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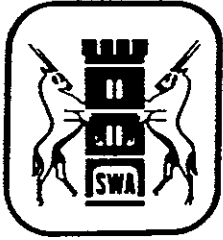
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# Invasive alien organisms in South West Africa/Namibia

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Edited by C J Brown, I A W Macdonald and S E Brown

This report results from a workshop organized by the Directorate of Nature Conservation and Recreation Resorts in Windhoek, and is produced in conjunction with the Council for Scientific and Industrial Research

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## CHAPTER 6 INVASIVE ALIEN PLANTS IN THE NAMIB-NAUKLUFT PARK

R D Vinjevold, P Bridgeford and D Yeaton

### INTRODUCTION

The Namib-Naukluft Park (23 400 km<sup>2</sup>) is situated in the central western region of SWA/Namibia and extends from the escarpment to the coast (Map 3). The park incorporates parts of the mountainous Pro-Namib at Naukluft (Bioclimatic region 3, cf Map 2) and covers the central portion of the Namib Desert (Bioclimatic region 1). The ecology of the extensive dune system south of the Kuiseb River which bisects the park has been extensively studied (eg Seely 1978; Holm and Schaltz 1980). The gravel plains that occur north of the Kuiseb River are less well known (Watson 1980). Most of the invasive alien plants in the park are located in the Kuiseb River (cf Seely et al (1979) and Theron et al (1980) for an account of the riverine fringing vegetation) and in the Swakop River which flows further north. The vegetation of the Swakop River has been extensively modified by livestock ranching up to 1977, when the small-holders were bought out. The Kuiseb River within the park is still occupied by numerous subsistence farmers (Topenaars) who hold large flocks of goats, cattle and donkeys which have extensively modified the vegetation around their well-points.

The following invasive alien species have been recorded for the Namib-Naukluft Park: Argemone ochroleuca, Datura innoxia, D stramonium, Melia azedarach, Nicotiana glauca, Opuntia aurantiaca, Prosopis sp and Ricinus communis.

### SPECIES ACCOUNTS

Argemone ochroleuca (Map 4). Light infestations of this species have been found in the upper Kuiseb and Swakop Rivers, and possibly on the Naukluft plateau. No control measures have been implemented as yet.

Datura innoxia (Map 8). This species is present in all the major water courses in the Park, but heavy infestations have been recorded only along the Kuiseb River. Recently drought has limited infestations in most areas of the Park, but following floods infestation levels increase rapidly. Light infestations also occur throughout the Naukluft mountains, along streams and around old farmsteads and, after rain, along roads. In the Kuiseb River the only areas where D innoxia is absent, apart from the areas where the river has not recently flowed, are around well-points. There is no evidence to indicate that livestock browse this species, so its absence is probably due to the effects of trampling by animals.

To test this point the following experiment was set up: 10 x 1 m<sup>2</sup> plots were randomly chosen at 100 m, 200 m, 400 m, 800 m, 1 600 m, 3 200 m and 6 400 m away from a well. A total of 1 750 pegs, 25 pegs per plot, were placed out. The plots were monitored over a period of one month, in order to determine the intensity of trampling. The results are evident from Figure 6.1.

A monitoring programme for the spread of this species in the Kuiseb is being set up, using transects which have already been sited. Populations will be removed and the rate of reinfestation measured.

Attempts will be made to remove D innoxia from all areas of high public visibility, viz hiking trails in Naukluft, campsites at Homeb on the Kuiseb river, Gobabeb etc. This is purely for aesthetic reasons. The only realistic control or eradication measure which can be envisaged at present would be some form of biological control.

Datura stramonium (Map 9). This species is only known to occur in the Kuiseb River and infestation is medium to dense. It coexists with D innoxia, but appears to prefer the river bank habitat to the riverbed. Monitoring and control will be identical to that described for D innoxia.

Melia azedarach (Map 12) and Opuntia aurantiaca. Both these species occurred historically around farmsteads in the Naukluft region. All Opuntia and most Melia plants have been removed, but it is suspected that rainfall will initiate reinfestation in these areas.

Nicotiana glauca (Map 13). This species has been recorded at low densities in the Kuiseb and Swakop Rivers. It is being removed as it is encountered.

Prosopis sp (Map 15). Dense infestations of this species are found along the entire length of the Swakop River. It also occurs around old farmsteads in the Naukluft region. This species was apparently introduced by early settlers in the German era (the beginning of the century) for shade and fodder. Figure 6.2 indicates how its occurrence in the Swakop River is closely related to early dwellings and well-points, most of which were only recently abandoned by man. This species has the potential to invade all the major rivers and water courses in the Park. Its occurrence has been noted in the headwaters of the Kuiseb, although it has not yet infested the lower reaches of this river, in the Park.

In an experiment to assess the ecological impact of this species a pressure chamber was used to determine the water potential of a Prosopis tree and an indigenous Acacia erioloba of similar size some 10 m away. Readings were taken over a 24 hour period, and results indicate a definite and constant difference, indicating that the Prosopis has access to more water than the A erioloba (Figure 6.3).

The potential rate of spread of this species is not known, but it is probably high during years when the rivers flood. The recent removal of livestock from the infested area may help to check the rate of spread.

Control around the old farmsteads is reasonably feasible, but in the Swakop River control is proving both difficult and time consuming. Tests were carried out with a herbicide, Tordon 155 (2,4,5-T/picloram), and the mortality rate for trees over three metres in height was 60%, while for trees of less than two metres it was 90%. It was found, however, that the herbicide also affected indigenous vegetation, insects and other wildlife. Since the use of such chemicals in a conservation area is not desirable, this form of control has been stopped.

At present mechanical control seems to be the only solution. The situation is complicated by the multistemmed growth form of the trees, particularly in the Swakop River, which makes it difficult to get to the stems and saw them off. The stems show a high potential for regrowth, but are fortunately killed by fire. In December 1984, 105 Prosopis trees were burnt in the Swakop River. By the end of February 1985, after rain and considerable river flooding, no signs of regrowth were evident. At this stage 54 man-days, using chain saws, have been spent on mechanical control operations, with 105 trees burnt (successfully) and another 250 prepared for burning (6,6 trees per man-day).

Prosopis sp is the invasive alien plant which causes the most concern in this Park at present, and will therefore receive the most attention.

Ricinus communis (Map 16). This species has only been recorded in the Naukluft watershed, and the Swakop and Kuiseb Rivers, but it is possible that it also occurs in other rivers in the park. Infestations are light and this species is being, and will continue to be, removed whenever encountered.

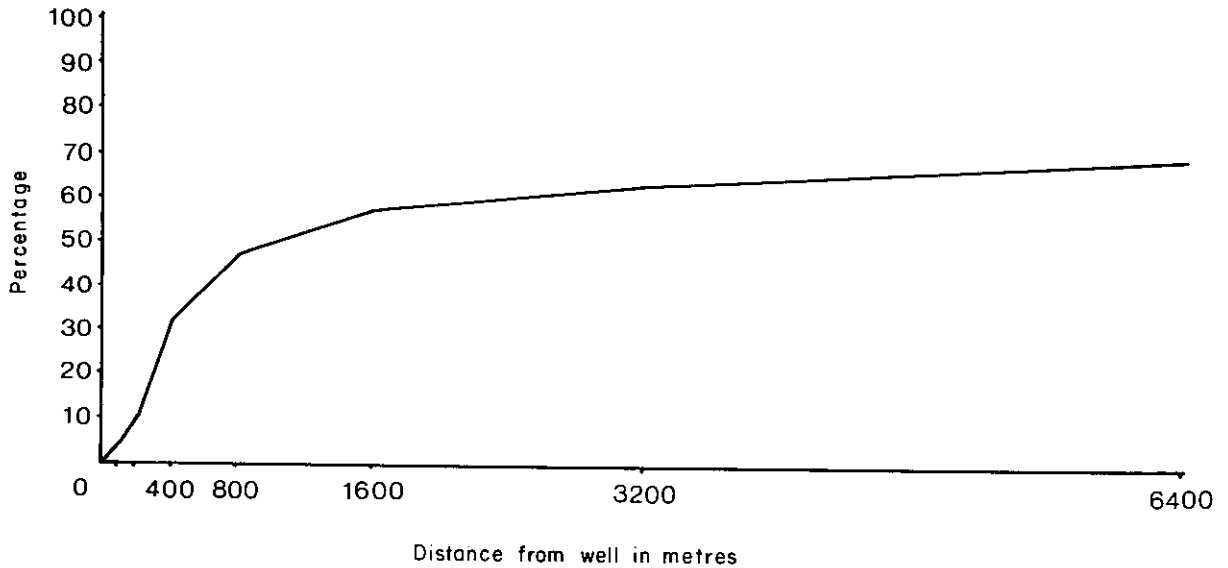


FIGURE 6.1. Percentage of pegs not knocked over by ungulates over one month at different distances from a well in the Kuiseb River.

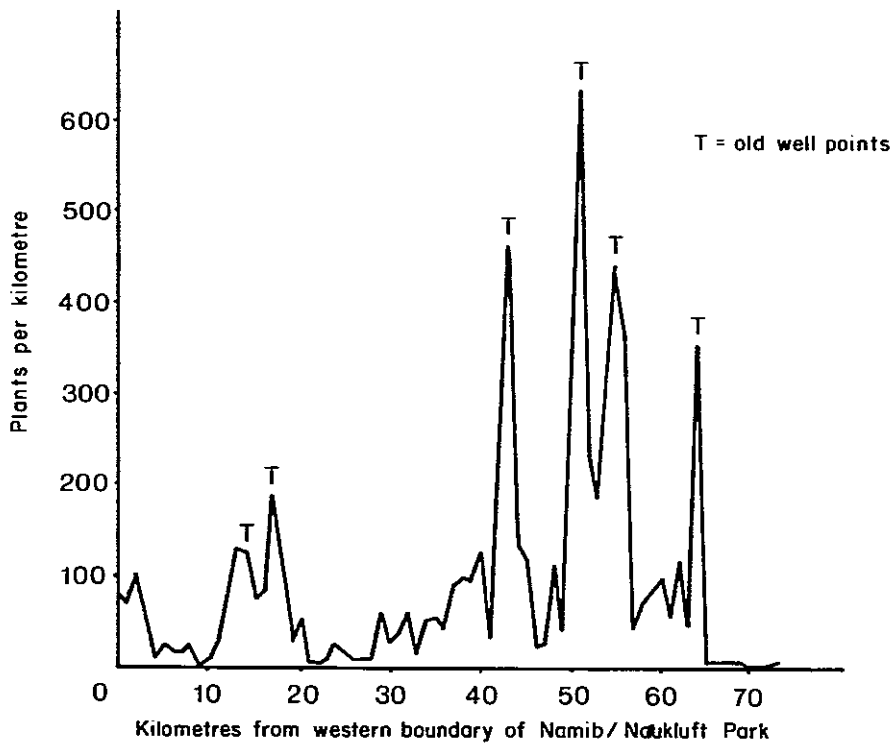


FIGURE 6.2. Density of *Prosopis* sp in the Swakop River related to the occurrence of old well-points.

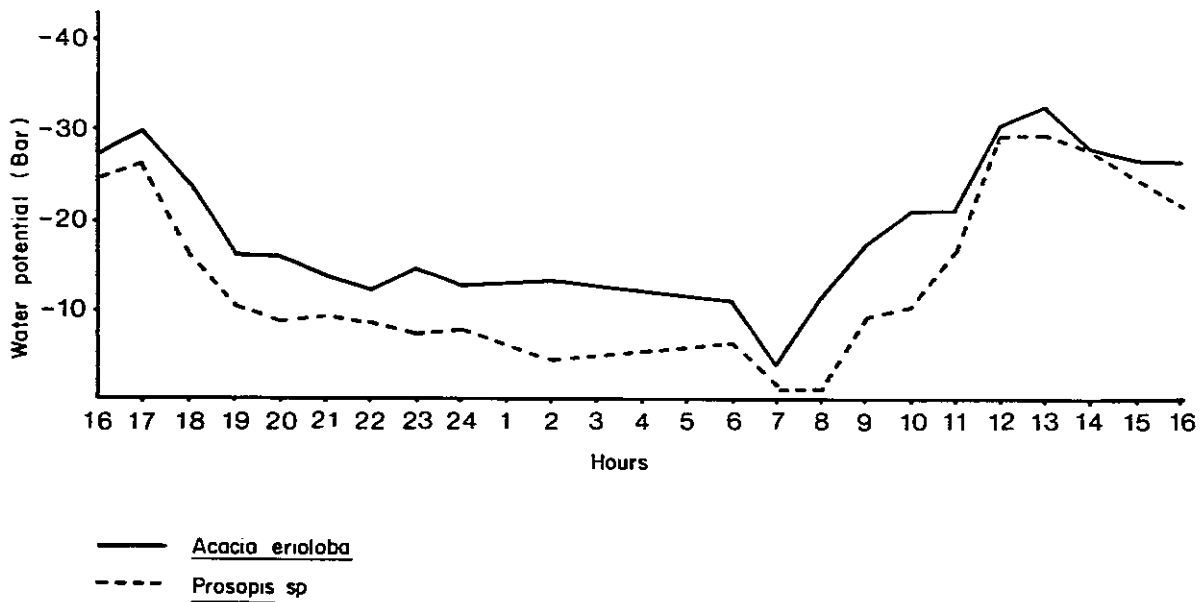
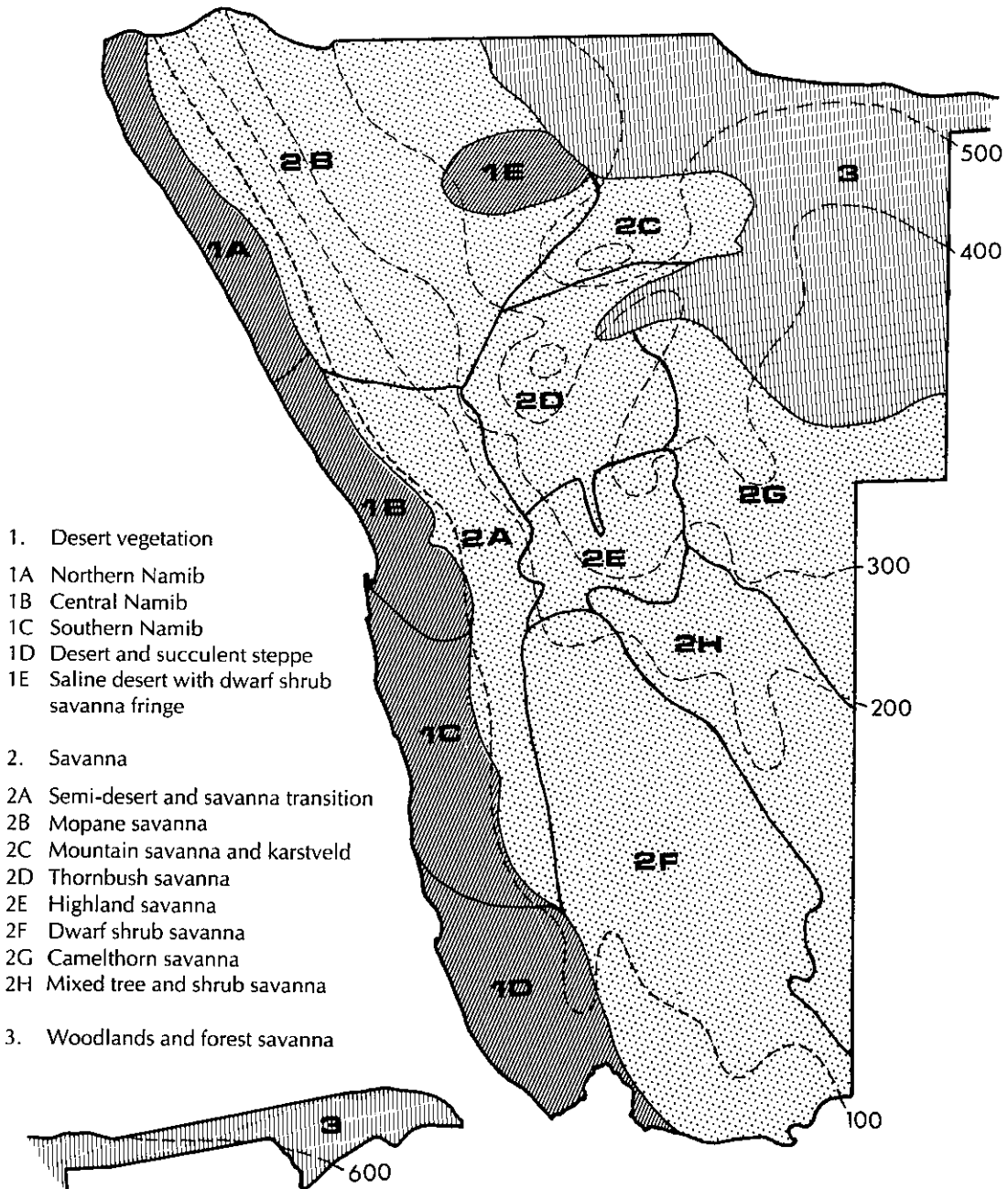


FIGURE 6.3. Water potential of a *Prosopis* tree and an adjacent *Acacia erioloba* tree over 24 hours.

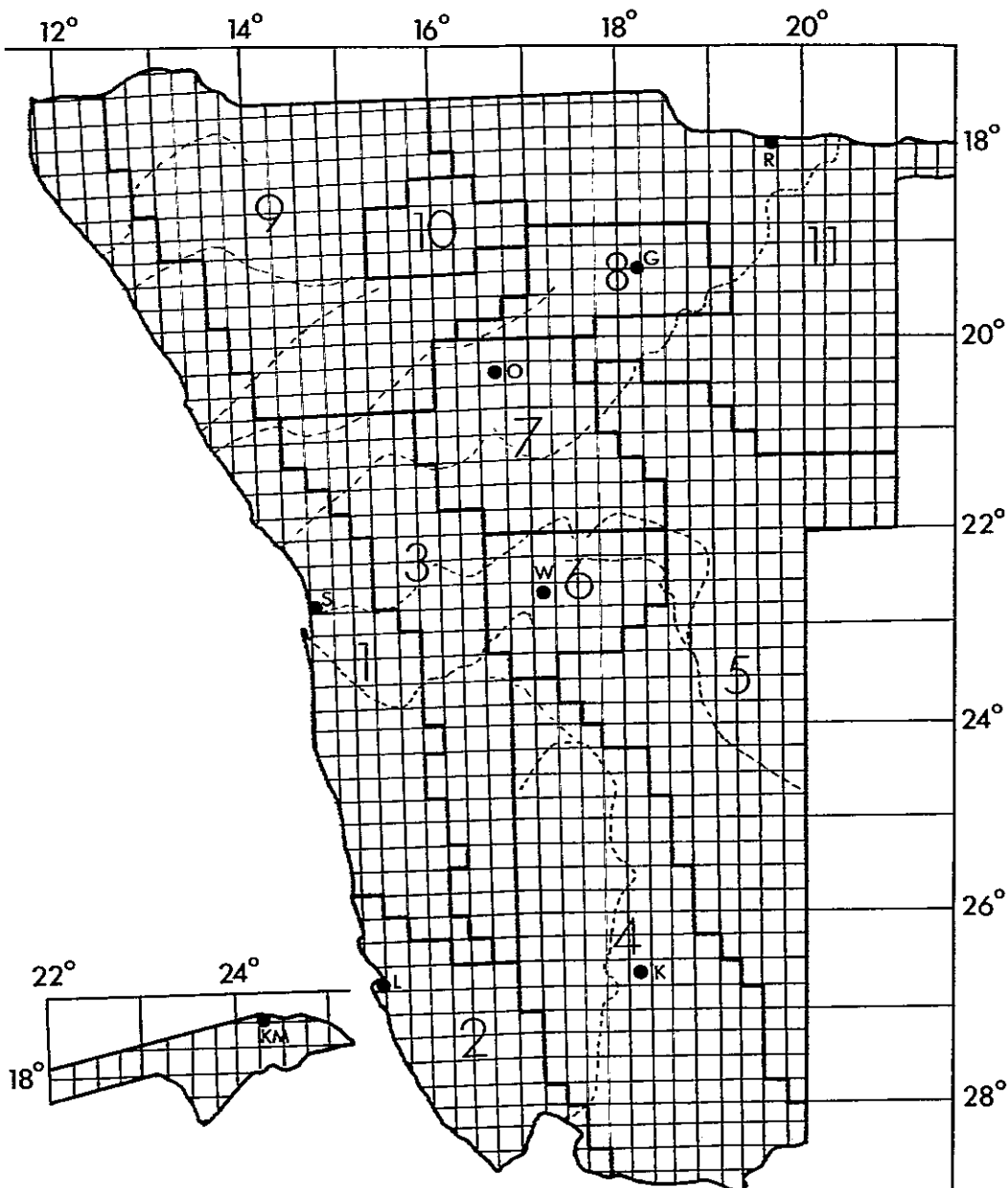
MAP 1. The vegetation zones (after Giess 1971) and the mean annual rainfall isohyets in South West Africa/Namibia.



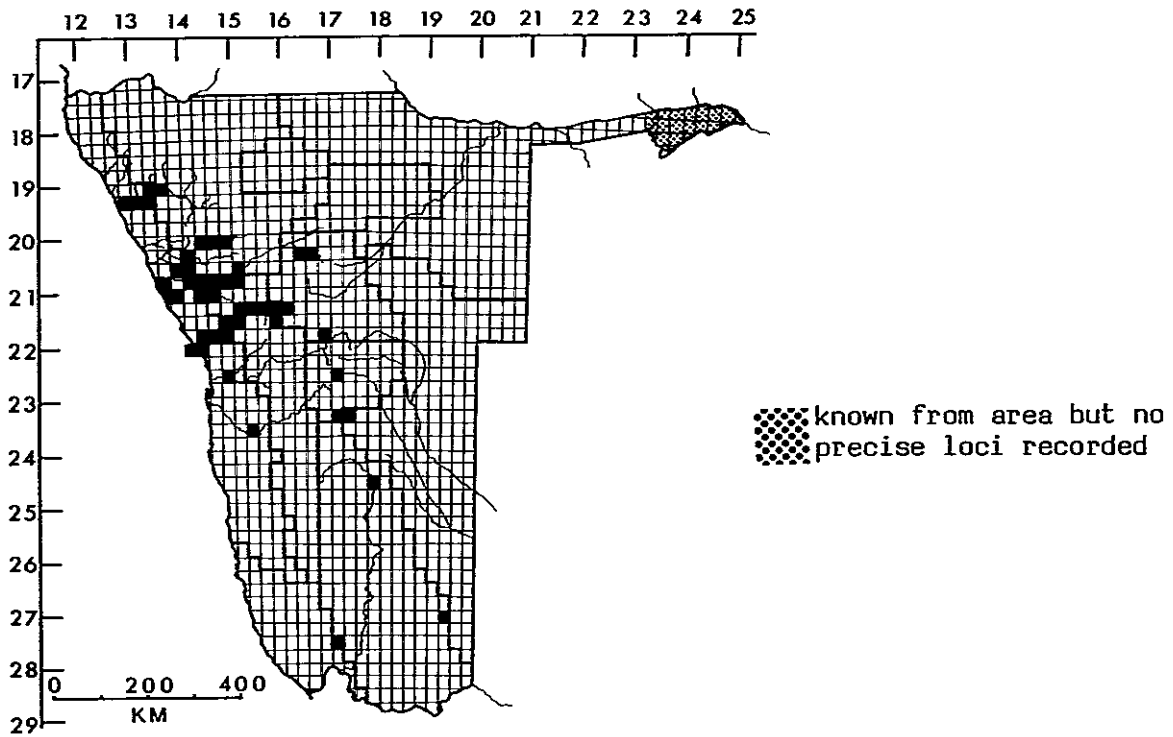


MAP 2. Bioclimatic map showing regions, quarter-degree squares, major rivers and major towns.

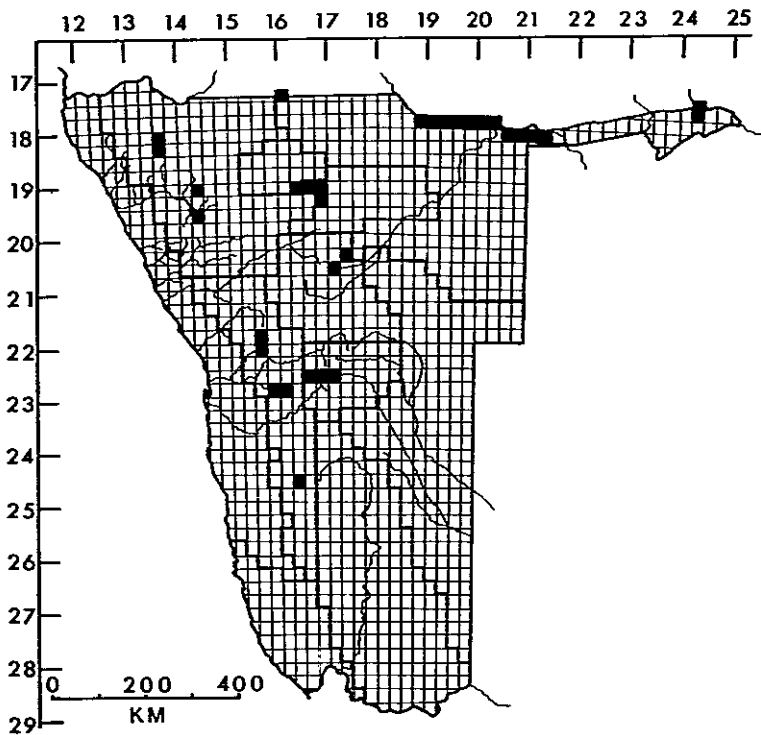
- Region 1 Namib Desert, summer rainfall; 50 mm
- 2 Namib Desert, winter rainfall; 50 mm
- 3 Semi-desert and savanna transition; 50-150 mm
- 4 Dwarf shrub savanna; 50-200 mm
- 5 Kalahari Acacia savanna; 150-400 mm
- 6 Highland savanna; 250-400 mm
- 7 Thornbush savanna; 350-450 mm
- 8 Mountain savanna; 450-600 mm
- 9 Mopane savanna; 100-400 mm
- 10 Saline pans with dwarf shrub fringe
- 11 Forest savanna and woodland; 400-700 mm



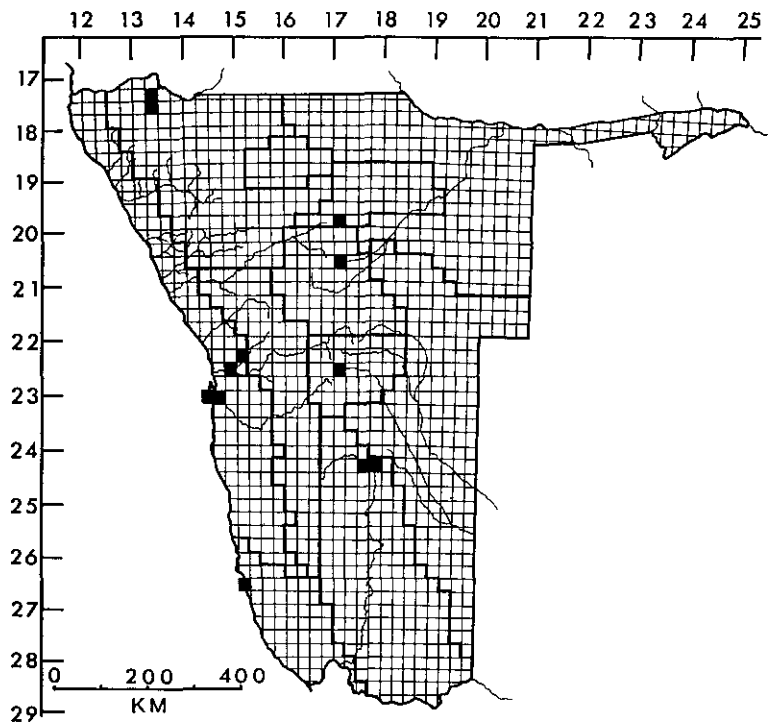




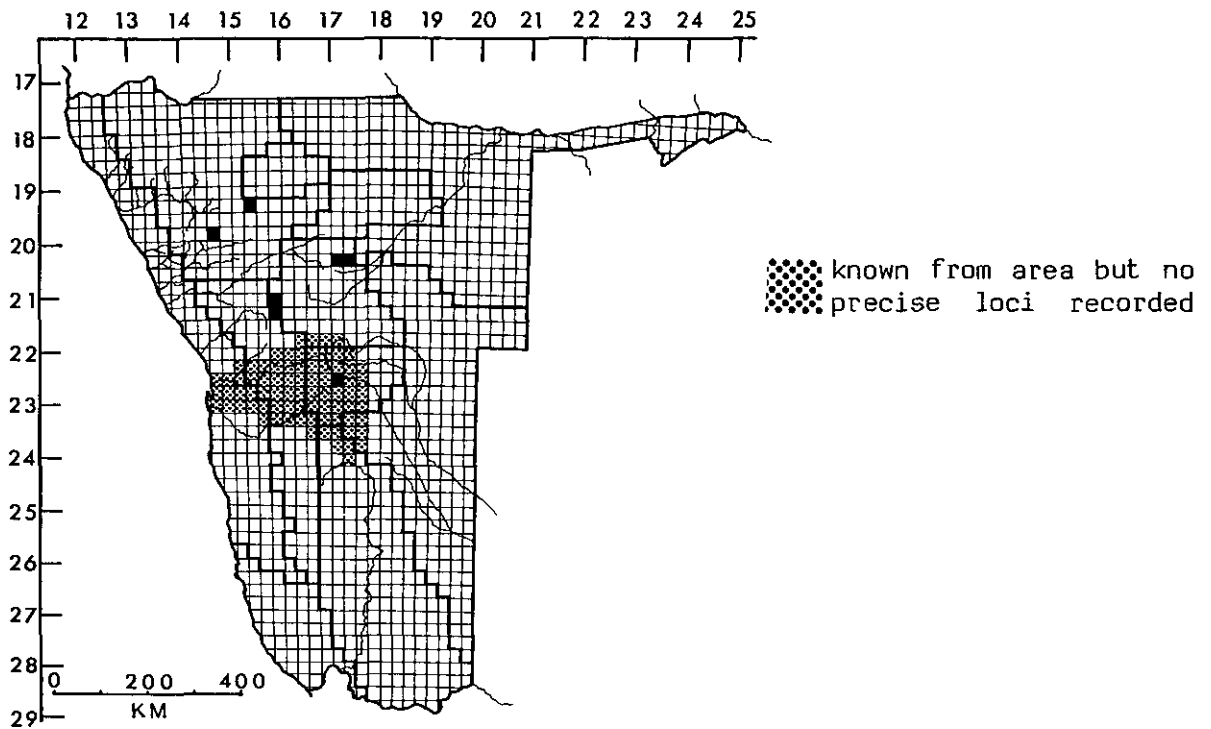
MAP 4. Distribution map of Argemone ochroleuca.



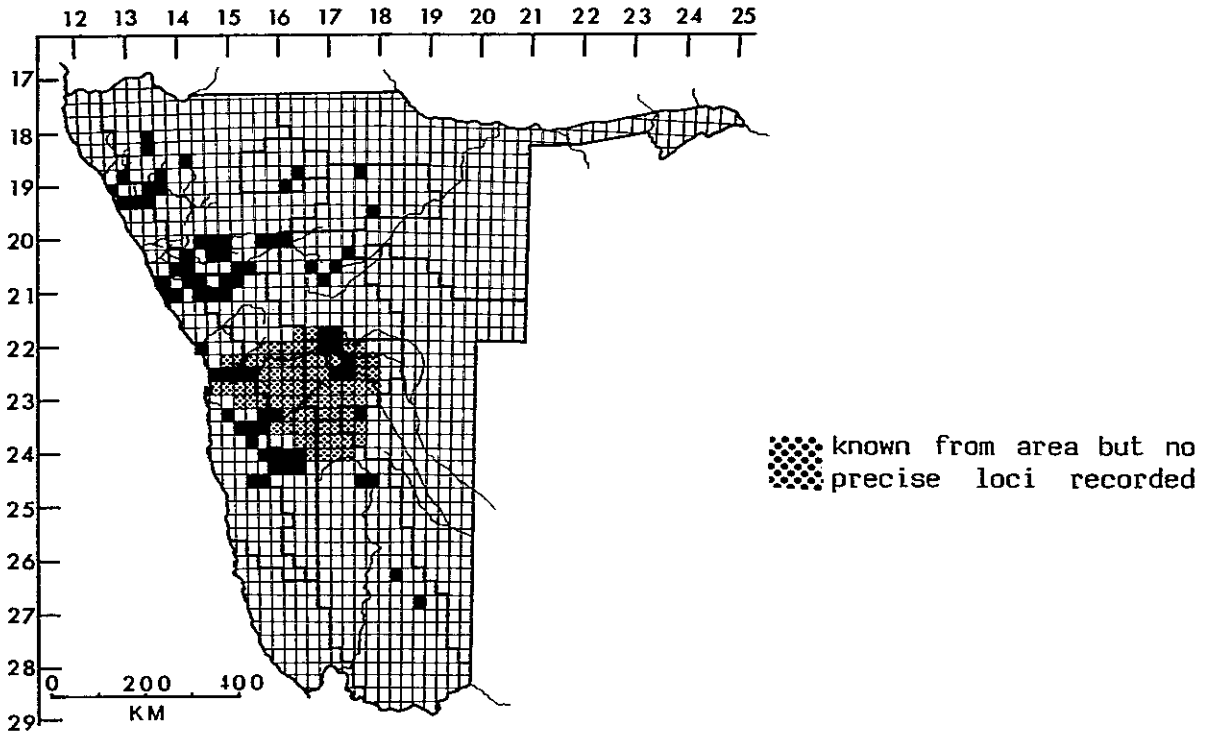
MAP 5. Distribution map of Bidens biternata.



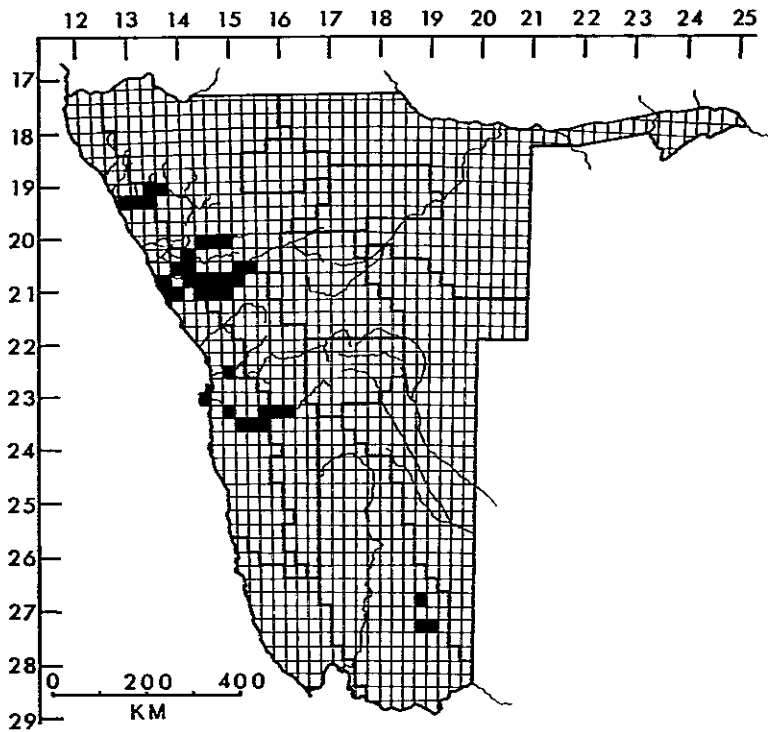
MAP 6. Distribution map of Chenopodium ambrosioides.



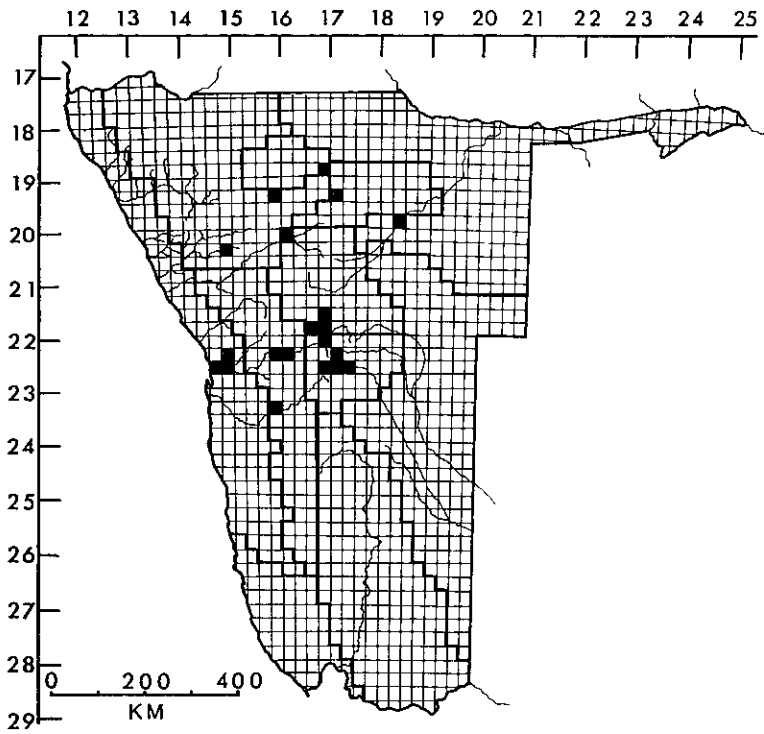
MAP 7. Distribution map of Datura ferox.



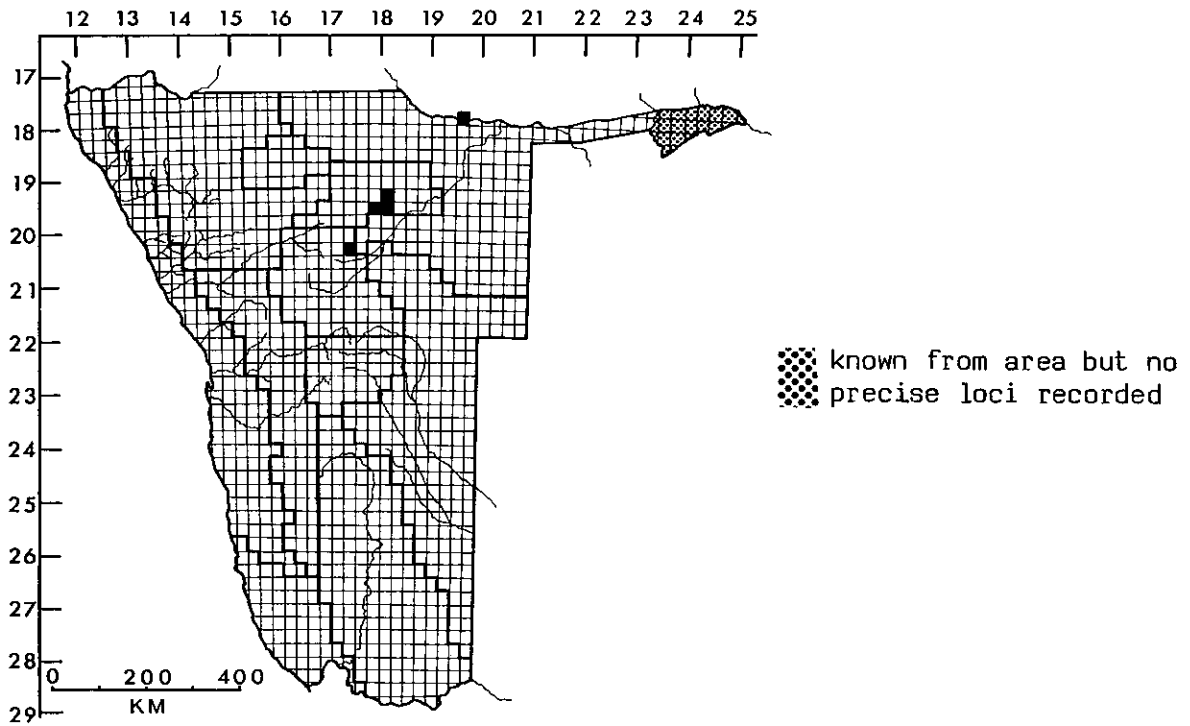
MAP 8. Distribution map of Datura innoxia.



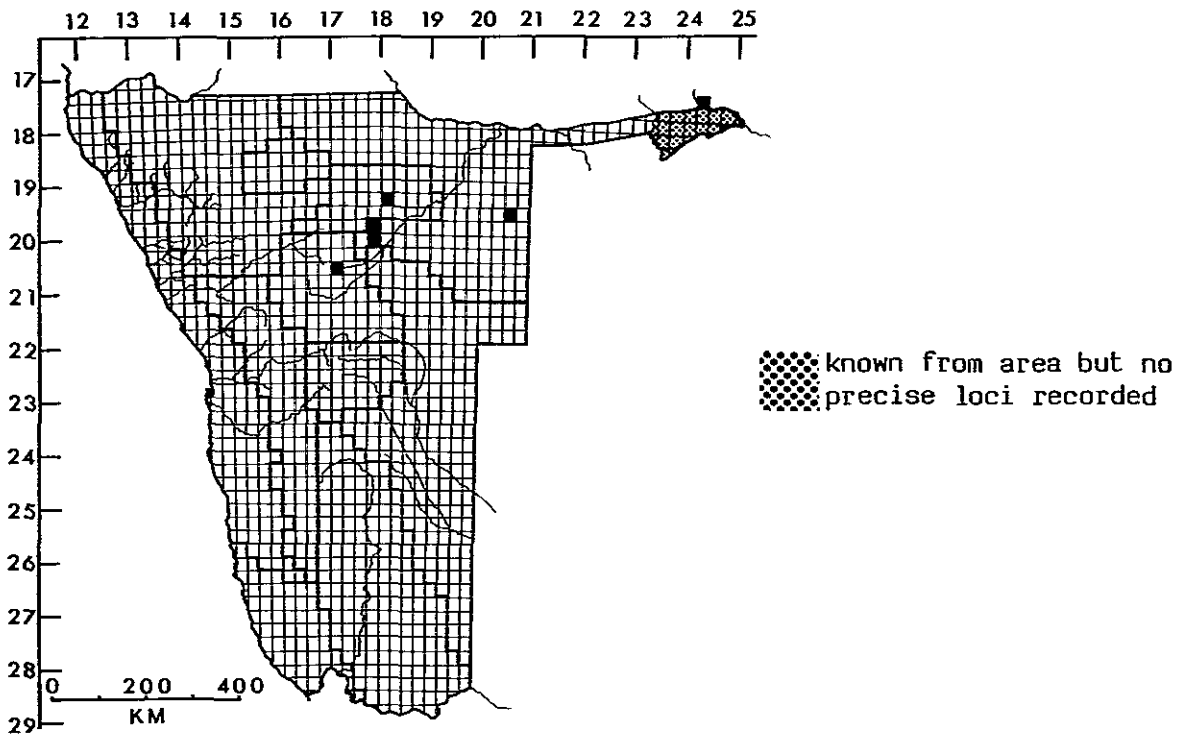
MAP 9. Distribution map of Datura stramonium.



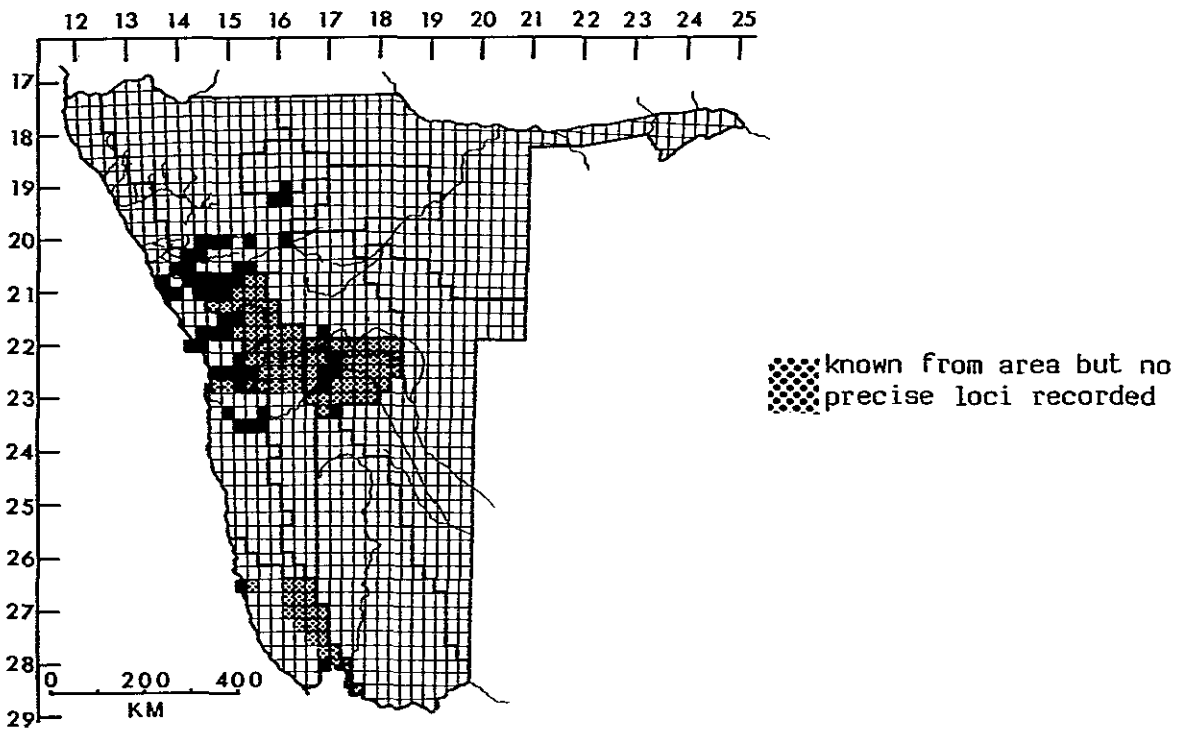
MAP 10. Distribution map of Flaveria bidentis.



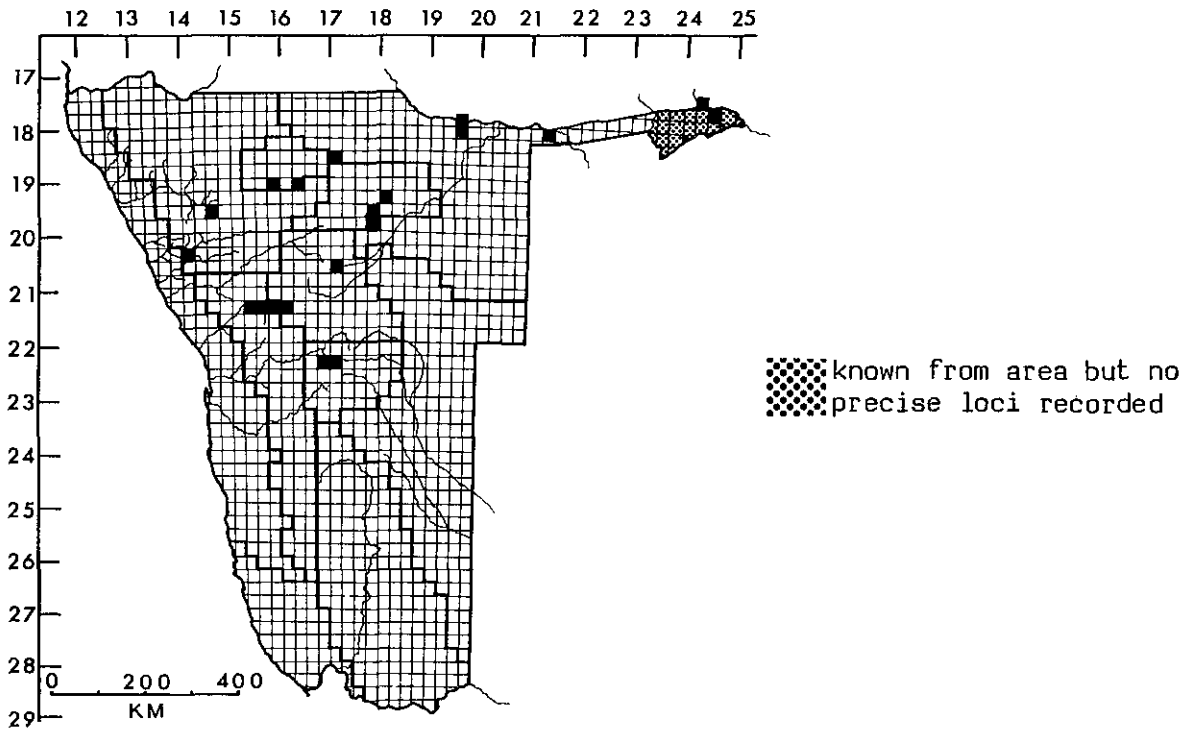
MAP 11. Distribution map of Lantana camara.



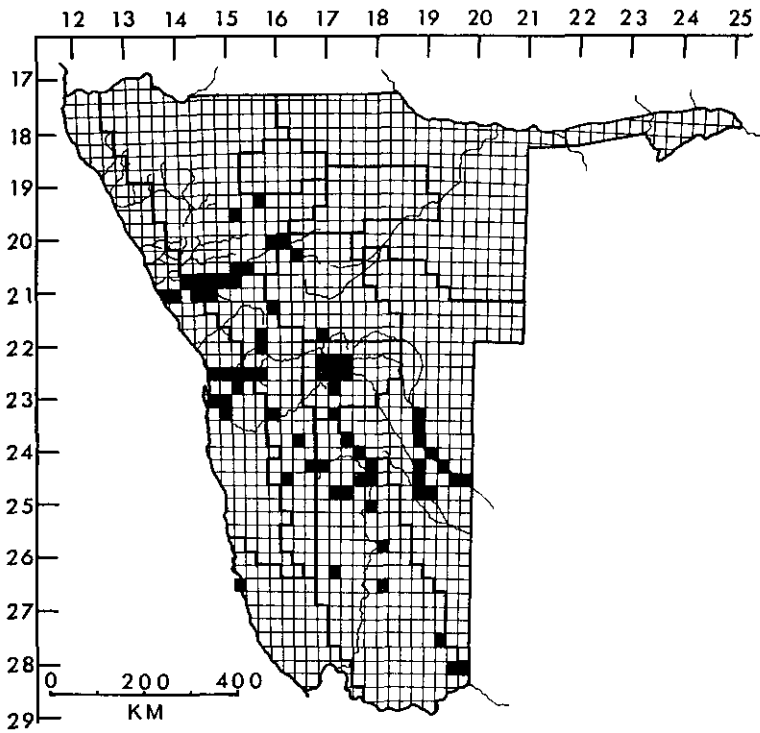
MAP 12. Distribution map of Melia azedarach.



MAP 13. Distribution map of Nicotiana glauca.

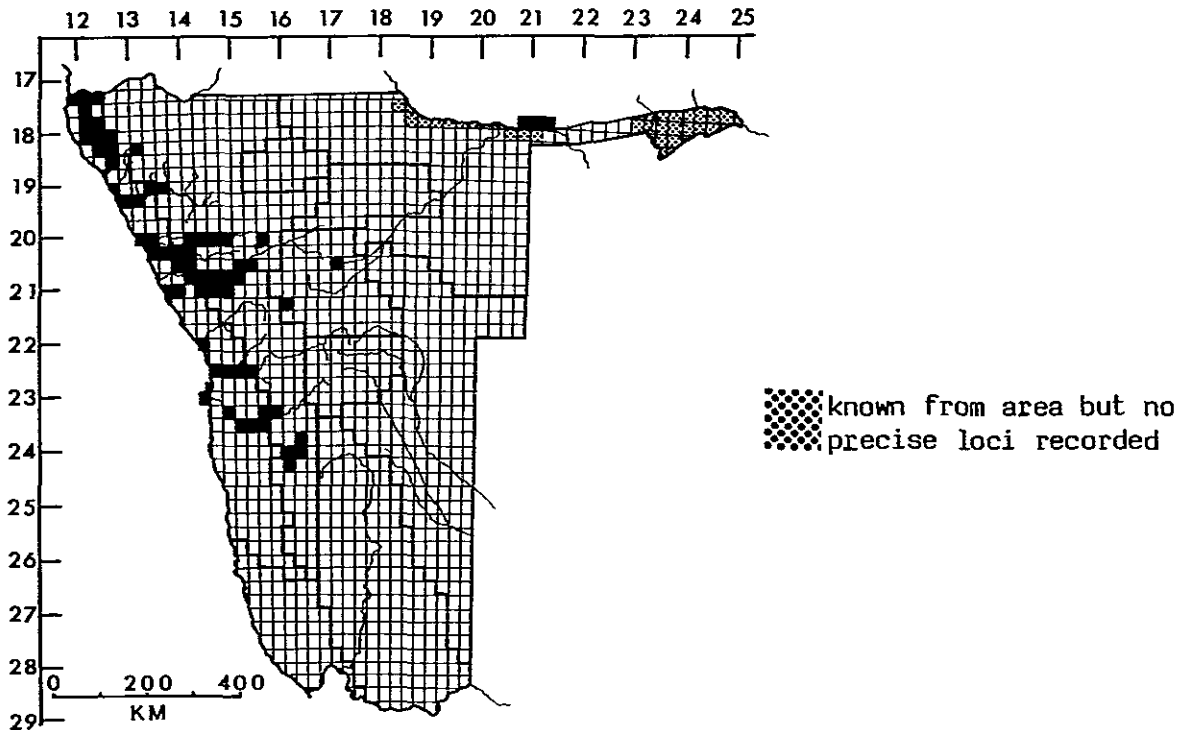


MAP 14. Distribution map of Opuntia ficus-indica.

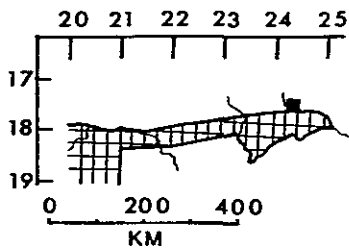


MAP 15. Distribution map of Prosopis spp.

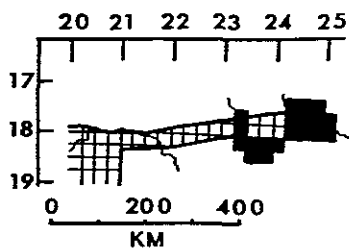




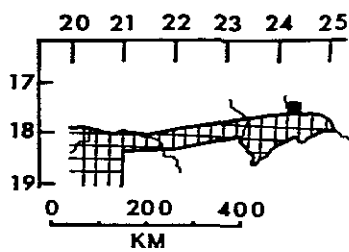
MAP 16. Distribution map of Ricinus communis.



Bambusa balcooa

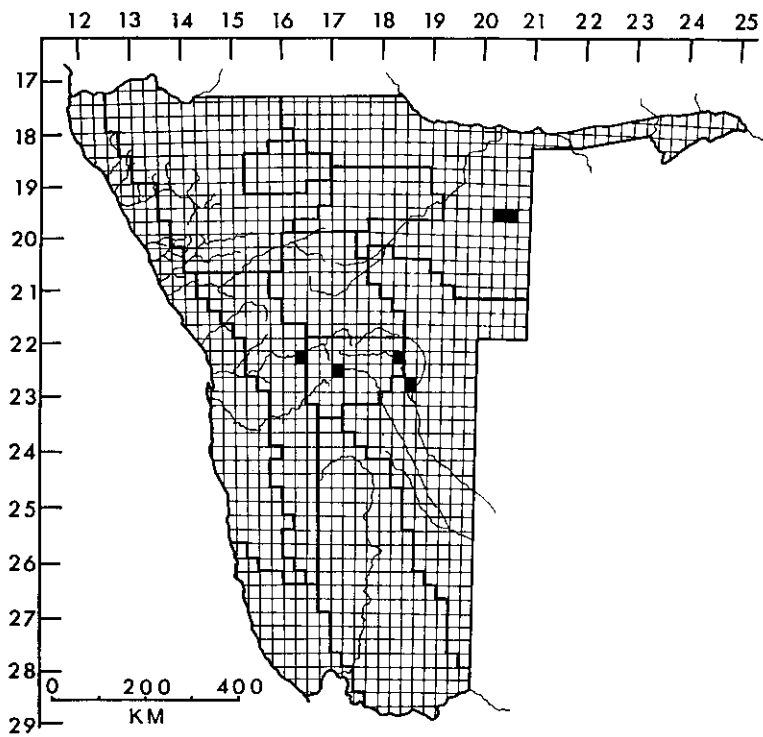


Salvinia molesta

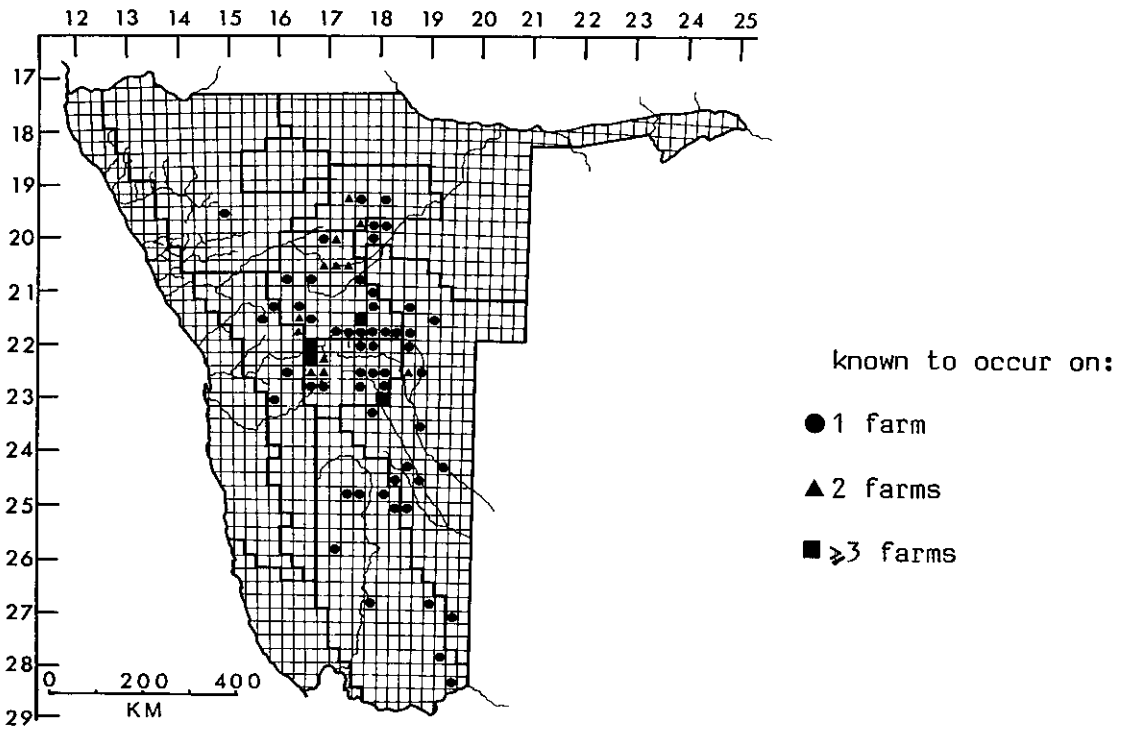


Solanum mauritianum

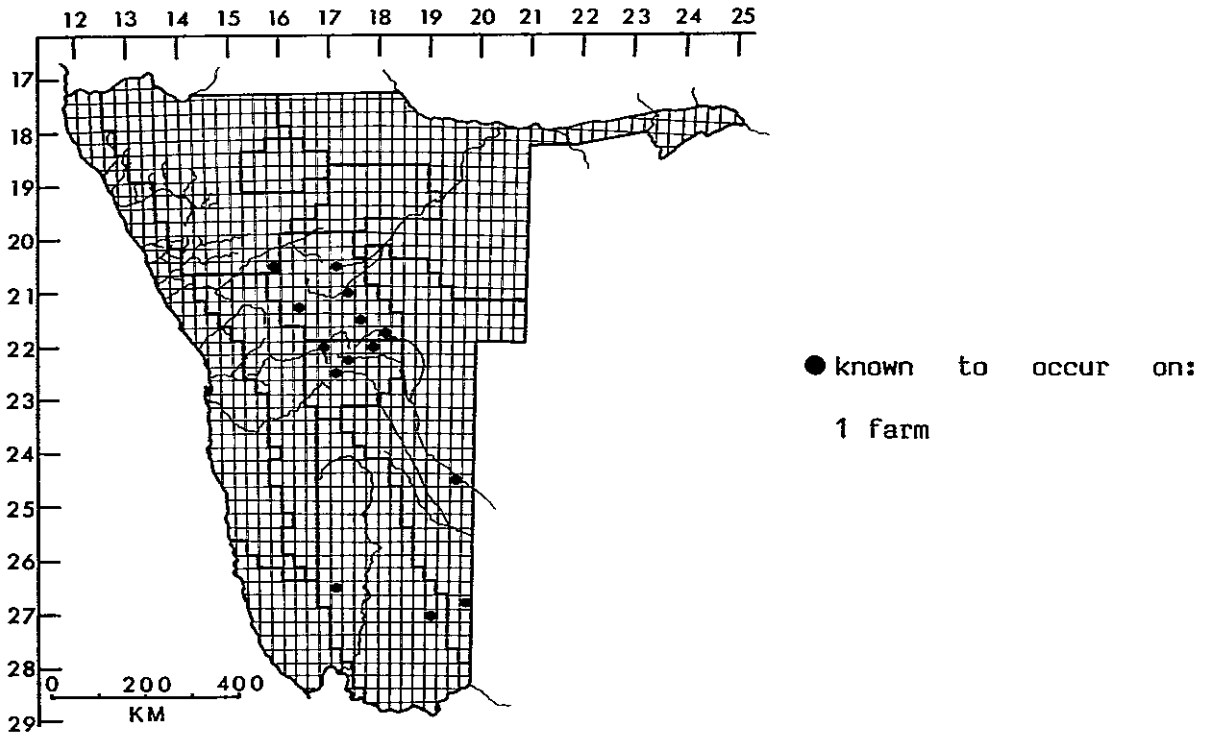
MAP 17. Distributions of three alien plant species known only from the Caprivi Strip.



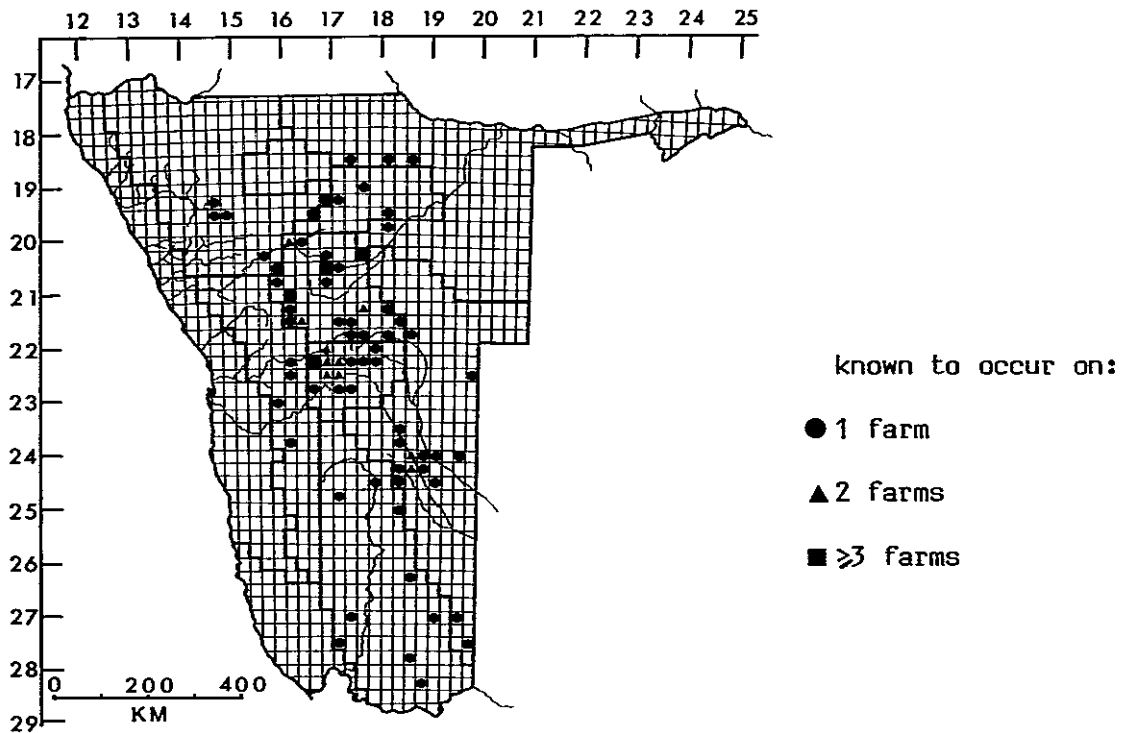
MAP 18. Distribution map of Xanthium spinosum.



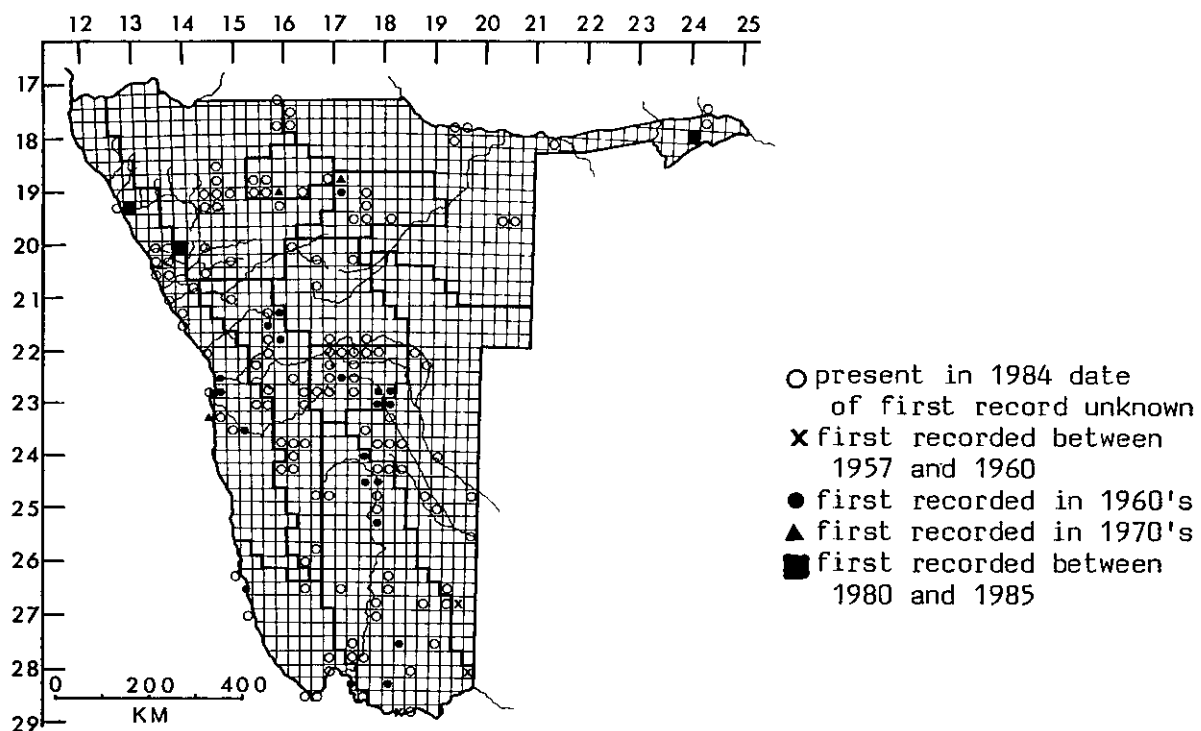
MAP 19. Distribution map of Cyprinus carpio.



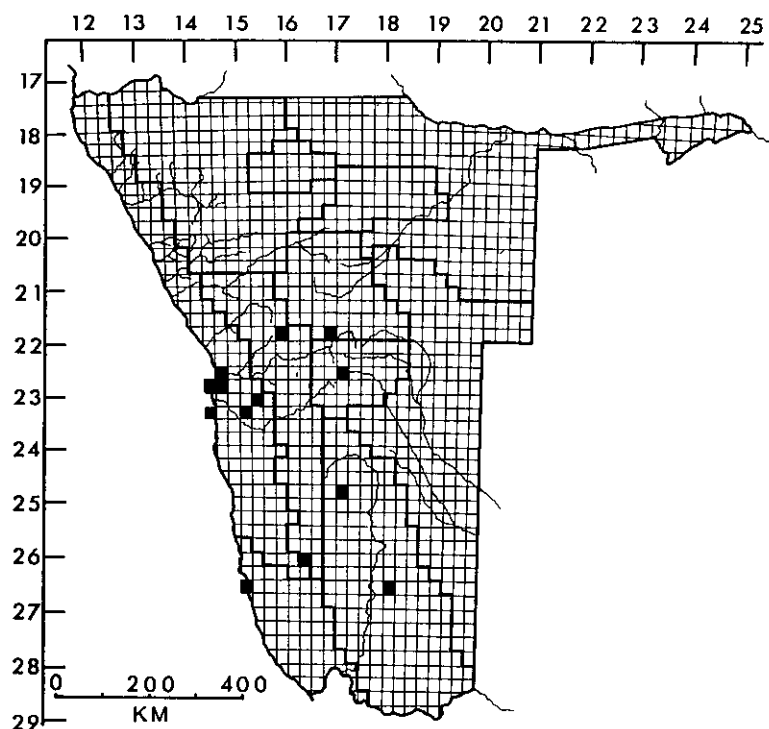
MAP 20. Distribution map of Micropterus salmoides.



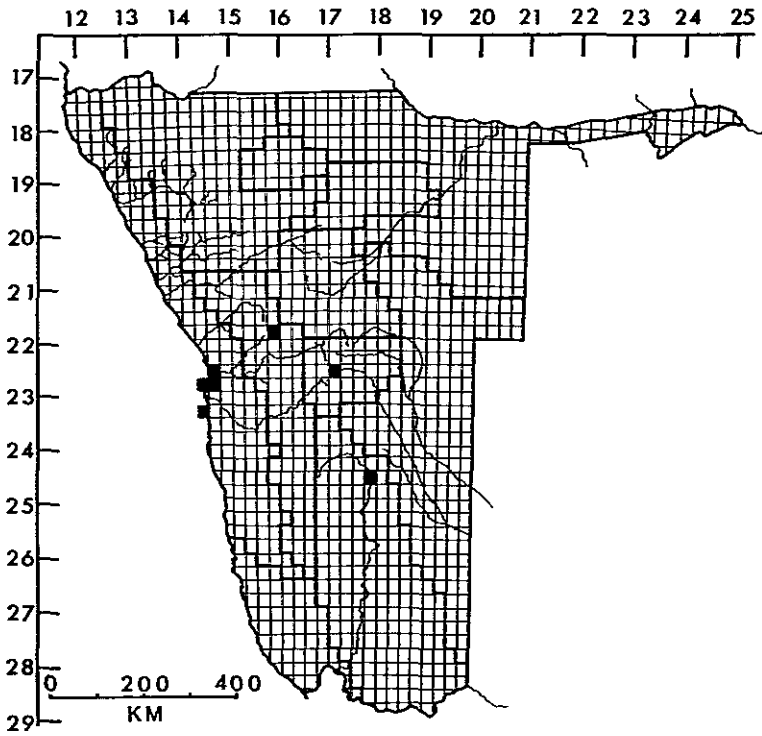
MAP 21. Distribution map of Oreochromis mossambicus.



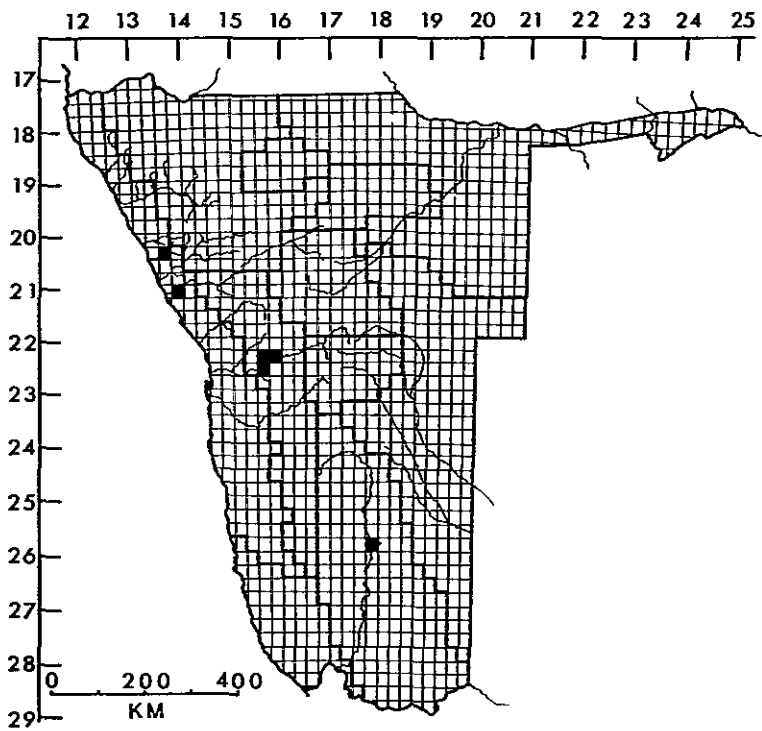
MAP 22. Distribution map of Passer domesticus.



MAP 23. Distribution map of Mus musculus.



MAP 24. Distribution map of Rattus rattus.



MAP 25. Distribution map of known feral population Capra hircus.