaceum* var. *latipinnum*, n=9; C. *Tanacetum ptarmaciflorum*, n=9; D. *Lugoa revoluta*, n=9; E. *Vieraea laevigata*, n=8. No a escala.

recolectado por E.R. Sventenius en Cueva del Rey, Gran Canaria.

El número de cromosomas de esta variedad que posee hojas de lóbulos anchos es comunicado por vez primera.

Tanacetum ptarmaciflorum (Webb & Berth.) Schultz Bip. n=9 (Fig. 2 C).

Material cultivado en el Jardín Botánico "Viera y Clavijo" y recolectado por E.R. Sventenius en Los Leales, Gran Canaria.

El número de cromosomas de esta especie es comunicado por primera vez.

Hay dos especies y una variedad que son endémicas de las Islas Canarias. Observaciones previas del género *Tanacetum* han señalado que es x=9 el número básico, y que especies tetraploides y hexaploides son bastante comunes (Moore, 1973).

Lugoa revoluta DC. n=9 (Fig. 2 D).

Material cultivado en el Jardín Botánico "Viera y Clavijo" y recolectado por E.R. Sventenius en Taganana, Tenerife.

Esta es la primera vez que el complemento meiótico de este género monotípico ha sido publicado.

El número diploide 2n=18 ha sido previamente publicado por Gagnieu *et al.* (1973) de material procedente de Casas Blancas, Tenerife. Se trata de un endemismo de las regiones costeras del norte de Anaga, Tenerife. Este género es muy parecido a *Gonospermum,* que ha demostrado tener 2n=18 (Larsen, 1963).

Tribu Cardueae Cass.

Atractylis preauxiana Schultz Bip. ex Webb & Berth. 2n=20 (Fig. 1 F).

Semillas procedentes de Arinaga, Gran Canaria, recolectadas por V. Montelongo. Este número de cromosomas comunicado por primera vez, para esta especie endémica, es el más frecuente encontrado en el género.

Tribu Lactuceae Cass.

Tolpis crassiuscula Svent. n=9 (Fig. 3 A).

Material cultivado en el Jardín Botánico "Viera y Clavijo", recolectado por E. R. Sventenius en El Fraile, Tenerife.

Esta es la primera vez que se comunica el número de cromosomas de esta especie que es endémica solamente de dos localidades de Tenerife.

Tolpis laciniata Webb & Berth. n=9 (Fig. 3 B).

Material cultivado en el Jardín Botánico "Viera y Clavijo",

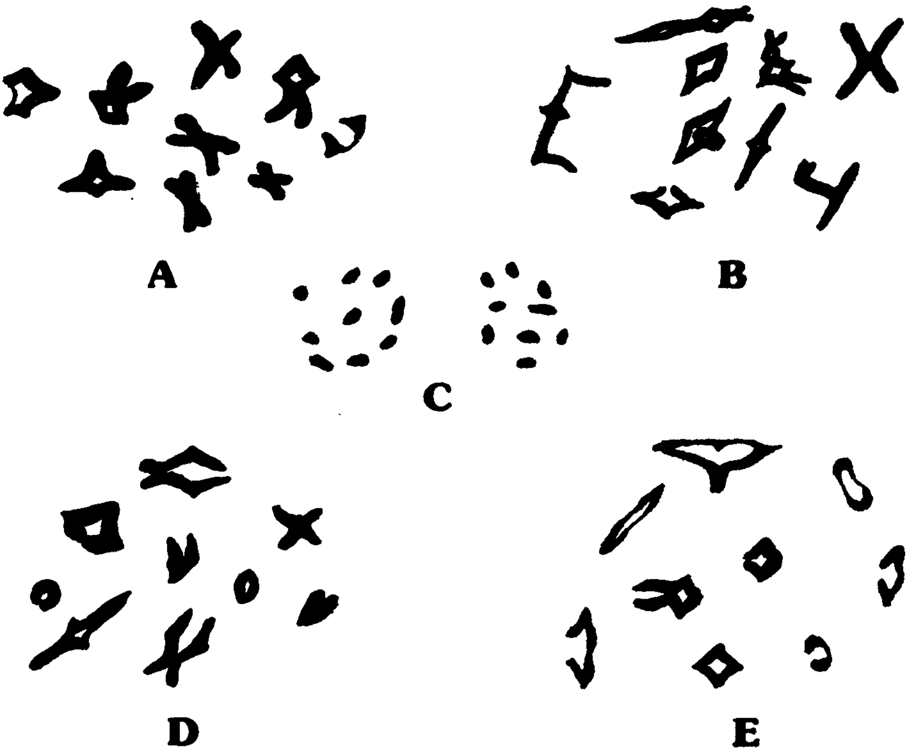


Figura 3. A. *Tolpis crassiuscula,* n=9; B. *Tolpis laciniata,* n=9; C. *Launaea picridioides,* Ana I, n=9; D. *Tolpis lagopoda* n=9; E. *Tolpis webbii,* n=9. No a escala.

recolectado por E. R. Sventenius en Taganana, Tenerife.

Este número de cromosomas no era conocido hasta la actualidad. Se trata de un endemismo morfológicamente muy variable, de las islas de Tenerife, La Palma y Gomera.

Tolpis lagopoda Chr. Sm. n=9 (Fig. 3 D).

Material cultivado en el Jardín Botánico "Viera y Clavijo" y recolectado por E. R. Sventenius en Aguamansa, Tenerife.

Este número confirma los comunicados previamente por Gagnieu *et al.* (1973) de material de Tenerife, y Bramwell *et al.* (1976) de material recogido en Gran Canaria. El número diploide 2n=18 ha sido publicado por Larsen (1963) de material de la misma localidad y por Borgen (1970) de material de Las Lagunetas, Gran Canaria. Es endémica de las islas de Tenerife, Gran Canaria y La Palma.

Tolpis webbii Schultz Bip. n=9 (Fig. 3 E).

Material cultivado en el Jardín Botánico "Viera y Clavijo", origen Las Cañadas, Tenerife, recolectado por A.E. Aldridge.

Este número confirma el publicado por Gagnieu *et al.* (1973). El número de cromosomas mitóticos 2n=18 está previamente publicado (Larsen, 1960) de material del mismo origen. Se encuentra solamente en Las Cañadas del Teide, Tenerife.

Aparte de *Tolpis calderae* Bolle que es una especie rara de La Palma, los complementos meióticos han sido ahora examinados en todas las especies endémicas canarias. Todos tienen como número básico el 9.

De las veinte especies de *Tolpis* existentes en el mundo, en las pocas que han sido examinadas citológicamente no se han encontrado poliploides (Federov, 1974).

Launaea picridioides (Webb) Robins n=9 (Fig. 3 C)

Material cultivado en el Jardín Botánico "Viera y Clavijo", origen Islas de Cabo Verde, San Antão, recolectado por E. R. Sventenius.

Esta es la primera vez que se publica el número de cromosomas de esta especie endémica de las Islas de Cabo Verde. El género *Launaea* parece tener los tres números básicos 7, 8 y 9 (Federov, 1974) y ninguna especie poliploide ha sido encontrada.

CONVOLVULACEAE

Convolvulus caput-medusae Lowe 2n=30 (Fig. 4 A).

El material de semillas fue recolectado por V. Montelongo en Arinaga, Gran Canaria. Se trata de un endemismo de Gran Canaria, probablemente extinto en Lanzarote y Fuerteventura. Su número de cromosomas, al parecer no era conocido.

EUPHORBIACEAE

Euphorbia mellifera Aiton 2n=40 (Fig. 4 C).

Proceden las semillas de Ribeiro Frío, Madeira, recolectado por D. Bramwell. Esta especie es endémica de Madeira y Canarias, donde sólo se ha encontrado en Tenerife. Se trata de una especie tetrapoide y este, representa la primera comunicación de este nivel de ploidia en el género *Euphorbia* en la flora Macaronésica.

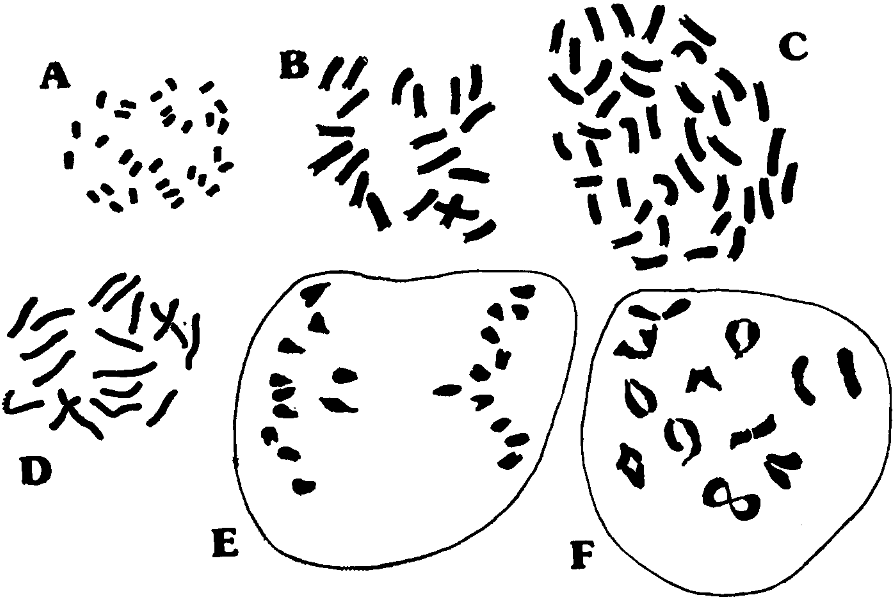


Figura 4. A. *Convolvulus caput-medusae*, 2n=30; B. *Euphorbia piscatoria*, 2n=40; C. *Euphorbia mellifera*, 2n=40; D. *Kickxia heterophylla*, 2n=18; E. *Pancratium canariensis*, n=11; F. *Solanum vespertilio*, n=12. No a escala.

Euphorbia piscatoria Aiton 2n=40 (Fig. 4 B).

Proceden las semillas de Ribeira Brava, Madeira, recolectado por D. Bramwell. Este número, al parecer, no era conocido hasta la actualidad.

Euphorbia handiensis Burchd. 2n=ca. 100

Material cultivado en el Jardín Botánico "Viera y Clavijo", origen, región de Jandía, Fuerteventura, recolectado por E. R. Sventenius. Se trata de un endemismo de Fuerteventura. Este número extraordinariamente alto en comparación con el de las demás especies del género en Macaronesia y que se comunica por primera vez, es análogo al calculado por Perry (1943) para *Euphorbia echinus* Hook. & Cass., especie norteafricana con dos especies vicariantes. Calculados ya los números de cromosomas de más del 80% de las especies del género *Euphorbia*, en la flora Macaronésica se observa que su número básico responde a x=10 y que las especies endémicas que pertenecen a la sección *Pachycladae*, presentan dotación diploide excepto *Euphorbia mellifera* Aiton, que es tetrapoide, mientras que las especies endémicas de la sección *Diacanthium*, presentan niveles de ploidia superiores, 6x y 10x.

LEGUMINOSAE

Lotus genistoides Webb & Berth. n=7 (Fig. I D).

Material de Guayadeque, Gran Canaria, recolectado por J. Ortega. Se trata de una especie endémica de Gran Canaria, cuyo número de cromosomas al parecer no ha sido calculado (Ortega, 1976). De esta especie poco conocida se ha encontrado una amplia población en Los Leales, Gran Canaria.

SCROPHULARIACEAE

Kickxia heterophylla (Schousb.) Dandy 2n=18 (Fig. 4 D).

Material recolectado por B. Navarro en el istmo de Jandía, Fuerteventura. De esta especie endémica de Fuerteventura y Lanzarote, al parecer, no se conocía el número de cromosomas.

SOLANACEAE

Solanum vespertilio Aiton n=12 (Fig. 4 F).

Material cultivado en el Jardín Botánico "Viera y Clavijo", recolectado por E.R. Sventenius. Origen, Sierra de Anaga, Tenerife. Se trata de un endemismo de Tenerife y Gran Canaria cuyo número de cromosomas, al parecer, se comunica por primera vez.

MONOCOTYLEDONEAE

AMARYLLIDACEAE

Pancratium canariensis Ker. Gawl. n=11 (Fig. 4E).

Material del barranco de Guiniguada, Gran Canaria, recolectado por J. Ortega. De esta especie no se conocía el complemento meiótico. El número diploide 2n=22 ha sido previamente publicado por Borgen (1969) y Bramwell *et al.* (1971).

AGRADECIMIENTOS

A.E.A. desea expresar su agradecimiento a la Royal Society de Londres y a la C.S.I.C. por la Beca de Intercambio Europeo, y J. O. agradece al Excmo. Cabildo Insular de Gran Canaria la Beca de Investigación que les han permitido realizar el presente trabajo.

REFERENCIAS

BORGEN, L. 1969. Chromosome numbers of vascular plants from the Canary Islands, with special reference to the occurrence of polyploidy. *Nyt. Mag. Bot.*, 16:81-121.

BORGEN, L., 1.970. Chromosome numbers of Macaronesian flowering plants. *Nytt Mag. Bot,*. 17: 145-61.

BORGEN, L., 1974. Chromosome numbers of Macaronesian plants II. *Norw.J.Bot.*, 21: 195-210

BRAMWELL, D., HUMPHRIES, C.J., MURRAY, B. & OWENS, S.J., 1971. Chromosome numbers in plants from the Canary Islands. *Bot. Notiser,* 124:376-82.

BRAMWELL, D., HUMPHRIES, C.J., MURRAY, B. & OWENS, S.J., 1972. Chromosome studies in the flora of Macaronesia. *Bot. Notiser,* 125: 139-52.

BRAMWELL, D., ORTEGA, J. & NAVARRO, B., 1976. *Helianthemum tholiforme, a* new species of Cistaceae from Gran Canaria. *Bot. Macar.*, 2: (in press).

BRAMWELL, D., PEREZ DE PAZ, J. & ORTEGA, J., 1976. Studies in the Flora of Macaronesia: some chromosome numbers in flowering plants. *Bot. Macar.*, 1: 9-16.

FEDEROV, A.A. (Ed.), 1974 *Chromosome Numbers of Flowering Plants.* Koenigstein West Germany : Otto Koeltz Science Publishers.

GAGNIEU, A., LINDER, R. & VOGGENREITER, V., 1973. Caryotypes de la flora insulaire de Tenerife. *Mongr.Biol.Canar.*, 4: 126-33.

LARSEN, K., 1960. Cytological and experimental studies on the flowering plants of the Canary Islands. *Biol. Skr. Dan. Vid. Selsk.*, 11 (3): 1-60.

LARSEN, K., 1962. Contribution to the cytology of the endemic Canarian element. *Bot. Notiser,* 115 (2): 196-202.

LARSEN, K., 1963. Contribution to the cytology of the endemic Canarian element. II. *Bot. Notiser, 116 (3): 409-24.*

MOORE, R.J. (Ed.), 1973. *Index to Plant Chromosome Numbers* 1967-1971. Utrecht.

ORTEGA, J., 1976. Citogenética del género *Lotus* en Macaronesia I. Números de cromosomas. *Bot. Macar.*, 1: 17-24.

PERRY, B.A., 1943. Chromosome number and phylogenetic relationships in the Euphorbiaceae. *Amer., J. Bot.*, 30 (7): 527-43.

SVENTENIUS, E.R.S., 1960. *Additamentum ad Floram Canariensem.* Matriti: Inst. Nac. Invest. Agronom. Minist. Agricult.

VAN LOON, J.C., 1974. A cytological investigation of flowering plants from the Canary Islands. *Acta Bot. Neerl.,* 23: 113-24.

BOTANICA MACARONESICA 2 (1976)

THE SYSTEMATIC POSITION OF THE GENUS BOSEA L. (AMARANTHACEAE)

D. BRAMWELL

Jardín Botánico "Viera y Clavijo" Las Palmas de Gran Canaria

RESUMEN

Este estudio considera la posición taxonómica del discutido género *Bosea* L. (Amaranthaceae) usando datos palinológicos y anatómicos. Como quiera que la morfología del polen y la anatomía del tallo de *Bosea* así cmo su inflorescencia y morfología floral son típicas de la familia Amaranthaceae, la reciente propuesta de separarla en una nueva familia monotípica Boseaceae no parece tener ningun base fundamental taxonómicamente y por consiguiente debiera ser rechazada.

CONTENTS

INTRODUCTION

The systematic position of the small, disjunctly distributed, woody genus *Bosea* L. originally caused taxonomists some problems and various 19th century botanists placed it in different families (Salsolaceae, Chenopodiaceae, Amaranthaceae). Its position was reviewed in 1893 by Schinz & Autran who considered it to be a member of the Amaranthaceae where it had first been placed by Bentham & Hooker (1880). Later Schinz (1934) and Airy-Shaw (1973) have confirmed this view of its position.

In 1972, however, Kunkel proposed the segregation of *Bosea* into a separate and new family, Boseaceae, but did not, at the time, give any taxonomic reasons for doing so. The proposal was surprisingly taken up by Eriksson, Hansen & Sunding (1974) in their important new checklist of the vascular plants of the Macaronesian region. Later Kunkel (1975) returned to the theme of the family Boseaceae thus "this family was proposed by the author (*Monogr. Biol. Canar.* 3: 31; 1972) but was never validly published because of certain disagreement with collegues (sic!) especially concerning other genera to be placed within this segregated family. Being convinced that this genus (*Bosea*) is nearer related to the Anacardiaceae than to (as currently placed) the Amaranthaceae, I wish some specialist would take up this matter for further discussion". Again, apart from the vague reference to a relationship with the family Anacardiaceae, any sort of reason for the separation of the family Boseaceae is not, unfortunately, presented.

We are currently, therefore, left with the very unsatisfactory situation that an invalidly published new family name proposed without any indication of the taxonomic reason for its separation has been taken up in a new floristic publication of considerable importance. The only information which might possibly be considered as being of taxonomic value, the suggested relationship with the Anacardiaceae, implies a major shift in the position of the genus from the Order Caryophyllales sub-class Caryophyllidae (Takhtajan 1969), where it has always been undisputedly placed, to the Order Rutales sub-class Rosidae. Because of the implications of this interesting *proposed change a study has been made of the relationships* of the genus *Bosea*, especially the Canarian endemic type species *Bosea yervamora* L., with other members of the family Amaranthaceae and also with members of the Anacardiaceae.

MATERIALS AND METHODS

All the material studied has been obtained from the living plant collections cultivated in the Jardín Botánico Canario "Viera y Clavijo". Fresh pollen for scanning electron microscopy was prepared by coating in a Polaron sputter coater and examined by means of an ISI Mini-Sem microscope. Anatomical sections were cut free-hand and stained using standard techniques.

POLLEN RELATIONSHIPS

Both Bentham & Hooker (1880) and Schinz (1934), on traditional morphological grounds, placed *Bosea* in the Amaranthaceae near to the type genus *Amaranthus*, Bentham & Hooker in their *Euamarantheae* and Schinz in his *Amaranthoideae*.

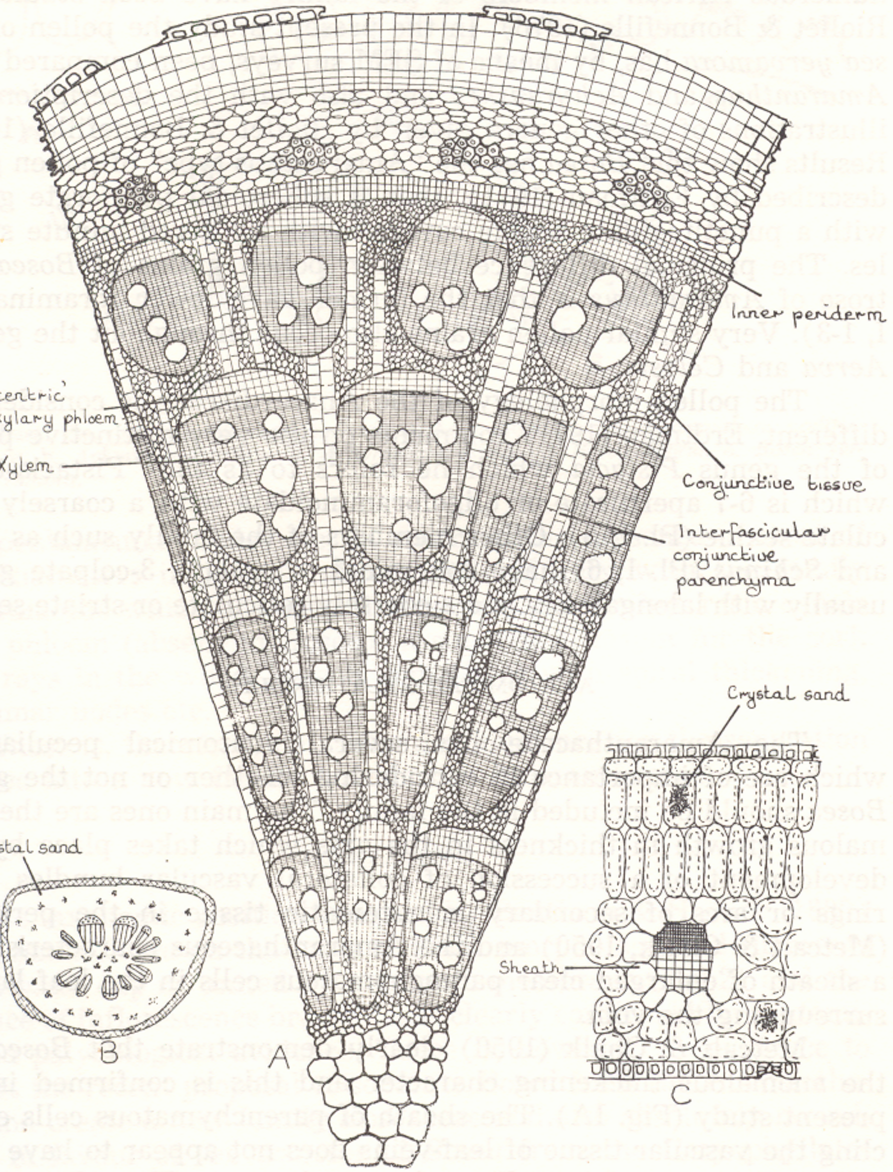


Fig. 1. Anatomical features of *Bosea yervamora* L. A. T.S. axis, showing anomalous secondary thickening. B. TS. mid-region of petiole, showing cylinder of separate bundles. C. TS. Leaf lamina, showing sheath of clear cells surrounding the wein.

The pollen morphology of Amaranthaceae has been described in considerable detail by Vishnu-Mittre (1963) and more recently numerous African members of the family have been studied by Riollet & Bonnefille (1976). In the present study the pollen of *Bosea yervamora* has, by means of SEM surveys, been compared with *Amaranthus* and *Achyranthes* and also with the description and illustrations of other genera given by Riollet & Bonnefille (1976). Results show that *Bosea* has the "Amaranthus-type" of pollen grain described by Erdtman (1971), that is spheroidal polyforate grains with a punctitegillate sexine covered with scattered minute spinules. The principal difference between pollen grains of *Bosea* and trose of *Amaranthus* is that the former have fewer foramina (Pl. I, 1-3). Very similar pollen grains also occur throughout the genera *Aerva* and *Celosia*.

The pollen morphology of the Anacardiaceae is considerably different. Erdtman (1971) comments on the very distinctive pollen of the genus *Pistacia* which he refers to as the "Pistacia-type" which is 6-7 aperturate or oligoforaminoidate with a coarsely reticulate sexine (Pl. I; 5). Other members of the family such as *Rhus* and *Schinus* (Pl. I; 6) have spheroidal to prolate, 3-colpate grains usually with lalongate ora and a coarsely reticulate or striate sexine.

ANATOMICAL RELATIONSHIPS

The Amaranthaceae has several anatomical peculiarities which are of importance in considering whether or not the genus *Bosea* should be included in the family. The main ones are the anomalous growth in thickness in the axis which takes place by the development of a succession of collateral vascular bundles from rings or arcs of secondary meristematic tissue in the pericycle (Metcalf & Chalk, 1950) and the Amaranthaceous characteristic of a sheath of enlarged clear parenchymatous cells in the leaf lamina surrounding the vein.

Metcalf & Chalk (1950) clearly demonstrate that *Bosea* has the anomalous thickening character and this is confirmed in the present study (Fig. IA). The sheath of parenchymatous cells encircling the vascular tissue of leaf-veins does not appear to have been previously reported from *Bosea* but as shown in (Fig. IC) it is obviously present.

Other features of the general anatomy of *Bosea* help to confirm its affinity with other members of the Family Amaranthaceae including crystals secreted in the form of sand (Fig. I, B & C.), subepidermal origin of cork, the pericycle with small strands of fibres, absence of rays in the wood, vessel without spiral thickennings, trila-

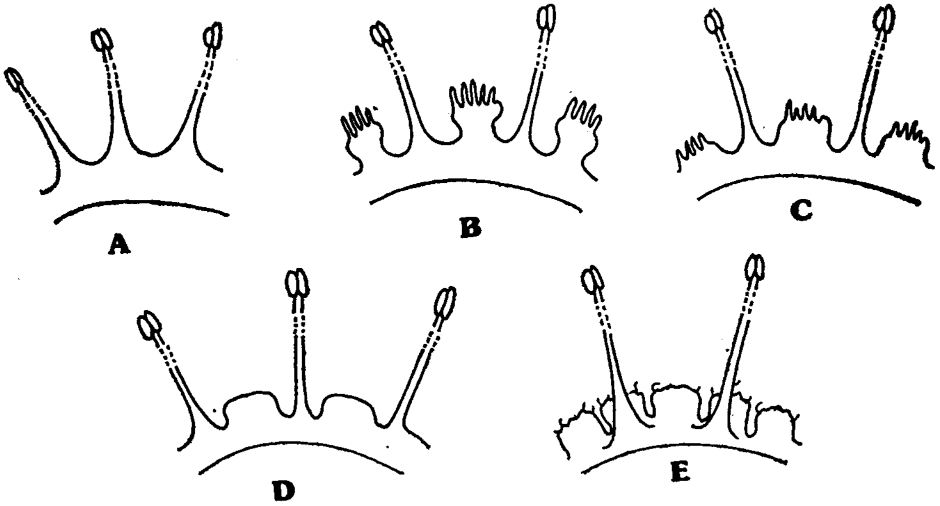


Fig. 2. Basal disc between filaments in various Amaranthaceae. o. *Alternanthera nodiflora*, b. *Achyranthes indica*, c. *Achyranthes aspera*, d. *Bosea cypria*, e. *Bosea yervamora.*

cunar-pentalacunar nodes etc. In contrast ,the presence of most of these characters in *Bosea* indicate little affinity with the family Anacardiaceae which has normal secondary thickening, resin canals in the phloem (absent in *Bosea*), a superficial origin for the cork layer, rays in the wood, vessels sometimes with spiral thickening, unilacunar nodes etc.

These is, therefore, no anatomical evidence for the separation of *Bosea* into a new family outside the Amaranthaceae.

CONCLUSIONS

The taxonomic position assigned by Bentham & Hooker (1880) to the genus *Bosea* on the basis of floral morphology and filaments with a basal cup or united by a crenate membrane (Fig 2) and the presence of inflorescence bracteoles is clearly confirmed by anatomical and palynological evidence. There is, however, no evidence to support the recent proposal to separate *Bosea* from the Amaranthaceae and create a new family Boseaceae and also absolutely no evidence in favour of the transfer of *Bosea* from the Caryophyllales to a position near the Anacardiaceae in the Rutales.

ACKNOWLEDGMENTS

The author would like to thank Dr. Angela Aldridge for preparing Figure 1 and for discussion of the implications of the anatomical data presented.

REFERENCES

AIRY SHAW H.K., 1973	A. Dictionary of the Flowering Plants and Ferns, by the late J.C. Willis. ixvi+1245 pp. Cambridge.
BENTHAM G. & HOOKER J.D. 1862-1880	Genera Plantarum 1 - 3, London.
ERDTMAN G., 1971	Pollen Morphology and Plant Taxonomy xii & 539 pp. Waltham Mass.
ERIKSSON O., HANSEN A. & SUNDING P., 1974	Flora of Macaronesia, Checklist of Vascular Plants. iv & 66pp. Umea.
KUNKEL G., 1972	Enumeración de las Plantas vasculares de Gran Canaria. *Monog. Biol. Canar.* 3:1-86
KUNKEL G., 1975	Additions and Corrections to O. Eriksson, A. Hansen & P. Sunding, "Flora of Macaronesia, Checklist of Vascular Plans 1974"., *Cuad. Bot. Canar.* 23/24: 29-59.
METCALFE C. R. & CHALK L., 1950	Anatomy of the Dicotyledons, 2 vols. Oxford.
RIOLLET G. & BONNEFILLE R., 1976	Pollen des Amaranthaceés du Bassin du Lac Dodolphe (Afrique Orientale). *Pollen et Spores.* 18: 67-92.
SCHINZ H., 1934	*Amaranthaceae* in Engler & Prantl. Die Naturlichen Pflanzenfamilien ed. 2, Bd. 16c, 7-84.
SCHINZ H. & AUTRAN E., 1893	Des Genres *Achatocarpus* Triana et *Bosia* Linné. *Bull. Herb. Boiss.* 1 : 1-16.
TAKHTAJAN R., 1969	Flowering Plants, Origin and Dispersal. x & 310pp. Edinburgh.
VISHNU-MITTRE P., 1963	Pollen Morphology of Indian Amaranthaceae. *J. Indian Bot. Soc.* 42: 86-101.

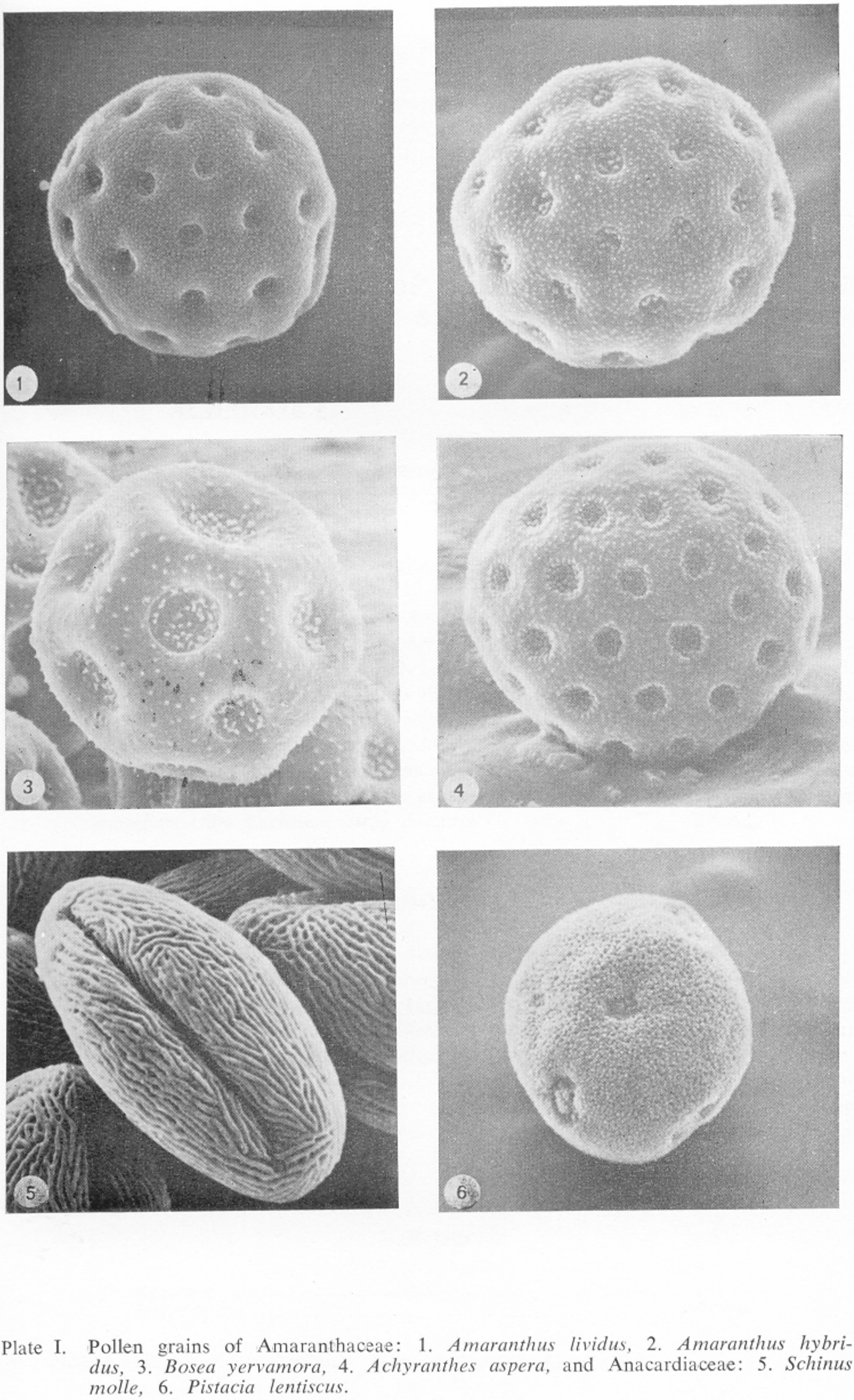


Plate I. Pollen grains of Amaranthaceae: 1. *Amaranthus lividus,* 2. *Amaranthus hybridus,* 3. *Bosea yervamora,* 4. *Achyranthes aspera,* and Anacardiaceae: 5. *Schinus molle,* 6. *Pistacia lentiscus.*

BOTANICA MACARONESICA 2 (1976)

A CRITICAL REAPPRAISAL OF THE MACARONESIAN SONCHUS SUBGENUS DENDROSONCHUS S.L. (COMPOSITAE - LACTUCEAE).

ANGELA E. ALDRIDGE *

Botany Department, Plant Science Laboratories, Reading University

---

RESUMEN

En su reciente revisión del género *Sonchus* L., Boulos reconoció tres géneros segregados, viz. *Babcockia, Taeckholmia* y *Embergeria.* Aquí se demuestra, por extensas investigaciones morfológicas, que el género *Babcockia y Taeckholmia* no pueden ser distinguidos de los miembros macaronésicos del género *Sonchus* L. sub-género *Dendrosonchus* Webb ex Schultz Bip., y también la consideración de *Embergeria* como género es posible que sea dudosa. La literatura taxonómica del subgénero *Dendrosonchus* s.l. es revisada y se da una explicación para el uso del nombre *Atalanthus* mejor que *Taeckholmia* a nivel de sección. Los conceptos del autor sobre las categorías del género, subgénero y sección dentro de este grupo de la Compositae. tribu Lactuceae están descritos.

SUMMARY

In his recent revision of the genus *Sonchus* L., Boulos recognised three segregate genera, viz *Babcockia, Taeckholmia* and *Embergeria.* It is shown here, by extensive morphological investigations, that the genera *Babcockia* and *Taeckholmia* cannot be distinguished from the Macaronesian members of the genus *Sonchus* L. subgenus *Dendrosonchus* Webb ex Schultz Bip., and also the status of the genus *Embergeria* is considered to be in doubt. The taxonomic literature on the subgenus *Dendrosonchus* s.l. is reviewed and an explanation is given for the use of the name *Atalanthus* rather than *Taeckholmia* at sectional level. The author's concepts of the categories genus, subgenus and section within this group of the Compositae, tribe Lactuceae are outlined.

CONTENTS

---

* Present address: Jardín Botánico "Viera y Clavijo", Las Palmas.

INTRODUCTION

The genus *Sonchus* L. (Compositae, tribe Lactuceae) has recently been revised by Boulos (1972, 1973, 1974a 1974b), Pons & Boulos (1972) and Roux & Boulos (1972), and the subgenera *Sonchus, Origosonchus* Boulos and *Dendrosonchus* Schultz Bip. ex Boulos were recognised. Boulos made no groupings within the subgenus *Dendrosonchus* in his first publication dealing with the genus (Boulos, 1960) but he recognised fourteen species which he later grouped into three separate genera. These were *Babcockia* Boulos, a monotypic genus (Boulos, 1965), *Taeckholmia* Boulos, comprising seven species (Boulos, 1967a) and the remaining species were kept in the subgenus *Dendrosonchus* of *Sonchus*. During research into the anatomy and evolution of *Dendrosonchus* s.l. (Aldridge, 1975) it was found neccesary to reappraise the taxonomy of this Macaronesian group.

HISTORICAL TAXONOMIC SURVEY

The woody pachycaulous species of *Sonchus* which are endemic to the islands of the Canaries, Cape Verdes and Madeira with one species also occurring in Western Morocco, were first considered to be distinct from all other species of this genus by Schultz Bipontinus (1949-50). He gave a detailed descriptive account of the group in the famous work *Phytographia Canariensis* of Webb & Berthelot (1936-50) in which he recognised six subgenera of Macaronesian *Sonchus* species based upon vegetative and floral differences. Two of these have since been included in the widespread genus *Launaea* Cass., one has been raised to generic level of *Lactucosonchus* (Schultz Bip.) Svent. which is a herbaceous, monotypic genus endemic to La Palma, and two subgenera which were composed of herbaceous species have since been placed into the subgenus *Sonchus* by Boulos (1973). Schultz Bipontinus recognised two groups in the remaining subgenus *Dendrosonchus* Webb ex

Schultz Bip. on the basis of the numbers of florets in the capitula and he called these *Macrocephali* Schultz Bip. and *Microcephali* Schultz Bip. respectively. As Schultz Bipontinus gave these groups the categories "Div. I" and "Div. II" respectively, Boulos (1972) did not consider the subgenus *Dendrosonchus* Shultz Bip. to be validly published. He explained that the subgenus *Dendrosonchus* Schultz Bip. "est invalide en raison de l'article 33, note 2 du Code (sous-genre subdivisé en divisions) est ici valídé", and consequently published the name *Dendrosonchus* Schultz Bip. ex Boulos. According to article 33, note 2 of the International Code of Botanical Nomenclature (1972) it is the names given to taxa whose ranks are denoted by misplaced terms, in this case the divisions *Macrocephali* and *Microcephali* which are not validly published. Boulos has, therefore, misunderstood the application of this article. In the present work the subgenus *Dendrosonchus* Webb ex Schultz Bip., is, therefore, considered to be validly published. It is quite clear, however, that Schultz Bipontinus did not intend his two groups of *Dendrosonchus* to be divisions in the modern sense. *Macrocephali* contained the type species, *Sonchus congestus* Willd., for the subgenus and must, therefore, be called *Dendrosonchus*. Schultz Bipontinus recognised two species in *Microcephali* of which one, *S. leptocephalus* Cass., was previously placed in the genus *Prenanthes* by C. Linné (1781). Don (1829) later recognised a new genus, *Atalanthus* D. Don, which is now typified by this species but later *Atalanthus* was sunk back into *Sonchus* as a section by A. P. De Candolle (1838). This is discussed in more detail below. The use of this particular article is, therefore, irrelevant to the nomenclature of the group.

Throughout the history of the subgenus *Dendrosonchus* a distinction between two morphological groups has been recognised (except by Boulos, 1960). Don (1829) distinguished the genus *Atalanthus* from *Sonchus* on the basis of their life-forms, being shrubs as opposed to herbs. The other shrubby, Macaronesian elements were not, however, taken into account. A. P. De Candolle (1838) recognised the two groups on the number of florets and by the indumentum of the capitulum. Section *Eusonchus* DC. subsection *Fruticosi* DC. was stated to have capitula with a subtomentose indumentum as distinct from section *Atalanthus* (D. Don) DC. which lacks this character. Since the work of De Candolle the erroneous placement of *S. pinnatus* Aiton within the section *Dendrosonchus* has been maintained to the present day. This species does not possess tomentose capitula and, therefore, should be associated with the other members of section *Atalanthus*. Even though this character was disregarded by later authors the alleged close relationship of *S. pinna-*

tus to other members of section *Dendrosonchus* was not sundered. This point is illustrated by the work of Schultz Bipontinus (1849-50) who recognised nine species, including *S. pinnatus* with two Canarian varieties and four Madeiran forms, in the *Macrocephali* group and two species in *Microcephali.* The division was made on the number of florets alone.

Lowe (1868) used the characters herbaceous perennial and shrubby perennial to distinguish between *S. ustulatus* Lowe and the shrubby species of *S. pinnatus* and *S. fruticosus* L. fil. when describing these species from Madeira. This distinction, although not categorized by Lowe, was later emphasised by Boulos (1972) in recognising the section *Pinnati* Boulos of the subgenus *Dendrosonchus.* Within this section *S. pinnatus* was grouped with the varieties recognised by Schultz Bipontinus, which Boulos raised to species, with various other new species possessing highly dissected leaves, as well as *S. fruticosus.* This latter species resembles the others of the section *Pinnati* only in its tree-like habit.

The distinction between the two groups, *Dendrosonchus* and *Atalanthus* was again recognised by Pitard and Proust (1908) who followed De Candolle (1838) in placing the Macaronesian species of *Sonchus* into the two separate sections, *Eusonchus* and *Atalanthus.* Within *Eusonchus* the Canarian woody element was placed in a separate series called *Fruticosi* DC. consisting of twelve species. These included *S. pinnatus,* its varieties and one new species, *S. gandogeri,* which also had highly dissected leaves. Three species were included in section *Atalanthus.* Boulos (1967a) in separating the genus *Taeckholmia* accentuated the differences prevalent within its members from those of *Dendrosonchus.* The natural affinities of the *Atalanthus* group to *S. pinnatus* s.l. have, however, once more been overlooked. *Bobcockia* and *Taeckholmia* are simply the extreme forms of the very variable subgenus *Dendrosonchus* and, as discussed below, are extremely difficult to delimit.

In his revision of the subgenus *Dendrosonchus,* Boulos (1972) recognised three sections which were *Dendrosonchus,* with eleven species, *Brachylobi,* with one species and two varieties, and *Pinnati,* with seven species and two subspecies. The sections were described in detail but the distinguishing features were basically the growith-form which characterized section *Pinnati Boulos,* and the leaf shape and presence of rhizomes which characterized section *Brachylobi* Boulos. *Sonchus brachylobus* Webb ex Schultz Bip. var. *canariae* (Pitard) Boulos has leaves which are not lyrate, and neither variety has been seen by me to have rhizomes. On the basis of these characters this section is not, therefore, acceptable. The section *Pinnati* was separated because of the tree-like habit of its species and, therefore, *S. fruticosus* was included.

The taxonomic treatments of the subgenus *Dendrosonchus* have all more or less followed the original workers in the separation of *S. leptocephalus* and similar taxa, in the retention of *S. pinnatus* and similar taxa within the body of the broad-leaved group and finally, in the grouping of *S. fruticosus* with the *pinnatus* group. Boulos' treatment differs only in the rank accorded to each group and in the recognition of the large headed *S. platylepis* Webb ex Schultz Bip. as distinct by placing it in a separate genus. On the basis of morphological features I have reorganised these well-established groups in order to reflect more natural affinities between the members. The section is chosén as the most suitable rank for subdividing the subgenus *Dendrosonchus* into *Dendrosonchus* and *Atalanthus* (D. Don) DC. These two sections accommodate the two most natural morphological groups of the woody, endemic and Macaronesian species of *Sonchus*.

Two other monotypic, Canarian genera which are closely related to *Sonchus* may be mentioned here. The first, *Lactucosonchus* (Schultz Bip.) Svent., was originally described by Schultz Bipontinus as a subgenus of *Sonchus* with one species, *S. webbii* Schultz Bip., endemic to La Palma. Sventenius (1968b) later gave it generic status. It is a herbaceous perennial with an extremely long, tuberous root, cypselas with a pappus of one type of seta and a leaf shape not known in any *Sonchus* species, even though the degree of dissection is very variable. Boulos (1974b) could not have examined this taxon in great detail as he reduced it to synonomy with *Taeckholmia heterophylla* Boulos, a dubious species described as a tall, woody shrub and which had the typical *Sonchus* pappus (see below). The other allied genus is *Sventenia* Font Quer with one species, *S. bupleuroides* Font Quer, which is endemic to Gran Canaria. Font Quer (1948) first described and illustrated this monotypic genus, the species of which is a low, perennial shrub and distinguished from any member of *Sonchus* by its entire leaves, beaked cypselas and yellow-tipped glandular hairs covering the inflorescence stalk, peduncles and involucral bracts.

Various authors have made contributions to the taxonomy of woody, Macaronesian species of *Sonchus* (C. Linné, 1781; Aiton, 1789; Cavanilles, 1801; Willdenow, 1807; Dumont de Courset, 1811;

Link, 1825; De Candolle, 1838). These works were of considerable importance to the classification of the subgenus *Dendrosonchus* by Schultz Bipontinus (1849-50). During this time much confusion arose in the nomenclature of the species *S. acaulis* Dum.—Courset and *S. congestus* Willd. The type specimens for these names and their many synonyms were later established by Boulos (1967b) and I am in agreement with his conclusions. A few synonyms, however, which Boulos quoted are a little dubious as several of the descriptions by Schultz Bipontinus consisted of only a brief statement. An example is *S. polyodon* Webb ex Schultz Bip. which was described as a variety of *S. abbreviatus* Link by the words "caule elongate gracili". Boulos placed this into synonomy with *S. acaulis* Dum.—Courset and correctly made *S. abbreviatus* Link synonymous with *S. congestus* Willd. The above description does not indicate that the elongated stem is a flowering stem and, therefore, could not be considered to be synonymous with *S. acaulis* with any certainty. Other authors who have contributed to the taxonomy of *Dendrosonchus* are Webb (1849), Lowe (1831, 1851), Pitard and Proust (1908), Knoche (1923) and Sventenius (1960, 1968a, 1968b). Sventenius (1960) gave highly informative descriptions of four new species of *Dendrosonchus* in his *Additamentum ad Floram Canariensem.* Each description was accompanied by a type locality, a collection date and an illustration. Boulos (1967a, 1967b) rejected these names stating that they were not validly published under article 37 of the Code, and consequently described three of these taxa under new names. In the introduction of his work, however, Sventenius stated that the plates were drawn from the holotypes. These are conserved in the herbarium of the Centro Regional de Investigaciones Agrarios in Valle de Guerra, Tenerife to where they were removed from the Orotava Botanical Garden (TENE). Bramwell (1970) argued that the publication of new species in *Additamentum ad Floram Canariensem* complies with the International Code of Botanical Nomenclature and his conclusions have been fully accepted in the present work.

SYNOPSIS OF RECOGNISED TAXA

The following is a synopsis of recognised taxa which are used throughout the present work.
Sonchus L.

Subgenus *Dendrosonchus* Webb ex Schultz Bip.

I. Section *Dendrosonchus*

1. *Sonchus brachylobus* Webb ex Schultz Bip.
2. *S. congestus* Willd.
3. *S. fruticosus* L. fil.
4. *S. pinnatifidus* Cav.
5. *S. platylepis* Webb ex Schultz Bip.
6. *S. fauces-orci* Knoche
7. *S. radicatus* Aiton
    - 7A. subspecies *radicatus*
    - 7B. subspecies *gummifer* (Link) Aldridge
    - 7C. subspecies *tectifolius* (Svent.) Aldridge
8. *S. gonzalezpadroni* Svent.
9. *S. ustulatus* Lowe
    - 9A. subspecies *ustulatus*
    - 9B. subspecies *maderensis* Aldridge
10. *S. ortunoi* Svent.
11. *S. hierrensis* (Pitard) Boulos
12. *S. daltonii* Webb
13. *S. bornmuelleri* Pitard
14. *S. acaulis* Dum.—Courset

II. section *Atalanthus* (D. Don) DC.

15. *S. arboreus* DC.
16. *S. leptocephalus* Cass.
    - 16A. subspecies *leptocephalus*
    - 16B. subspecies *capillaris* (Svent.) Aldridge
17. *S. pinnatus* Aiton
    - 17A. subspecies *pinnatus*
    - 17B. subspecies *canariensis* (Schultz Bip.) Aldridge
    - 17C. subspecies *palmensis* (Webb ex Schultz Bip.) Aldridge

MORPHOLOGY

In recognising the genera *Taeckholmia* and *Babcockia*, Boulos (1965, 1967a) relied on several characters which were stated to distinguish them from *Sonchus*. These characters are thoroughly examined here to show that these genera were inadequately based and consequently are not accepted. The species of the two genera have been included in *Sonchus* L. subgenus *Dendrosonchus* Webb ex Schultz Bip. throughout these investigations. The branching patterns, seedling, leaf and capitula morphology of several species of *Dendrosonchus* have recently been described in detail by Ebel (1971). The following results extend this information to all the members of *Dendrosonchus* s. l. to describe the morphological characteristics which typify the subgenus.

HABIT

The life-forms of *Dendrosonchus* species are either suffruticose chamaephytes or nanophanerophytes (Raunkier, 1934). Both types have their shoot apices partially protected by the withered remains of the leaves during the unfavourable or dry season. The growth-forms are rosette shrubs (Warming, 1909). As they are plants which grow on rocks or soil poor in water, they could be termed chylophytes (Warming, 1923). Figures 1 and 2 illustrate the growth-forms of some species of the subgenus. The roots are large and tuberous with many lateral tubers completely covered by matted fibrous roots. Reports of some of the species being rhizomatous are erroneous (cf. Boulos, 1974a). Buds, however, develop on the roots allowing propagation of the plants by root stocks. This root-bud development commonly occurs in *Sonchus leptocephalus* subspecies *leptocephalus* (Fig. 1B) and *capillaris*, giving these plants a shrubby habit. This branching from the root can occur in all the species of *Dendrosonchus* and does so especially when the main stem is damaged.

The degree of woodiness varies within the subgenus. All the members of section *Atalanthus* have a tall, shrubby or tree-like, much-branched habit. *Sonchus pinnatus* subspecies *palmensis* (Fig. 1C), *pinnatus* and *canariensis* and *S. arboreus* (Fig. 1A) are all low, tree-like shrubs. The tallest shrubs are found in section *Dendrosonchus*. *Sonchus hierrensis*, *S. congestus* (Fig. 2C) and *S. fruticosus* may all attain heights of up to five metres. In all species of the subgenus, inflorescences are terminal and branching occurs behind these flowering stems after they die down. Also in section *Dendrosonchus* many species are caudex (or short, woody-stemmed) perennials with caudices up to 100 cm high. *Sonchus acaulis* (Fig. 2E), *S. radicatus* subspecies *radicatus* (Fig. 2B), *tectifolius* and *gummifer*, *S. gonzalezpadroni*, *S. ustulatus* subspecies *ustulatus* and *maderensis*, *S. fauces-orci*, *S. daltonii* and *S. bornmuelleri* are all caudex perennials with a very short stem or caudex and a tall inflorescence stem. *Sonchus platylepis* (Fig. 2D) has an intermediate type of habit in that it is a low shrub. *Sonchus brachylobus* (Fig. 2A) has an unusual growth habit as the woody stems arise mainly from the root and many grow horizontally above the ground. The internodes of all species are congested and the leaves are in a terminal rosette.

The members of *Taeckholmia* were distinguished by Boulos (1967a) by possessing a frutescent habit with solid, often stick-like branches. This is obviously not a distinguishing feature as the frutescent habit is found in all members of *Dendrosonchus* s. l. and the stick-like branches can be seen in *S. brachylobus* and *S. pinnatifi-*

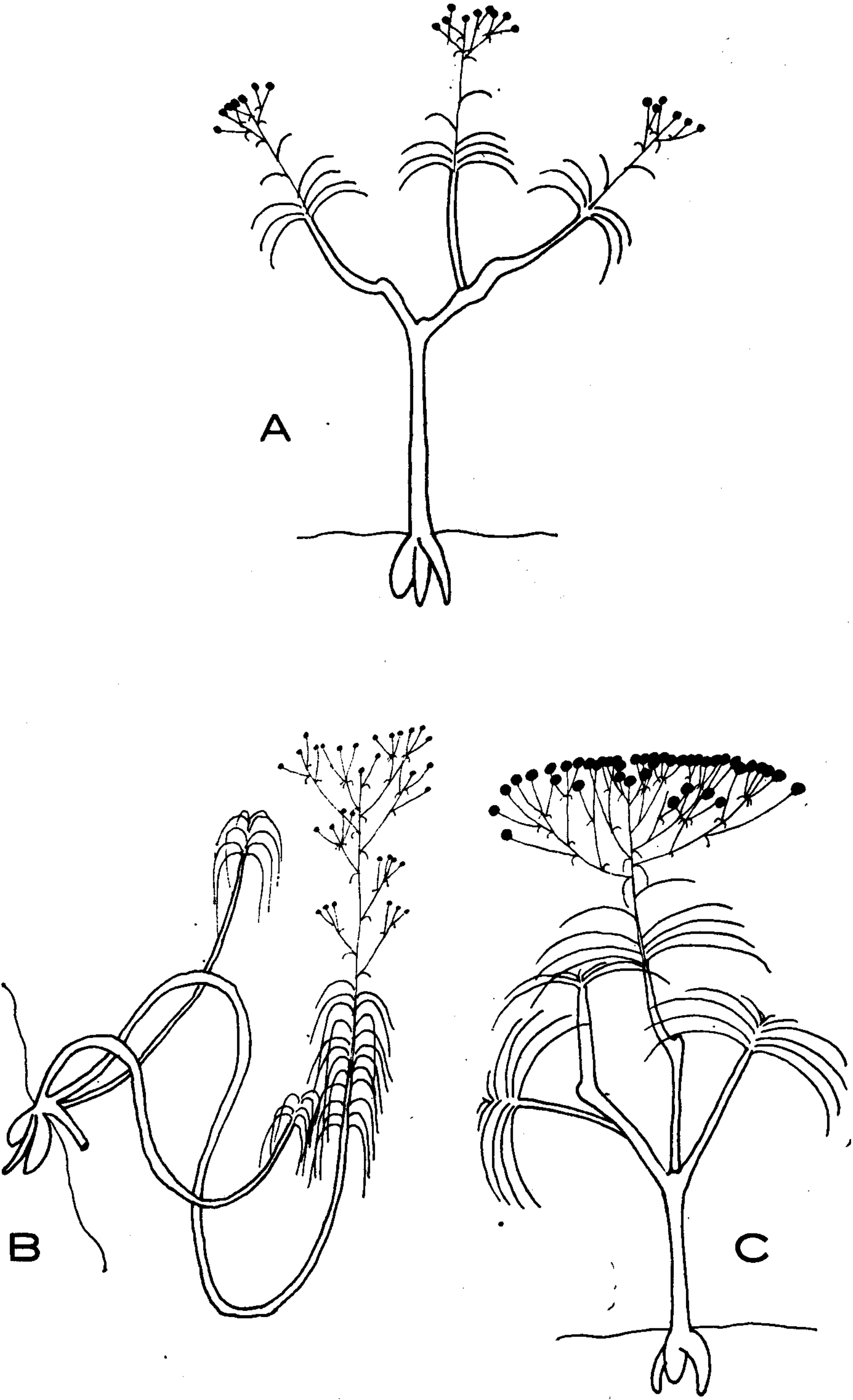


Figure 1 Growth forms of *Sonchus* subgenus *Dendrosonchus* section *Atalanthus* (not to scale). A. *Sonchus arboreus*, B. *S. leptocephalus*, C. *S. pinnatus* subsp. *palmensis*.

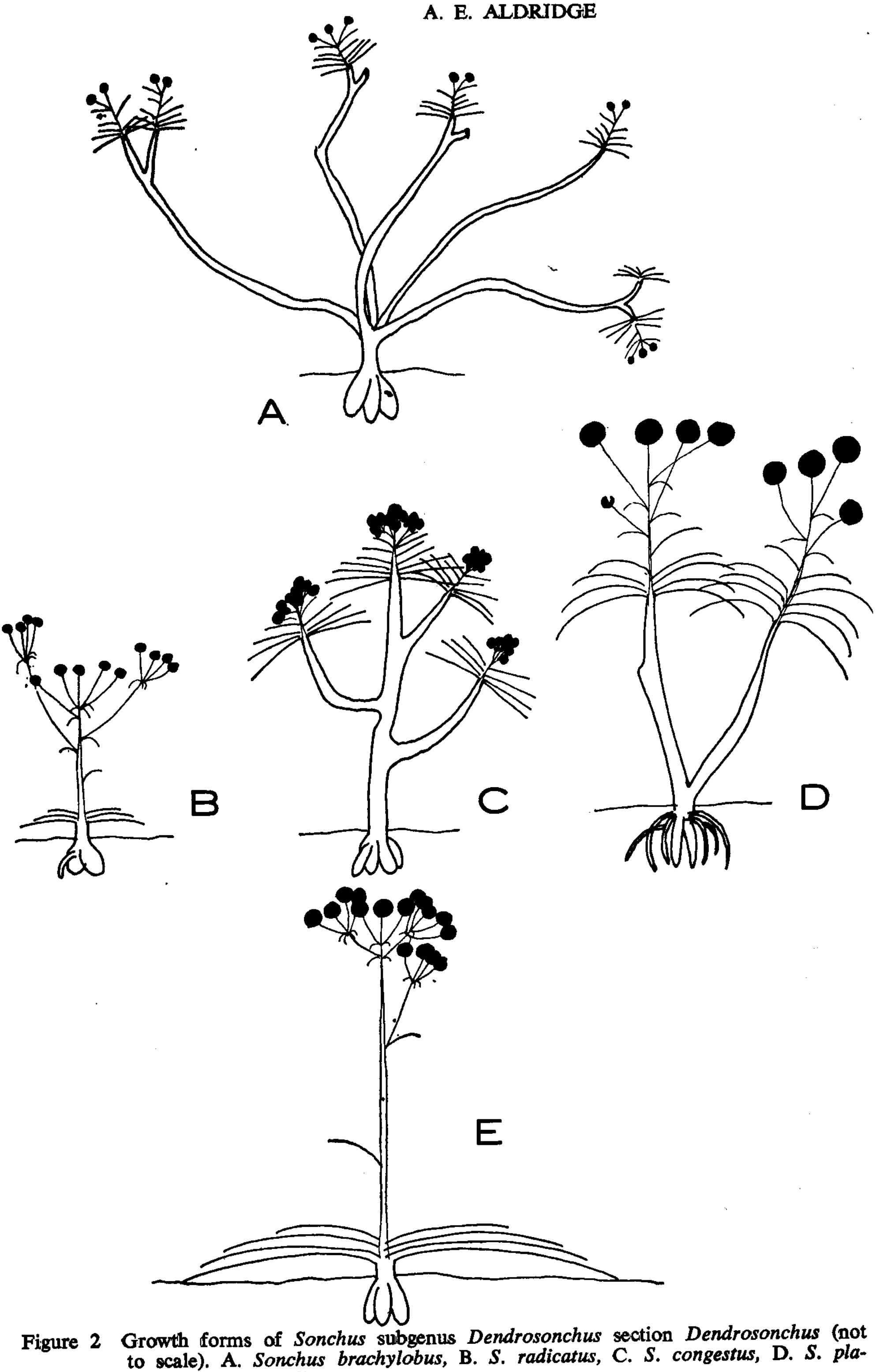


Figure 2 Growth forms of *Sonchus* subgenus *Dendrosonchus* section *Dendrosonchus* (not to scale). A. *Sonchus brachylobus*, B. *S. radicatus*, C. *S. congestus*, D. *S. platylepis*, E. *S. acaulis*.

dus as well as *S. pinnatus* and its three subspecies which were not included in *Taeckholmia* although the latter species most closely resembles the members of this segregate genus.

LEAVES

The leaves are arranged spirally around the stem and the young leaves are crowded at the stem apices in terminal rosettes. In section *Atalanthus* (Fig. 3) the leaves are differentiated into lamina and petiole. The lamina is pinnatisect with the leaf-lobes filiform, linear or linear- to oblong-lanceolate. The numbers, widths and lengths of leaf-lobes are all very variable for each species and in some cases where the plants have been damaged, more than one type of leaf can be found on one plant. The morphological diferences of the leaves for each species are maintained in cultivation and are generally useful taxonomically. Hybrid plants can easily be recognised by their possession of intermediate or very variable leaves (e. g. *Taeckholmia heterophylla* Boulos (Boulos, 1967a), a probable hybrid between *S. arboreus* and *S. leptocephalus* on Gomera). The leaf margins within this section are entire or sparsely denticulate. The denticles or spinules in both sections are the sites of hydathodes where the veins end blindly at the margins of the leaves.

In the section *Dendrosonchus* the leaves are also pinnatifid to pinnatisect. Figures 4, 5 and 6 show the leaf morphology of most of the members of this section. *Sonchus brachylobus* var. *canariae* is shown at the top of Figure 4 to illustrate that the leaf morphology is very similar to *S. pinnatifidus* (Fig. 4C) and *S. congestus* (Fig. 4E). Most of the species within this section have leaves with a sheathing base and the petioles are obscured by this. *Sonchus pinnatifidus* (Fig. 4C) and *S. fauces-orci* (Fig. 5A) are petiolate.

The leaf-lobes are narrowly- to broadly-triangular, ovate or broadly-ovate. In *S. fauces-orci* (Fig. 5A), the subspecies of *S. radicatus* (Fig. 5B, C and D), *S. gonzalezpadroni* and *S. ustulatus* subsp. *maderensis,* the lobes are angular with the proximal angle more pronounced. In some cases these extended angles of the leaf-lobes overlap the immediate proximal lobes and the midrib (e.g. *S. radicatus* subsp. *tectifolius,* Fig. 5D). The margins of the leaves are sparsely denticulate, denticulate, doubly spinulose or doubly serrulate and are useful taxonomically. *Sonchus congestus* (Fig. 4E) can easily be distinguished from any other taxon within the subgenus by its doubly serrulate leaf margins. The largest leaves of the subgenus are found in *S. acaulis* (Fig. 6C) in which they may attain the length of 80 cm.

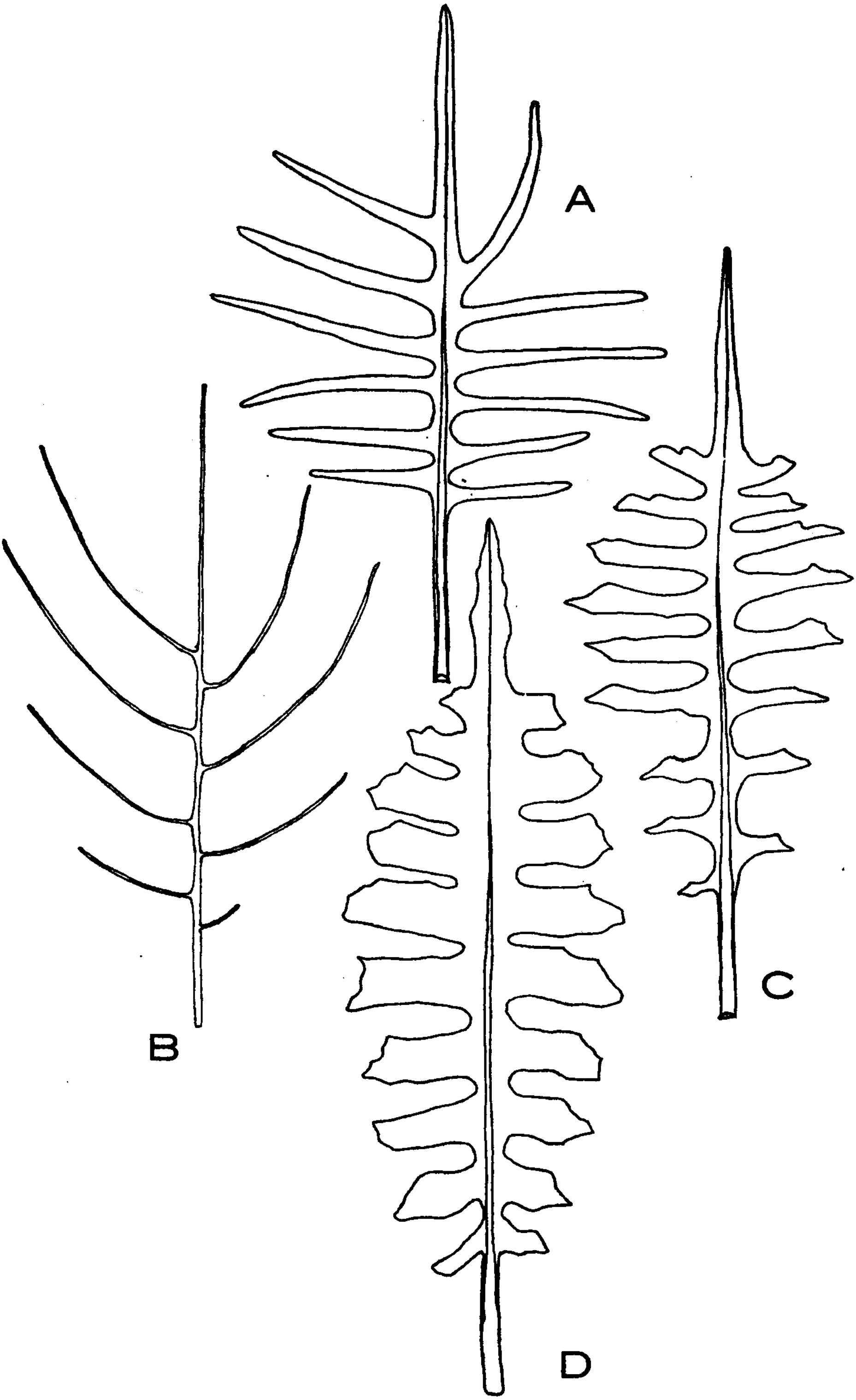


Figure 3 Leaf shapes - section *Atalanthus* (not to scale). A. *Sonchus arboreus*, B. *S. leptocephalus* subsp. *capillaris*, C. *S. pinnatus* subsp. *canariensis*, D. *S. pinnatus* subsp. *palmensis*.

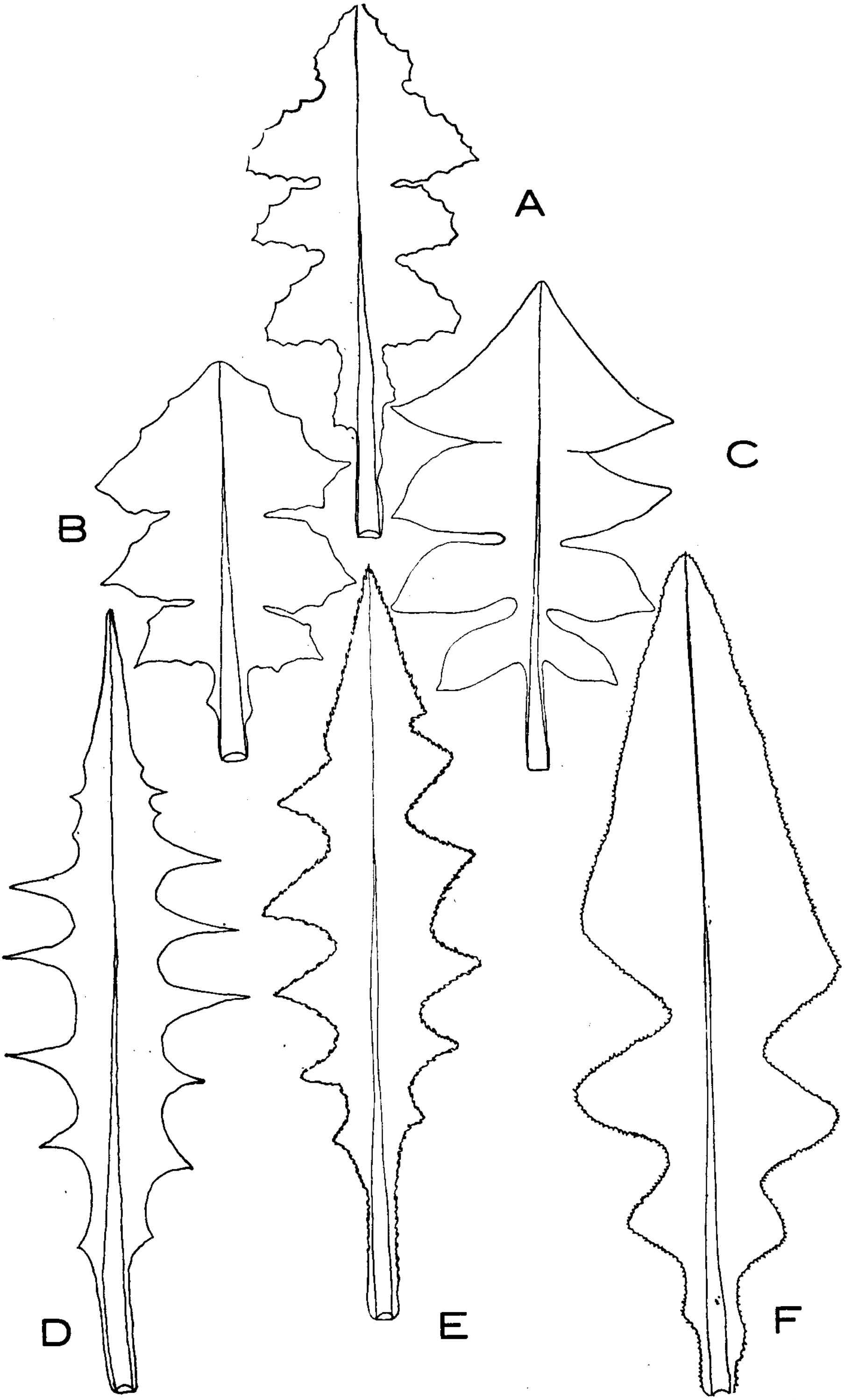


Figure 4 Leaf shapes- section *Dendrosonchus* (not to scale). A. *Sonchus brachylobus* var. *canariae*, B. *S. brachylobus*, C. *S. pinnatifidus*, D. *S. platylepis*, E. *S. congestus*, F. *S. fruticosus*.

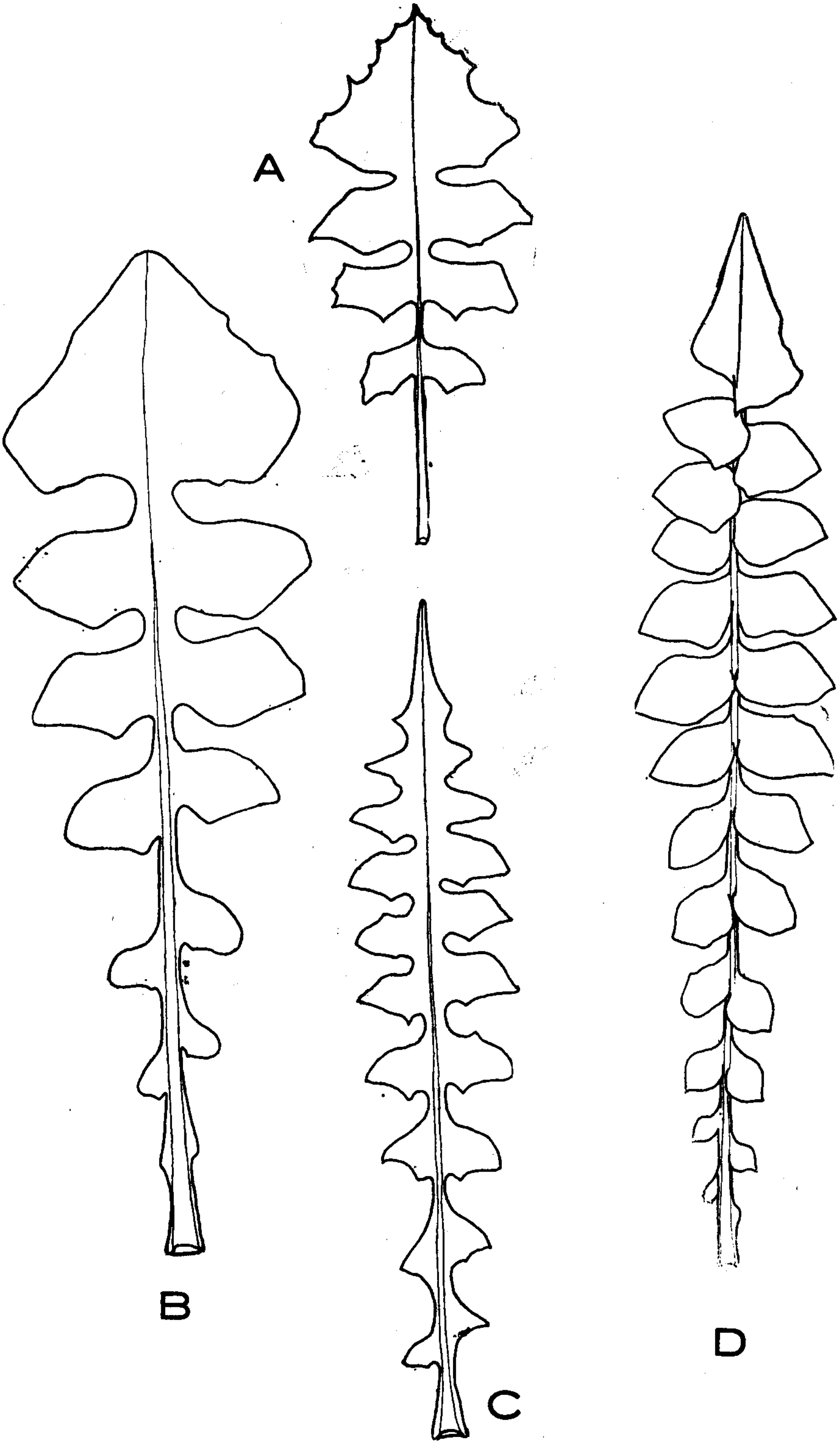


Figure 5 Leaf shapes - section *Dendrosonchus* (not to scale). A. *Sonchus fauces-orci*, B. *S. radicatus* subsp. *radicatus*, C. *S. radicatus* subsp. *gummifer*, D. *S. radicatus* subsp. *tectifolius*.

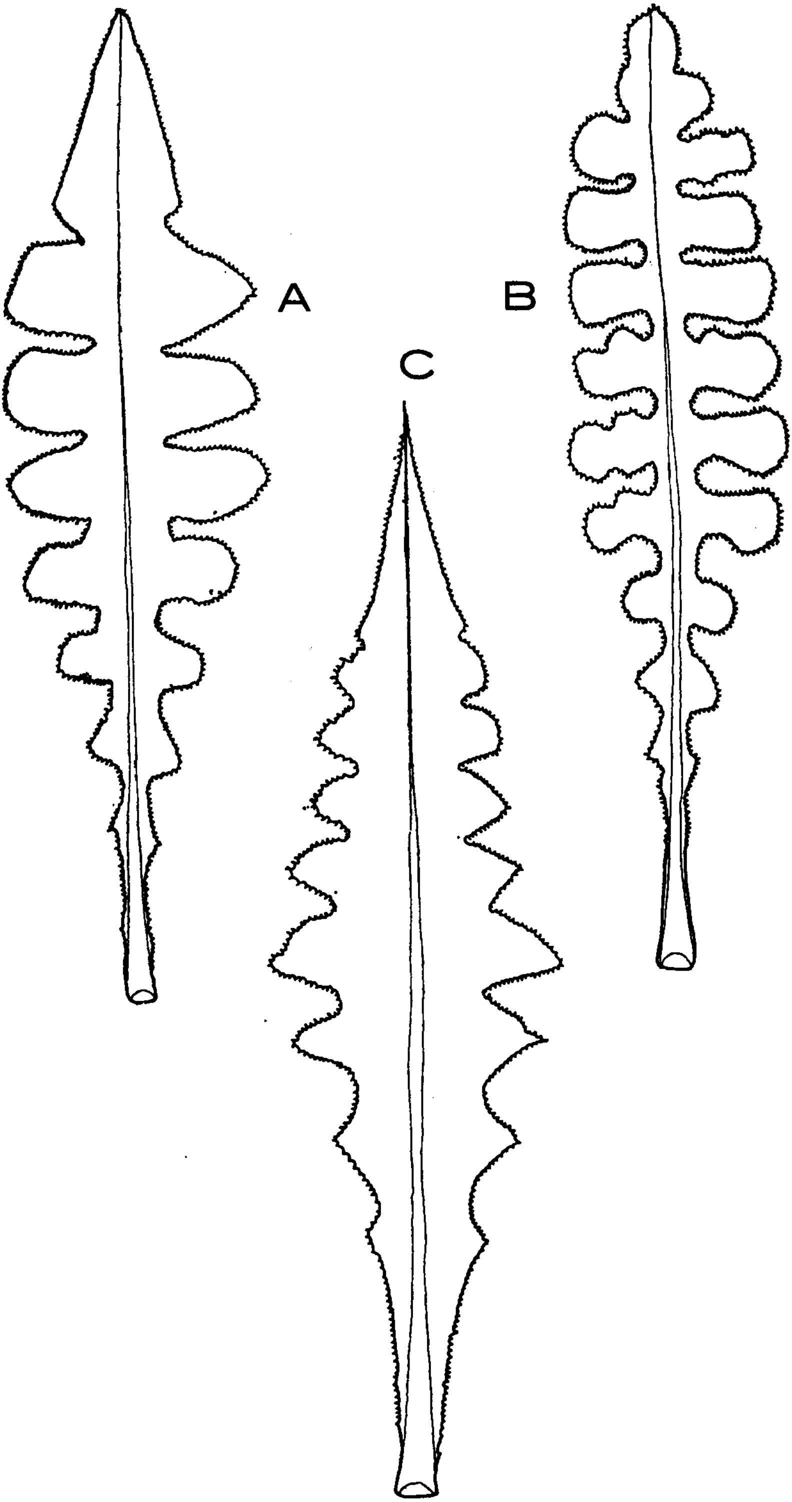


Figure 6 Leaf shapes - section *Dendrosonchus* (not to scale). A. *Sonchus hierrensis*, B. *S*
bornmuelleri, C. *S. acaulis*.

The leaves of section *Atalanthus* are glabrous. Many species of section *Dendrosonchus* have leaves which are pruinose, being covered with a waxy secretion of the epidermis which is easily rubbed off (e.g. *S. radicatus* and *S. platylepis*). This pruina is found over the rest of the plant in these species and especially on the involucral bracts and the peduncles. In some other species of section *Dendrosonchus* the leaves are floccose-tomentose or sparsely tomentose (e.g. *S acaulis* and *S. hierrensis*) and a few species have glabrous leaves (e.g. *S. bornmuelleri* and *S. pinnatifidus*). In all species of the subgenus the leaves of the young bud are protected by a heavy covering of white floccose-tomentose hairs.

A relationship between the degree of dissection of the leaves and rainfall, as was the case for the genus *Argyranthemum* Webb ex Schultz Bip. in the Canary Islands (Humphries, 1976), is not easily seen in this subgenus. The finely dissected leaves of *S. leptocephalus* subsp. *capillaris* are associated with extremely xerophytic conditions such as are found on the south coasts of Tenerife and Gran Canaria. Other species of both sections which possess broader leaf-lobes are also found in xerophytic conditions (e.g. *S. fauces-orci, S. pinnatifidus* and *S. platylepis*). A pruinose covering of the leaves is generally associated with coastal conditions (e.g. *S. radicatus* and *S. ustulatus*) but it is also found in *S. platylepis* which can be found in xerophytic high altitudes above the cloud zone. This latter species which has broad leaves also occurs in the cloud zone and broad-leaved species are found in mesic habitats (e.g. *S acaulis, S. hierrensis* and *S. fruticosus*). *Sonchus pinnatus* subsp. *palmensis,* however, has dissected leaves and is also found in these conditions.

Boulos (1967a) partially characterized *Taeckholmia* by the possession of leaves which are not auriculate, are in more or less dense groups at the summits of the vegetative branches or at the bases of the flowering shoots and are deeply dissected into narrow lobes. All species of subgenus *Dendrosonchus* have this arrangement of leaves. *Sonchus pinnatus* subspecies *pinnatus, palmensis* and *canariensis* were not included in *Taeckholmia* even though they have deeply dissected leaves with narrow lobes.

INFLORESCENCES

The inflorescences are corymbose, determinate, monochasial cymes (e.g. *S. arboreus* and *S. platylepis*) or determinate, dichasial, umbel-like cymes (e.g. *S. radicatus* and *S. acaulis*). In all species the inflorescences are terminal on the main stem or branches.

The numbers of capitula per inflorescence ranges from about 8 in *S. platylepis* to approximately 350 in *S. leptocephalus*. The branching patterns of the inflorescences of five species of *Dendrosonchus* s.l. have been described by Ebel (1971).

As the inflorescence develops, the main axis of the stem or caudex elongates and the leaves become separated by longer internodes. These cauline inflorescence leaves are smaller, generally auriculate and often possess fewer lobes than the caudical leaves. Higher up the inflorescence these cauline leaves give way to smaller bracts of the peduncles. The numbers, sizes and shapes of all these leaves and bracts are sometimes useful taxonomically (e.g. the peduncle bracts of *S. fauces-orci* and the inflorescence bracts of *S. ustulatus*).

The majority of capitula have peduncles but when very young they often appear to be sessile. The peduncles range in length from 1 mm (e.g. in all species of section *Atalanthus*) to 100 mm (e.g. *S. radicatus*, *S. ustulatus* and *S. platylepis*). They sometimes have an identical indumentum to that of the involucral bracts but in most species are glabrous. The majority of species have a low number (0—4) of bracts on the peduncles, but up to 21 can be present in *S. fauces-orci.*

In distinguishing the genus *Babcockia*, Boulos stated that the diagnostic characters include the extraordinary length of the peduncles (up to 18 cm) and the presence of a large number of bracts on the peduncles (up to 15). The range of peduncle length of *S. platylepis,* which was the only species placed in the genus *Babcockia,* ranges from 30 to 90 mm, which overlaps with the ranges for all other members of the section *Dendrosonchus*. Boulos's measurement of 18 cm for *S. platylepis* is indeed "extraordinary". As mentioned above the highest number of peduncle bracts is in *S. fauces-orci*, whereas only 2 to 4 bracts are present in *S. platylepis*. The high number of 15 given by Boulos was not encountered in this study but it does not exceed that found regularly in *S. fauces-orci*. The shape of the peduncle bracts for *Babcockia platylepis* was stated by Boulos to be long and acuminate but I do not consider this character to be any more important than the distinct leaf shape possessed by *S. platylepis*.

CAPITULA

The smallest capitula are found in *S. leptocephalus* (6-9 mm x 1.5-4 mm at anthesis) and the largest in *S. platylepis* (20-30 mm x 18-30 mm). The former species was assigned to the genus *Taeck-*

holmia and the latter to *Babcockia* by Boulos (1967a, 1965 respectively) who used the sizes of the capitula and the component numbers of involucral bracts and florets as criteria to distinguish them from *Sonchus*. All sizes of capitula between these two limits are found in subgenus *Dendrosonchus*. Boulos gave the capitula sizes of the genus *Taeckholmia* to be 3-7 mm x 2-3 mm with 10-12 mm x 3-4 mm in one species. Those species which Boulos placed into this new genus have been examined here and quite different measurements were obtained. The ranges are 6-10 mm x 1.5-5 mm in *S. arboreus, S. leptocephalus* and its two subspecies (all members of Boulos's new genus), 7-15 mm x 3-12 mm in *S. pinnatus* and its three subspecies (all considered by Boulos to be the closest, morphologically to *Taeckholmia*) and 9-30 mm x 4-30 mm in all the members of section *Dendrosonchus*. As the measurements given by Boulos show a much smaller length of the capitulum, I assume that they were taken from young capitula and not from heads at anthesis, which is the most commonly accepted method in floristic works of today. This measurement is easily repeatable, whereas the young capitulum measurement certainly is not. In his descriptions of the species of subgenus *Dendrosonchus,* Boulos (1974a) often gave measurements of the capitula before and after anthesis. Unfortunately the measurement before anthesis in many cases seems to be of the young bud, and those after anthesis definitely included the ligules which project above the involucre. Both measurements are not easily repeatable and are, therefore, unreliable.

The heads are compressed-globose in bud, becoming subconical at anthesis and after flowering the bases of the outer involucral bracts in many species become swollen, giving the heads a conical appearance (e.g. *S. hierrensis, S. acaulis* and *S. radicatus*). This swelling of the bracts closes the involucre during maturation of the cypselas. When the cypselas have reached maturity the involucre dries and withers, releasing the ripened fruits. In the species of section *Atalanthus* the swelling of the outer bracts is not so pronounced and yet the same mechanism for protection of the maturing fruits is still prevalent.

The larger capitula are generally found in mesic conditions and the smaller in xerophytic habitats. *Sonchus platylepis* appears to be the exception to this rule with its extra large heads and by growing in the high altitudes of Gran Canaria which are generally above the cloud zone. It is, however, also found in the cloud zone as well as these sub-alpine conditions. The coastal species have capitula of an intermediate size (e.g. *S. radicatus* and *S. ustulatus*) The shape of the capitulum is very characteristic for each species and Figure 7 illustrates a few of these.

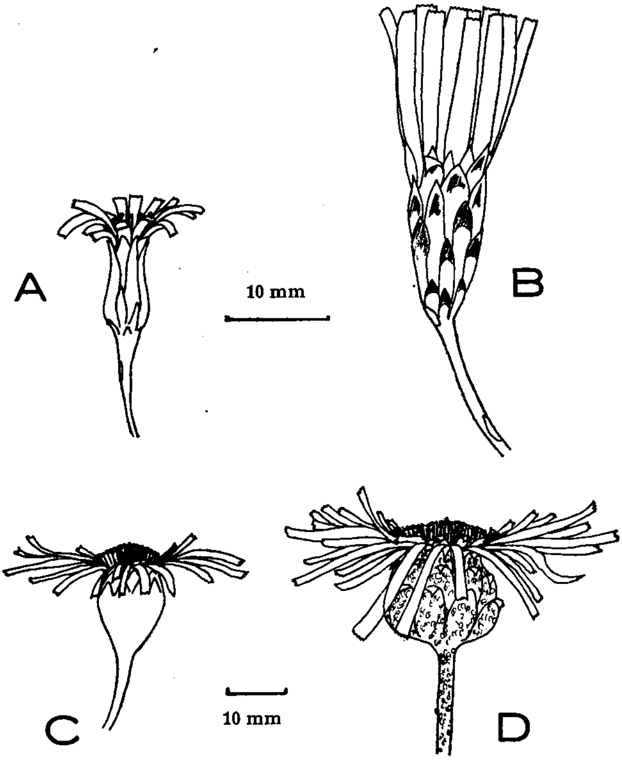


Figure 7 Capitula types of some members of subgenus *Dendrosonchus*. A. *Sonchus arboreus*, B. *S. fauces-orci*, C. *S. radicatus* subsp. *radicatus*, D. *S. acaulis*.

INVOLUCRAL BRACTS

The involucral bracts are imbricate and spirally arranged into three to six, rarely seven, series with the outer bracts shorter than the inner. In section *Atalanthus* the bracts are arranged into three or four series. The numbers of bracts for this section range from 13 in *S. leptocephalus* to 48 in *S. pinnatus*. The involucral bracts are usually glabrous but occasionally small appendages on the midrib were seen in some samples of *S. pinnatus* subsp. *palmensis* and *S. leptocephalus* subsp. *capillaris*. These, apparently functionless, appendages are distinct from the elaborate, glandular hairs on the involucral bracts and peduncles of several species in the subgenus *Sonchus* and of the closely related, monotypic genus, *Sventenia*. In section *Dendrosonchus* the involucral bracts are arranged in from four to six series, rarely seven as in *S. platylepis*. The numbers of bracts for this section range from 20 in *S. brachylobus* to about 75 in *S. radicatus* and *S. acaulis*. The involucral bracts of the coastal species, those which have pruinose leaves, are usually pruinose. The appendages mentioned above were also seen in some samples of *S. brachylobus* and *S. ustulatus* subsp. *maderensis*. Involucral bracts which are floccose-tomentose, at least at the base, are present in *S. hierrensis, S. acaulis, S. bornmuelleri, S. congestus* and *S. ortunoi*. The inner bracts of *S. fauces-orci* are very distinctive in having a yellow colouration making them difficult to distinguish from the florets.

The involucral bracts of subgenus *Dendrosonchus* are generally of three to four types. The outer bracts are smallest and are triangular or ovate. The margins are entire to shortly ciliate, sometimes revolute (e.g. *S. hierrensis*) and very slightly scarious. These outer bracts merge gradually into the peduncle bracts below and the inner involucral bracts above. The intermediate bracts are less thickened and ovate, broadly-ovate or spathulate. The inner bracts are scarious and usually linear-lanceolate. Ebel (1971) illustrated these types for two species of section *Atalanthus* and three of section *Dendrosonchus*.

Boulos (1965) used the number of involucral bracts to distinguish *Babcockia* from *Sonchus*. His estimate of "±" 98 bracts for *S. platylepis*, which he placed into the new genus, was not observed for this or any other species within the subgenus *Dendrosonchus* during the present study. *Sonchus platylepis* usually has from 44 to 68 involucral bracts and a higher number is frequently present in *S. acaulis* and *S. radicatus* as noted above. Many of the large-headed species of section *Dendrosonchus* have involucral bracts of four or more types and, therefore, this character does not distinguish *Babcockia* from *Sonchus* as was suggested by Boulos. To distinguish the genus *Taeckholmia*, Boulos (1967a) used the low number of involucral bracts as one of the diagnostic characters. This character is unreliable as equally low numbers of bracts are present in *S. pinnatus* subspecies *pinnatus* and *palmensis* of section *Atalanthus* and in *S. brachylobus* and *S. fauces-orci* of section *Dendrosonchus*.

FLORETS

The florets are typical for the tribe, being all ligulate with five corolla teeth and five anthers which are laterally connate around a stigma with two terminal and papillate branches. All species of the genus have yellow florets which range from yellow (e.g. *S. arboreus* and *S. leptocephalus*) to a deep orange-yellow (e.g. *S. radicatus* and *S. acaulis*). The ligules are linear-lanceolate with five equal or unequal, acute or rounded teeth. The junction between the ligule and the tube is covered with white unicellular hairs. These hairs extend down the tube becoming more sparse nearer the inferior ovary. The ligule is glabrous and is provided with six vascular strands which supply the marginal positions of each segment of the five lobed corolla. The ratio of the length of the ligule to the length of the tube is more or less constant for a species and ranges from 1 to 2. The tube is usually shorter than the ligule but rarely, as in *S. bornmuelleri,* the tube is constantly longer.

The numbers of florets per capitulum in section *Atalanthus* range from 5 in *S. leptocephalus* to about 170 in *S. pinnatus.* This count of five florets in one sample of *S. leptocephalus* from Gran Canaria is low for this species (usually 9-29) and is unusual for the genus. The numbers of florets per capitulum in section *Dendrosonchus* range from 52 in *S. brachylobus* to about 660, which is high for the tribe, in *S. platylepis.* The number of florets is more or less constant for each taxon and the dimensions of the florets are useful taxonomically.

Boulos (1965) used the high number of florets to distinguish *Babcockia* from *Sonchus.* He gave a figure of "plus de 500" but the specimens counted in the present study revealed a range in floret number of from 300 to 600 in *S. platylepis.* Although this is the highest number of florets encountered in this subgenus, other species have numbers which come within this range (e.g.*S. acaulis* with 240-450 florets and *S. radicatus* with 140-540 florets). Similarly, Boulos (1976a) used the low number of florets to distinguish the genus *Taeckholmia* from *Sonchus.* He gave a range of 12-29 florets for this new genus but for those species involved this range is extended to (5) 9-29 in the present work. Within section *Atalanthus* a low number of florets is typical, apart from *S. pinnatus* subsp. *canariensis.* In *S. pinnatus* subspecies *pinnatus* and *palmensis* as few as 25 florets have frequently been counted. This character is, therefore, equally unreliable for the distinction of the genus *Taeckholmia.*

The anther tube is usually 3-4 mm long with narrowly-triangular tails. The stylar branches are 1-3 mm long with small rounded papillae on their inner surfaces and long pointed papillae on the outer surfaces. Dehiscence is typically introrse and the pollen is pushed from the staminal tube by the elongating style.

RECEPTACLE

The receptacle of all the species of this subgenus is flat and reticulately pitted. Each small pit corresponds to the position at which a cypsela was attached and has little or no surrounding wall.

CYPSELAS AND PAPPUS

The cypsela and pappus morphologies provide the clearest distinguishing features of the genus *Sonchus*. The cypselas are compressed, beakless, attenuated towards both ends and slightly curved. The pappus is composed of two dissimilar types of seta, some being fine, flexuous hairs which are fasciculate at their bases and others being much longer, coarser, straight bristles wich are separate. Both types of seta are scabrid by the extension of tips of the component cells directed away from the main body and towards the apex of the seta. The bristles are thicker than the hairs as they are composed of many more cells. The difference in length between the two types of seta is not so distinct in section *Atalanthus* as it is in section *Dendrosonchus*. In general the bristles are more caducous than the hairs, but in *S. leptocephalus* both types of seta are more or less equally deciduous. In *S. arboreus* and *S. leptocephalus* subspecies *leptocephalus* and *capillaris* there are setae of intermediate lengths and thicknesses between the hairs and the bristles. Another distinguishing feature of the pappus is that the hairs usually have hooked tips, whereas the bristles are acute. The hooked tips are formed by the doubled back apices of the individual cells which terminate the hairs (illustrated by a pappus hair of *S. radicatus* in Plate 2a). The typical bristle tip is composed of cells which are pointed at their apices (illustrated by a pappus bristle of *S. leptocephalus* in Plate 2b).

Other distinguishing features of the cypsela and pappus are present but are a little more variable than those mentioned above. The surfaces of the cypselas have ribs running from the apex to the base. In the majority of species of *Sonchus* the number of prominent ribs is usually one to two on each side of the compressed cypselas, together with the two laterals. Between these ribs are smaller and less conspicuous ones which vary in number. Anatomical examination of the cypselas of each taxon of *Dendrosonchus* has proved to be useful taxonomically and this will be discussed in more detail in a later paper concerning the anatomy and evolution of the subgenus. Boulos (1960) noted that the number of prominent ribs on each face of the cypsela was generally three. If this was the case then an average of six major ribs per cypsela would be expected. The commonest number per cypsela, however, is four. The number given by Boulos probably included the two lateral ribs and these were probably counted twice if both faces of the cypsela were examined separately. Boulos also mentioned that the presence or absence of tubercles on the prominent ribs is a character of taxonomic importance for the separation of closely allied species. These tubercles, here termed papillae, are found not only on the prominent ribs in the species which possess them but all over the cypsela surface (e.g. *S. pinnatifidus*, Plate 1b). Generally, the cypselas are devoid of papillae (e.g. *S. brachylobus*, Plate 1a). The presence or absence of papillae may be a useful taxonomic character at the level of species. All the species of the subgenus have homocarpous fruits and all these fruits are fertile.

Much attention has been given by Boulos (1965, 1967a, 1972, 1974b) to the features of the cypsela from the standpoint of separation of the two genera *Babcockia* and *Taeckholmia* from the subgenus *Dendrosonchus*. It is necessary to discuss these opinions in detail because these two genera are not accepted here. Boulos (1965) recognised *Babcockia* with one species, *B. platylepis* (Webb) Boulos, as distinct from *Dendrosonchus* on the basis of several features of which the following apply to the cypsela and pappus:

"1. Les akènes ± cylindriques et dépourvus de côtes.
2. L'apex des deux types de soies de l'aigrette est ± identique".

In his generic description of *Babcockia*, Boulos stated that the cypselas are 5.5 mm x 1 mm, have four grooves and are dimorphic, the outer being brown and rugose and the inner being cream-yellow and smooth. The pappus was described as having bristles 9-12 mm long with well developed lateral spines and apical cells reflexed towards the base and having hairs 4 mm long with few lateral spines and reflexed tips.

The anatomy of the cypselas of *S. platylepis* with respect to their ribbing and outline in transverse view does not distinguish it from other members of the subgenus *Dendrosonchus*. The cypselas of *S. platylepis* are the longest found within the subgenus and range from 5-7 mm. This is the *only* character which shows no overlap with other members of the subgenus which have cypselas of 1-4 mm in length. The width of the fruits between the lateral ribs of this species is 0.8-1.8 mm and the width between the two faces is 0.5-0.9 mm, thus indicating that they are definitely compressed. No evidence for the presence of dimorphic fruits, as suggested by Boulos, can be seen in the mature cypselas. I suggest that the two types of cypsela described by him are simply mature and immature fruits. The maturation of the cypselas in the capitulum of any species of this subgenus proceeds from the outside to the inside and in a developing head the fruits on the inside are yellow and smooth as they have not yet acheived maturity.

Boulos's observation that the tips of the two types of pappus setae in *S. platylepis* both have reflexed cells was, to some extent, confirmed during the present study. This feature is, however, also present in many other species of the subgenus. Hooked bristles are present occasionally in *S. arboreus, S. leptocephalus* subsp. *capillaris* and *S. brachylobus* as well as in *S. platylepis*. On average the number of hooked cells on the hairs is about 8 but the tips of these hairs are just as variable in possessing hooks as the bristles. Some hairs which do not have the typical reflexed cells are occasionally present in *S. arboreus, S. leptocephalus* subspecies *leptocephalus* and *capillaris, S. ustulatus* subspecies *ustulatus* and *maderensis* and *S. fruticosus* as well as in *S. platylepis*. The tips of the hairs which lack reflexed cells appear to be reductions from the typical hooked apex. The bristles with hooked tips appear to have obtained reflexed cells as a secondary feature. Boulos (1960) suggested that the flexuous hair is derived from the coarse bristle and the presence of intermediate types of seta, seen during the present study in some of the species, seems to support this view. Boulos (1974b) gave another list of features to distinguish the genus *Babcockia* from *Sonchus* but in this list the characteristics of the pappus were omitted.

Boulos (1967a) described another genus, *Taeckholmia,* which comprised seven species, originally of the subgenus *Dendrosonchus.* The cypsela was used to provide one of the most important characteristics of this new genus. The following features of the cypsela were used:

> "The small size of achenes (1.7-2.5 mm long and about 0.6 mm broad) which are attenuated towards both ends and are of variable shape within the same capitulum. The achenes are provided at their upper end with a protuberance surrounded by a white disc."

In his generic description of *Taeckholmia,* Boulos stated that the cypselas are rugose, possess about four ribs on each side and are heteromorphic. The cypselas were described as either narrowly oblanceolate, more or less narrowly elliptic or more or less narrowly rectangular and also that they are either erect or curved. Comparing the cypsela sizes of the members of *Taeckholmia* with those of subgenus *Dendrosonchus* reveals that this particular character is definitely of no taxonomic value at the generic level. *Sonchus arboreus, S. leptocephalus* subspecies *leptocephalus* and *capillaris* (which constitute all the species of *Taeckholmia*) have a range of cypsela sizes from 1 to 3 mm long by 0.4 to 1.1 mm broad, which is a much wider range than that given by Boulos (1967a). The range of cypsela sizes for all the subspecies of *S. pinnatus* is 1.5 to 3 mm long by 0.7 to 1.6 mm broad. The ranges of the two groups can hardly be separated. As mentioned previously, the typical *Sonchus* cypsela is attenuated towards both apices and, therefore, this character does not distinguish the genus *Taeckholmia* either. The third feature mentioned by Boulos in his diagnosis concerning the variability in the shape of the cypselas within the same capitulum is not seriously considered. This variability may be observed throughout the genus *Sonchus* and is probably due merely to small, genetic or developmental differences as are expressed in any plant or part of a plant. The cypselas of section *Atalanthus* are equally as homomorphic as those within section *Dendrosonchus*. The statement by Boulos that the cypselas of *Taeckholmia* species possess four ribs on each face is inaccurate. This condition does not exist in any of the species of subgenus *Dendrosonchus* s.l. Plate 3 shows the range in cypsela morphology for the two sections, *Atalanthus* (3a and b) and *Dendrosonchus* (3c and d) respectively. That Boulos should have used the feature of the cypselas possessing a protuberance surrounded by a white disc at the upper end to distinguish the genus *Taeckholmia*, as the sole character in a key, seems totally unjustified. This central protuberance is nothing more than the remains of the floret after it has broken away from the cypsela during maturation. This feature is illustrated by Plate 4. A slight protuberance was seen in *S. arboreus, S. platylepis* (Plate 4d) and *S. pinnatifidus* (Plate 4c) but not in any of the other members of either section. When the fruits are not fertilized the remnant of the floret at the tip of the cypsela is more likely to be found as it does not appear to detach itself as readily from the undeveloped cypsela.

Boulos (1972) gave a key to the genera which he recognised, thus stressing certain features discussed above which have been shown to have no taxonomic value at this level. His key to the genera was as follows:

"1. Akène non comprimé (± cylindrique) *Babcockia*
1. Akène comprimé
2. Akène pourvu au sommet d'un disque blanc à protubérance centrale *Taeckholmia*
2. Akene sanes disque blanc an sommet
3. Akène 0.5-1.75 mm de large *Sonchus*
3. Akène 2-3 mm de large *Embergeria*"

I have little knowledge of the two Australasian species of *Embergeria* but at least two species of section *Dendrosonchus* hace cypselas up to 2 mm in width. This part of the key is, therefore, also questionable.

POLLEN

The basic structure of the pollen grains in the subgenus *Dendrosonchus* s.l. is the same as that shown in the work by Pons and Boulos (1972) for *Sonchus* s.l. In distinguishing *Babcockia* from *Sonchus,* Boulos (1965) placed great emphasis on pollen morphology. Similarly, Boulos (1967a) used this as another feature to distinguish the genus *Taeckholmia* from *Sonchus.* In both cases no details were given but information was later provided by Pons and Boulos (1972).

The first detailed palynological study of the genus *Sonchus* was by Saad (1961). He acetolysed, chlorinated and embedded the pollen grains in glycerine jelly which, according to Pons and Boulos, causes a swelling of 20-30% in the overall sizes as compared to acetolysed and chlorinated grains mounted in pure glycerine, the technique used by the latter authors. In these two works the measurements of the pollen grains were obtained from light microscopy. In the present work the pollen grains of all species of *Dendrosonchus* s.l. were examined untreated, from fresh and herbarium material, under a scanning electron microscope. The measurements obtained from this method showed constant differences from those of Pons and Boulos of from 20 to 30%. The effect of the vacuum in the scanning electron microscope may have been to cause slight shrinkage, but as little damage to the grains was seen it is probable that the effect of acetolysis, chlorination and mounting in pure glycerine is greater on the disturbance of the grains. When some pollen grains were mounted in pure glycerine the measurements obtained with the light microscope were found to be equivalent to those given by Pons and Boulos. As the differences in dimensions were constant the relative sizes obtained from the two techniques are considered to be comparable.

Saad (1961) found four types of pollen grain in the genus *Sonchus.* Each type was based upon the differences in the polar thickenings. Type 3 was stated to be the most common in subgenus *Dendrosonchus* although types 2 and 4 were also recorded. Type 3 is that in which the polar thickenings are small, triangular areas surrounded by three large polar lacunae which are between the paraporal lacunae (cf. Plate 6A and B). Type 2 has moderately developed polar thickenings with smaller polar lacunae and type 4 has a much reduced polar thickening (cf. Plate 6C and 7D). Each type was illustrated by Saad. He concluded that the direction of evolution of the pollen grain types has been from type 1 to type 4. Eleven species of subgenus *Dendrosonchus* s.l. were examined by Saad and the largest pollen grains were found in *S. abbreviatus* Link (= *S. congestus*) and *S. bornmuelleri.*

Pons and Boulos (1972) gave a detailed table of the measurements and features of the pollen grains for the genus *Sonchus* and its allied genera. Comparative measurements were made in the present study for the subgenus *Dendrosonchus* s.l. The genus *Babcockia* was stated by Pons and Boulos to possess pollen grains which could be distinguished from those of *Sonchus*. The characters used were the large size (38.9-42 um), the thickness of the ridges (6-6.5 um), the type 2-3 polar thickening and a large number of polar spines (18-22). In the present study the measurements, as explained above, were generally 20-30% smaller than those of Pons and Boulos. The measurements obtained from pollen grains of *S. platylepis*, however, showed a difference of up to 40%. The reason for this is not at all clear since, as explained above, the majority of other measurements were relatively comparable. The range of pollen sizes in the section *Dendrosonchus* is from 21.6 um in *S. ustulatus* to 29.7 um in *S. congestus* and *S. ortunoi*, with *S. platylepis* having a range in pollen diameter of 23.3 to 24.6 um. Pons and Boulos also recorded a large size for the pollen grains of *S. hierrensis* (39-42 um) which are, therefore, not separable, even in their own studies, from *S. platylepis*. The range in the thickness of the ridges in section *Dendrosonchus* is from 1.8 um in *S. pinnatifidus* to 4.3 um in *S. platylepis*. The range for *S. platylepis* is 2.8 to 4.3 um which is a 50% difference between the measurements found here and those of Pons and Boulos as given above. *Sonchus hierrensis* has a range of 2.5 to 3.6 um in its ridge thickness and, therefore, overlaps with that of *S. platylepis*. Pons and Boulos also showed *S. hierrensis* to have high ridges (3.9 um). The type 2-3 polar thickening is present in *S. radicatus* subsp. *gummifer* and *S. congestus* as well as in *S. platylepis* of section *Dendrosonchus* (cf. Plate 7C). Pons and Boulos found this type 2-3 range within *S. congestus* and *S. ustulatus* and it is, therefore, not a feature confined to *S. platylepis*. The range in the number of polar spines for section *Dendrosonchus* is from 4 in *S. ustulatus* to 22 in *S. brachylobus*. The highest number of polar spines was found by Pons and Boulos to be 25 in *S. hierrensis*. *Sonchus platylepis* (Plate 7C) was found here to possess 12-16 polar spines, a much lower number than was recorded by Pons and Boulos.

The genus *Taeckholmia* was distinguished by Boulos (1967a) from *Sonchus* with the aid of pollen characters. Pons and Boulos stated that the grains of the species within this genus are heteromorphic and have variable dimensions, polar thickenings and numbers of polar spines. They gave the diameter of the pollen (26-36.5 um) as a distinguishing feature as well as the type 2-4 range in polar thickening. For comparisons of data only those species of section *Atalanthus* which Boulos placed in *Taeckholmia* will be considered. A range in total diameter of these species is from 20.6 *um* in *S. leptocephalus* subsp. *capillaris* to 24.6 *um in S. arboreus* and *S. leptocephalus* subsp. *leptocephalus*. The range in total diameter of the other members of section *Atalanthus* is 22.6 *um* in *S. pinnatus* subsp. *pinnatus* to 26.4 *um* in *S. pinnatus* subsp. *canariensis*. As given above, the total range of diameter for the section *Dendrosonchus* is 21.6-29.7 *um* and, therefore, there is almost a complete overlap with the dimensions of the genus *Taeckholmia*. The type 2-4 range in polar thickening, recorded by Pons and Boulos, was not seen in section *Atalanthus*. The usual type is the 3 or 4 which is also typical for the subgenus (Plate 6). Pons and Boulos recorded the type 1 polar thickening for *S. canariensis* (= *S. pinnatus* subsp. *canariensis*) and for *S. hierrensis*. Both of these taxa were found here to have the type 3 polar thickening.

Tetracolporate pollen has previously only been recorded for the subgenus *Sonchus* (Saad, 1961). In the present study three samples with tetracolporate pollen grains have been seen. A sample of *S. arboreus* from La Palma and one of its progeny grown in the greenhouse at Reading possessed a mixture of tricolporate and tetracolporate pollen (Plate 5A). The tetracolporate pollen was also seen in herbarium specimens (*Bramwell* 1180, *Kunkel* 1285, both held in RNG). These specimens were collected from Gran Canaria, were different morphologically and were considered by their respective collectors to be new species. They are, however, probably variants of *S. leptocephalus* subsp. *leptocephalus* as they have broader leaf-lobes, larger capitula and various other combinations of features not seen in any other collection of this subgenus. The presence of tetracolporate pollen may, therefore, be indicative of genetic abnormalities. The sample of *S. arboreus* from La Palma was taken from a very localized population of one or two individuals and may have retained this abnormality of the pollen without any adverse affects. Plates 5B and C show the equatorial and poral views respectively, of *S. pinnatus* subsp. *canariensis* to illustrate the typical structure of *Dendrosonchus* pollen.

Plate 6 shows polar views of three species from the section *Atalanthus*. A polar view of a pollen grain of *S. arboreus* with the type 3 polar thickening and 17 polar spines is shown in 6A. A pollen grain of *S. pinnatus* subsp. *pinnatus* with the type 3 polar thickening and 18 polar spines is shown in 6B. Plate 6C shows a pollen grain of *S. leptocephalus* subsp. *leptocephalus* with the type 4 polar thickening and 3 polar spines. Plate 7 shows the polar views of four species of section *Dendrosonchus*. Plate 7A is a pollen grain of *S. fauces-orci* with the type 3 polar thickening and 20 polar spines. Pollen of *S. congestus* with the type 3 polar thickening and 17 polar spines is shown in 7B. This species has the largest pollen grains encountered in this study. Plate 7C shows pollen of *S. platylepis* which possesses very high ridges, the type 2-3 polar thickening and 13 polar spines, and 7D is a pollen grain of *S. ustulatus* subsp. *maderensis* which has the smallest diameter and the lowest number of polar spines found within this section. It has the type 4 polar thickening and 4 polar spines.

With reference to the opinion of Saad (1961) that the evolution of the pollen has been from type 1 to type 4, it can be seen that within the two separate sections of *Dendrosonchus* the trend from type 3 to type 4 is apparent. This is in agreement with the lines of evolution which will be proposed on anatomical evidence in later papers. As so many differences, however, prevail in the qualitative as well as quantitative data between those recorded by Pons and Boulos and those given here, it is probable that the pollen surface features are so variable in this group as to be almost useless taxonomically. Thorough population studies in the field would be of immense value in clearing up this point.

DISCUSSION AND CONCLUSIONS

Throughout this study the two genera *Babcockia* and *Taeckholmia* have been critically reviewed in relation to the individual characteristics by which they have been recognised by Boulos. It is quite apparent that neither genus is of any taxonomic value and some doubt has also been mentioned concerning the validity of the genus *Embergeria*. The genus *Taeckholmia* might have been more acceptable if all the other members of section *Atalanthus* had been included. If this genus were accepted its correct name would have to be *Atalanthus* as it has priority over *Taeckholmia*.

A conflict has arisen in the literature concerning *Launaea* and *Sonchus* as to the use of the name *Atalanthus* for a genus. It was originally described by Don (1829) with *Prenanthes pinnata* L. and *P. spinosa* Vahl as its only members. *Prenanthes pinnata* L. is synonymous with *Sonchus leptocephalus* Cass., and Jeffrey (1966) has shown that *Prenanthes spinosa* Vahl is now known as *Launaea spinosa* (Forssk.) Schultz Bip. and Don's description was in no way based upon this distinct species. He suggested that Don's description was based upon *Lactuca spinosa* Lam which is a synonym of *Launaea arborescens* (Batt.) Murb. From the latin description it is obvious that the name *Atalanthus* applies to *Sonchus leptocephalus* and not to *Launaea arborescens* because Don described the pappus as being composed of two types of seta, one longer and thicker than the other, and also the cypselas as being compressed. These being typical *Sonchus* features and not seen in *Launaea* it is difficult to understand how the conflict arose. All the features described by Don are applicable to *S. leptocephalus* whereas only a few of them are present in *Launaea arborescens.* Pomel (1874), Kirpichnikov (1964) and Boulos (1967a) all considered *Atalanthus* to be lectotypified by *Launaea arborescens* (Batt.) Murb. Only Jeffrey (1966) has previously recognised that *Atalanthus* should be lectotypified by *Prenanthes pinnata* L. and I am in full agreement with his decision. I have no intention, however, of retaining or even reorganising the boundaries of either of the genera recognised by Boulos for the reason that both possess all the typical defining characteristic of the genus *Sonchus* L. and in particular those of subgenus *Dendrosonchus* Webb ex Schultz Bip.

THE USE OF TAXONOMIC CATEGORIES

THE GENUS

There are a number of distinct characters which, when used together, consistently identify the genus *Sonchus* L. Briefly, these are the compressed and curved cypselas without beaks, the two types of seta in the pappus, the flattened and naked receptacle and the yellow ligules. Boulos split the group into four genera on the basis of leaf-lobe widths, numbers of florets, lengths of corollas, sizes of capitula and cypselas, all of which are characters shown to be highly variable. The pollen and cypsela characters chosen by Boulos to distinguish the genera *Babcockia* (Boulos, 1965) and *Taeckholmia* (Boulos, 1967a) have equally been shown to be of no taxonomic significance at this level. The members of these two genera are treated here as belonging to the genus *Sonchus* as they all possess the combination of characters which define the group.

THE SUBGENUS

The subgenus *Dendrosonchus* Webb ex Schultz Bip. can clearly be distinguished from all others of the genus on the basis of the woody habit of its members. A few members of the subgenera *Sonchus* and *Origosonchus* Boulos also have a slightly woody caudex but the habit of these plants is generally much more reduced than any found in the woody, Macaronesian element. The leaves of the subgenus *Dendrosonchus* are crowded at the apices of the woody caudices or branches and the general construction of the plants is pachycaulous. Pachycauls have a wide pith, a broad apex, few branches and rosettes of leaves at the ends of these branches. None of the species of the subgenus *Sonchus* or *Origosonchus* have this pachycaul construction. The pith of these plants has a constant diameter from base to apex. The leaves of the members of *Dendrosonchus* are generally petiolate or sheathing and sessile. Only the cauline leaves, of which there are a few confined to the inflorescence-stem, are auriculate. The members of the other two subgenera have auriculate leaves which are mostly cauline.

THE SECTION

It is apparent that within the subgenus *Dendrosonchus* two distinct morphological groups exist. The differences between these have been recognised by various authors in the earlier literature, as discussed above. The exact delimitation of these groups has differed from treatment to treatment, leading to confusion as to the affinities of one species to another. Essentially, the differences between the two groups are in the capitula and leaf morphologies. The section *Atalanthus* (D. Don) DC. can be recognised by the shrubby or low, tree-like habit and the petiolate, pinnatisect leaves with linear or filiform leaf-lobes. All members are glabrous and have capitula which are the smallest for the genus. The section *Dendrosonchus* also has members with a shrubby or low, tree-like habit as well as a caudex (or short, woody-stemmed perennial habit. The leaves may also be dissected but the leaf-lobes are either triangular or ovate and they are sheathing and sessile or rarely petiolate. Some members of this section have involucral bracts and leaves with a white, floccose-tomentose indumentum and the capitula are the largest for the genus.

ACKNOWLEDGEMENTS

I would like to thank the trustees of the Studley College Trust, Leamington Spa and the University of Reading Research Board for financial aid. I wish to express my gratitude to Dr. D. M. Moore and Professor V. H. Heywood for their advice and guidance throughout this study carried out at the University of Reading. I am particularly indebted to Dr. D. Bramwell for his enthusiastic discussions, encouragement and interest in my work.

REFERENCES

AITON, W. 1789. *Hortus Kewensis; or, a catalogue of the plants cultivated in the Royal Botanic Gardens at Kew*. Ed. 1, 3: 116. London.

ALDRIDGE, A. E., 1975. *Taxonomic and anatomical studies in* Sonchus *L. subgenus* Dendrosonchus *Webb ex Schultz Bip. and related genera*. Unpubl. PhD Thesis, University of Reading.

BOULOS, L., 1960. Cytotaxonomic studies in the genus *Sonchus* 2. The genus *Sonchus* a general systematic treatment. *Bot. Not.*, 113(4): 400-20.

BOULOS, L., 1965. *Babcockia*, un nouveau genre de Composées des îles Canaries. *Bull. Jard. bot. État*, 35: 63-6.

BOULOS, L., 1967a. *Taeckholmia*, a new genus of Compositae from Canary Islands. *Bot. Not.*, 120: 95-108.

BOULOS, L., 1967b. Nomenclatural changes and new taxa in *Sonchus* from the Canary Islands. *Nytt Mag. Bot.*, 14: 7-18.

BOULOS, L., 1972. Révision systématique du genre *Sonchus* L. s.l. I. Introduction et classification. *Bot. Not.*, 125: 287-305.

BOULOS, L., 1973. Révision systématique du genre *Sonchus* L. s.l. IV. Sous-genre 1. *Sonchus*. *Bot. Not.*, 126: 155-96.

BOULOS, L., 1974a. Révision systématique du genre *Sonchus* L. s.l. V. Sous-genre 2. *Dendrosonchus*. *Bot. Not.* 127: 7-37.

BOULOS, L., 1974b. Révision systématique du genre *Sonchus*. L. s.l. VI. Sous-genre 3. *Origosonchus*. Genres *Embergeria, Babcockia* et *Taeckholmia*. Species exclusae et dubiae. Index. *Bot. Not.*, 127: 402-51.

BRAMWELL, D., 1970. On some recent nomenclatural changes in the Canary Islands Flora. *Cuad. Bot.* (*Gran Canaria*), 9: 17-19.

CAVANILLES, A. J., 1801. De las plantas que el ciudadano Augusto Broussonet colectó en las costas septentrionales de la Africa y en las Canarias. *Anales C. Nat.*, 4: 78-9.

DE CANDOLLE, A. P., 1838. *Prodromus Systematis naturalis Regni vegetabilis*, 7(1): 184-9. Paris.

DON, D., 1829. An attempt at a new classification of the Cichoraceae with some observations on the geographical distribution of this family. *Edinburgh New Philos. J.*, 6: 305-12.

DUMONT DE COURSET, G. L. M., 1811. *Le Botaniste Cultivateur*. Ed. 2, 4: 9. Paris.

EBEL, F., 1971. Zur Morphologie einiger Kanarischen *Sonchus* - Arten. *Wiss, Z. Martin-Luther-Univ. Halle-Wittenberg*, 20(2): 39-71.

FONT QUER, P., 1948. Plantae novae. *Collect. Bot.* (*Barcelona*), 2: 201-3.

HUMPHRIES, C. J., 1976. A revision of the Macaronesian genus *Argyranthemum* Webb ex Schultz Bip. (Compositae - Anthemideae). *Bull. Br. Mus. nat. Hist.* (*Bot.*), 5(4): 147-240.

INTERNATIONAL CODE OF BOTANICAL NOMENCLATURE, 1972. Adopted by the eleventh International Botanical Congress. Seattle, 1969. Utrecht.

JEFFREY, C., 1966. Notes in Compositae I. The Cichoreae in East Tropical Africa. *Kew Bull.*, 18: 475.

KIRPICHNIKOV, M. E., 1964. *In* E. G. BOBROV & N. N. TSVELYOV eds. *Flora URSS*, 29: 241-2.

KNOCHE, H., 1923. *Vagandi Mos. Reiseskizzen eines Botanikers I. Die Kanarische Inseln*, : 244. Strasbourg and Paris.

LINK, H. F., 1825. *Sonchus gummifer*. *In* L. VON BUCH *Physikalische Beschreibung der Canarischen Inseln*, : 146. Berlin.

LINNÉ, C. VON, FIL., 1781. *Supplementum Plantarum Systematis Vegetabilium Editionis XIII, Generum Plantarum Editionis VI et Specierum Plantarum Editionis II*, : 346-7. Brunsvigae.

LOWE, R. T., 1831. *Primitiae Faunae et Florae Maderae et Portus Sancti; sive Species quaedam novae vel hactenus minus rite cognitae Animalium et Plantarum in his Insulis degentium breviter descriptae* (reprinted from *Trans. Cambridge Philos. Soc.*, 4, 1831), : 22-3. Cambridge.

LOWE, R.T., 1851. *Primitiae et Novitiae Faunae et Florae Maderae et Portus Sancti - Two memoirs on the ferns, flowering plants and land shells of Madeira and Porto Santo ... with an Appendix* (reprinted from *Trans. Cambridge Philos. Soc.*, 6, 1838), : 22-3. London.

LOWE, R. T., 1868. *A Manual Flora of Madeira and the Adjacent Islands of Porto Santo and the Desertas I. Dichlamydeae*. J. van Vorst. London.

PITARD, C. J. & PROUST, L., 1908. *Les Iles Canaries. Flore de L'Archipel*. Paris.

POMEL, A., 1874. *Nouveaux Matériaux pour La Flore Atlantique*, : 6-7. Paris and Alger.

PONS, A. & BOULOS, L., 1972. Révisión systématique du genre *Sonchus* L. s.l. III. Étude palynologique. *Bot. Not.*, 125: 310-19.

RAUNKIAER, C., 1934. *The Life Forms of Plants and Statistical Plant Geography*. Clarendon Press. Oxford.

ROUX, J. & BOULOS, L., 1972. Révision systématique du genre *Sonchus* L. s.l. II. Étude caryologique. *Bot. Not.*, 125: 306-9.

SAAD, S. I., 1961. Pollen morphology in the genus *Sonchus*. *Pollen & Spores*, 3(2): 247-60.

SCHULTZ BIPONTINUS, C. H., 1849-50. *In* P. B. WEBB & S. BERTHELOT, 1836-50, *Phytographia Canariensis*, Vol. 3(2) of *Histoire Naturelle des Iles Canaries*. Paris.

SVENTENIUS, E. R. S., 1960. *Additamentum ad Floram Canariensem I*. Inst. Nac. Invest. Agronom. Minist. Agricult. Madrid.

SVENTENIUS, E. R. S., 1968a. *In* J. BERMEJO, J. L. BRETON, A. G. GONZALEZ & A. VILLAR DEL FRESNO, Terpenoides de los *Sonchus* VII. Lactonas sesquiterpénicas de *Sonchus hierrensis* (Pit.) Svent., stat. nov. var. *benehoavensis* Svent. var. nova. *An. R. Soc. esp. Fís. Quím.*, 64: 893.

SVENTENIUS, E. R. S., 1968b. *Plantae macaronesienses novae vel minus cognitae*, 1: 1-18.

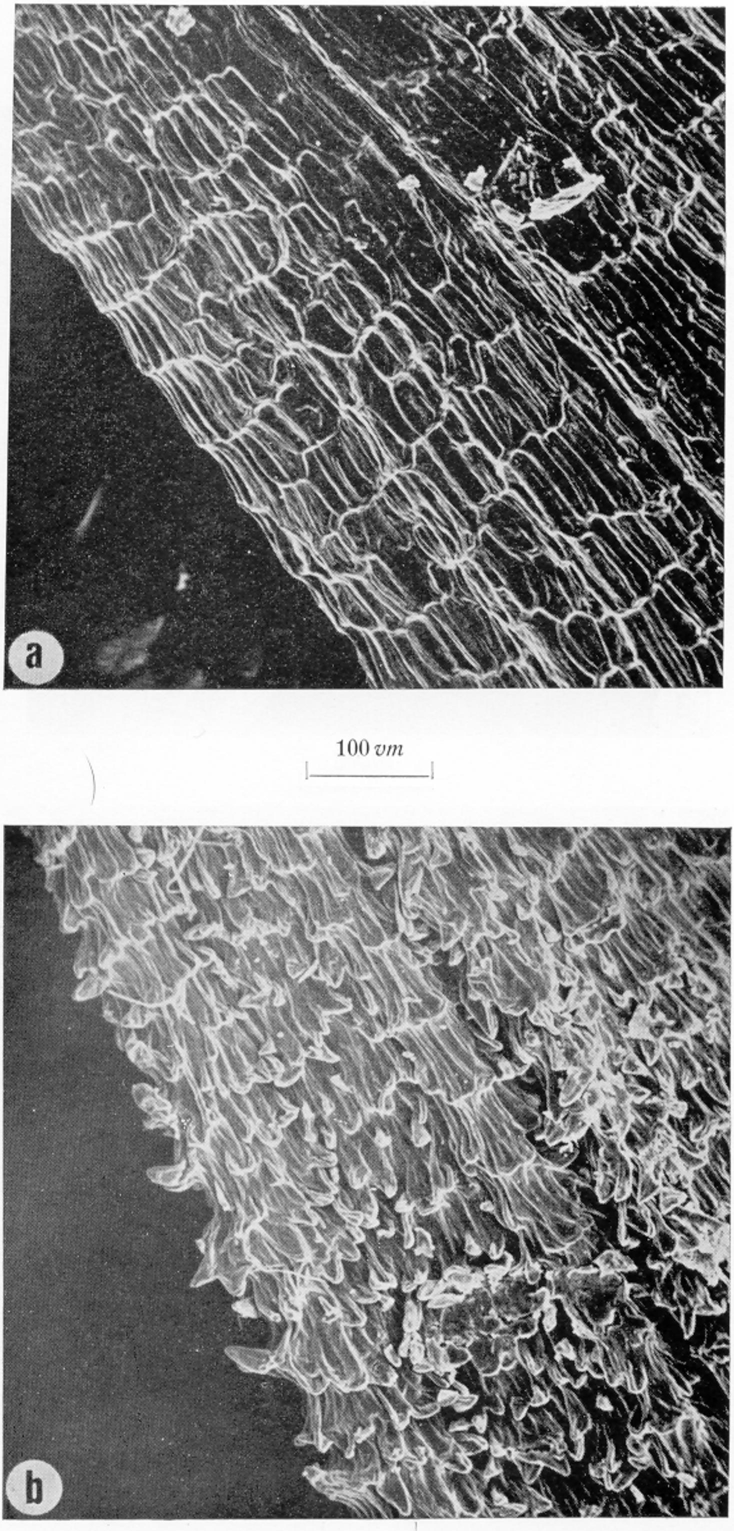
WARMING, E., 1909. *Oecology of Plants. An Introduction to the Study of Plant Communities*. Oxford.

WARMING, E., 1923. Økologiens Grundformer. Udkast til en systematik Ordning. *Kongel. Dansk. Vidensk. Selsk. Naturvidensk. Math. Afh.* V, 8.

WEBB, P. B., 1849. Spicilegia Gorgonea or a catalogue of all the plants as yet discovered in the Cape de Verd Islands. *In* W. J. HOOKER & J. D. HOOKER eds. *Niger Flora*, : 144-5. London.

WEBB, P. B. & BERTHELOT, S., 1836-50. *Phytographia Canariensis*. Vol. 3 (2) of *Histoire Naturelle des Iles Canaries*. Paris.

WILLDENOW, C. L., 1807. *Sonchus congestus*. *In Ges. Naturf. Freunde Berlin Mag.*, 1: 136.



late 1 Cypsela surfaces. a. *Sonchus brachylobus*. b. *S. pinnatifidus*.

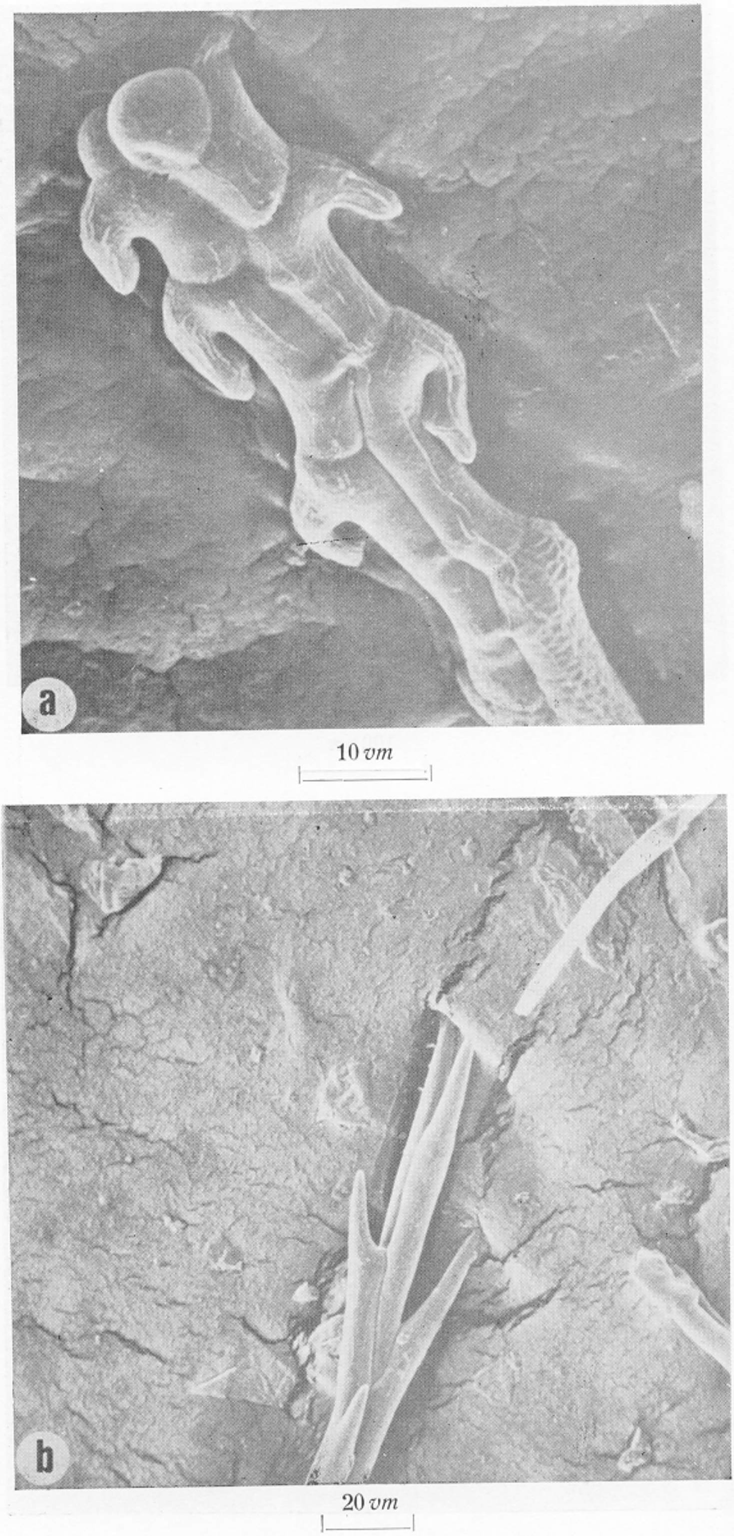


Plate 2 Pappas setae. a. Typical hair tip. b. Typical bristle tip.

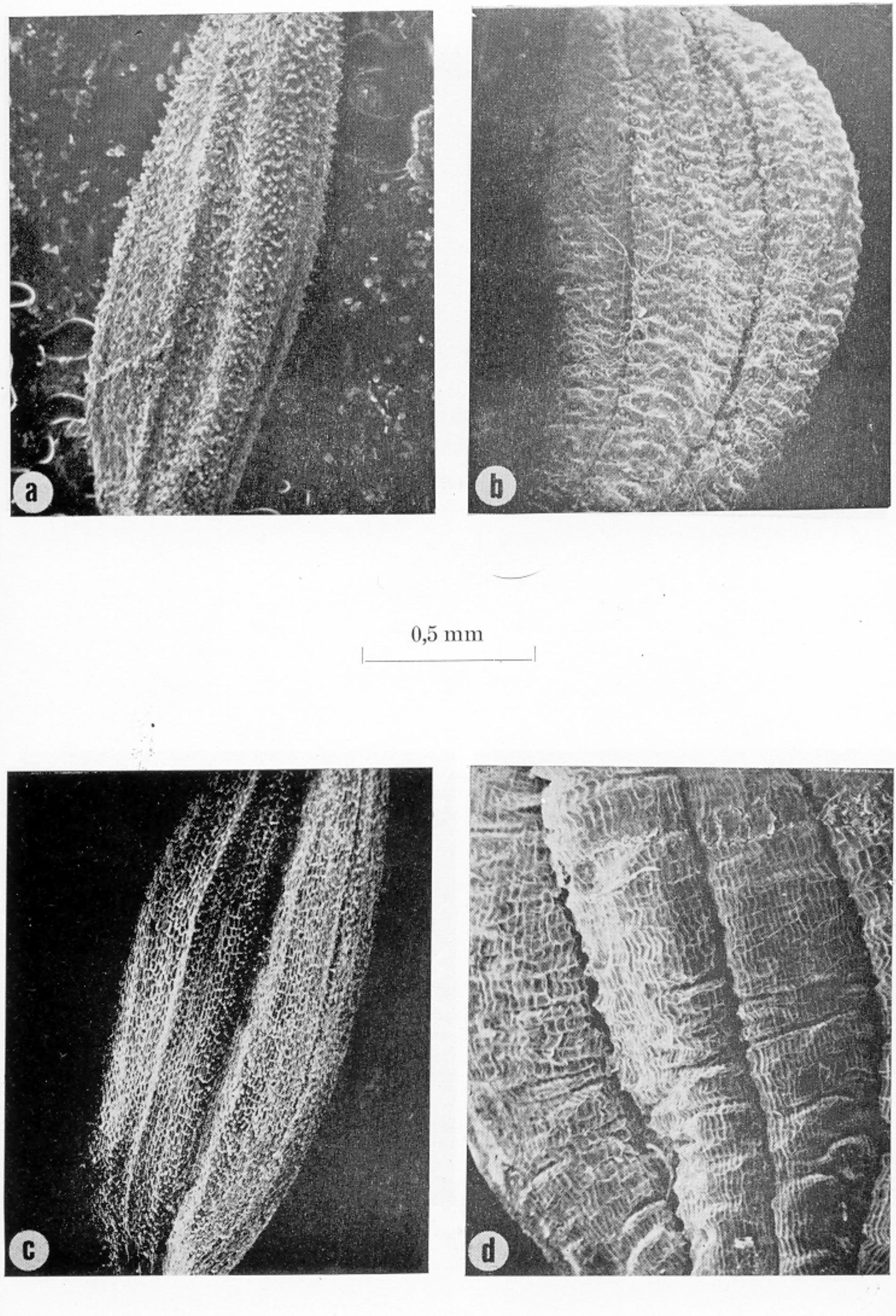


Plate 3 Cypselas. a. *Sonchus arboreus*. b. *S. pinnatus* subsp. *canariensis*. c. *S. brachylobus*. d. *S. acaulis*.

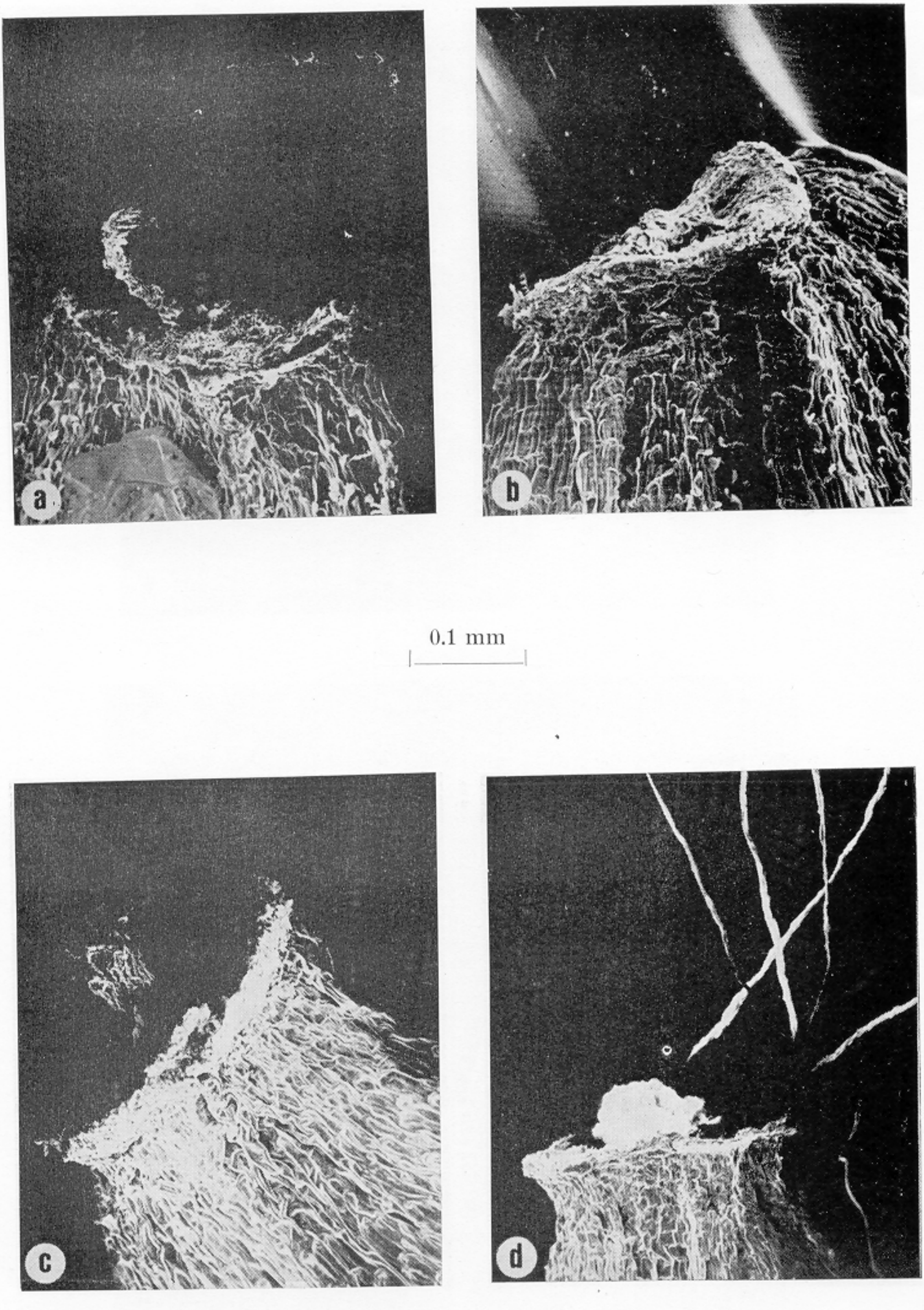


Plate 4 Cypsela apices. a. *Sonchus leptocephalus* subsp. *capillaris*. b. *S. radicatus* subsp. *radicatus*. c. *S. pinnatifidus*. d. *S. platylepis*.

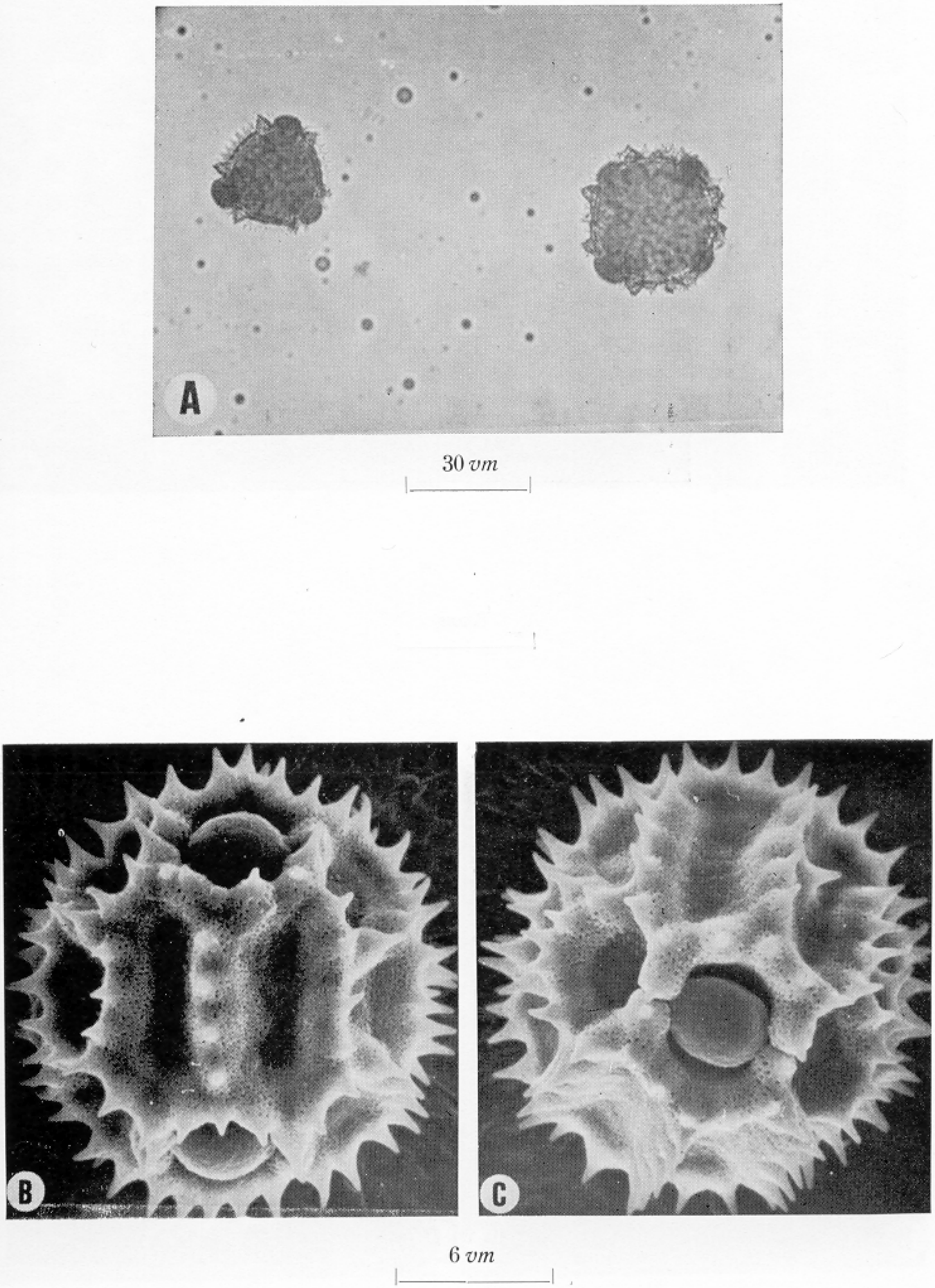


Plate 5 Pollen form and wall sculpturing. A. Tetracolporate and tricolporate pollen in *Sonchus arboreus*. B. Typical equatorial view. C. Typical poral view.

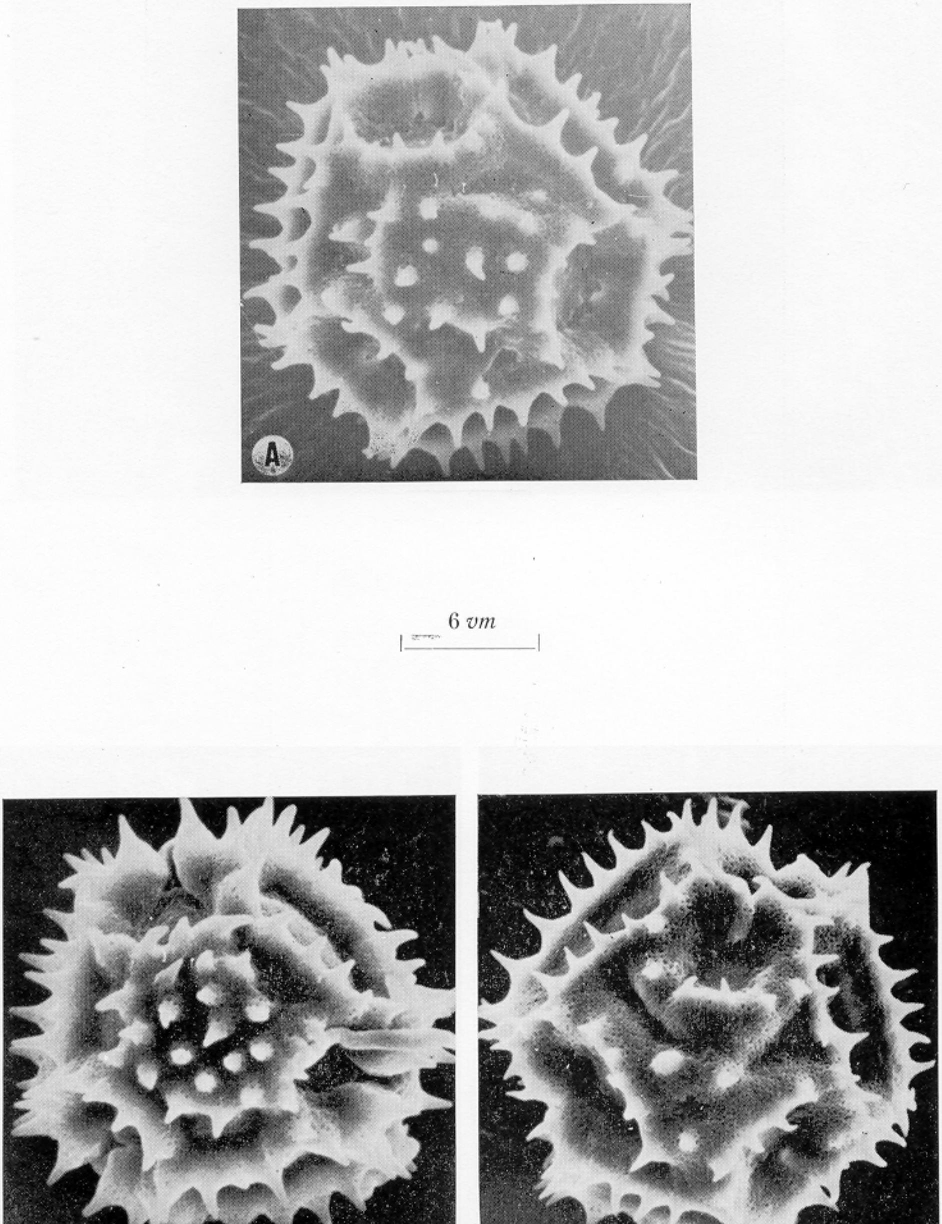


Plate 6 Pollen (polar view) - section *Atalanthus*. A. *Sonchus arboreus*. B. *S. pinnatus* subsp. *pinnatus*. C. *S. leptocephalus* subsp. *leptocephalus*.

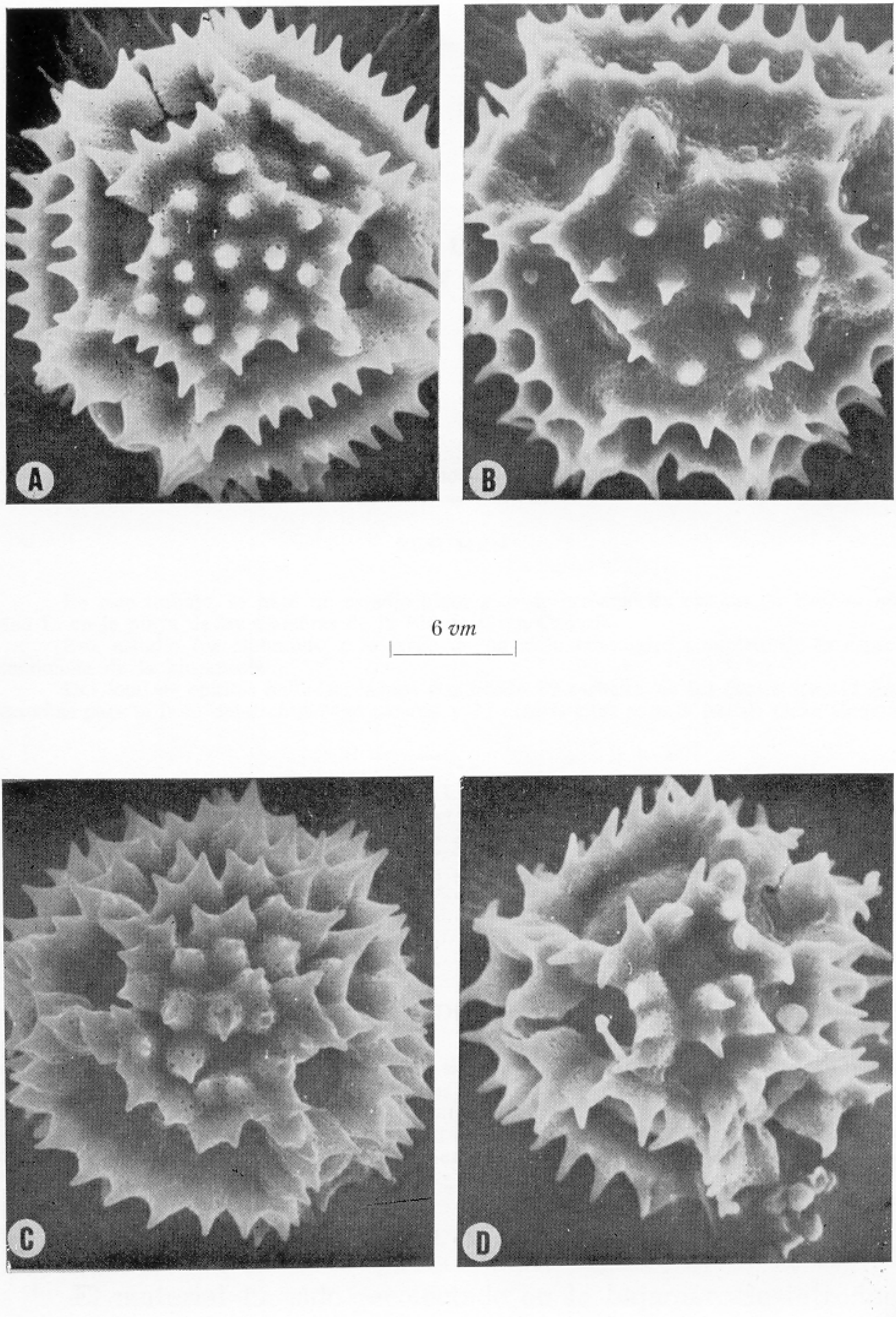


Plate 7 Pollen (polar view) - section *Dendrosonchus*. A. *Sonchus fauces-orci*. B. *S. congestus*. C. *S. platylepis*. D. *S. ustulatus* subsp. *maderensis*.

BOTANICA MACARONESICA 2 (1976)

CONTRIBUCION AL ESTUDIO DEL EPIFITISMO EN ZOSTERA MARINA L. (ZOSTERACEAE) EN LA PLAYA DE LAS CANTERAS (GRAN CANARIA)

N. GONZALEZ

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

RESUMEN

En este trabajo, se hace un estudio algológico de las especies epífitas de *Zostera marina* L. en la playa de las Canteras de la isla de Gran Canaria.

Este estudio fue elaborado a lo largo de un ciclo fenológico completo de la especie dominante de la biocenosis.

Del total de epífitas halladas, hemos clasificado 89 especies, de las cuales son, 13 nuevas citas para la flora del archipiélago canario y 25 nuevas citas para la isla de Gran Canaria.

CONTENIDOS

INTRODUCCION

La playa de las Canteras se encuentra situada en el MNW de la isla de Gran Canaria, formando parte del istmo natural que une a las Isletas con el resto de la isla. Su situación geográfica es 15°26' de longitud W y 28º05 de latitud N. Recibe directamente la acción del oleaje, un poco atenuado por el arrecife de la barra. La exposición es total en todas las estaciones del año y la profundidad varía desde 0,5-3m. en la bajamar hasta 1-5 m. en pleamar.

MATERIAL Y METODO

El material ha sido recolectado en la bajamar. Se introduce rápidamente en tarros, los cuales se han llenado previamente de agua de mar y formol al 1%. De esta forma son transportados al laboratorio para su posterior estudio.

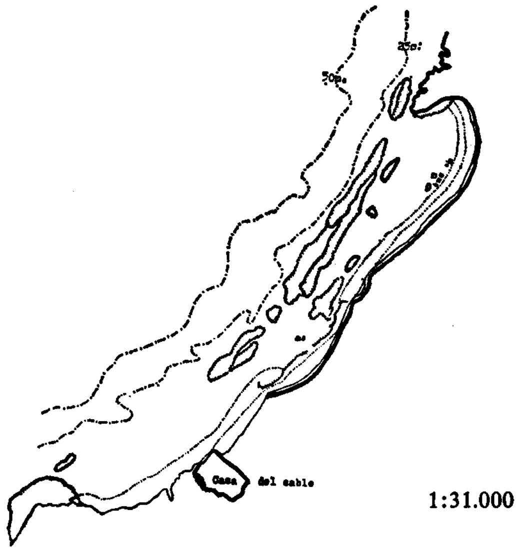


Fig. 1 Playa de las Canteras, Las Palmas de Gran Canaria.

El método de trabajo seguido ha sido el clásico en todo trabajo taxonómico y ecológico.

A) Labor de campo y laboratorio: se procedió a la recolección de ejemplares, toma de datos locales, observaciones morfológicas y ecológicas. En el diario de campo además de las anotaciones ecológicas pertinentes, hemos realizado unos cuadros de las especies epífitas.

B) En el laboratorio se estudiaron en frascos las especies epífitas por el procedimiento de la gelatina-glicerinada.

OBSERVACIONES

La especie dominante en la pradera marina es *Zostera marina* L., característica de la biocenosis.

El epifitismo en *Zostera marina* L. se ha observado sobre hojas jóvenes y hojas desarrolladas. Este se inicia en las partes basales mientras que los extremos están libres; por el contrario en las hojas desarrolladas se observa un desplazamiento de las epífitas hacia los bordes de las hojas y hacia el extremo de las mismas.

El grado de epifitismo depende de varios factores, entre ellos de la profundidad a la que se encuentran los ejemplares de *Zostera,* ya que según parece la densidad y el número de especies varían con el tamaño de la hoja.

Estos datos se pueden apreciar en la tabla núm. 1.

Toda esta serie de observaciones han sido realizadas siguiendo la pauta señalada por G. Van den Ende y Pauli Haage en estudios efectuados en las costas bretonas, solo que, nosotros ampliamos el tiempo de observaciones a lo largo de un año con lo que pudimos seguir la dinámica fenológica total de la biocenosis, frente a sólo dos meses de observaciones efectuadas por los autores citados.

El epifitismo observado es de dos tipos:

A) incrustante
B) filamentoso

El primer tipo se inicia sobre hojas jóvenes, corresponde a las especies *Melobesia farinosa* y *M. lejolisii* que se incrustan y progresivamente se extienden por ambas caras foliares.

Preparando este sustrato superficial de tipo laminar muy exiguo y de consistencia calcárea se produce el desarrollo del alga *Champia parvula* de tipo filamentoso y poco a poco se instalan las restantes incrustaciones así como las gelatinosas y filamentosas.

Dentro de este epifitismo cabe una nueva diferenciación de especies: las euepífitas, que tienen un gran valor fitosociológico y las epífitas accidentales que generalmente son litófilas y que debido a su gran agresividad y capacidad de adaptación son capaces de instalarse en un medio pseudolítico poco favorable, lo que se demuestra por el grado de raquitismo que alcanzan en este ambiente.

Las euepífitas son: *Lyngbya infixa, Phaeophila dendroides, Enteromorpha plumosa, Ectocarpus virescens, Phaestroma pustulosum, Sphacelaria hystrix, Erythrotrichia carnea, Erythrotrichia ciliaris, Drematolothon pustulatum, Melobesia farinosa, Melobesia lejolisii, Antitamnion antillanum, Ceramium transversales, Herposiphonia secunda,* y de estas, algunas son exclusivas de *Z. marina*: *Melobesia lejolisii, Phaeophila dendroides, Erythrotrichia ciliaris.*

RESULTADOS

Del total de epífitas halladas y clasificadas tenemos:

CYANOPHYCEAS	10 especies (3)
CHLOROPHYCEAS	24 especies (3 7 2)
PHAEOPHYCEAS	12 especies (5)
RHODOPHYCEAS	43 especies (5 y 7)
TOTAL	89 especies

De estas 89 especies epífitas, seis son accidentales cuyo porte epifítico es notablemente inferior a cuando viven en el medio habi-

GENERO/ESPECIE	DENSIDAD	PARTE DE HOJA	Profundidad
Apharocapsa marina Hansg.	H. maduras + H. jóvenes	Cara parte media	3 metros
Gomphos-phaenia aponina Kutz.	H. maduras —	" " "	5 "
Dendocarpa prasina (Reinsch) Born et Thur.	H. maduras +	" " "	5 "
Oscilla-teoria subuliformis Kutz.	H. maduras +	" " "	1,5 "
" *corallinae* Kutz.	H. maduras —	Borde de extremos	1,5 "
Lyngbya majuscula Harv.	H. maduras +	Borde parte media	1,5 "
* " *infixa* Fremy	H. maduras +	Borde de extremos	1,5 "
* *Micrococeus codii* Fremy	H. maduras +	" " "	1,5 "
* " *Wuitren* Fremy	H. maduras +	" " "	1,5 "
Rivularia atra Roth.	H. maduras —	Cara parte media	3 "
Ulothriz flacca (Dillw.) Thur.	H. maduras —	" " "	1,5 "
** *Phaeophila dentroides* Batt. Crouan y *Phaeophila*		" " "	3 "
Floridearum Hanck. Endoderma viride Lagerh.	H. maduras —	Borde parte media	3 "
Enteromorpha plumosa Kutz.	H. maduras —	Cara de extremos	1,5 "
" *erecta* (Lyngs) J.Ag.	H. maduras —	Cara de extremos y parte media	3 "
" *clatharata* (Roth) J.Ag.	H. maduras y H. jóvenes +	Cara de extremos	1,5 "
" *ranulosa* (Eng.) Bot. Hook.	H. maduras —	Cara parte media y extremos	3 "
" *compressa* (L.) Grev.	H. maduras + H. jóvenes	Cara de extremos	1,5 "
" *minima* Nageli	H. maduras +	" " "	1,5 "
" *intestinalis* (Link) Grev.	H. maduras +	Cara parte media	3 "
** *Percursaria percursa* Rosenv.	H. maduras +	Cara parte media	3 "
* *Blidingia minima* Nageli	H. maduras +	Cara de extremos	1,5 "

GENERO/ESPECIE	DENSIDAD	PARTE DE HOJA	Profundidad
Cladophora boodleoides Borgs.	H. maduras —	Cara de extremos y parte media	1,5 metros
“ *trichotoma* (Ag) Kutz.	H. maduras +	Cara parte media *	1,5 ”
“ *prolifera* (Roth) Kutz.	H. maduras +	“ “ “	1,5 ”
“ *inclusa* Borgs.	H. maduras +	Cara de extremos	1,5 ”
“ *pellucida* (Huds.) Kutz.	H. viejas, maduras, jóvenes +	Borde de extremos	1,5 ”
“ *Cymopolias* Borgs.	H. maduras +	“ “ y cara parte media	1,5 ”
** “ *ramosissima* (Drap) Kutz.	H. maduras +	Borde de extremos	1,5 ”
Chaetomorpha pachynema Montagne	H. maduras +	“ “ “	1 ”
* “ *linum* Kutz.	H. maduras +	Cara parte media	1,5 ”
Urospora laeta (Thur.) Borgs.	H. viejas y maduras +	Borde de extremos	1,5 ”
Valonia utricularis (Roth) Ag.	H. maduras —	Cara de extremos	1 ”
Codium adherens (Cabr.) Ag.	H. maduras —	“ “ “	1 ”
Ectocarpus confervoides (Roth.) Le Jolis.	H. maduras +	Parte media, extremos *	1 ”
“ *siliculosus* (Dillw. fma. arcta (Kutz) Kuck.	H. maduras +	“ “ cara	1,5 ”
“ *virescens* Thuret	H. maduras +	Cara parte media	1,5 ”
“ *globifer* Kutz.	H. maduras +	Cara de extremos	3 ”
** “ *repens* Reinke		——— *	1 ”
** “ *fasciculatus* Harvey	H. viejas —	Extremos	3 ”
** *Ectocarpus sp.*	H. maduras +	Borde de extremos *	3 ”
** *Phaestroma pustulosum* Kuck	H. maduras +	Cara parte media	1,5 ”
Colpomenia sinuosa (Royh.) Dreb. et Sol	H. viejas y maduras —	“ “ “	3 ”
Sphacelaria hystrix Suhr.	H. maduras —	“ “ “	3 ”

GENERO/ESPECIE	DENSIDAD	PARTE DE HOJA	Profundidad
** *Sphacelaria racemosa* Grev.	H. maduras —	" " "	3 metros
Halopteris scoparia (L.) Savag.	H. maduras —	" " "	1,5 "
** *Bangia fusco-purpurea* Lyng.	H. maduras +	Borde parte media	3 "
Erythrotrichia carnea (Dillw.) J. Agardh.	H. maduras —	Cara parte media	3 "
** " *ciliaris* batt.	H. maduras —	" " "	3 "
Goniotrichum Chauv.) Le Jolis	H. viejas y maduras +	Borde parte media	3 "
Liagora canariensis Borgs.	H. viejas y maduras —	Cara parte media	3 "
Galaxaura flagelliformis Foslie	H. maduras —	" " "	3 "
Lithothaminum hisparum. Foslie	H. maduras +	Cara parte media e inferior	3 "
** *Lithophyllium cronani* Foslie	H. viejas —	Cara parte inferior	3 "
Dermatolithon pustulatum. Foslie	H. maduras +	Cara parte media e inferior	3 "
Melobesia fainosa Lmx.var. *solmsiana Flkg.*	H. viejas y maduras +	Extremos y parte media	3 "
" *sauvageani* Foslie	H. maduras +	Cara parte media	3 "
** " *lejolisii* Rosenv.	H. viejas y maduras +	Extremos	3 "
Jania pumila Lamx.	H. maduras —	Cara parte media	3 "
Asparagopsis taxiformis (Delile) Collins et Herv.	H. maduras —	Base de hoja	3 "
* *Hypnea musciformis* (Wulf.) Lamour.	H. viejas y maduras —	Borde parte media *	3 "
" *cervicornis* J.Ag.	H. maduras —	" " " *	3 "
* *Chrysymenia ciajeana* Meneg.	H. maduras —	Cara parte media	3 "
* *Lomentaria articulata* (Huds.) Lyngb	H. maduras —	" " "	3 "
Champia parvula (Agardh) Harv.	H. jóvenes +	Cara y borde toda la hoja	3 "
Spermothamnion repens (Dillw.) K.Rosenvinge	H. maduras —	Cara parte media	3 "

GENERO/ESPECIE	DENSIDAD	PARTE DE HOJA	Profundidad
Spermothamnion sp.	H. viejas y maduras +	Cara parte media	2 metros
Antithamnion antillanum Borgs.	H. viejas y maduras +	" " "	3 "
" *elegans* Berth.	H. maduras —	" " "	3 "
Spyridia filamentosa (Wulf) Harv.	H. viejas —	Borde parte media *	3 "
" *aculeata* (Schipm.) Kutz.	H. maduras —		3 "
Ceramium rubrum (Huds) Ag.	H. maduras y viejas +	Cara y borde parte media *	3 "
" *diaphanum* (Lighf) Roth.	H. maduras +	Borde parte media	3 "
" *transversale* Collins & Harvey		——— *	3 "
" *ciliatum* (Ellis) Ducl.	H. maduras y viejas +	Borde y cara parte externa	3 "
" *flabelligerum* J. Agardh	H. viejas —	Borde de extremos	3 "
* " *gracillinum* Harv.	H. maduras +	Borde parte media	1,5 "
Centroceras clavulatum (Ag.) Mont.	H. maduras —	" " "	3 "
Chondria clasyphylla (Woods.) Ag.	H. maduras +	Cara parte media	3 "
Polysiphonia macrocarpa Harv.	H. maduras y jóvenes +	Borde parte media	3 "
" *violacea* (Roth) Grev. emnd. Rosenv.	H. maduras —	Borde de extremos	3 "
" *breviarticulata* (Ag.) Zanard.	H. maduras —	Cara parte media	3 "
" *sp.*	H. viejas	Borde parte media, extremos *	1,5 "
* *Herphosiphonia secunda* (Ag.) Nagl.	H. maduras —	Borde parte media	3 "
Stichotamnion cymatrophilum Borgs.	H. viejas y maduras +	Extremos	3 "
Cottoniella fusiformis Borgs.	H. viejas +	Bordes y cara parte media y extremos *	3 "

* Nueva cita para Gran Canaria

** Nueva cita para el Archipiélago Canario.

* Presentan epífitas en rizomas viejos

tual, donde pueden alcanzar varios cm. de longitud frente a un máximo de 0,5 cm. en el medio apifítico.

Estas especies son:

Spyridia filamentosa (Wulf.) Harv.
Asparagosa taxiformis (Delile) Collins & Herv.
Galaxaura flagelliformis (Kjellm.) emed. Borgs.
Liagora canariensis Borgs.
Hypnea musciformis (Wulf.) Lamour.
Hypnea cervicornis J. Ag.

Aparte de las algas de la biocenosis y las epífitas, hemos encontrado, de vez en cuando, otras especies en medio de ejemplares jóvenes de *Zostera marina* L., sobre sustrato distinto a la arena, viviendo en los acúmulos de arena gruesa más o menos compacta formando un tipo que varía ecológicamente el tipo de sustrato de piedras, entre estas especies hemos visto:
Halopteris scoparia (L.) Sauv.
Padina pavonia (L.) Gaillon
que junto con *Cymopolia barbata,* son especies características de una comunidad que, a modo de cinturón de algas, rodea la pradera de *Zostera marina* L. y cuyo desarrollo de anchura parece depender de la fenología de esta. A esta comunidad se le puede considerar como o un ecotono.

Esta asociación de algas se la puede tener en cuenta como otra comunidad aparte de la estudiada, cuyo estudio sería interesante acometer para observar su dinámica en función de la posible expansión o reducción de la pradera de *Z. marina L.*

Cuadro fenológico de epifitismo:

Melobesia farinosa ——▶ Otras incrustantes ——▶ Talosas
Melobesia lejolisii ——▶ Gelatinosas

La hoja al ser invadida comienza su marchitamiento por interferencia de las epífitas sobre la función clorofílica a medida que se produce el recubrimiento calcáreo de la hoja antes aludido, que hace posible el establecimiento sobre esta costra de algas de talo gelatinoso y filamentoso que normalmente vive sobre rocas.

Este epifitismo continúa una vez marchita la hoja y cae en la capa de forna del sustrato A del suelo de la pradera. Frecuentemente estos residuos son arrastrados por las pleamares y depositados en el borde límite de mareas sobre la arena de la playa donde termina por desecamiento el ciclo biológico de esta parte de la biocenosis.

En las muestras tomadas en Septiembre de 1974, Enero de 1975, Marzo de 1975 y Julio de 1975, hemos podido comprobar que la vegetación epifítica en *Zostera marina*. L. no es zonal, siendo la máxima concentración de epífitas en las hojas viejas y en la zona de 20 a 50 cm. de profundidad, mientras que en las hojas jóvenes se presentan en la parte basal.

Las condiciones ecológicas de las estaciones del año tienen influencia en la calidad y cantidad de las algas epífitas como se verá a continuación, observándose que en los lugares resguardados prefieren localizarse sobre los bordes, mientras que en las zonas donde la corriente les puede afectar prefieren los limbos de las hojas.

Solo en el otoño se produce crecimiento epítico sobre rizoides huecos viejos, mientras que no pudimos observar este fenómeno en el resto del año.

AGRADECIMIENTOS

Este trabajo de investigación ha sido realizado en el Departamento de Botánica de la Universidad de La Laguna, en el cual se encuentra todo el material clasificado y fichado en el herbario.

Asimismo agradecemos la colaboración prestada en este trabajo al catedrático Dr. W. Wildpret de la Torre y al Dr. A. Acuña.

BIBLIOGRAFIA

AUGIER, H. & BOUDOURESQUE, Ch. 1.971. "Notions d'ecobiocénotique marin excursions en méditerranéee". *U.E.R. des Sciences de la Mer et de l environnement Centre regional de documentation pedagogique*. Marseille pp. 260

BARDAN, E. & BELLON, L. 1932. "Oceanografía de la Bahía de Las Palmas. Canarias". *Inst. Español de Oceanografía. Serie II núm*. 61. Madrid pp. 210.

BORGESEN, Fh. 1925. "Marine algae of the Canary Islands specially from Tenerife and Gran Canaria. *Danske Videnskabernes Selskab. Biol. Meddel* pp. 630

BOUDOURESQUE, Ch. 1969. "Un nouvelle methode d analyse phytosociologique et son utilisation pour l etude des phytocoenoses marines bentiques" *Extrait de Lethys I* pp. 340
1970. "Probleme de la regresión de l'herbier de posidonies". *Bulletin de Museum d'histoire Naturelle de Marseille XXX* pp. 320
1970. "Recserches sur les concepts de continum au niveau de peuplemens benthiques sciáphiles". *Extrait de "Vie et Milieu". Serie B: Oceanographie XXI* 103-106

DINARD, L. 1959. "Ecologie des Algues Marines". *Colloques internacionaux du Centre National de la Recherche Scientifique* (20-28 Sep. 1957). Paris pp. 276.

FELDMANN, J. 1946. "La flore marine des Iles Atlantides". *Mem Soc. Biogeogr*. 8 395-435.

FREMY, P. 1936. "Cyanophyceae collected by F. Borgesen, worked out by P. Frémy in Marine algae from the Canary Islands specially from Tenerife and Gran Canaria. *Kgl. Danske vidensk. Jelsk. Biol. Medd.* 1-43

GAYRAL, P. 1966. "Les algues des Cotes Francaises". *La nature au Maroc II. Paris* pp. 450.

BOTANICA MACARONESICA 2 (1976)

HELIANTHEMUM THOLIFORME, A NEW SPECIES OF CISTACEAE FROM GRAN CANARIA.

D. BRAMWELL, J. ORTEGA & B. NAVARRO.

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

RESUMEN

Se describe por primera vez *Helianthemum tholiforme* sp.nov. una especie nueva de Cistaceae de la isla de Gran Canaria. Esta rara especie se halla en el Barranco de Guayadeque (900-1300 m.s.m.) en la zona sureste de la isla. Se comenta sobre la ecología y distribución de *H. tholiforme* y se presenta un mapa de distribución y un dibujo de la planta.

CONTENTS

INTRODUCTION

Helianthemum tholiforme sp. nov. (*Sectio Helianthemum*).

Species haec ab *H. teneriffae* Cosson stipulis petiolis minoribus, gemmis parvioribus, pedicellis brevioribus differt; a *H. bystropogophyllo* Svent. habitibus confertioribus, foliis margine integris, seminibus grandioribus, inflorescentiis parvis densis, recedit.

Small dome-shaped shrub up to 35 cm. Stems densely hairy with white patent to deflexed hairs. Leaves 2.0-3.5 cm long x 1.0-1.8 cm broad, broadly lanceolate to ovate; upper surface pubescent, the lower densely villous; apex obtuse; petiole 0.8-1.0 cm. long. Stipules very small, 2-3 mm. long, narrowly triangular or lanceolate.

Inflorescence dense, up to 20-flowered; pedicels short, usually equalling or shorter than the inner sepals. Buds conical, 0.8 cm long; outer sepals linear, villous; inner sepals ovate, the ribs green or brownish, densely fasciculate-hairy, the surface between the ribs whitish or pale yellow, subglabrous. Flowers about 1 cm across. Petals yellow usually with a darker orange-brown spot at the base. Capsule oblong, 4-5 mm, finely pubescent. Seeds black, 2 mm long, slightly flattened, rugose. Figure 1.

Flowering period: March to May; Fruiting period: May to July.

Holotype: Gran Canaria, Barranco de Guayadeque, rocky slopes below cliffs 1000 m. April 19th 1976, *D. Bellamy et al.*, Herbarium of Royal Botanic Gardens Kew (K). *Isotypes*: Herbarium of Jardín Botánico Viera y Clavijo (TAF) and British Museum (BM).

Fig. 1 *Helianthemum tholiforme* sp. nov.

Other collections: Gran Canaria, Barranco de Guayadeque, North-facing cliffs and rocky slopes between 900 and 1300 m. February 11th 1976, *D. Bramwell, J. Ortega, B. Navarro* (TAF, BM).

TAXONOMY

Helianthemum tholiforme is a very rare, yellow-flowered, dwarf shrub known at present only from a single locality on the island of Gran Canaria in the Canarian Archipelago. The new species belongs to the section *Helianthemum* (*Euhelianthemum* Dunal emend. Willk.) and is closely related to two other endemic Canarian species. Of these *H. teneriffae* Cosson is found only at Ladera de Guimar in the South of the island of Tenerife and *H. bystropogophyllum* Svent. in montane pine forests on the West side of Gran Canaria.

H. tholiforme is easily distinguishable from *H. bystropogophyllum* which is a much taller plant with a much more lax habit, smaller seeds and has narrower leaves with erose-crenate margins with fasciculate hairs on the projections, the stipules are also much larger. From *H. teneriffae* it differs principally in the smaller, minute stipules, which in the Tenerife species are as long as the petiole, the leaf shape and large seeds.

Three other perennial *Helianthemum* species, *H. broussonetii* Dunal (Sect. *Polystachyum* Willk.), the polymorphic *H. canariense* (Jacq.) Pers. and the very rare *H. thymiphyllum* Svent. (both Sect. *Eriocarpum* Dunal), also occur as native or endemic species in the Canary Islands but are not closely related to and are very easily distinguishable from the *H. tholiforme* group.

KEY TO THE PERENNIAL HELIANTHEMUM SPECIES IN THE CANARY ISLANDS.

1. Dwarf shrubs 25-70 cm, most leaves at least 1.8 cm long, flowers about 1.0 cm across.
  2. Leaves shortly and very densely silvery pubescent, petals without dark spot at base .... *H. broussonetii*
  2. Leaves villous or tomentose, petals with dark spot at base.
    3. Stipules more or less equal to the petiole ...... *H. teneriffae*
    3. Stipules less than half the length of petiole.
      4. Leaf-margins erose-crenate with fasciculate hairs on the projections .... *H. bystropogophyllum*
      4. Leaf-margins entire, without fasciculate hairs. *H. tholiforme*

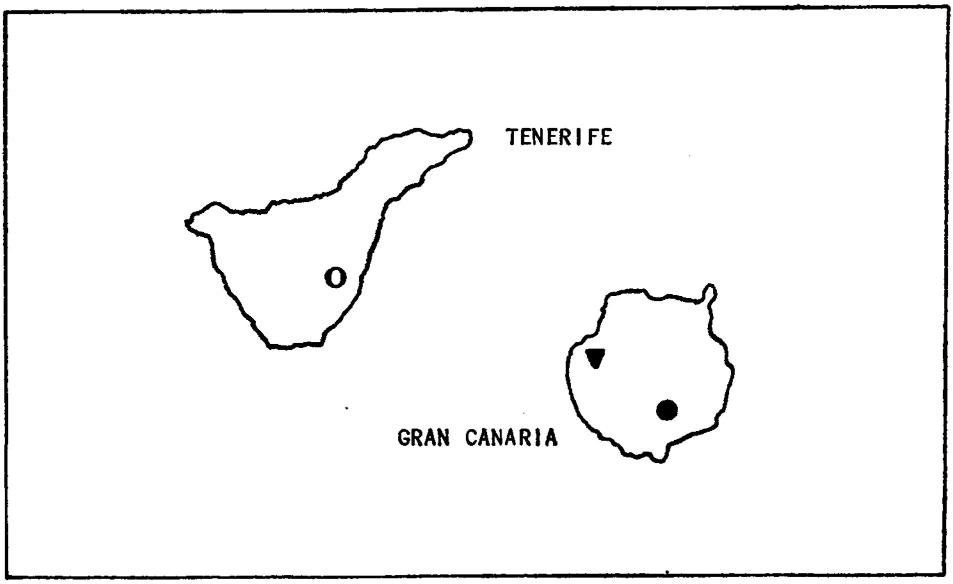


Fig. 2 Distribution of ○ *H. teneriffae*, △ *H. bystropogophyllum* and ● *H. tholiforme*.

1. Very small shrublets normally less than 20 cm. leaves usually less than 1 cm long, flowers less than 0.8 cm. across.
   5. Leaves very densely silvery-pubescent, ovate... *H. canariense*
   5. Leaves glabrous or very sparsely pubescent, oblanceolate to oblong or obovate .... *H. thymiphyllum*

ECOLOGY

H. tholiforme has, so far, been found only at a single station in the Barranco de Guayadeque on the island of Gran Canaria (Fig. 2). The locality is well known to botanists as several other local endemic species, *Marcetella moquiniana* (Rosaceae), *Kickxia pendula* (Scrophulariaceae) and *Kunkeliella canariensis* (Santalaceae) etc., are to be found in the lower accesible parts. The upper regions and high cliffs are much more difficult to explore and it is not surprising that there are new taxa still to be discovered in the area.

The Guayadeque area is of volcanic origin and consists of Post-Miocene olvine-bearing basalts with columnar jointings (Hausen, 1962). The area has a moderate Winter rainfall and extremely hot, dry Summers when many species, including *H. tholiforme*, shed all their leaves.

	1	2	3	4
Helianthemum tholiforme	+	+	+	+
Chamaecytisus proliferus	+	—	+	—
Teline microphylla	—	+	+	—
Adenocarpus foliolosus	+	+	—	+
Echium callithyrsum	+	—	—	+
Argyranthemum adauctum	+	+	+	+
Senecio webbii	+	+	—	—
S. vulgaris	+	+	+	—
Carlina salicifolia	+	—	—	+
Silene cf. nocteolens	+	—	—	+
Silene vulgaris	+	+	—	+
Buffonia teneriffae	+	—	—	—
Avena alba	+	+	+	+
Briza maxima	+	—	+	—
Aeonium undulatum	+	+	+	+
A. simsii	+	+	—	+
A. manriqueorum	+	—	—	—
Greenovia aurea	+	+	+	+
Moanthes brachycaulon	+	—	—	—
Todaroa montana	+	—	—	+
Ferula linkii	—	+	—	—
Bupleurum salicifolium	+	—	—	—
Salvia canariensis	—	+	—	—
Sideritis dasygnaphala	—	—	—	+
Micromeria benthamii	+	+	+	+
Tolpis lagopoda	+	—	—	+
Sonchus platylepis	—	—	+	+
S. leptocephalus	+	—	—	+
Lobularia intermedia	+	+	—	+
Descurainia preauxiana	+	—	—	+

Principal associated species in *H. tholiforme* communities in Barranco de Guayadeque, Gran Canaria.

1 & 4 cliffs, 2& 3 N — NE slopes.

This species is found between 900 and 1300 m above sea-level on steep, North facing slopes and cliffs in a transition zone between the *Euphorbia*-dominated communities of the lower zone and the higher altitude, montane pine forests. It is highly probable that the small *H. tholiforme* colony discovered originates from the pine forest regions of the ridges above Guayadeque.

The plant community in which *H. tholiforme* occurs is dominated by *Adenocarpus foliolosus, Argyranthemum adauctum, Echium callithyrsum, Senecio webbii, Greenovia aurea* etc. A list of associated species is given in table 1. The community belongs to the phytosociological alliance *Cytision canariensis* Sunding (Sunding, 1972).

SUMMARY

A new species of Cistaceae, *Helianthemum tholiforme,* from the island of Gran Canaria is described for the first time. This rare species is found in the South - East part of Gran Canaria in the Barranco de Guayadeque between 900 and 1300 m.

H. tholiforme differs from other, related, Canarian species such as *H. bystropogophyllum* and *H. teneriffae* by its minute stipules, condensed inflorescences and large seeds.

An account of its relationships, ecology and distribution is given and the species is illustrated.

REFERENCES

BRAMWELL, D. & Z. I., 1974: *Wild Flowers of the Canary Islands.* Stanley Thornes (Publishers) L.D. Burford, 261 & X pp.

COSSON, E., 1856: Notes sur quelques plantes des Iles Canaries. *Bull. Soc. Bot. Fr.* 3: 56-59.

HAUSEN, H., 1962: New contributions to the geology of Gran Canaria. *Soc. Sci. Fenn. Comm. Phys. - Math.* 27: 1 - 278.

GROSSER, W., 1903: *Cistaceae* in Engler H.G.A., *Das Pflanzenreich, Regni Vegetabilis Conspectus,* 14 (IV 193) 1 - 161.

SUNDING, P., 1972: The Vegetation of Gran Canaria. *Skr. Norske. Vidensk. Akad. Mat. - Naturv.,* N.S. 29, 186 & LIII pp.

SVENTENIUS, E. R. S., 1960: *Additamentum ad Floram Canariensem* 1. Matriti, 95 pp.

BOTANICA MACARONESICA 2 (1976)

CONTRIBUCION AL ATLAS PALINOLOGICO DE ENDEMISMOS CANARIO - MACARONESICOS

JULIA PEREZ DE PAZ

Jardín Botánico "Viera y Clavijo", Tafira Alta, Las Palmas de Gran Canaria

---

RESUMEN

El presente trabajo recoge características morfológicas del polen, especialmente caracteres externos de la exina, de diez especies de fanerógramas endémicas de la región canaria. De estas diez especies, al parecer sólo el género endémico monoespecífico, *Plocama,* de la familia Rubiaceae ha sido descrito parcialmente. Los otros endemismos que aquí se incluyen son: *Pancratium canariensis* Ker-Gawl (Amaryllidaceae); *Salix canariensis* Chr. Sm. (Salicaceae); *Prunus lusitanica* L. (Rosaceae); *Jasminum ordoratissimum* L. (Oleaceae); *Lavandula canariensis* (L.) Mill. (Labiatae); *Salvia canariensis* L. (Labiatae); *Solanum lidii* Sunding, *S. vespertilio* Ait. (Solanaceae) y *Withania aristata* (Ait.) Pers. (Solanaceae).

CONTENIDOS

INTRODUCCION

De todos los estudios a que ha sido sometida la flora Canaria, muy pocos han sido los destinados a la observación palinológica de sus endemismos. Es por eso por lo que se ha pensado hacer un "Atlas Palinológico", no sólo dedicado a los endemismos de la región canaria, sino también a los de la Macaronesia.

Este trabajo es pues, una contribución al "Atlas palinológico de endemismos Canario-Macaronésicos".

MATERIALES Y METODOS

Las muestras examinadas proceden de plantas vivas que se encuentran en el Jardín Botánico "Viera y Clavijo", de entre las cuales, los ejemplares de *Pancratium, Withania, Lavandula* y *Salvia* son espontáneas, ya que el área de distribución de éstos incluye la zona de Tafira, donde está ubicado dicho Jardín (Bramwell & Bramwell, 1974). Las demás especies proceden de plantas traídas del campo y a las que se les ha procurado un habitat bastante parecido al de su lugar de origen.

Para la observación de los granos de polen frescos al microscopio óptico, éstos han sido montados y teñidos con geletina glicerinada coloreada con fucsina básica; las observaciones y fotografías se han hecho de 600 a 1.600 x (inmersión). Las medidas han sido tomadas a 600 x sobre granos sin embeber montados en aceite de silicona (Merck) y después de transcurrido un espacio de tiempo similar en todas las preparaciones (4 días), siendo el número de medidas por ejemplar generalmente 15 o más, de los cuales se ha hallado la media aritmética.

Para las observaciones y fotografías con el microscopio electrónico de barrido (scanning) modelo Mini-sem ISI, las muestras han tenido que ser sometidas a alto vacío y cubiertas con una fina película de oro mediante un sputtering modelo PS-2.

La nomenclatura que se sigue en la descripción de los granos es generalmente propuesta por Erdtman (1969 y 1971), castellanizando a veces términos procedentes de otras literaturas: Biesboer, D. (1975), Font-Quer, P. (1970), Pla Dalmau, S. (1957), Kapp, R. (1969) Panelatti, G. (1961) y Saens de Rivas, C. (1973).

OBSERVACIONES

FAM. AMARYLLIDACEAE

Pancratium canariensis Ker. — Gawl. (Lam. 1.1, 1.2).

El polen procede de plantas que crecen espontáneamente en el jardín.

Simetría y Forma: Granos monosulcados y heteropolares, con simetría bilateral, marcadamente elipsoides al natural (36,6 x 89,1 *um*) y más o menos elipsoidales embebidos; más o menos planos en la cara distal y abombados en la proximal.

Aberturas: Un sólo sulco atraviesa completamente la cara distal.

Exina: Reticulada, angustimurada, disminuyendo la amplitud de las lúminas a medida que se acercan a los extremos y bordes del sulco, heterobrochado.

FAM. SALICACEAE

Salix canariensis Chr. Sm. (Lám. 1.3, 1.4, 1.5)

El material procede de plantas cultivadas en el Jardín, procedentes de las recolectadas por E. Sventenius en el Barranco de Pajonales, Gran Canaria.

Simetría y Forma: Polen tricolporoidado con simetría bilateral, isopolar, marcadamente prolado al natural (26 x 14,5 um), embebido en vista polar es subtriangular, ángulo aperturado, con zona apocólpica escasa.

Aberturas: Tres aberturas compuestas, la ectoapertura es un colpo largo, siendo la endoapertura de contorno no muy preciso, más o menos circular.

Exina: Parcialmente tectada de superficie reticular, angustimurada heterobrochada: disminuyendo la amplitud de los brochis a medida que se acercan a los polos y bordes de los colpos; en el centro de las lúminas aparecen estructuras baculadas.

FAM. ROSACEAE

Prunus lusitanica L. (Lám. 1.6, 2.1 — 2.7)

El polen procede de plantas cultivadas en el Jardín, originariamente traídas por E. Sventenius de Las Mercedes, Tenerife.

Simetría y Forma: Variable, polen normalmente tricolporoidado, a veces tetracolporoidado y muy raramente pentacolporoidado; los granos triaperturados se muestran con simetría bilateral, isopolares, prolados o subprolados de dimensiones variables (43,3 x 25,6 um - 39 x 25,8 um), embebidos presentan una visión polar triangular, ángulo aperturados y sin embeber fosaperturados; los granos tetraperturados muestran formas polares cuadradas, ángulos aperturados siendo la visión polar de los penta-aperturados pentagonal y ángulo aperturada.

Aberturas: Presentan tres, cuatro y a veces cinco colporoides; colpos no muy largos y a veces con borde irregular; endoabertura con bordes imprecisos.

Exina: Ornamentación variable, aparecen granos estriados más o menos rugulosos de tectum perforado, otros microreticulados de brochado irregular y muris no uniformes.

FAM. OLEACEAE

Jasminum odoratissimum L. (Lám. 3.1 — 3.4)

Polen de plantas cultivadas en el Jardín y originariamente recolectadas por E. Sventenius en La Frontera, Isla del Hierro.

Simetría y Formas Polen tricolporado, con simetría bilateral, isopolar, prolado al natural (73,7 x 46,8 um) y esférico embebido.

Aberturas Tres aberturas compuestas; los colpos de contorno irregular no son largos y dejan bastante zona apolcópica; la endoabertura no se presenta bien definida, pareciendo a veces que algunos granos presentan dos endoaberturas.

Exina: Considerablemente gruesa, de superficie reticulada, angustimurada, con brochis más o menos uniformes por todo el grano.

FAM. LABIATAE

Lavandula canariensis (L.) Mill. (Lám. 3.5, 3.6, 4.1, 4.2)

El polen procede de plantas que crecen espontáneamente en el Jardín.

Simetría y Forma: Granos exacolpados, de simetría bilateral, isopolares, subprolados (49,6 x 38,2 *um*) al natural y oblados embebidos; en vista polar tienen forma circular o hexagonal regular, ángulo-aperturados, con zona apocólpica más o menos grande.

Aberturas: En número de seis, de tipo colpo, los cuales son más bien pequeños, con reborde irregular y cuya zona de abertura es rugosa, a veces escabrosa.

Exina: De superficie psilada con microperforaciones más o menos espaciadas.

Salvia canariensis L. (Lám. 4.3, 4.4, 4.5)

El material polinífero procede de plantas que crecen espontáneamente en el Jardín.

Simetría y Forma: Granos hexacolpados de simetría bilateral, isopolares, prolados, (66,3 x 46,3 *um*) al natural y embebidos oblados; en vista polar tienen forma elipsoidal o elíptico hexagonal y presentan una zona apocólpica más bien pequeña.

Aberturas: seis colpos más bien largos y bien delimitados.

Exina: En su superficie externa se muestra palirreticulada, unditegilada, heterobrochada, con unos brochis mayores poligonales que encierran a otros brochis de formas más o menos redondeadas entre los que se destacan uno, dos y a veces tres de lúminas mayores.

FAM. SOLANACEAE

Solanum lidii Sunding. (Lám. 4.6, 5.1, 5.2, 5.3)

Las muestras de polen proceden de plantas traídas de Temisas, Gran Canaria.

Simetría y Forma: Polen tricolporado de simetría bilateral, isopolar, prolado al natural (38 x 20,6 *um*) y esferoidal al estar embebido, en vista polar tienen forma subtriangular, ángulo aperturados y a veces son subcirculares. Zona apocólpica muy escasa.

Aberturas: Tres aberturas copuestas, laectoabertura es un colpo bastante largo, siendo las endoaberturas lalongadas, bastante largas y pareciendo que en sus finales se tocan, pero sin llegar a intercomunicarse, para formar un cinturón ecuatorial como ocurre en otras especies de *Solanum*.

Exina: De superficie más bien psilada en la que se pueden destacar microrugulaciones más o menos definidas.

Solanum vespertilio Ait. (Lám. 5.4, 5.5, 5.6)

Las muestras fueron extraídas de plantas cultivadas en el Jardín y recolectadas originariamente por E. Sventenius en Anaga, Tenerife.

Simetría y Forma: Polen tricolporado de simetría bilateral, isopolar, prolado al natural (34,6 x 21,8 $_{um}$) y esperoidal al estar embebido, en vista polar aparecen formas subtriangulares y subcirculares; zona apocólpica bastante escasa.

Aberturas: Como *S. lidii*.

Exina: Con superficie más o menos psilada pero presentando una micro-ornamentación diferente a la de *S. lidii*.

Withania aristata (Ait.) Pers. (Lám. 6.1, 6.2, 6.3)

Polen extraído de plantas que crecen espontáneamente en el Jardín.

Simetría y Forma: Grano tricolporado, de simetría bilateral, isopolar, prolado al natural (45,5 x 26,4 $_{um}$) y más o menos circular embebido.

Aberturas: Tres colporus; los colpos bastante largos; ora (endoabertura) bastante lalongada.

Exina: De superficie normalmente escabrosa con nanoverrugas, a veces se presenta como densamente verrucosa.

FAM. RUBIACEAE

Plocama pendula Ait. (Lám. 6.4, 6.5, 6.6)

Descripción anterior, Erdtman (1971): 3-Colporoidate, subprolate (45 x 34 ^{um}). Sexine thicker than nexine (punctitegilate?; superficie slightly undulating).

Los granos aquí examinados proceden de plantas cultivadas actualmente en el Jardín, originariamente traídos por E. Sventenius del Barranco de Ayagaure, Gran Canaria.

Simetría y Forma: Tricolporoidado, generalmente con simetría bilateral, isopolar, más o menos prolado al natural (44,6 x 29 $_{um}$) y a veces subprolado, vista polar embebida subcircular, a veces subtriangular.

Aberturas: Tres colporoides con colpos más o menos largos con oroide (endoabertura) mal definida.

Exina: Con superficie reticulada, heterobrochada, los muris de los brochis con cierta frecuencia presentan verrugas supratectales.

SUMMARY

In this work pollen characters, especially those of the exine, are described for 10 species of flowering plants endemic to the Canarian reoign. Of these 10 species, only the single species of the monotypic endemic genus *Plocama* (Rubiaceae) has been previously studied. The other species here reported ar:: *Pancratium canariensis* Ker-Gawl. (Amaryllidaceae); *Salix canariensis* Chr. Sm. (Salicaceae); *Prunus lusitanica* L. (Rosaceae); *Jasminum odoratissimum* L. (Oleaceae); *Lavandula canariensis* (L) Mill. (Labiatae); *Salvia canariensis* L. (Labiatae); *Solanum lidii* Sunding, *S. vespertilio* Ait. (Solanaceae) and *Withania aristata* (Ait.) Pers. (Solanaceae).

REFERENCIAS

BIESBOER, D. 1975, Pollen Morphology of the Aceraceae. *Grana* 11: 19-27.

BRAMWELL, D. & BRAMWELL, Z. 1974, *Wild Flowers of the Canary Islands.* London & Burford: ST (P) LTD.

ERDTMAN, G. 1969, *Handbook of Palynology.* Copenhagen: Munksgaard.

ERDTMAN, G. 1971, *Pollen Morphology and Plant Taxonomy.* New York: Hafner Publishing Co.

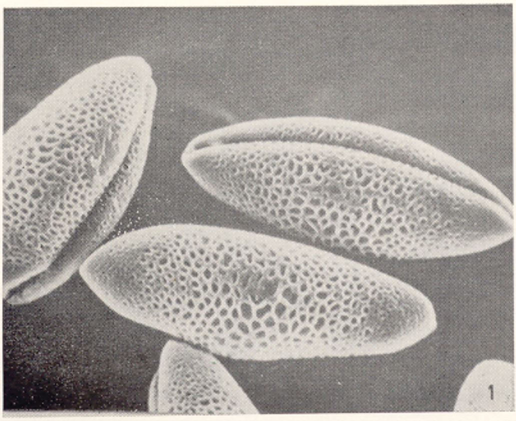
FONT-QUER, P. 1970, *Diccionario de Botánica.* Barcelona: Labor S.A.

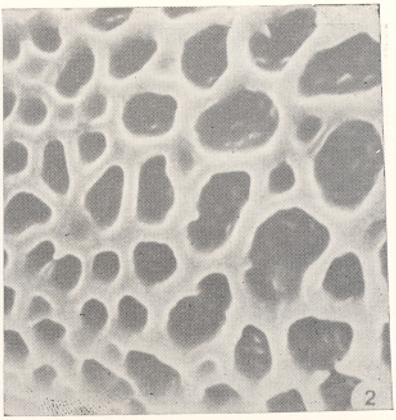
PLA DALMAU, S. 1957, *Polen.* Barcelona: Univ. Barcelona.

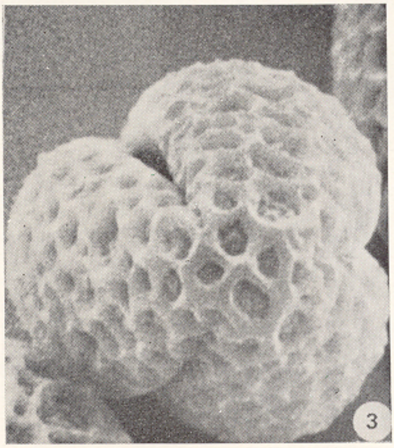
KAPP, R. 1969, *Polen and Spores.* Dubuque: WC. Brown Co. Publishers.

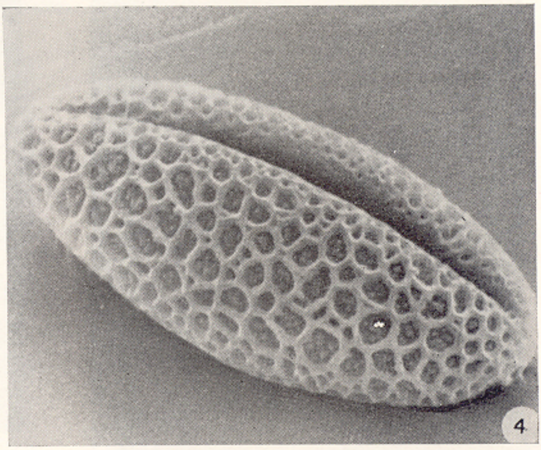
PANELATTI, G. 1961, Quelques résultats de palynologie analytique et descriptive pour le Maroc. *Trav. Inst. Sce .Chérif., Sér. Bot.* 23: 1-83.

SAENS DE RIVAS, C. 1973, *Estudios palinológicos sobre* Quercus de la España Mediterránea. *Bot. R. Soc. Española Hist. Nat.* (*Biol.*) 71: 315-329 (1973).









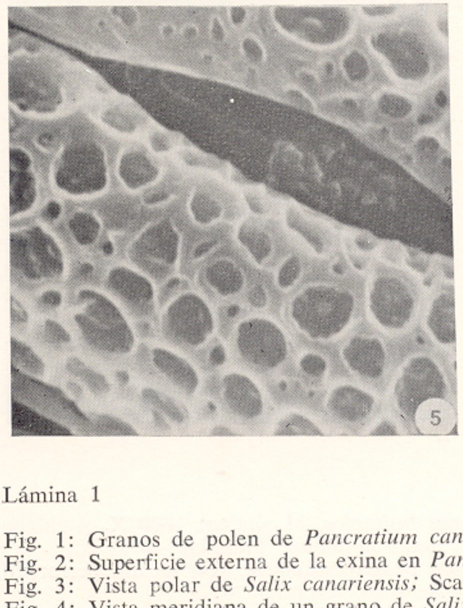
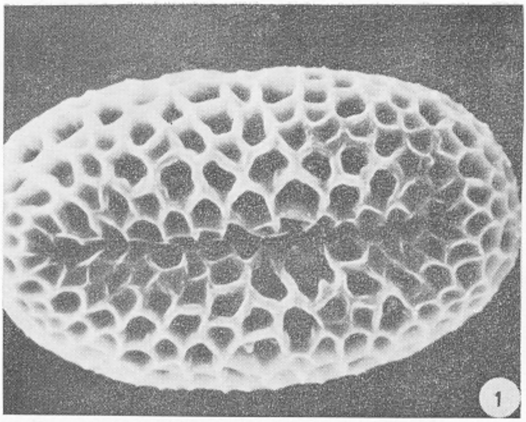
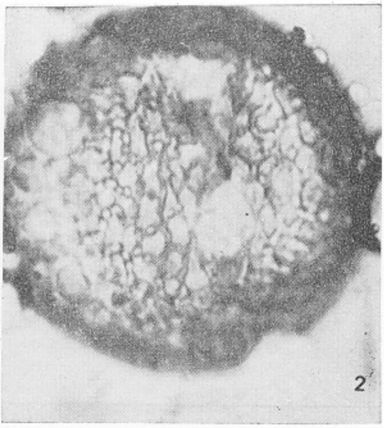
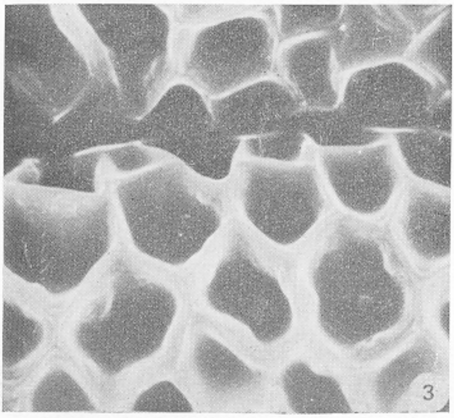


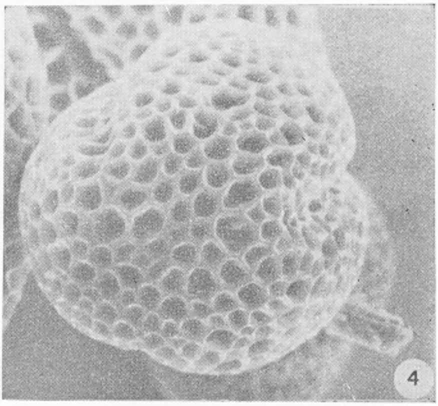
Lámina 1

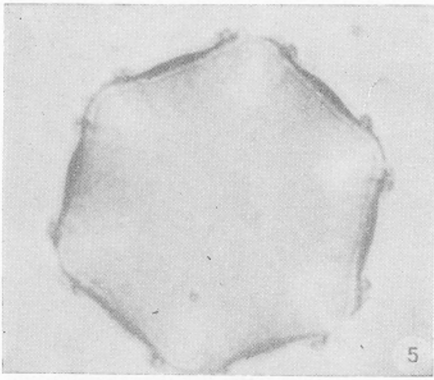
Fig. 1: Granos de polen de *Pancratium canariensis,* Scanning: 1000 X.
Fig. 2: Superficie externa de la exina en *Pancratium canariensis,* Scanning: 7000 X.
Fig. 3: Vista polar de *Salix canariensis;* Scanning.
Fig. 4: Vista meridiana de un grano de *Salix canariensis,* Scanning: 4000 X.
Fig. 5: Detalle de la parte central de un colpo que muestran algunos granos de *Salix canariensis* y de la superficie exínica, Scanning: 10.000 X.
Fig. 6: Vista polar de un grano de *Prunus lusitanica,* Scanning: 4000 X.











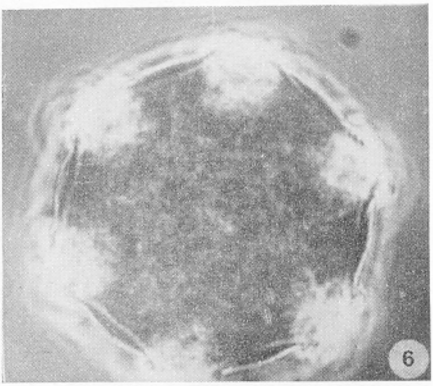
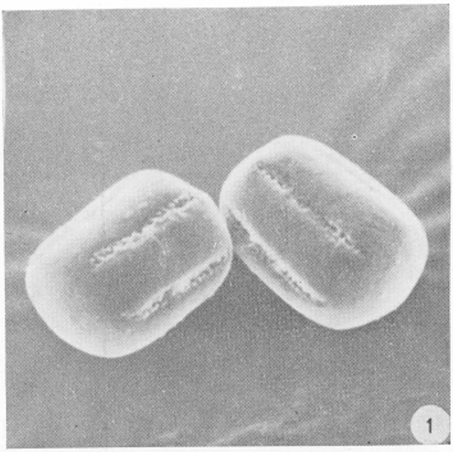
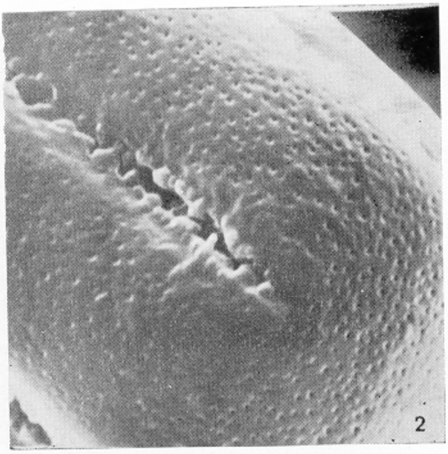
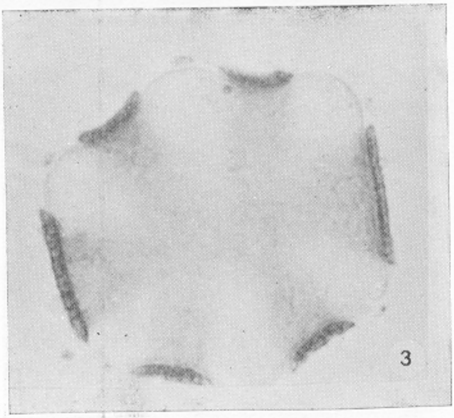


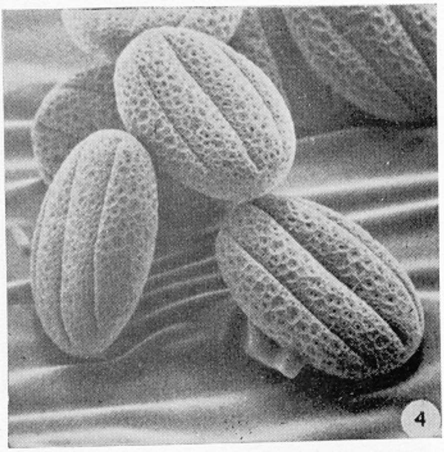
Lámina 3

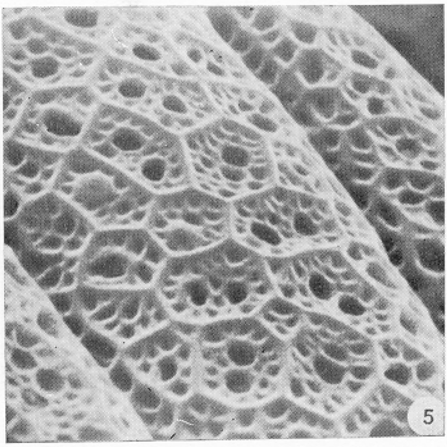
Fig. 1:	Vista meridiana de *Jasminum odoratissimum,* Scanning: 2000 X.
Fig. 2:	Vista meridiana de polen de *Jasminum odoratissimum,* M. óptico, 1600 X.
Fig. 3:	Detalle de la superficie exínica de *Jasminum odoratissimum,* Scanning: 5000 X.
Fig. 4:	Vista polar de un grano de *Jasminum oboratissimum,* Scanning.
Fig. 5 y Fig. 6:	Vistas polares del polen de *Lavandula canariensis,* M. óptico, 1600 X.











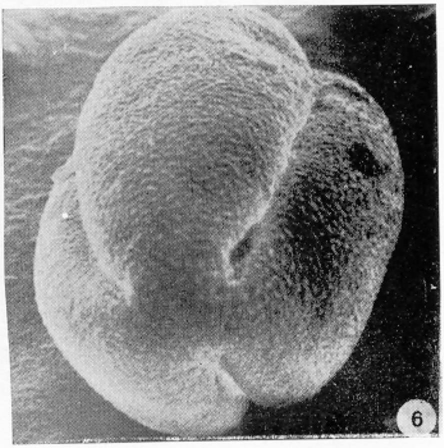
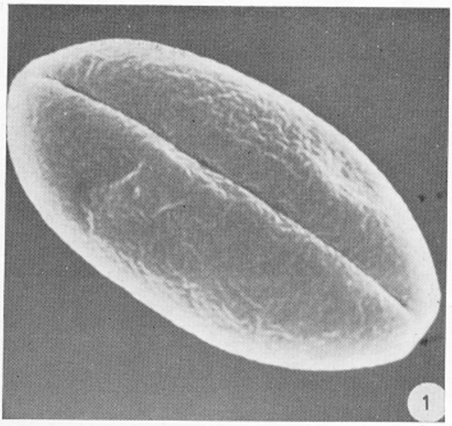
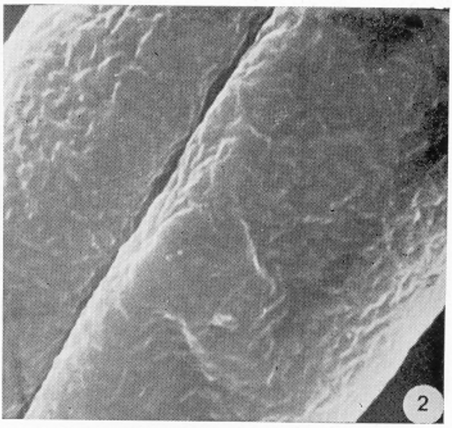
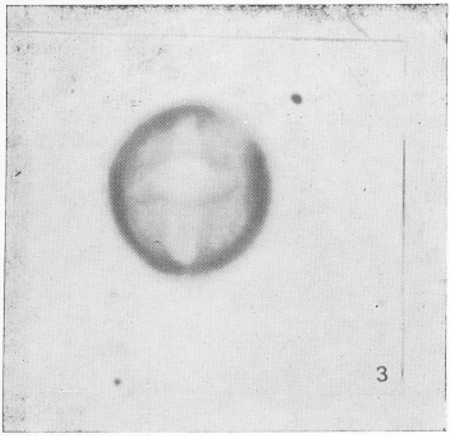


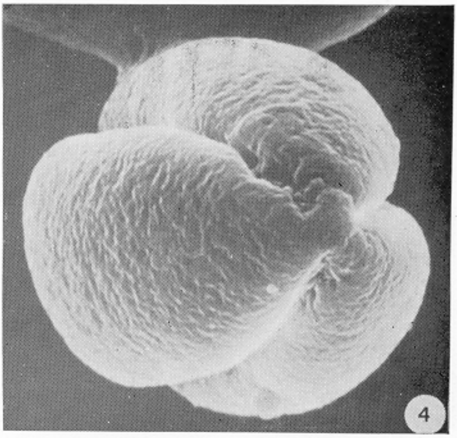
Lámina 4

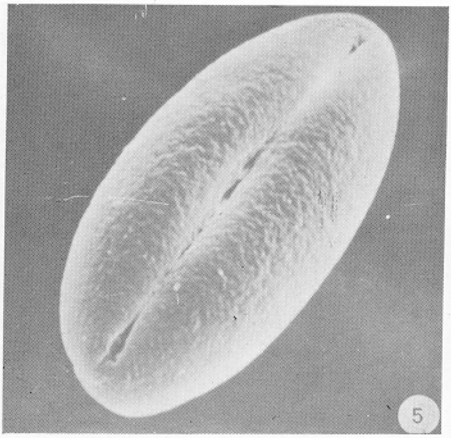
Fig. 1:	Granos de polen de *Lavandula canariensis,* Scanning 1000 X.
Fig. 2:	Detalle de un colpo y de la exina de *Lavandula canariensis,* Scanning, 4000 X.
Fig. 3:	Vista polar de *Salvia canariensis,* M. óptico, 1600 X.
Fig. 4:	Granos de polen de *Salvia canariensis,* Scanning 800 X.
Fig. 5:	Detalle de la superficie exínica de *Salvia canariensis,* Scanning, 3000 X.
Fig. 6:	Grano de polen de *Solanum lidii,* Scanning, 3000 X.











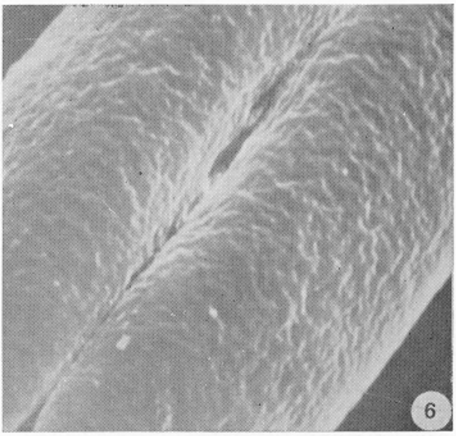
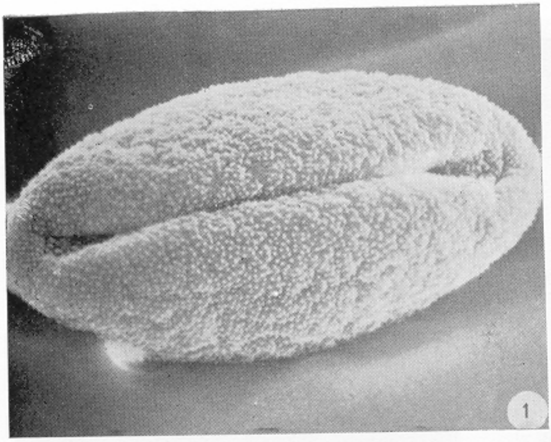
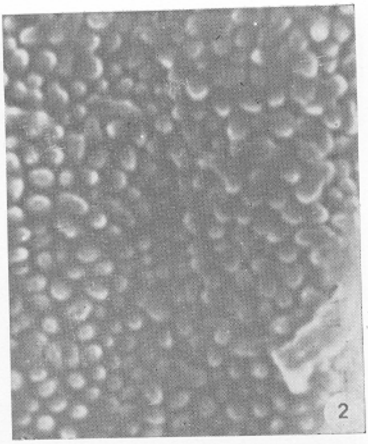
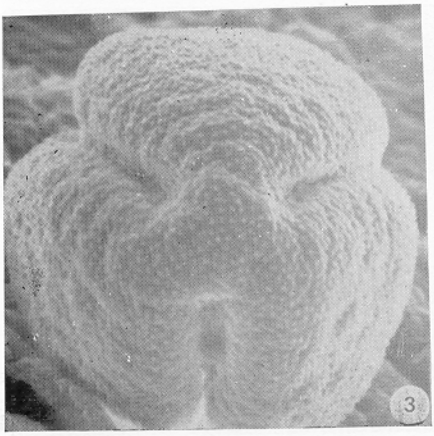


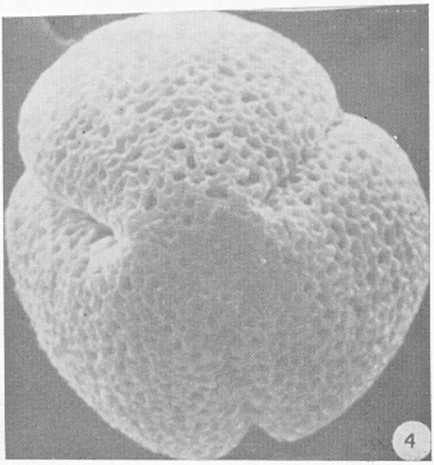
Lámina 5

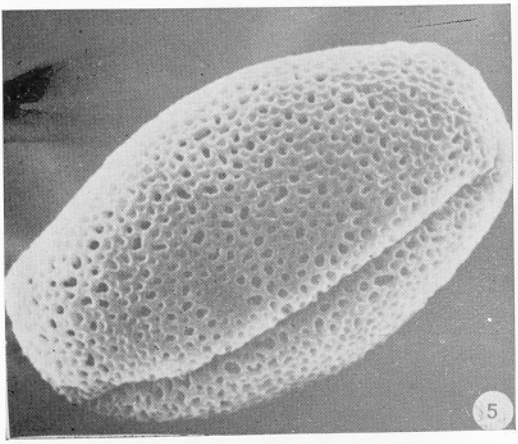
Fig. 1: Vista meridiana del polen de *Solanum lidii,* Scanning: 3000 X.
Fig. 2: Detalle de la cubierta exínica de *S. lidii,* Scanning: 6000 X.
Fig. 3: Vista meridiana del polen embebido de*S. lidii,* M. óptico: 1600 X.
Fig. 4: Vista polar del polen de *Solanum vespertilio,* Scanning: 5000 X.
Fig. 5: Vista meridiana del polen de *S. vespertilio,* Scanning: 3000 X.
Fig. 6: Detalle de la cubierta exínica del polen de *S. vespertilio,* Scanning: 6000 X.











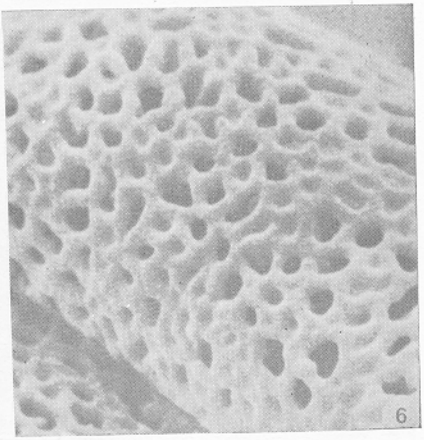


Lámina 6

Fig. 1: Vista meridiana de un grano de *Withania aristata* con exina escabrosa, Scanning: 3000 X.

Fig. 2: Detalle de la exina de un grano de *Withania aristata* con ornamentación densamente verrucosa, Scanning 15000 X.

Fig. 3: Vista polar de un grano de *Withania aristata,* Scanning: 4000 X.

Fig. 4: Vista polar de un grano de *Plocama pendula,* Scanning: 4000 X:

Fig. 5: Vista meridiana de un grano de *Plocama pendula,* Scanning: 3000 X.

Fig. 6: Detalle de la cubierta exínica en un grano de *Plocama pendula,* Scanning: 7000 X.

BOTANICA MACARONESICA 2 (1976)

MACARONESIAN SONCHUS SUBGENUS DENDROSONCHUS S.L. (COMPOSITAE - LACTUCEAE), INCLUDING A REAPPRAISAL OF THE SPECIES CONCEPT AND NEW COMBINATIONS.

ANGELA E. ALDRIDGE

Botany Departament ıPlant Science Laboratories Reading University

RESUMEN

Boulos, en su reciente revisión del género *Sonchus L.*, dió las claves de las especies de los miembros macaronésicos de este género y de los géneros emparentados. La variación en ciertos caracteres morfológicos de amplio material de *Dendrosonchus* s.l. se muestra aquí como mucho más extensa de lo que Boulos anticipó.

Nuevos conceptos de especies y subespecies son descritos seguidos por una sinopsis de reconocida taxa y nuevas combinaciones incluyendo una nueva subespecie, *S. ustulatus* Lowe subesp. *maderensis* Aldridge. Se han suministrado nuevas claves para las especies y subespecies.

SUMMARY

Boulos, in his recent revision of the genus *Sonchus* L., gave keys to the species of the Macaronesian members of this and related segregate genera. The variation in certain morphological characters of ample material of *Dendrosonchus* s.l. is shown here to be far more extensive than Boulos anticipated. New species and subspecies concepts are outlined followed by a synopsis of recognised taxa and new combinations including one new subspecies, *S. ustulatus* Lowe subsp. *maderensis* Aldridge. New keys to the species and subspecies are provided.

CONTENTS

INTRODUCTION

In the spring of 1973 I visited the seven principal islands of the Canaries for a period of four months. During this time extensive collections and observations were made of the members of the subgenus *Dendrosonchus* Webb ex Schultz Bip. This subgenus constitutes the woody and pachycaulous group of the genus *Sonchus* L. (Compositae, tribe Lactuceae) and is endemic to the islands of the Canaries, Madeira and Cape Verdes with one species also occurring in Western Morocco. At this time, keys to the species had been published by Boulos (1968, 1972) and these were applied in the field. It soon became apparent that many taxa could not be identified with the aid of these keys.

In a previous paper (Aldridge, 1976) it has been established that the subgenus *Dendrosonchus* includes the genera *Babcockia* Boulos (Boulos, 1965) and *Taeckholmia* Boulos (Boulos, 1967a) and also that Boulos' key to these genera has no value. The plants collected by me and those stored in the herbaria of the Royal Botanic Gardens, Kew, the British Museum (Natural History), London and Reading University were then thoroughly examined and a new revision of the group was found to be necessary (Aldridge, 1975).

MORPHOLOGICAL VARIATION AND SPECIES DELIMITATION

The variation within and between the species recognised by Boulos is far greater than he appeared to have observed. In his keys, Boulos stressed the value of such characters as leaf-lobe width, number of florets and length of corolla, especially for the members of the subgenus which possess highly dissected leaves. As the greatest discrepancies between my data and those of Boulos arise within this group, they are discussed in some detail below.

Boulos (1976a) placed six species into the genus *Taeckholmia*, the value of which has previously been discussed (Aldridge, 1976). These species were *T. pinnata* (L. fil.) Boulos (= *Sonchus leptocephalus* Cass.), *T. canariensis* Boulos (= *S. filifolius* Svent.), *T. capillaris* (Svent.) Boulos (= *S. capillaris* Svent.), *T. microcarpa* Boulos, *T. heterophylla* Boulos, *T. regis-jubae* (Pitard) Boulos (= *S. regis-jubae* Pitard) and *T. arborea* (DC.) Boulos (= *S. arboreus* DC.). The *Sonchus* nomenclature will be used in this discussion. Boulos separated *S. arboreus* and *S. regis-jubae* from the other members of the group on the basis of the leaf-lobe width and the ratio of ligule to tube of the corolla. The leaf-lobe width is an extremely variable character as demonstrated in Figure 1. The ran-

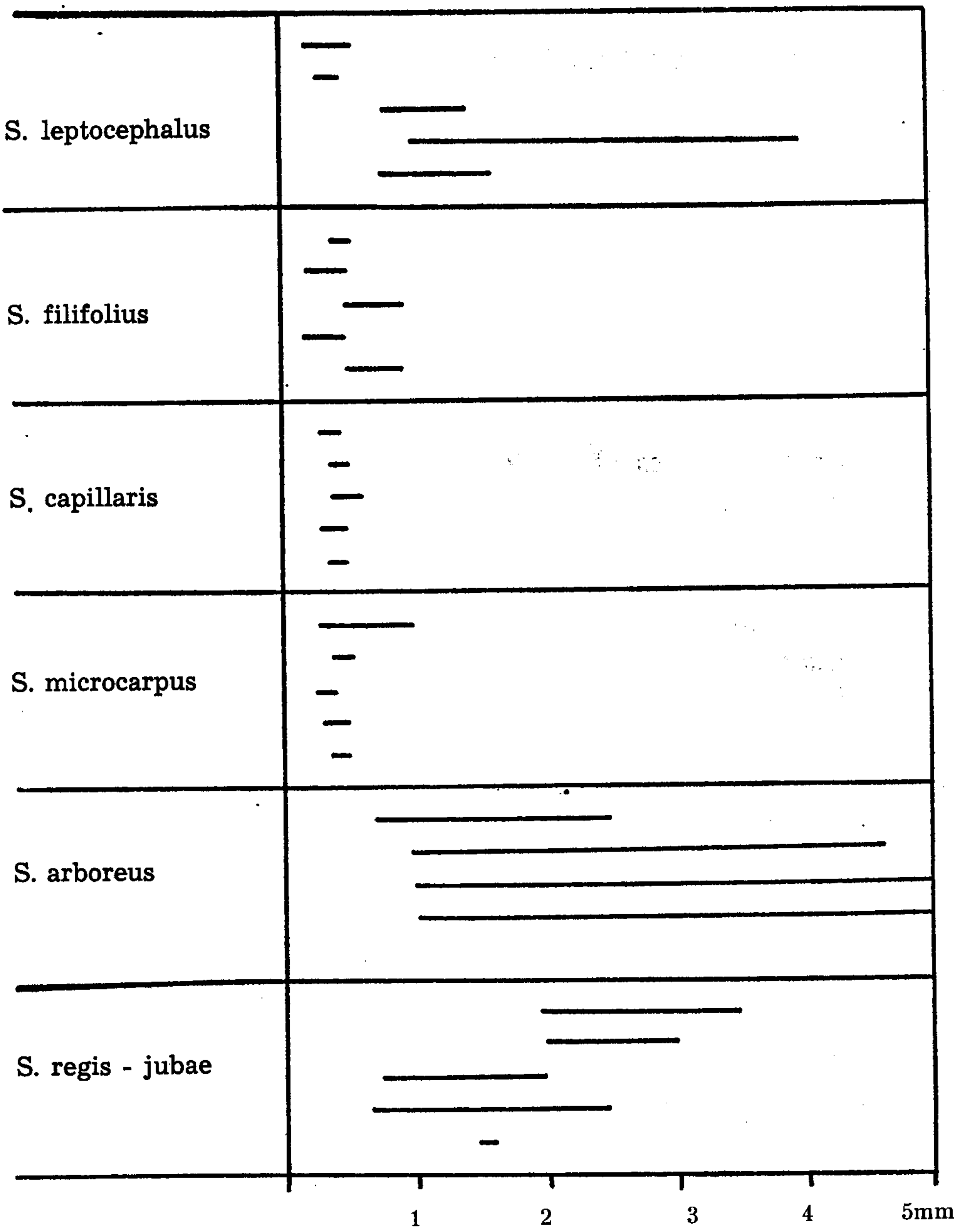


FIGURE 1. Variation in Leaf-lobe Width.
Each line represents one plant (from 10 leaves/plant).

ge of leaf-lobe width for each of a few selected samples from each of the above taxa, excluding *T. heterophylla,* is shown in this figure. The lines indicate single samples using ten leaves per plant and it is evident that this character does not distinguish the two groups.

Boulos used the length of the corolla and length of the pappus in separating the taxa *S. leptocephalus* and *S. filifolius*, considered in the present study to be synonymous. The variation in the length of the corolla is illustrated for the whole group in Figure 2. Even when only one corolla per plant in four to five plants per species are examined it is apparent from Figure 2 that *S. leptocephalus* and *S. filifolius* cannot be distinguished on this character. *Taeckholmia heterophylla* has not been included in these figures as I consider it to be a hybrid from Gomera. Boulos described this species as having variable leaves, but it possesses intermediate leaves and capitula between *S. arboreus* and *S. leptocephalus*. These species grow in close proximity to one another on Gomera.

Other examples of a wider range in variation seen by me than observed by Boulos for the preparation of his keys, can be illustrated by an examination of his subgenus *Dendrosonchus*. Boulos (1974a) included in the subgenus *Dendrosonchus* several species with narrow leaf-lobes. These were *S. palmensis* (Schultz Bip.) Boulos, *S. pinnatus* Aiton, *S. canariensis* (Schultz Bip.) Boulos, *S. canariensis* subsp. *orotavensis* Boulos and *S. gandogeri* Pitard. Within this group *S. canariensis* subsp. *orotavensis*, from Tenerife, and *S. gandogeri*, from Hierro, are probably hybrids between members of the *S. pinnatus* group and those of either narrower or broader leaf-lobed species. *Sonchus gandogeri* is probably the result of hybridization between *S. pinnatus* subsp. *canariensis* and *S. hierrensis* and it may now prove to be a well-established species following more detailed field investigations. *Sonchus pitardii* and *S. lidii* which were also described by Boulos (1976b), also possess intermediate characteristics between members of the *S. gandogeri* population and *S. hierrensis*. These hybrid-like taxa all originate from localities in which they were very rare and surrounded by other, more widely distributed species. An investigation into the origination of all these rare samples by crossing experiments would take many years as in many species it takes two to three years to attain maturity. It seems, however, premature to recognise every variant at the species level as this type of treatment results in a large and unwieldy number of indistinct taxa. It is essential that the potential variability within plant groups, which is exhibited by the occasional rarity, is taken into consideration before a revision of that group is attempted.

Boulos used the number of florets as the sole, key character in the separation of *S. palmensis* from the other narrow, leaf-lobed species which are listed above. The number of florets is generally quite constant for a species but an overlap between the species is

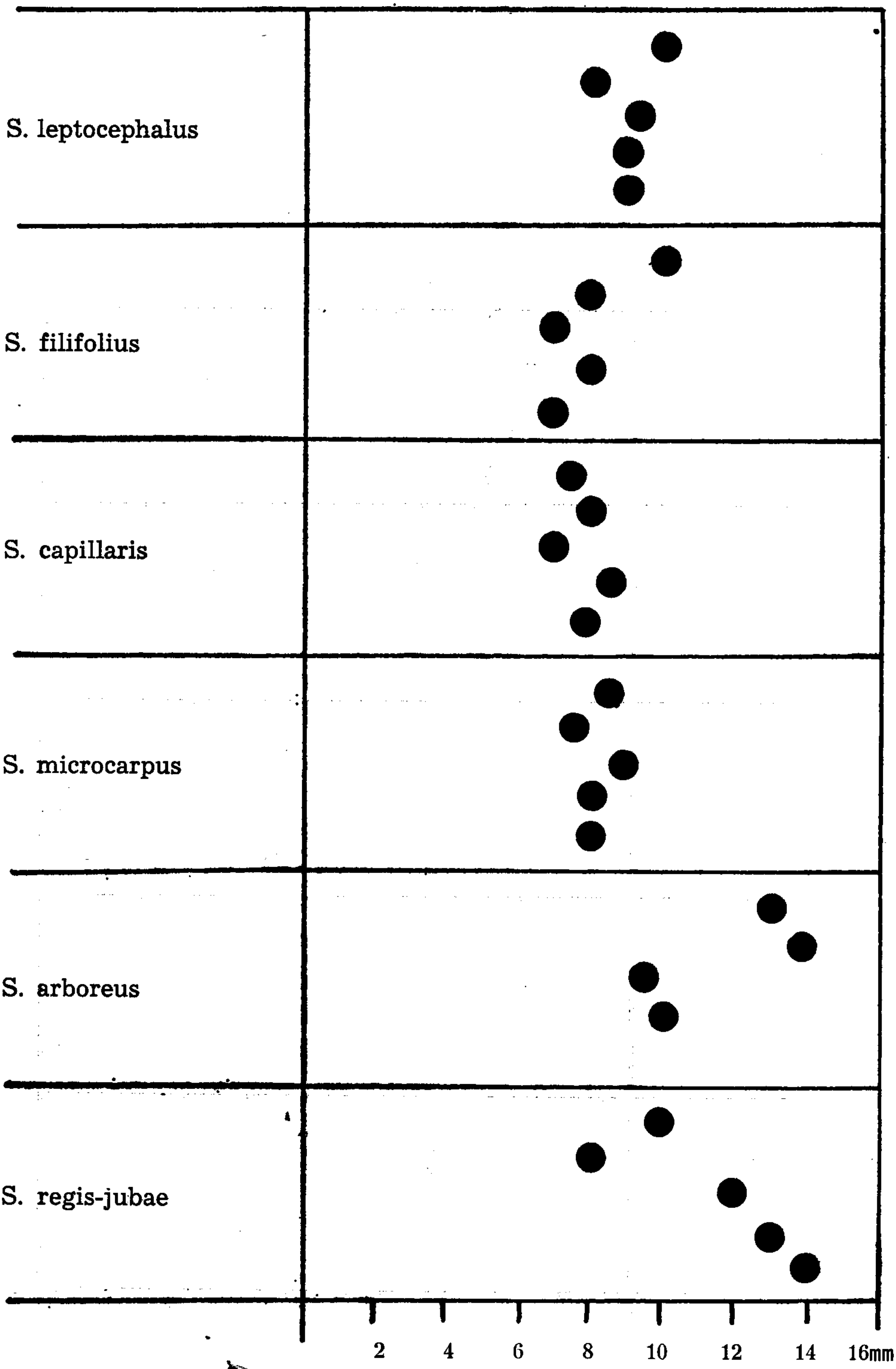


FIGURE 2. Variation in Corolla Length.
Each spot represents one plant (from 1 corolla/plant).

quite usual. Figure 3 illustrates the variation in number of florets for this narrow, leaf-lobed group. This variation was found by counting the number of florets in one capitulum per plant and in one to five plants per species. If the species *S. gandogeri* and *S. canariensis* subsp. *orotavensis* are not taken into consideration for the reasons given above, then the number of florets would be useful as a character for separating *S. palmensis* from *S. pinnatus* and *S. canariensis*. The size of the involucre, however, is a more

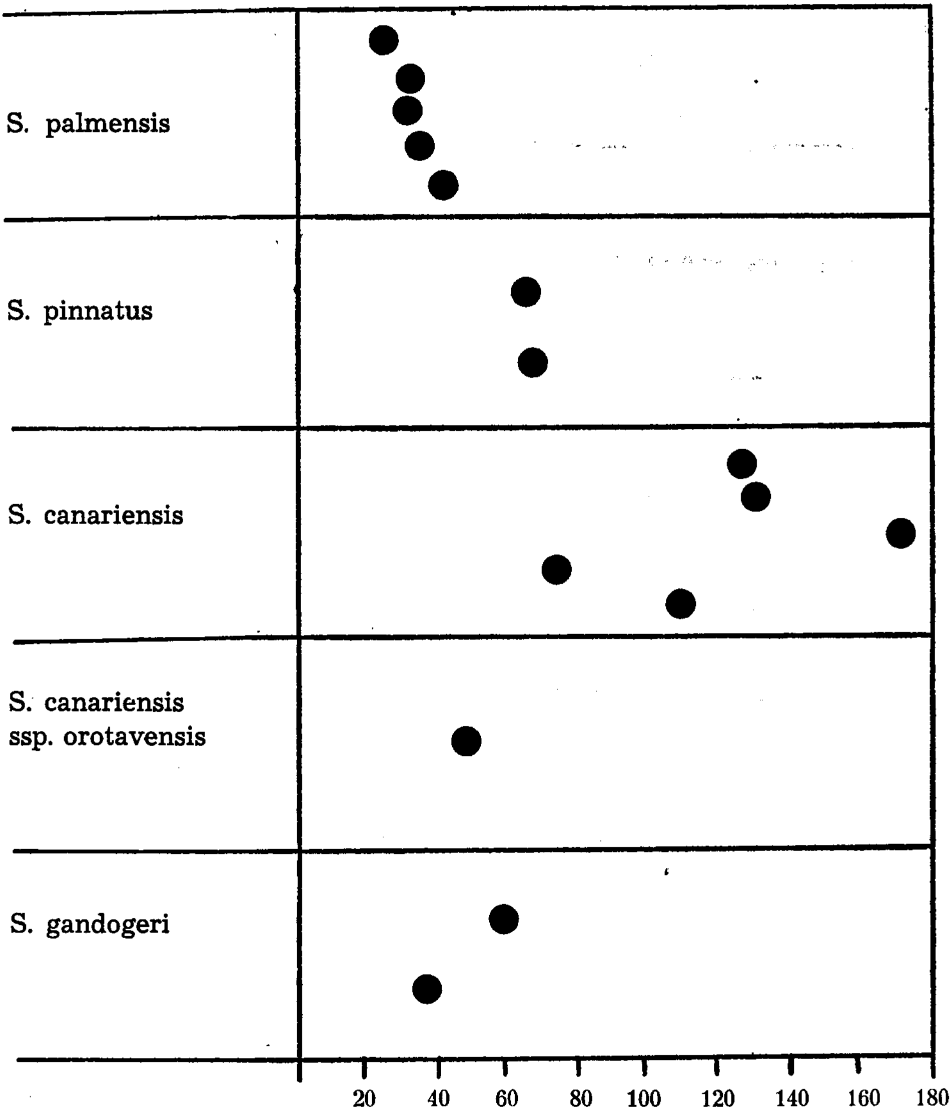


FIGURE 3. Variation in Floret Number.
Each spot represents one plant (from 1 capitulum/plant).

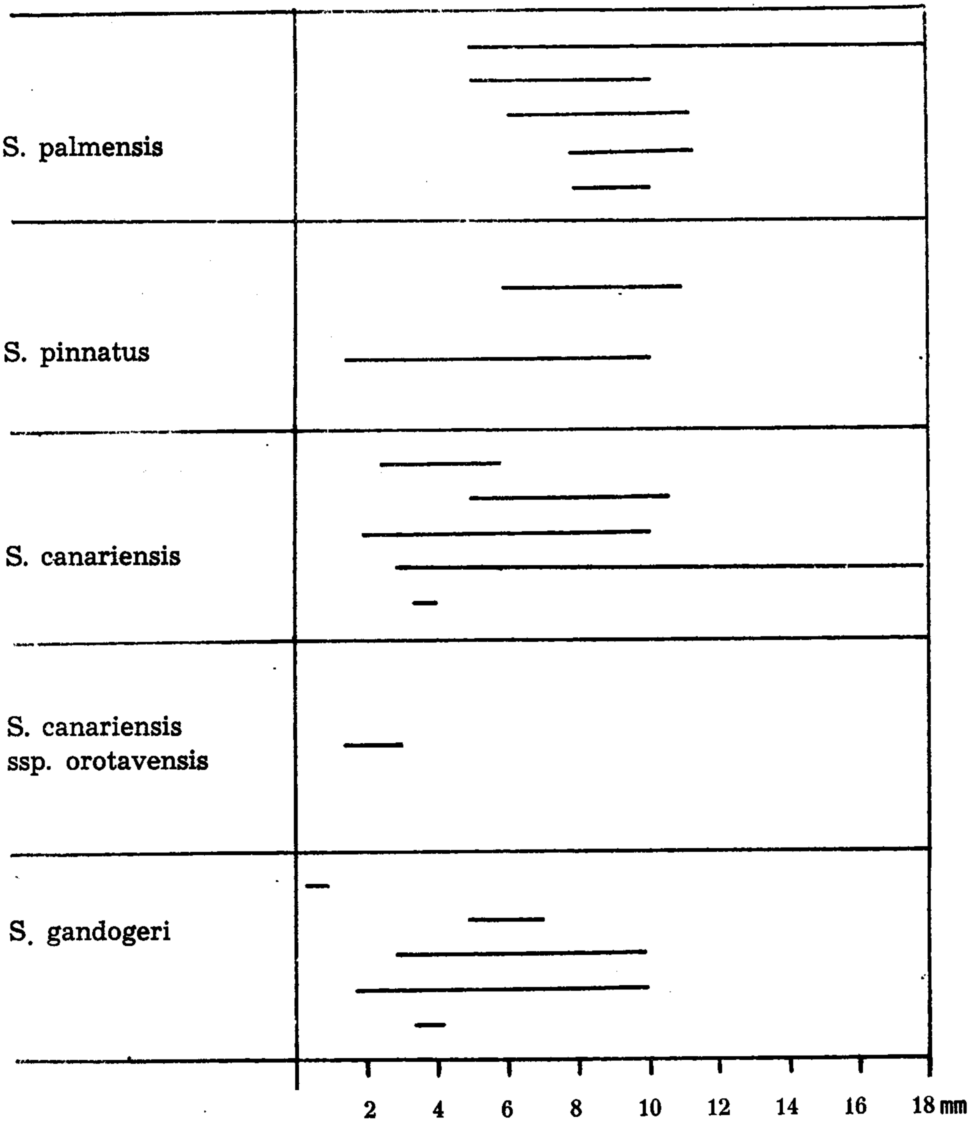


FIGURE 4. Variation in Leaf-lobe width.
Each line represents one plant (from 10 leaves/plant).

useful character for keying out *S. pinnatus* subsp. *palmensis* from the other two subspecies, as they are recognised here, especially for field observations.

In the same keys, Boulos again used the leaf-lobe width for separating *S. canariensis* from its subspecies *orotavensis*. The range in leaf-lobe width is shown in Figure 4 for all the members of this narrow leaf-lobed group. When only ten leaves per plant and one to five plants per species are examined the ranges can be seen to overlap in all cases. In many other respects the keys produced by Boulos are highly impracticable, and were usually unreliable in the field.

From these observations it is clear that the classification of the woody members of the genus *Sonchus* which was provided by Boulos requires revision. The subgenus *Dendrosonchus* comprises species which have evolved rapidly by adaptive radiation in response to the high selective pressures resulting from biotic and environmental factors. As the adaptive features produced by these selection pressures have possibly occurred only since the Tertiary period, the resultant taxa still show close relationships with one another, especially in features of the leaf, capitulum and cypsela. The evolution of the subgenus will be dealt with in more detail in a later paper.

THE USE OF TAXONOMIC CATEGORIES

The concepts of the genus, subgenus and section have been dealt with in a previous paper (Aldridge, 1976) and the concepts of the species and subspecies are discussed here.

THE SPECIES

Boulos (1972, 1973, 1974a 1974b) employed a narrow species concept in his recent revision of the genus *Sonchus* s.l. This type of treatment is generally applicable to little-worked areas where material is limited. A wider species concept would cause confusion at this pioneer phase (Davis & Heywood, 1965). I have examined abundant material which was in part collected from the Canary Islands, Madeira and Morocco during the course of study, and in part stored in the herbaria of Reading University, the Royal Botanic Gardens, Kew and the British Museum (Natural History), London. Although much of this material was available to Boulos, and although he made his own collections from the Canary Islands and Madeira, the resulting treatment of the species appears not to take into consideration the continuity of variation within the group. Many of the "species" recognised by Boulos cannot be determined unless their origin is known.

According to Davis & Heywood (1965), splitting is often the result of having a limited flora to deal with or of a lack of appreciation of variability, which may be because the plants have not been studied in the field or because the biological nature of the group is not understood. In the works by Boulos there is no mention of any cultivation of the plants in question and it appears that a very limited time was spent in the field. The argument that small groups are more natural and easier to use does not apply to this situation as it has been shown here that the small groups recognised by Boulos are difficult to distinguish when sufficient material is examined. The systematic investigations made and discussed in this and the previous paper (Aldridge, 1976) have revealed that more natural and easily identifiable groups result from a broader species concept than that held by Boulos. The species are recognised by unique combinations of several morphological characters. These are essentially phenetic species and it is intended that any observer should have little hesitation in recognising them as they are delimited here.

Du Rietz (1930) defined the species on the basis of recognising discontinuity in natural variation. This concept forms the basis of the systematic investigations discussed in this and the previous paper. An essential part of the formulation of taxonomic decisions involving the subgenus *Dendrosonchus* was found to result from extensive field observations. These studies of the variation of the plants in their natural environments may not have been sufficient or comprehensive enough for exact interpretations of the discontinuities between the species, but it is obvious that a broader species concept, than that previously shown by Boulos, is required to account for this variation observed in natural populations.

Due to geographical barriers the species are in effect isolated breeding units in nature, although they cross freely when brought together. Where geographical barriers have been removed by man in the course of road building and land development, hybridization often occurs. Where the natural geographical barriers are not so pronounced there is a more continuous variation between two taxa. In these cases the rank of subspecies has been used (see below). In several instances a species occurs on more than one island and the members are effectively isolated. These components of a species may be termed vicariads as they are obviously geographically, as well as reproductively, isolated. Several very similar species occurring on different islands but in similar habitats may also be considered as vicariads. The possible origin of these taxa will be treated in a later paper.

THE SUBSPECIES

The rank of subspecies is well defined in the literature (Davis & Heywood, 1965; Du Rietz, 1930; Rothmaler, 1944, 1943, 1955). It generally relates to a considerable portion of a species which is more or less distinct by a combination of morphological characters, but is essentially isolated geographically. They may be entirely isolated geographically or they may overlap in part. In the former case the subspecies have become more distinct than in the latter. Where subsspecies of the same species overlap, hybridization may occur.

SYNOPSIS OF RECOGNISED TAXA AND NEW COMBINATIONS IN THE SUBGENUS DENDROSONCHUS

Subgenus *Dendrosonchus* Webb ex Schultz Bip. in Webb & Berth., *Phyt. Canar.*, 3(2): 425 (1849-50).
Syn. *Dendrosonchus* Schultz Bip. ex Boulos in *Bot. Not.*, 125: 297 (1972).

I. section *Dendrosonchus*
Syn. *Sonchus* subgenus *Dendrosonchus* section *Brachylobi* Boulos in *Bot. Not.*, 125: 299 (1972).
Sonchus subgenus *Dendrosonchus* section *Pinnati* Boulos, *loc. cit.*, pro parte.

1. *Sonchus brachylobus* Webb ex Schultz Bip. in Webb & Berth., *Phyt. Canar.* 3(2): 438 (1849-50).
Syn. *S. neglectus* Pitard in Pitard & Proust, *Iles Canaries Fl. Archipel.* : 261 (1908).
S. canariae Pitard in Pitard & Proust, *loc. cit.*
S. branchylobus var. *canariae* (Pitard) Boulos in *Nytt. Mag. Bot.*, 14: 13 (1967).

2. *Sonchus congestus* Willd. in *Ges. Naturf. Freunde Berlin Mag.*, 1: 136 (1807).
Syn. *S. fructicosus* Jacq., *Collect. Bot.*, 1: 83 (1786) non L. fil. (1781).
S. jacquinii DC., *Cat. Pl. Horti Monsp.*, : 147 (1813).
S. macranthus Poiret, *Encycl. Suppl.*, 3: 289 (1813).
S. broussonetii Desf., *Tabl. Ecole Bot.*, : 101 (1815).
S. abbreviatus Link in Buch, *Phys. Beschr. Canar.*, : 149 (1825).
S. jacquinii Sprengel, *Syst. Veg.*, 3: 647 (1826) pro parte.
S. abbreviatus var. *gibbosus* Svent., *Plantae Macaronesienses novae vel minus cognitae,* 1: 55 (1968).

3. *Sonchus fruticosus* L. fil., *Suppl. Pl.*, : 346 (1781).
Syn. *S. laevigatus* Willd., *Enum. Pl. Horti Berol. Suppl.*, : 54 (1814).
S. lyratus Willd., *op. cit.*, : 53 (1814).
S. squarrosus DC., *Cat. Pl. Horti Monsp.*, : 147 (1813).
S. laevigatus var. *lyratus* DC., *Prodr.*, 7(1): 188 (1838).

4. *Sonchus pinnatifidus* Cav. in *Anal. Cienc. Nat.*, 4: 78 (1801).
Syn. *S. acidus* Schousboe ex Willd., *Sp. Pl.*, 3(3): 1511 (1803).
S. runcinatus Vent. ex Schultz Bip. in Webb & Berth., *Phyt. Canar.* 3(2): 434 (1849-50).

5. *Sonchus platylepis* Webb ex Schultz Bip. in Webb & Berth., *Phyt. Canar.*, 3(2): 433 (1849-50).
Syn. *Babcockia platylepis* (Webb ex Schultz Bip.) Boulos in *Bull. Jard. Bot. État Brux.*, 35: 64 (1965).

6. *Sonchus fauces-orci* Knoche, *Vagandi Mos. Reiseskizzen Botanikers. I. Kanar. Ins.*, : 244 (1923).

7. *Sonchus radicatus Aiton, Hort. Kew,* 3: 116 (1789).
7A. subspecies *radicatus*
7B. subspecies *gummifer* (Ling) Aldridge, *comb. et stat. nov.*
Syn. *Sonchus gummifer* Link in Buch, *Beschr. Canar. Ins.*, : 146 (1825).
7C. subspecies *tectifolius* (Svent.) Aldridge, *comb. et stat. nov.*
Syn. *Sonchus tectifolius* Svent., *Plantae Macaronesienses novae vel minus cognitae,* 1: 14 (1968).

8. *Sonchus gonzalezpadroni* Svent., *Addit. Fl. Canar.*, 1: 79 (1960).
Syn. *S. gomerensis* Boulos in *Nytt Mag. Bot.*, 14: 11 (1967).

9. *Sonchus ustulatus* Lowe in *Trans. Camb. Philos. Soc.*, 4: 22 (1831).
Syn. *S. dentatus* Sol. ex Lowe in *op. cit.* : 23 (1831), non *S. dentatus* Ledeb., (1829).
9A. subspecies *ustulatus*
Syn. *Sonchus ustulatus* var. a *angustifolia* Lowe in *Trans. Camb. Philos. Soc.*, 4: 22 (1831).

9B. subspecies *maderensis* Aldridge, *subsp. nov.*

Typus: 'Madeira, *S .ustulatus* var. 8 Lowe (DC.), *Mason* 249' (BM-BH!).

Syn. *Sonchus ustulatus* var. *β latifolia* Lowe in *Trans. Camb. Philos. Soc.*, 4: 22 (1831).

S. ustulatus var. 8 *latifolia* Lowe, *Man. Fl. Mad.*, : 548 (1868).

S. ustulatus var. *β imbricata* Lowe, *loc. cit.*

S. naturatus var *β imbricata* Lowe loc. cit.

Folia pinnatipartita vel pinnatisecta; lobi terminales 8-30 mm longi, lanceolati vel ovati; lobi laterales 10-15, 6-40 x 6-28 mm, ovati vel lati ovati, imbricati vel distantes, angulares cum angulus proximalis prolatus, integri, in angulis apiculati; pagina supera pruinosa. Corolla 12-14 mm longa; ligula 7-9 mm longa; tubus 4.5-5.0 mm longus.

Distribution: North and North-East Madeira, Desertas, Porto Santo.

10. *Sonchus ortunoi* Svent., *Addit. Fl. Canar.*, : 81 (1960).

11. *Sonchus hierrensis* (Pitard) Boulos in *Nytt Mag. Bot.*, 14: 11 (1967).

Syn. *S. jacquini* var. *hierrensis* Pitard in Pitard & Proust, *Iles Canar. Fl. Archipel.*, : 258 (1908).

S. congestus var. *palmensis* Schultz Bip. in Webb & Berth., *Phyt. Canar.*, 3(2): 432 (1849-50).

S. hierrensis var. *benehoavensis* Svent. in *Anales Real Soc. Esp. Fis. y Quim.*, 64: 893 (1968).

12. *Sonchus daltonii* Webb in Hooker, *Niger Fl.*, : 144 (1849).

13. *Sonchus bornmuelleri* Pitard in Pitard & Proust, *Iles Canar. Fl. Archipel.*, : 259 (1908).

14. *Sonchus acaulis* Dum.-Courset, *Bot. Cult.*, (ed. 2) 4: 12 (1811).

Syn. *S. jacquinii* Sprengel, *Syst. Veg.*, 3: 647 (1826) pro parte.

S. chuquitensis Meyen ex Walp. in *Nov. Act. Nat. Cur.*, 19(1): 294 (1843).

II. section *Atalanthus* (D. Don) DC., *Prodr.*, 7: 189 (1838).

Syn. *Atalanthus* D. Don in *Edinb. New Philos. Jour.*, 6: 311 (1829).

Taeckholmia Boulos in *Bot. Not.*, 120: 97 (1967).

Sonchus subgenus *Dendrosonchus* section *Pinnati* Boulos in *Bot. Not.*, 125: 299 (1972) pro parte.

15. *Sonchus arboreus* DC., *Prodr.*, 7: 189 (1838).

Syn. *Prenanthes arborea* Brouss., *Elenchus Plant. Horti Bot. Monsp.*, : 47 (1805) nom. nud.

Sonchus regis-jubae Pitard in Pitard & Proust, *Iles Canar. Fl. Archipel.*, : 262 (1908).

Taeckholmia regis-jubae (Pitard) Boulos in *Bot. Not.*, 120: 104 (1967).

Taeckholmia arborea (DC.) Boulos, *op. cit.*, : 106 (1967).

16. *Sonchus leptocephalus* Cass. in *Dict. Sci. Nat.*, 43: 281 (1826).

Syn. *Prenanthes pinnata* L. fil., *Suppl.*, : 347 (1781) non *Sonchus pinnatus* Aiton (1789).

Chondrilla pinnata (L. fil.) Lam., *Encycl. Meth. Bot.*, 2: 79 (1786).

Taeckholmia pinnata (L. fil.) Boulos in *Bot. Not.*, 120: 99 (1967).

16A. subspecies *leptocephalus*

Syn. *Sonchus filifolius* Svent., *Addit. Fl. Canar.*, 1: 83 (1960).

Taeckholmia canariensis Boulos in *Bot. Not.*, 120: 100 (1967).

Taeckholmia filifolia (Svent.) Kunkel in *Cuad. Bot. Can.*, 22: 28 (1974).

16B. subspecies *capillaris* (Svent.) Aldridge, *comb. et stat. nov.*

Syn. *Sonchus capillaris* Svent., *Addit. Fl. Canar.*, 1: 85 (1960).

Taeckholmia capillaris (Svent.) Boulos in *Bot. Not.*, 120: 100 (1967).

Taeckholmia microcarpa Boulos, *op. cit.*, : 102 (1967).

17. *Sonchus pinnatus* Aiton, *Hort. Kew*, 3: 116 (1789).

Syn. *S. hyoseridifolius* Hornem., *Hort. Hafn.*, 2: 752 (1815).

S. pinnatus var. *β latiloba* Lowe, *Man. Fl. Mad.*, 1: 551 (1868).

S. pinnatus var. *∞ angustiloba* Lowe, *loc. cit.*

17A. subspecies *pinnatus*

17B. subspecies *canariensis* (Schultz Bip.) Aldridge, *comb. et stat. nov.*

Syn. *Sonchus pinnatus* var. *canariensis* Schultz Bip. in Webb & Berth., *Phyt. Canar.*, 3(2): 411 (1849-50).

Sonchus canariensis (Schultz Bip.) Boulos in *Nytt Mag. Bot.*, 14: 14 (1967).

17C. subspecies *palmensis* (Schultz Bip.) Aldridge, *comb. et stat. nov.*

Syn. *Sonchus pinnatus* var. *palmensis* Schultz Bip. in Webb & Berth., *Phyt. Canar.*, 3(2): 441 (1849-50).

Sonchus palmensis (Schultz Bip.) Boulos in *Nytt Mag. Bot.*, 14 : 13 (1967).

KEY TO THE SPECIES

1 Involucres floccose-tomentose, at least at the base
2 Leaf-margins doubly serrulate .... 2. *congestus*
2 Leaf-margins doubly spinulose, denticulate or sparsely denticulate
3 Involucres densely floccose-tomentose throughout
4 Capitula 10 - 11 x 9 - 10 mm .... 13. *bornmuelleri*
4 Capitula 17 - 23 x 14 - 18 mm .... 14. *acaulis*
3 Involucres floccose-tomentose only at the base
5 Stem tall and branched, 30 - 150 cm high .... 11. *hierrensis*
5 Stem a short caudex, 1 - 10 cm high
6 Capitula 10 - 13 x 10 - 13 mm .... 8. *gonzalezpadroni*
6 Capitula 18 - 20 x 14 - 15 mm .... 10. *ortunoi*
1 Involucres glabrous
7 Leaves petiolate
8 Leaf-lobes narrowly-triangular to triangular or angular-ovate
9 Leaf-lobes angular-ovate, with the proximal angle more pronounced; penduncle bracts 10 - 21 .... 6. *fauces-orci*
9 Leaf-lobes narrowly-triangular to triangular; peduncle bracts 2 - 8 4. *pinnatifidus*
8 Leaf-lobes filiform or linear- to oblong-lanceolate
10 Leaf-lobes lanceolate to oblong-lanceolate, mostly more than 5 mm wide; capitula 10 - 15 x 3.5 - 12 mm. .... 17. *pinnatus*
10 Leaf-lobes filiform, linear or linear-lanceolate, mostly less than 5 mm wide; capitula 5 - 10 x 1.5 - 5 mm.
11 Corolla 6.5 - 10 mm long; pendant shrubs .... 16. *leptocephalus*
11 Corolla 12 - 14 mm long; erect tree-like shrubs .... 15. *arboreus*
7 Leaves sessile with sheathing bases
12 Leaves pruinose
13 Leaf-lobes narrowly- to broadly-triangular; capitula 22 - 30 x 18 - 30 mm .... 5. *platylepis*
13 Leaf-lobes ovate to broadly-ovate, angular with the proximal angle more pronounced; capitula 9 - 14 x 8 - 13 mm
14 Lower inflorescence-bracts lobed, auriculate, not scarious ...... 7. *radicatus*
14 Lower inflorescence-bracts mostly entire, not auriculate, scarious 9. *ustulatus*
12 Leaves glabrous
15 Stem a short caudex, 1 - 12 cm, scarcely branched
16 Inflorescence lax; capitula 8 - 13 mm long .... 9. *ustulatus*
16 Inflorescence dense; capitula 15 - 17 mm long .... 12. *daltonii*
15 Stem long, 15 - 400 cm, much branched
17 Capitula 11 - 14 x 5 - 7 mm .... 1. *brachylobus*
17 Capitula 16 - 22 x 10 - 20 mm .... 3. *fruticosus*

KEYS TO THE SUBSPECIES

Sonchus radicatus Aiton
1 Capitula arising in clusters of three or more, at least at the termination o fthe primary inflorescence-stem; plant erect on cliff ledges (North coast, Tenerife; North-east, Gomera) .... 7A. *radicatus*
1 Capitula arising singly, rarely in pairs, from along the length of the inflorescence-stem; plant pendant on vertical cliffs
2 Leaf-lobes with proximal angles not overlapping the midrib (South coast, Tenerife) .... 7B. *gummifer*
2 Leaf-lobes with proximal angles overlapping the midrib (East Tenerife) 7C. *tectifolius*
Sonchus ustulatus Lowe
1 Leaf-lobes linear-lanceolate, sometimes almost pinnatifid (South coast, Madeira .... 9A. *ustulatus*
1 Leaf-lobes ovate to broadly-ovate, sometimes angular (North coast, Madeira; Porto Santo; Desertas) .... 9B. *maderensis*
Sonchus leptocephalus Cass.
1 Leaf-lobes linear, plane (Gomera; North Tenerife; North Gran Canaria) .... 16A. *leptocephalus*

1 Leaf-lobes filiform, terete (South Tenerife; South Gran Canaria) ...... 16B. *capillaris*

Sonchus pinnatus Aiton
1 All leaves with depth of lamina to midrib between lobes 0 - 1.5 mm (Madeira) 17A. .... *pinnatus*
1 Most leaves with depth of lamina to midrib between lobes more than 1.5 mm
  2 Capitula 10 - 12 mm in diameter (Gran Canaria; Tenerife) .... 17B. *canariensis*
  2 Capitula 3.5 - 6 mm in diameter (La Palma) .... 17C. *palmensis*

ACKNOWLEDGEMENTS

An expedition to the Canary Islands in the spring of 1973 was undertaken with the aid of grants from the John Spedan Lewis Trust for the Advancement of the Natural Sciences, the Godman Exploration Fund, the University of Reading Research Board, the University of Reading, Botany Department and the Gilchrist Educational Trust. For all this aid I am most grateful. I also wish to thank Dr. D. Bramwell for providing me with material from his personal collections.

REFERENCES

ALDRIDGE, A. E. 1975. *Taxonomic and anatomical studies in* Sonchus L. *subgenus* Dendrosonchus *Webb ex Schultz Bip. and related genera.* Unpubl. PhD Thesis, University of Reading.
ALDRIDGE, A. E., 1976. A critical reappraisel of the Macaronesian *Sonchus* subgenus *Dendrosonchus* s.l. (Compositae - Lactuceae). *Bot. Macar.*, 2: in press.
BOULOS, L., 1965. *Babcockia,* un nouveau genre de Composées des iles Canaries. *Bull. Jard. bot. État Brux.*, 35: 63-6.
BOULOS, L., 1967a. *Taeckholmia,* a new genus of Compositae from Canary Islands. *Bot. Not.*, 120: 95-108.
BOULOS, L., 1967b. Nomenclatural changes and new taxa in *Sonchus* from the Canary Islands. *Nytt. Mag. Bot.*, 14: 7-18.
BOULOS, L., 1972. Révision systématique du genre *Sonchus* L. s.l. I. Introduction et classification. *Bot. Not.*, 125: 287-305.
BOULOS, L., 1973. Révision systématique du genre *Sonchus* L. s.l. IV. Sous-genre 1. *Sonchus. Bot. Not.*, 126: 155-96.
BOULOS, L., 1974. Révision systematique du genre *Sonchus* L. s.l. V. Sous genre 2. *Dendrosonchus. Bot. Not.*, 127: 7-37.
BOULOS, L., 1974b. Révision systématique du genre *Sonchus* L. s.l. VI. Sous-genre 3. *Origosonchus.* Genre *Embergeria, Babcockia* et *Taeckholmia. Species exclusae et dubiae.* Index *Bot. Not.*, 127: 402-51.
DAVIS, P. H. & HEYWOOD, V. H., 1965. *Principles of Angiosperm Taxonomy. Oliver* & Boyd. Edinburgh and London.
DU RIETZ, G. E., 1930. The fundamental units of biological taxonomy. *Svensk Bot. Tidskr.* 24: 333-428.
ROTHMALER, W., 1944. Systematische Einheiten in der Botanik. *Feddes Repert. Spec. Nov. Regni. Veg.*, 54: 1-22.
ROTHMALER, W., 1954. Terminologie des subdivisions de l'espece. 8e *Congr. Int. Bot. Paris, Rapp. & Comm.*, 1(4): 67-74.
ROTHMALER, W., 1955. *Allgemeine Taxonomie und Chorologie der Pflanzen.* Ed. 2. Jena.

BOTANICA MACARONESICA 2 (1976)

THE JARDIN BOTANICO "VIERA Y CLAVIJO"

D. BRAMWELL

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

RESUMEN

Se expone brevemente lo que ha sido la historia del Jardín Botánico "Viera y Clavijo" que el próximo año cumplirá sus primeros 25 años de vida, después de que lo fundara el insigne Botánico E. R. Sventenius, al que dedicó hasta los últimos años de su vida.

A continuación se señalan las realizaciones conseguidas y actualizadas en una segunda fase de desarrollo, concentradas en la extensión de las actividades del Jardín hacia estudios científicos más modernos y la puesta en marcha de los nuevos laboratorios, herbario, libros y publicaciones.

Se señalan las actuales líneas de estudio seguidas en el Jardín junto con el personal dedicado a ellas, y por último se exponen los proyectos previstos para el futuro desarrollo del jardín y las facilidades que se ofrecen para aquellos botánicos que lo deseen visitar.

CONTENTS

INTRODUCTION

The Jardín Botánico Canario "Viera y Clavijo" is due, next year 1977, to celebrate the 25th aniversary of its foundation by the local government authority the Excmo. Cabildo Insular de Gran Canaria. The garden is dedicated to the cultivation, conservation and scientific study of the Macaronesian Flora especially that of the Canary Islands.

It was between 1950 and 1952 that the distinguished resident botanist Dr. Eric R. Sventenius convinced the then President Don Matías Vega Guerra and the island council that the creation of a garden devoted to the local Canarian Flora would be an extremely foresighted investment for the future. In 1952 his proposal and initial project were accepted and the garden founded.

The first years of the garden, when it was under the very capable direction of Dr. Sventenius, were devoted to the landscaping and planting of a magnificent natural site in the Barranco de Guiniguada near Tafira Alta, a few kilometres from the city of Las Palmas. The scientific labour of the garden during this stage of development was orientated towards the exploration of remote parts of the Canary Islands, and the collection and identification of new and poorly known taxa thus building up herbarium and living collections as a basis for study in the future. At this time Sventenius was also the senior botanist at the Jardín de Aclimatación de La Orotava, on the island of Tenerife, where the bulk of his herbarium collections are still to be found.

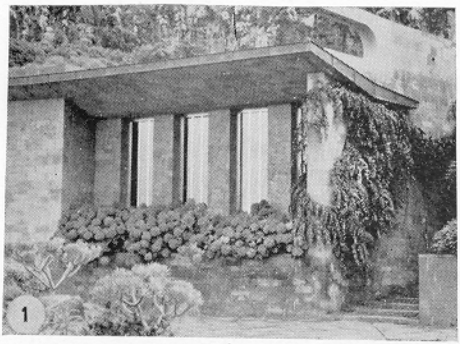
The results of this work were published at regular intervals and culminated in 1960 with the appearance of "Additamentum ad Floram Canariensem", one of the major 20th Century works on the Canarian flora and which was intended by its author to be a supplement to Webb & Berthelot's "Phytographia Canariensis". A further series of papers "Plantae Macaronesienses Novae vel minus Cognitae" was also published by Sventenius from 1969-71 following visits to the island of Madeira, the Cape Verde Islands and the Salvage Islands.

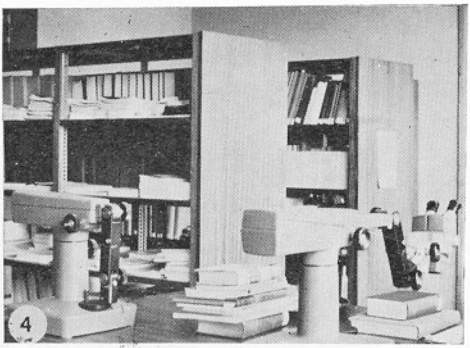
During this period Sventenius collected together a substantial personal library of books and reprints on the Macaronesian, Iberian and African Floras and on succulent plants. This library was, following Sventenius' untimely death in a road accident in 1973, presented to the garden by his family.

Towards the end of this first phase of development Sventenius initiated a programme of more modern scientific studies of the Canarian flora and, probably influenced by an old friend Prof. G. Erdtman, started palynological research with the aid of a post-graduate assistant. It is on this considerable legacy that we have, in the past two years been able to lay the foundations of the most recent phase of the expansion of both the scientific and public aspect of the botanical garden.

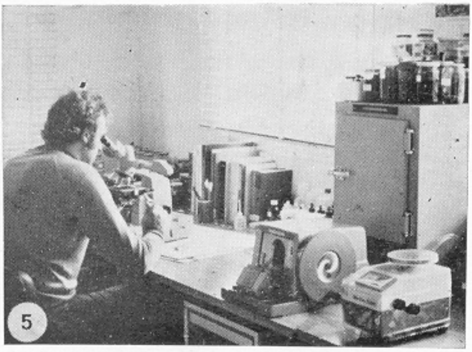
NEW FACILITIES

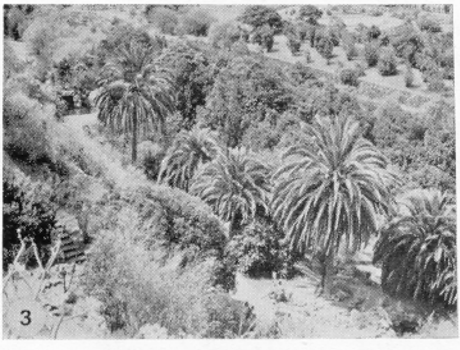
In August 1974 the Jardín Botánico Canario "Viera y Clavijo"


1


4


2


5


3

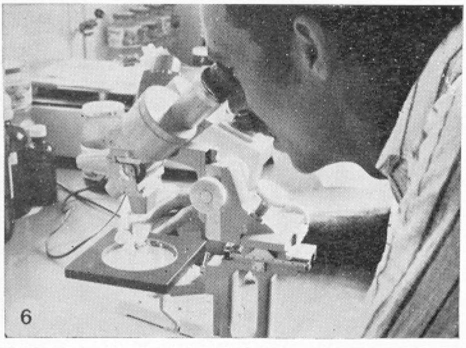

6

Plate 1. Jardín Botánico "Viera y Clavijo" : 1 . Laboratory and administration building. 2 & 3 Views of the garden. 4. Library and herbarium. 5 & 6 View of laboratory section.

began its second phase of development which has, so far, concentrated on the extension of research activities. It was immediately obvious that this could not take place without more research space, facilities, equipment, library etc., and the funds available to the garden have been generously increased to allow for this expansion.

LIBRARY AND PUBLICATIONS

The garden library started in 1974, now contains over 2000 volumes including the Sventenius collection and forms a working basis for taxonomic studies and for modern plant research in the fields of ecology and conservation, cytogenetics, palynology, anatomy and biosystematics.

An extensive reprint collection especially on Macaronesian topics is also available. The garden receives a number of journals and the publication of a new periodical "Botanica Macaronésica" should lead to a considerable increase in the number of journals taken by exchange. The garden also publishes an annual seed-list (Index Seminum) and various publicity leaflets. A Spanish language edition of D. & Z. I. Bramwell "Flores Silvestres de las Islas Canarias" will be published in October 1976.

HERBARIUM

The scientific personell of the garden are currently engaged in the formation of a Macaronesian herbarium. The basis of the herbarium, at present, is part of the Sventenius collection especially specimens from Gran Canaria, La Palma, Salvage Islands and Cape Verde Islands. Canary Islands and Madeira specimens collected by D. Bramwell and various other workers are also available It is hoped that the herbarium will in future be a major repository for Macaronesian plants. The garden staff will undertake the collection of herbarium specimens, seeds, etc., for genuine research workers whenever possible.

LABORATORIES

New laboratories have been set up for modern research in systematic and evolutionary botany in order to study living material, populations in the field and in comparative cultivation and generally take advantage of the "natural island laboratory" that is the Canarian Archipelago.

The garden has cytology, anatomy, palynology and ecology laboratories and a scanning electron microscopy unit and these will, in the near future, be moved to a new building with further room for expansion.

RESEARCH IN PROGRESS

Research projects currently in progress are under the general supervision of the garden director Dr. D. Bramwell in conjunction with an internationally - based scientific advisory committee. This committee is a unit of the recently formed garden council which meets twice a year to consider and advise on all aspects of the garden's development.

The principal research under way at present is as follows:

DR. D. BRAMWELL,	Flora of Macaronesia. Cytotaxonomy and biosystematics of the Canarian Flora. The genera *Echium* and *Silene* in Macaronesia.
JULIA M.ª PEREZ DE PAZ,	Biosystematics of Macaronesian *Senecio* species. Palynology of Canarian endemics.
JOSE ORTEGA GARCIA,	Cytogenetics of Macaronesian *Lotus* and other Leguminosae. Ecological variation in Canarian *Sideritis*.
BERNARDO NAVARRO VALDIVIELSO,	Reproductive biology of Canarian endemics. Pollination mechanisms.
ANA ROSA BARRY GOMEZ,	Systematic anatomy of forest tree species. Comparative study of epidermis and trichomes.
VICTOR MONTELONGO PARADA,	Reproductive ecology. Dispersal mechanisms in Canarian endemics. Biology of halophytes.
ALICIA ROCA SALINAS,	Palynology of Canarian endemics, especially Labiatae. Comparative morphology and structure of pteridophyte spores.
MIGUEL ANGEL MORENO CAMENO,	Biosystematics and cytotaxonomy of Macaronesian *Tolpis* species. Ecology of Lichens in pioneer habitats.
M.ª NIEVES GONZALEZ HENRIQUEZ,	Ecology of *Zostera marina* and its epiphytes. Cryptogamic botany.
DR. ANGELA ALDRIDGE,	Anatomy and evolution of woody insular endemics. Macaronesian *Sonchus*. Macaronesian *Bryophyta*.

FUTURE DEVELOPMENT

A new building has been aquired for the garden and work will begin towards the end of 1976 on converting the interior to house the library, herbarium and laboratories more adequately than at present. It is hoped that this will be completed in 1977. Four postgraduate studentships will also be available from September 1976 through the "Plan Cultural" of the Province of Las Palmas de Gran Canaria, and several new research projects will, therefore, be started.

A landscape project for the development of all 26 hectares available to the garden has been drawn up and has been accepted in principle. Work has already started on the initial phases of this and it is hoped that it will go ahead quickly when discussions concerning finance and staff are completed.

FACILITIES FOR VISITING BOTANISTS

The existence of this relatively new and important research centre is not generally known to outside workers and, therefore, the facilities available are sometimes overlooked. As general policy the garden welcomes short-and long-term visits by research workers with a supecial interest in island botany and the Macaronesian flora. Such visits stimulate interest and scientific exchange of material and ideas and, when the new building is completed, extra laboratory space will be available to house visiting workers.

NOTA PARA LOS AUTORES

1.—Botánica Macaronésica publica trabajos científicos originales en español o inglés dentro del tema de botánica descriptiva y experimental relacionada con la región Macaronésica (Islas Canarias, Madeira, Azores, Islas de Cabo Verde e Islas Salvajes).

2.—Los trabajos son aceptados para su publicación bajo el asesoramiento de al menos un árbitro independiente.

3.—Los manuscritos presentados deberán ajustarse al estilo utilizado en Botánica Macaronésica N.º 2. Un resumen conciso y cuadro sinóptico deberán ser incluídos.

4.—Los manuscritos deberán ser mecanografiados a doble espacio y solamente en una cara de papel.

5.—Los nombres científicos en latín deberán ser subrayados con una sola línea, todas las demás marcas deberán ser dejadas a los editores.

6.—Fotografías en blanco y negro y grabados de buena calidad son aceptados como también material ilustrativo.

7.—Los manuscritos deberán ser enviados al Editor, Botánica Macaronésica, Jardín Botánico "Viera y Clavijo", Tafira Alta, Las Palmas de Gran Canaria, Islas Canarias, España.

8.—Los autores recibirán 50 separatas gratis y también pueden encargar más de antemano a precio de costo.