

VARIATION IN LEAF FORM AND FLOWERING PERIOD OF CAPEWEED
(*ARCTOTHECA CALENDULA*)

H. Wood

School of Science and Technology, Charles Sturt University,
Wagga Wagga NSW 2678, Australia

Summary. A total of 332 specimens of capeweed from major Australian herbaria, comprising 578 separate plants, were examined in an investigation of leaf-form variation and flowering period across the continent. The degree of leaf incision ranged from almost entire margins to highly dissected leaves and was not related to habitat or land use. The incidence of leaf-form types varied significantly among States, suggesting that at least three separate introductions of capeweed occurred in Western Australia, South Australia and New South Wales. Over 97% of the plants in this study were flowering when collected, and specimens were located in flower in every month of the year although the majority occurred in the latter half of the year. The relationship between collection date and latitude was significant with later collections in more southerly locations.

INTRODUCTION

The ability to predict in advance which plant species are likely to pose weed problems when introduced to a new environment remains an elusive goal for weed scientists. With a few notable exceptions (1, 2), the history of introduction and spread of existing weeds is one source of information to which little attention has been paid (3). Plant specimens preserved in herbaria provide a readily available source of historical information about introduction patterns, rates of spread, changes in morphology over time and other aspects of the biology and ecology of the species. This paper is part of a larger study of capeweed introduction and spread in Australia based on herbarium specimens and other historical sources (Wood, unpublished data).

METHODS

Herbarium specimens of capeweed from the following herbaria were examined: the State Herbarium of South Australia, the Queensland Herbarium, the Tasmanian Herbarium, the Western Australian Herbarium and the Australian National Herbaria in Canberra, Melbourne and Sydney. All 332 specimens collected prior to 1985 were examined and for each specimen the date, location of collection and collector's comments (if any) were recorded, and the latitude and longitude of each location was determined where possible; not all information was available for every specimen. Only four specimens were collected from the Northern Territory and these were not included in the analyses described in this paper. Some specimens consisted of several plants on a single sheet and for each of the 578 plants the flowering status and leaf form were also recorded where possible.

Leaf form was scored in three subjective categories: relatively smooth leaf margin (designated as type A), moderately incised leaf margin (type B) and highly incised leaf margin (type C). The type C leaf form was the least common and for some analyses types B and C were combined to yield an adequate sample size. Information about the habitat and land use at the collection site was available for 146 plants; the categories used in the analysis were disturbed ground (including roadsides), urban areas, agricultural land and others. Insufficient data were

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available to analyse cultivation and grassland separately. Data were analysed using G-tests for equality of proportions (4) and the 0.1% significance level was used throughout.

RESULTS AND DISCUSSION

Leaf form. A significant difference in leaf form among States was observed (Table 1). Over 95% of plants collected in SA and Tas were type A, and Type C plants were virtually absent. By contrast over 44% of plants collected in NSW (including ACT) were types B and C, and other States had intermediate leaf form patterns. There was no relationship between leaf form and either latitude or land use at the site of collection.

Table 1. Summary of plant collection data by State

State	WA	SA	NSW ^a	Vic	Qld	Tas
Number of plants	62	263	93	59	58	43
Type A (%)	68.3	96.5	55.4	65.5	64.3	95.2
Type B (%)	26.7	3.5	38.6	31.0	28.6	2.4
Type C (%)	5.0	0	6.0	3.4	7.1	2.4
(n)	(60)	(260)	(83)	(58)	(56)	(42)
Flowering (%)	96.7	96.9	98.9	94.7	96.2	100
Flowering in						
Jan-Mar (%)	0	0.4	0	12.5	0	14.6
Apr-June (%)	1.9	0.8	1.1	6.3	0	2.4
July-Sept (%)	65.4	40.6	88.9	22.9	62.0	17.1
Oct-Dec (%)	32.7	58.2	10.0	58.3	38.0	65.9

^a Includes ACT

The variation among States is probably the result of separate introductions of capeweed with differing leaf forms. The earliest recorded collections of capeweed in Australia date from the 1830s in WA, followed by SA in the 1840s and NSW in 1865 (Wood, unpublished data). The populations in southern Qld were probably derived from a northward expansion from NSW, while the pattern of introduction into Vic and Tas is less clear. It is intriguing to speculate that the dissected-leaf form may have been better adapted to the more humid climate of the east coast than the smooth-margined form. A survey of the current distribution of capeweed leaf forms in NSW is planned for 1994.

The proportion of type A plants collected has increased significantly over time, however this may be attributable to the preponderance of SA specimens collected in the recent past; about 45% of all plants were collected in SA and of these 81% were collected after 1964. When data from individual states (SA and NSW) were analysed separately there was no change in leaf form incidence over time, but data sets may have been too small to detect trends.

Flowering. Overall 97% of all plants collected were in flower; this percentage did not vary significantly among States (Table 1). Plants in flower were collected in all months of the year,

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but almost all collections (97%) occurred in the second half of the year. Collection month was significantly related to latitude (Table 2) with flowering plants collected later at more southerly latitudes.

While this observation is not conclusive evidence of a later flowering season with increasing latitude (it is possible that, for a variety of reasons, collection activity in more southerly locations increases towards the end of the year), variation in flowering season with latitude due to photoperiodic effects is well known (5) and this is the most likely explanation. The significant difference in collection incidence among the States (Table 1) is most probably a reflection of the latitude effect.

Table 2. Relationship between collection month and latitude of capeweed specimens collected in flower. Values are percent plants from each latitude range collected in each quarter.

Latitude (°S)	(n)	Jan-Mar	Apr-June	July-Sept	Oct-Dec
<30	(70)	0	0	60.0	40.0
30-34	(261)	0.4	0.4	48.3	51.0
35-39	(149)	4.0	0	40.3	55.7
40+	(40)	15.0	0	17.5	67.5

ACKNOWLEDGEMENTS

The assistance of the Director and staff of the Australian National Herbarium, Canberra, is gratefully acknowledged.

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