

Weed flora of South Africa 1: major groupings

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ABSTRACT

Whilst attention has been focussed on combating priority weeds we have neglected to obtain an overall picture of our weed flora. To rectify the position a National Weed List has been compiled, the weeds have been classified and an analysis made of the weed flora. Aspects covered in this paper are: major taxa, exotic and indigenous species and kinds of weeds.

The presence of imbalances or power shifts between indigenous taxa is indicated by the fact that most weeds are supplied by a few families, and that Monocotyledon species are twice as likely to be weeds as are Dicotyledon species. The preponderance of Monocotyledon weeds is explained by re-invasion of cultivated and abandoned fields in grassland areas rather than by a shift towards Monocotyledon species in the veld.

Exotic weeds contribute to imbalances via their greater versatility as well as by re-inforcing some taxa or kind of weed groupings at the expense of others. There is a power shift towards exotic Gymnosperms. Apart from flora weeds, exotics provide most agrestals, lawn weeds and weeds of planted pastures, and nearly as many ruderals as the indigenous species.

RÉSUMÉ

LA FLORE DES PLANTES NUISIBLES D'AFRIQUE DU SUD 1: PRINCIPAUX GROUPEMENTS

Tandis que l'attention se concentrait sur la lutte contre les plantes nuisibles prioritaires, on avait négligé la recherche d'une connaissance exhaustive de notre flore de plantes nuisibles.

Pour remédier à cette situation, on a établi un Catalogue national des plantes nuisibles, ces dernières ont été classées et leur flore a fait l'objet d'un examen approfondi. Les aspects traités dans cette note sont: les principaux taxons, les espèces exotiques et indigènes et les diverses catégories de plantes nuisibles.

La présence de déséquilibres ou de changements de dynamisme entre taxons indigènes tient au fait que la plupart des plantes nuisibles appartiennent à quelques familles seulement et que les espèces monocotylédones ont deux fois plus de probabilité d'être des plantes nuisibles que les espèces dicotylédones. La prépondérance de plantes nuisibles monocotylédones résulte de la réinvasion des champs cultivés et abandonnés dans des régions herbeuses plutôt que par un changement favorable aux monocotylédones dans le veld.

Les plantes nuisibles exotiques contribuent à des déséquilibres par leur versatilité plus grande, de même qu'en renforçant certains taxa ou certaines catégories de groupements de plantes nuisibles aux dépens des autres. Il y a un changement de dynamisme en faveur des Gymnospermes exotiques. En dehors des plantes nuisibles de la flore, les exotiques fournissent la plupart des plantes agrestes, des mauvaises herbes des pelouses et des plantes nuisibles des pâturages artificiels, et à peu près autant de plantes rudérales que les espèces indigènes.

1. INTRODUCTION

In the past 20 years there has been a growing realization of the importance of weeds, not only as competitors with our crops and pastures, but also as invaders of natural vegetation and water-systems. Attention has rightly been focussed on pest plants such as *Stipa trichotoma* (nassella tussock), *Opuntia aurantiaca* (jointed cactus), the Australian *Hakea* and *Acacia* species, and *Eichhornia crassipes* (water hyacinth). Whilst these pest plants demand our attention and their control still stretches our resources to the limits, it is understandable that less obviously important weeds receive little attention.

The dangers are that: without assessment of weed status, *ad hoc* decisions may be made, and these can be costly; without monitoring of changes in weed status all chance of early control can be lost; without a picture of the weed scene as a whole groups of plants (whose component species may be relatively unimportant) can invade unnoticed and unchecked, and; without a knowledge of *all* the weeds of a

particular crop or vegetation type, control of the most important species may achieve nothing more than opening the way to other species in the 'pecking order'.

The first step in obtaining a perspective of our weed flora, has been to draw up a National Weed List which, we hope, will provide a platform for decision-making in the fields of weed research, control and legislation.

2. THE NATIONAL WEED LIST

The National Weed List has been compiled from the literature, from herbarium records and by consulting correspondents (Balsinhas *et al.*, in press).

It has not been possible at this stage to check in any depth the weedy credentials of every species put forward for inclusion in the list. We have been guided by our correspondents working in weed-related fields such as pasture science, crop production and nature conservation. On their advice, we have taken a conservative line in not including all the less troublesome species associated with woody encroachment in the veld. Perhaps the best measure of the conservatism of our approach is that of the more than 20 000 vascular plant species indigenous to South Africa only 4-5% are presently

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included in the weed list. This compares with over 50% of the flora of the United States of America 'considered undesirable by some segment of society' (USDA Agricultural Research Services, 1970).

Initially the weeds in the list were classified according to taxa, and whether they were exotic or indigenous. A preliminary analysis at this stage (Wells *et al.*, 1981) showed, *inter alia*, that: the list contains the names of some 1 600 species; it is growing fast, with an ever-increasing proportion of indigenous species being regarded as weeds and; although our weeds (both indigenous and exotic) come from 137 plant families, over 50% of the species are supplied by six families (Poaceae, Asteraceae, Fabaceae, Cyperaceae, Solanaceae and Lamiaceae).

3. ANALYSIS OF OUR WEED FLORA

3.1 Major taxa

Since the first analysis was made, a few species of doubtful weediness have been eliminated from the list. It now contains the names of 1 573 species of which 56% are indigenous and 44% exotic.

The contributions of the major taxa, the Dicotyledons, Monocotyledons, Gymnosperms and Pteridophytes, to the list has been analysed in Tables 1, 2 and 3.

Nearly two-thirds of our indigenous weed species are Dicotyledons (almost all the rest are Monocotyledons). Indigenous Gymnosperms are particularly unaggressive and, though the ferns contain a number of weeds, very few are serious pests.

If the contribution of the major taxa is analysed in terms of species available that could have become weeds, then the Monocotyledons are seen to have by far the highest percentage of weediness—almost double that of the Dicotyledons.

Exotic weeds add only 3 to 4% in numbers of species to the three largest taxa (the Dicotyledons, Monocotyledons and Pteridophytes) but add over 24% to the Gymnosperms, indicating a possible shift in their favour.

In the Dicotyledons the numbers of indigenous and exotic weed species are almost equal, but in the Monocotyledons indigenous weed species outnumber exotics two to one. Whether this indicates that

we have particularly aggressive indigenous Monocotyledons, ready to fill the available niches caused by disturbance, is not clear. It would be revealing to compare the South African figures with those of other countries to see whether this is a local or general phenomenon.

The Monocotyledons contain the highest percentage of indigenous, weedy genera and families — indicating that their richness in weedy species is not due to one species-rich family, the Poaceae, alone. Further investigation of this point reveals that although the Poaceae contributes nearly all (120 out of 145) of the *exotic* Monocot. weeds, it contributes only about half (155 out of 294) of the *indigenous* Monocotyledon weed species. Other Monocot. families that are major contributors of indigenous weed species are the Cyperaceae and the Liliaceae.

The exotic weed species (694 of them) belong to 384 genera, of which 218 (57%) are new to the country. Of the 90 families that they belong to, 10 are also new to the country.

3.2 Kinds of weeds

To evaluate these apparent changes in the fortunes of taxa, calls for further classification of our weed flora into different kinds of weeds (Table 4)

- ruderals — weeds of waste places e.g. roadsides and old lands,
- agrestals — weeds of crops, orchards and gardens,
- silvicultural — weeds of forestry plantations,
- floral — naturalized exotics that compete with the indigenous flora,
- pastoral — weeds of grassland.

The percentages shown in Table 4 refer to the number of indigenous or exotic weeds in a particular category relative to the number of weeds classified (1 573). The percentages total well over 100, because many species occur as weeds in more than one category. For example, *Bidens pilosa*, the blackjack is both a ruderal and an agrestal and, since it is an exotic naturalized in the veld, it is also a flora weed.

To enable a clearer distinction to be drawn between weeds of the veld and other weeds it was

TABLE 1.—Indigenous and exotic weed species within major taxa in South Africa

Major taxa	(A) Total no. indigenous species	(B) Indigenous weed species	(C) % weediness $\frac{B}{A} \times 100$	(D) Exotic weed species	(E) Total weed species B + D
Dicotyledons	15 472	574	3.7	531	1 105
Monocotyledons	4 307	294	6.8	145	439
Gymnosperms	37	0	0	9	9
Pteridophytes	228	11	4.8	9	20
Total (vascular plants)	20 044	879	4.4	694	1 573

TABLE 2.—The numbers of indigenous and exotic weed genera within major taxa in South Africa

Major taxa	(A) Total no. indigenous genera	(B) Indigenous genera containing indigenous weed species	(C) % indigenous genera containing indigenous weeds $\frac{B}{A} \times 100$	(D) Genera containing exotic weed species		
				Indigenous genera	Exotic genera	Total
Dicotyledons	1 472	269	18	113	179	292
Monocotyledons	456	113	25	48	33	81
Gymnosperms	5	0	0	0	2	2
Pteridophytes	70	12	17	5	4	9
Total (vascular plants)	2 003	394	20	166	218	384

TABLE 3.—The numbers of indigenous and exotic weed families within major taxa in South Africa

Major taxa	(A) Total no. indigenous families	(B) Indigenous families containing indigenous weed species	(C) % indigenous families containing indigenous weeds $\frac{B}{A} \times 100$	Families containing exotic weed species		
				Indigenous families	Exotic families	Total
Dicotyledons	159	73	46	63	6	69
Monocotyledons	36	19	53	12	2	14
Gymnosperms	5	0	0	0	1	1
Pteridophytes	27	8	30	5	1	6
Total (vascular plants)	227	100	44	80	10	90

necessary to subdivide the pastoral weeds category (Table 5).

The various kinds of weeds can be grouped according to the kind and degree of disturbance in their habitats, which is linked to their position in the plant succession.

The largest group are weeds of the veld, where disturbance results mainly from combinations of grazing and burning and where the communities may be pre- or post-climax. This group includes weeds of natural pastures, flora weeds and recreational weeds, totalling 1 088 species.

The next largest group are weeds of waste areas i.e. previously cleared areas at various stages of succession back to veld. These are the ruderals, totalling 835 species.

The last and smallest group are the weeds of areas that are maintained in a state of disturbance i.e. agrestal weeds, silvicultural weeds, lawn weeds and weeds of planted pastures, totalling 558 species.

3.2.1 *Kinds of weeds in major taxa*

Investigation of the weeds of major taxa that appear to be on the increase shows that:

(a) Most indigenous Monocotyledon weeds (including grasses) are agrestals and ruderals i.e. their preponderance does not reflect a power shift in the veld so much as attempts to re-invade cultivated and abandoned lands in areas naturally occupied by grassland.

(b) The exotic Gymnosperm weeds, on the other hand, are all weeds of the veld and their preponderance does reflect a power shift between major taxa.

3.2.2 *The contribution of exotics*

Exotic weeds are in the minority: 694 exotic species to 879 indigenous species (see Table 1) yet they figure in more 'kind of weed' categories — 1 275 to 1 206 (see Table 4). The species/category ratio is 1,8 for exotics and 1,4 for indigenous species, indicating that the exotics have, on the whole, considerably greater versatility as weeds than have the South African species in their home environment.

Indigenous species supply most pasture weeds, ruderals, silvicultural weeds and recreational weeds. Exotics provide all the flora weeds, most agrestals, lawn weeds and weeds of planted pastures, and

TABLE 4. —The distribution of indigenous and exotic weeds in 'kind of weed' categories

Kind of weed categories	Weed species					
	Indigenous		Exotic		Total	
	Number	% *	Number	% *	Number	% *
Ruderal	445	28	390	25	835	53
Agrestal	176	11	265	17	441	28
Silvicultural	48	3	24	2	72	5
Floral	0	0	481	31	481	31
Recreational	37	2	24	2	61	4
Pastoral	500	32	91	6	591	38
Total species in categories	1 206	76	1 275	83	2 481	159

* of 1 573 = total number of species in the Weed List.

TABLE 5.—The distribution of indigenous and exotic weeds in pastoral weed sub-categories

Kind of weed Categories	Weed species		
	Indigenous	Exotic	Total
Lawn	11	22	33
Planted pasture	4	8	12
Natural pasture	485	61	546
Total pastoral weeds	500	91	591

nearly as many ruderals as do the indigenous species.

3.3 Further classification

The sub-division of the pastoral weed category reveals how few weeds of planted pastures have been recorded. This is almost certainly a short-coming of data gathering, and it is important since these weeds are likely to increase rapidly as efforts as veld improvement are stepped up.

It is our intention to continue sub-dividing and refining the 'kind of weed' categories and it is anticipated that they will become increasingly useful in weed control situations, as this is done. For example, weeds of natural pastures need to be further sub-divided according to veld types or similar vegetation units, and agrestal weeds need to be classified according to the crops where they cause problems.

The weeds in the national list have already been classified in terms of: region or origin, habitat favoured, weedy characteristics, useful characteristics, life cycle, reproduction, growth form and woodiness. These characteristics will be used in further assessments of our weed flora and its effects.

4. CONCLUSIONS

With most weeds being supplied by a few families and with Monocotyledon species almost twice as likely to be weeds as are Dicotyledon species there

appear to be imbalances or power shifts developing between indigenous taxa. Investigation shows that the preponderance of Monocotyledon weeds reflects reinvasion of cultivated and abandoned lands in grassland areas rather than a power shift towards Monocotyledons in the veld. The position at family and species level has still to be investigated.

Exotic weeds contribute to imbalances through their greater versatility as well as by reinforcing some taxa or kind of weed groupings at the expense of others. There is a power shift towards exotic Gymnosperms. Apart from flora weeds exotics provide most agrestals, lawn weeds and weeds of planted pastures, and nearly as many ruderals as do the exotic species.

Classification of weeds helps expand knowledge of our weed flora and helps identify areas where knowledge is lacking. It is essential that the process of classification and assessment should be continued to provide a broad base for weed research, control and legislation.

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