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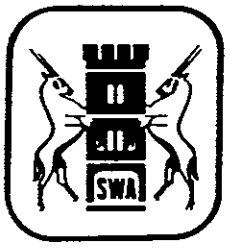

Invasive alien organisms in South West Africa/Namibia

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 5 INVASIVE ALIEN PLANTS IN THE SKELETON COAST PARK, WESTERN DAMARALAND AND WESTERN KAOKOLAND

P W Tarr and R Loutit

INTRODUCTION

This chapter covers the northern coastal region of SWA/Namibia, from the Ugab River in the south to the Cunene River in the north, and extends westwards to the mountainous escarpment in Damaraland and Kaokoland, about 80 km from the coast (Map 3). The region is carved by numerous episodic rivers (only the Cunene River is perennial), many of which rise on farmlands in the central parts of the country, and which run through deep valleys in the escarpment and open into broad floodplains over the narrow coastal plain. The rainfall is low (<100 mm per annum) although the regular occurrence of coastal fog considerably increases precipitation. The vegetation of the Northern Namib (Bioclimatic region 1, cf Map 2) is discussed by Giess (1971).

The alien flora of north-western SWA/Namibia was quantitatively mapped in order to assess the distribution and degree of infestation of each species. Alien plants were found to be confined to the major, periodically flowing river courses within the area. The following species were encountered: Argemone ochroleuca, Datura innoxia, D stramonium, Nicotianaglauca, Opuntia ficus-indica, Prosopis spp and Ricinus communis.

Wherever possible these species have been discussed with respect to: the current area infested; the degree of infestation; potential habitats; their ease of control and their impact on invaded ecosystems.

METHODS

Each of the river systems were surveyed from a vehicle during 1984. The density of each alien species was estimated for each five kilometre stretch of riverbed traversed (Table 5.1). The density of infestation has been quantitatively defined as follows:

Nicotiana glauca:
- Dense infestation: more than 2 000 plants/km
- Moderate infestation: 500-2 000
- Light infestation: 1-500.

All other alien species:
- Dense infestation: more than 250 plants/km
- Moderate infestation: 100-250
- Light infestation: 1-100.

TABLE 5.1. The percentage of five kilometre-long blocks supporting varying degrees of alien infestations for the river beds of the Skeleton Coast Park and adjacent areas

Species	River System	% of densely infested blocks	% of moderately infested blocks	% of lightly infested blocks	% of uninfested blocks	No of blocks surveyed
Argemone ochroleuca	Ugab	0	0	87,5	12,5	16
	Huab	0	22,2	55,6	22,2	18
	Hoanib	0	0	6,3	93,8	16
Datura innoxia	Ugab	12,5	6,3	75,0	6,3	16
	Huab	11,1	27,8	38,9	22,2	18
	Hoanib	50,0	18,8	31,3	0	16
	Hoarusib	37,5	37,5	25,0	0	8
	Cunene	0	0	100	0	1
Datura stramonium	Ugab	0	0	50,0	50,0	16
	Huab	0	0	50,0	50,0	18
	Hoanib	0	0	6,3	93,8	16
Nicotiana glauca	Ugab	25,0	6,3	68,8	0	16
	Huab	0	11,1	77,8	11,1	18
Prosopis sp	Ugab	0	0	37,5	62,5	16
Ricinus communis	Ugab	6,3	0	56,3	37,5	16
	Huab	0	22,2	44,4	33,2	18
	Uniab	0	0	21,4	78,6	14
	Koichab	0	6,3	31,3	62,5	16
	Hoanib	25,0	0	43,8	31,3	16
	Hoarusib	0	0	62,5	37,5	8
	Khumib	4,8	0	81,0	14,3	21
	Sechomib	0	0	25,0	75,0	12
	Nadaf	25,0	0	50,0	25,0	4
	Engo	8,3	0	8,3	83,3	12
	Cunene	0	0	100	0	1

SPECIES ACCOUNTS

Argemone ochroleuca (Map 4). This is a recent invader of this area, appearing in the Ugab, Huab and Hoanib Rivers after the 1984 floods. In all three rivers, light infestations currently occur. Open sandy riverbeds and floodplains appear to be the favoured habitat of this species.

The impact of A ochroleuca on the ecosystem is unknown. It could, however, be highly invasive. The removal of the existing population is planned.

Datura innoxia (Map 8). This species currently infests five of the 12 rivers surveyed in this region. In the Cunene, Hoarusib, Huab and Ugab Rivers infestation occurs along the entire riverbed almost to the coast. In the Hoanib River infestation occurs as far west as the Hoanib floodplain. D innoxia is believed to have entered the northern areas of this region in the same manner and at the same time as Nicotiana glauca. In the south it was first observed in the Huab and Ugab Rivers after the 1982 floods. At present the degree of infestation varies from light in the Cunene, to moderate in the Hoarusib, upper Hoanib, Huab and Ugab Rivers, to dense in the Hoanib floodplain where virtually continuous stands occur.

The potential habitat of this species includes all riverbeds where waterborne seed dispersal can occur. D innoxia tends to favour the banks of rivers and the high ground in riverbeds. Dense infestations are likely where floodplain conditions occur, or on the up-river sides of dense reed beds.

D innoxia will be difficult to control because of the high reinvasion potential caused by the periodic westward flow of the rivers. Test plots in the Hoanib floodplain have shown that reinvasion of 100% or more may occur after flooding. Furthermore, a single Datura plant in this area can produce an average of 15 pods at any one time. Each pod contains an average of 650 seeds of which, according to Landsdell (1927), at least 87% germinate. He mentions that the seeds are viable for up to 20 years.

Birds and mammals ingesting the seeds and leaves of this alien could be affected by various poisonous alkaloids such as Daturine, Hyosayamine and Atropine which are found in all Datura species (Landsdell 1927). This author mentions that in South Africa the seeds are fatal to young ostriches Struthio camelus, but that farmers in the Karoo and Highveld districts have observed cattle and goats eating the leaves with impunity. Over 1 000 seeds were found in the crop and stomach of a doublebanded sandgrouse Pterocles bicinctus (Brown et al 1984) and Cape turtle doves Streptopelia capicola and laughing doves Streptopelia senegalensis have been observed feeding on these seeds.

Hand removal of small plants is relatively simple and an intense eradication campaign, using manual methods and starting at the source of the rivers is advocated. However, because the middle and lower reaches of the Hoanib River support relatively high game numbers, including the desert dwelling elephants which are sensitive to human disturbance, it is strongly recommended that, before a full-scale eradication programme is undertaken west of Sesfontein, an in-depth monitoring programme should be completed. This programme would include investigation of the extent to which the

aliens in the Hoanib are increasing and the extent to which the natural vegetation and ecology of this area are being threatened.

It is believed that this species is likely to constitute an ecological threat in the future especially where it occurs in dense stands. Areas of dense indigenous vegetation appear not to be susceptible to invasion, but fast flooding creates channels through such areas which soon become invaded, thereby reducing the indigenous floral component.

Datura stramonium (Map 9). This species lightly infests the Hoanib, Huab and Ugab Rivers. It occurs within four kilometres of the coast in the Ugab River and as far west as the floodplain in the Hoanib River. It is uncertain when and how it was introduced into these areas.

D stramonium is relatively easy to remove by hand, and low densities favour manual methods. However, no control has been exercised to date.

Nicotiana glauca (Map 13). This species currently occurs in the Ugab and Huab Rivers, both in western Damaraland and the Skeleton Coast Park. It is believed to have been introduced to this area in horse fodder, which was imported from South America at the turn of the century during the German occupation of SWA/Namibia. At present dense infestations occur in the lower reaches of the Ugab River from the coast to 20 km inland. Light infestation occurs along the remainder of the Ugab River and along the Huab River.

The potential habitat for this species includes sparsely vegetated riverbeds where nonsaline, sandy soils are present. Investigations have shown that this species is susceptible to drowning when exposed to standing water for any length of time.

N glauca is difficult to control since reinfestation occurs with seasonal river flow from farming areas inland. Natural control of this species does occur, specifically where dense beds of Phragmites australis are found, and where standing water causes drowning. Nevertheless, large scale reinfestations of N glauca after river flow far outweigh the natural removal by flood erosion and other factors.

The potential rate of spread of this species appears to be fairly rapid. A 100 m^2 plot in the Ugab River mouth area showed an increase of 6,22% after flooding despite clearing operations to the east of the site and the presence of dense stands of natural vegetation in the surrounding areas.

Seedlings and immature plants are easily removed by hand provided they do not occur in compact soils or dried silts. No large-scale control has been attempted, and it is felt that the Directorate of Agriculture should identify and monitor inland farming areas from which reinvasion occurs. Efforts should be made to initiate a national eradication campaign, starting in the east and moving westwards, using manual labour methods.

Reinvasion after flooding ensures that this species colonizes the majority of the open riverbed, thus competing with indigenous plants for available ground water. It is possible that these plants are able to absorb moisture

from fog since isolated specimens have been encountered far away from river beds. The longevity and apparent ability of Nicotiana glauca to thrive under arid conditions makes this species a formidable alien invader in this area.

Opuntia ficus-indica (Map 14). Currently this species is confined to the farm 'Eerste Begin', in western Damaraland. The potential rate of spread of this species is unknown as is the year of its introduction into the area.

Since its distribution is localized, control of this species should be simple and all efforts should be made to prevent a westward spread down the Huab River.

Prosopis sp (Map 15). This plan is confined to the Ugab River and is found both within the Skeleton Coast Park and western Damaraland. Less than 20 trees occur and a removal programme is under way.

No further infestation has occurred during the period 1978-1984 and no trees have produced seeds during this period.

Ricinus communis (Map 16). This species currently infests all 12 rivers surveyed in this region. In the south it was first observed in the Koichab, Huab and Ugab Rivers following the 1982 floods, but could have been present in the Uniab River from as early as 1964.

Light infestations occur in the Cunene, Engo, Nadas, Munutum, Sechomib, Khumib, Hoarusib, upper Hoanib, Uniab, Koichab, Huab and Ugab Rivers. The western extremes of the last three rivers are currently uninfested. Isolated areas of the Springbok River in western Damaraland are also lightly infested while moderate infestation occurs in the middle Ugab area (in the vicinity of the Skeleton Coast Park boundary) and in the western floodplains of the Engo and Hoanib Rivers.

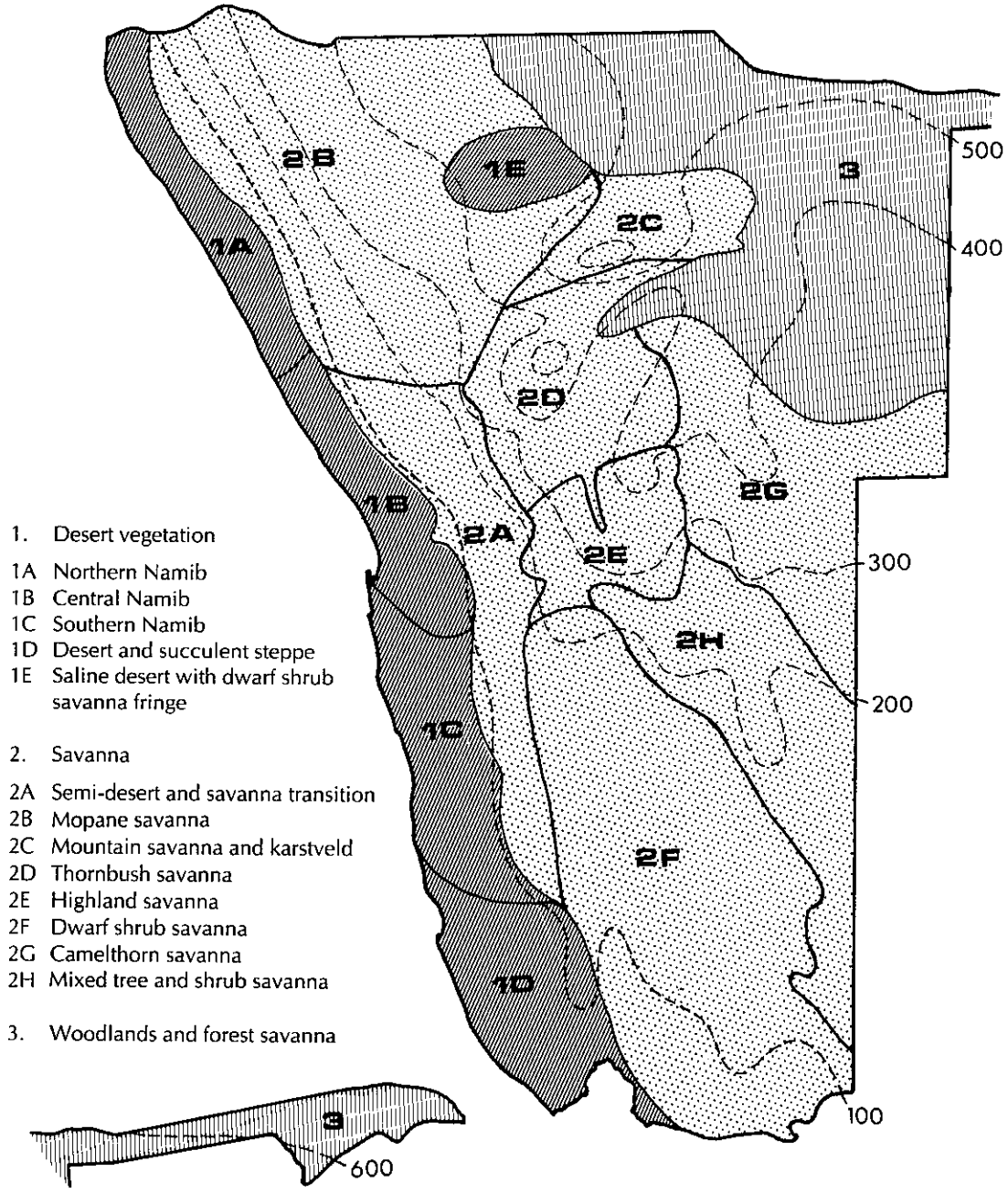
The open stretches of all riverbeds provide an ideal habitat for this species particularly where loose sandy soils predominate. This species favours the banks of rivers and high ground in riverbeds.

R communis is not as aggressive as N glauca or D innoxia and westward infestation in the south appears to be limited by dense stands of indigenous vegetation, mainly Phragmites australis and Suaeda plumosa. Periodic flooding has also helped to keep this species under control as it is susceptible to drowning when subjected to standing water for any length of time.

Plants less than one year old are very easy to pull out by hand, but reinvasion of cleared areas occurs after river-flow.

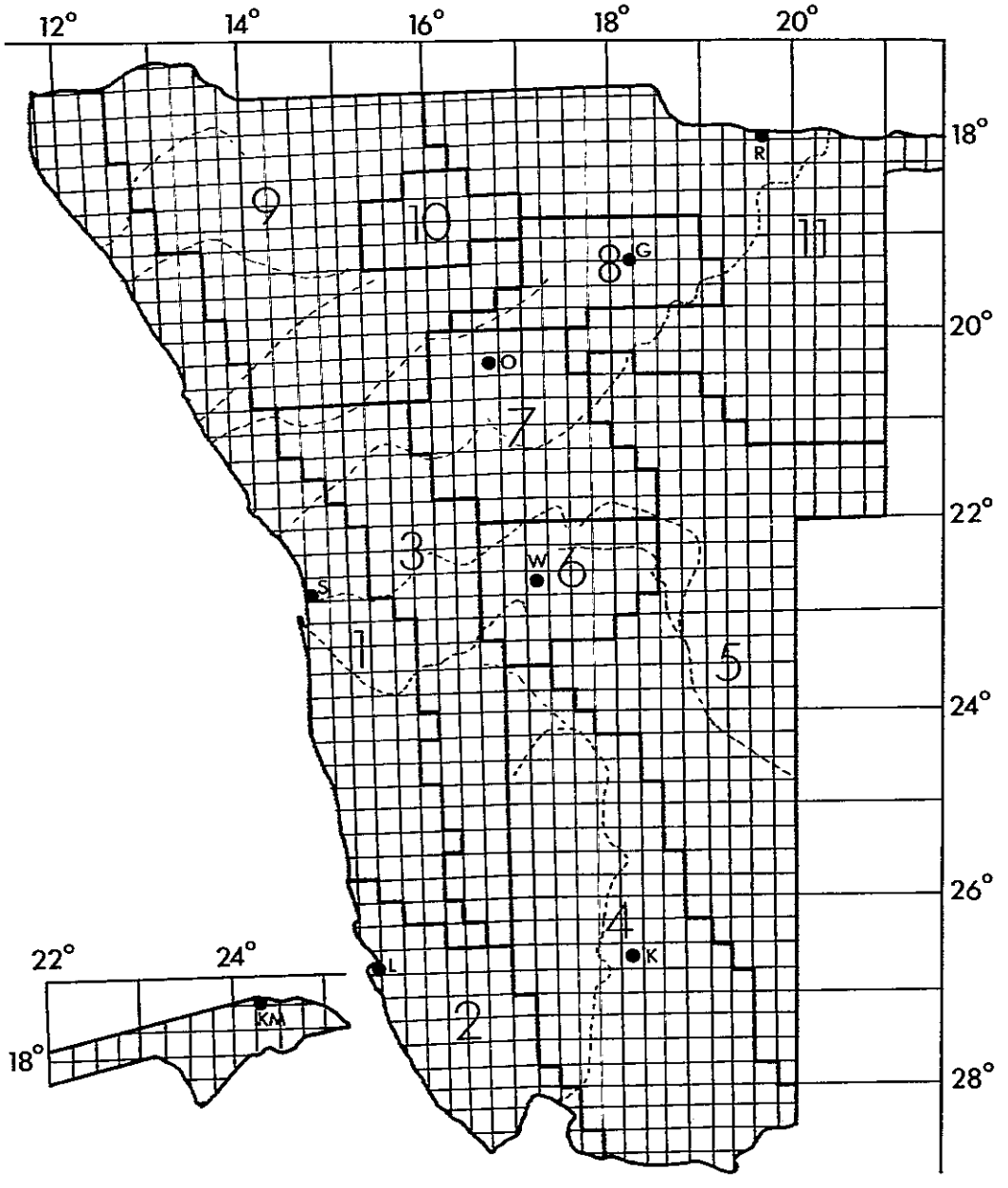
The ecological impact of R communis has not been established but it is thought to be less than that of the previous two species. Elephants Loxodonta africana periodically browse this species in the Hoanib floodplain, while birds are thought to utilize the seeds.

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

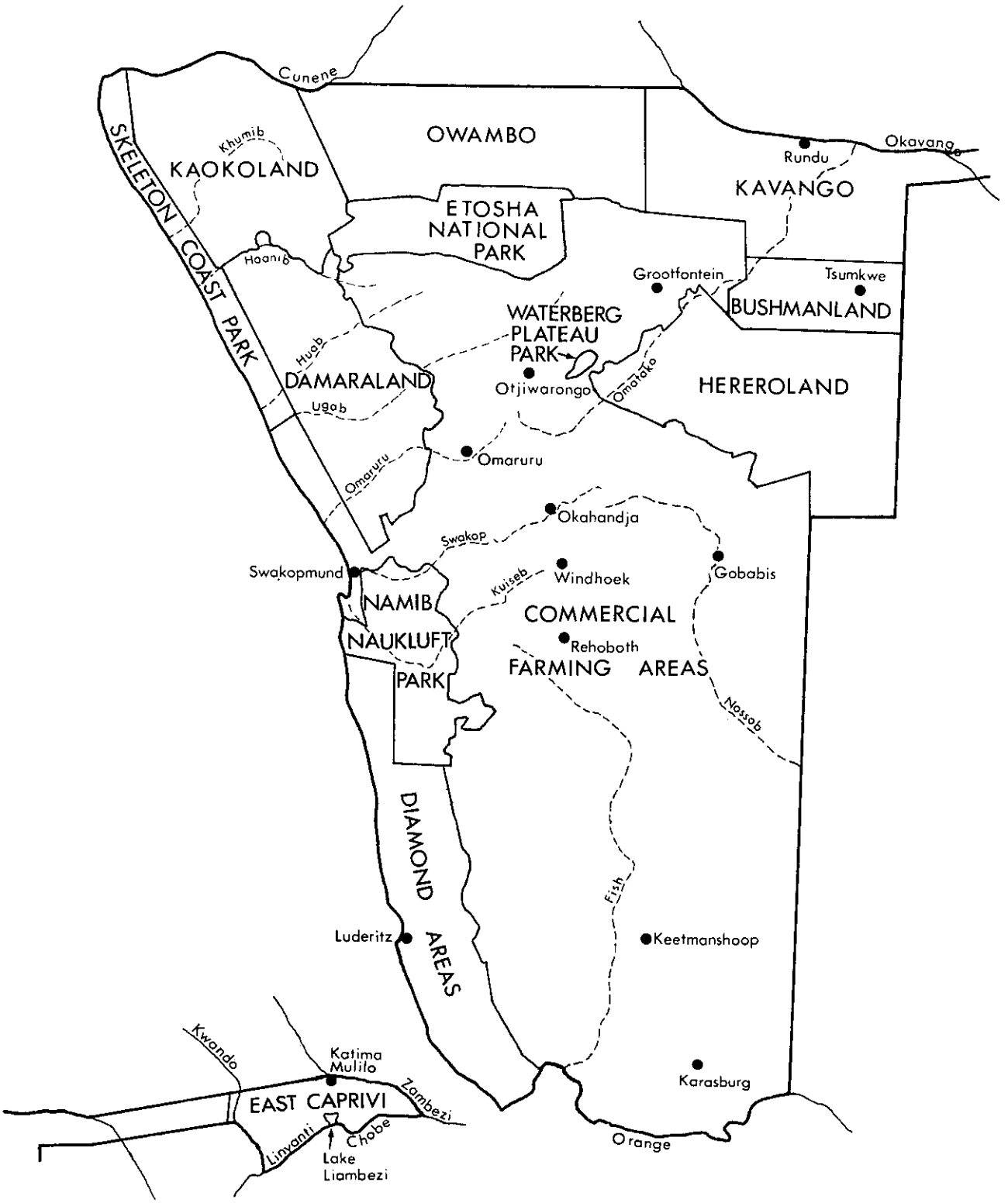


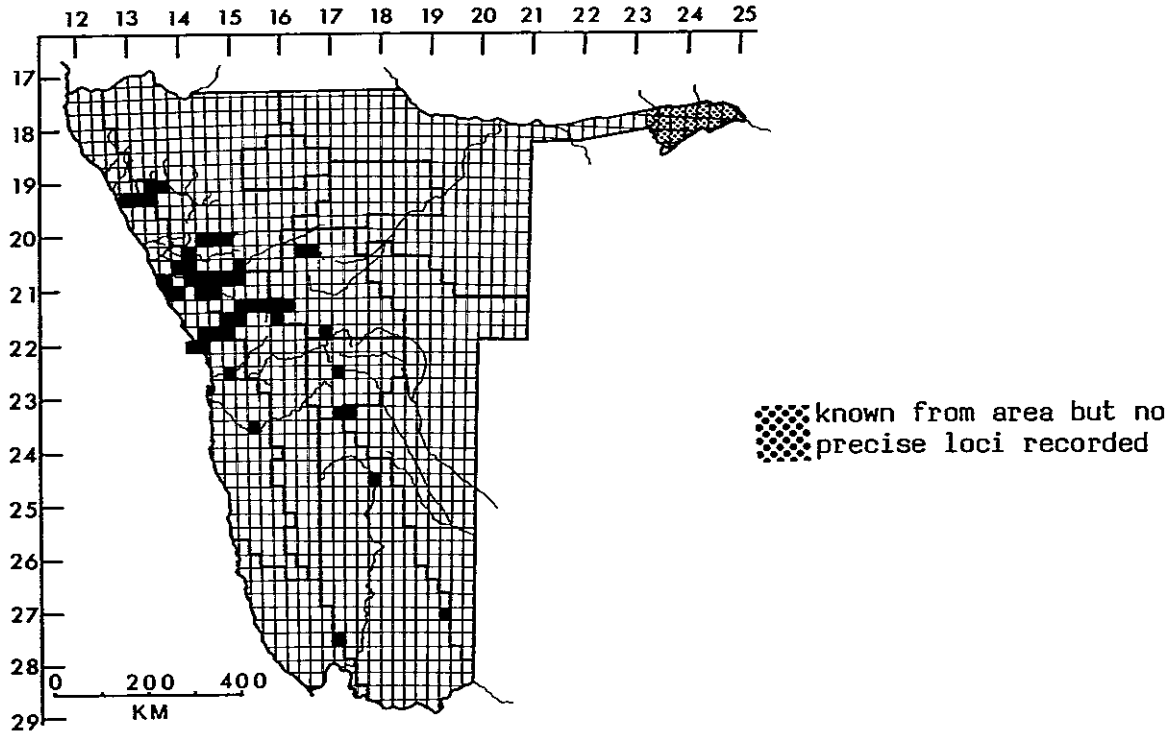
MAP 2. Bioclimatic map showing regions, quarter-degree squares, major rivers and major towns.

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

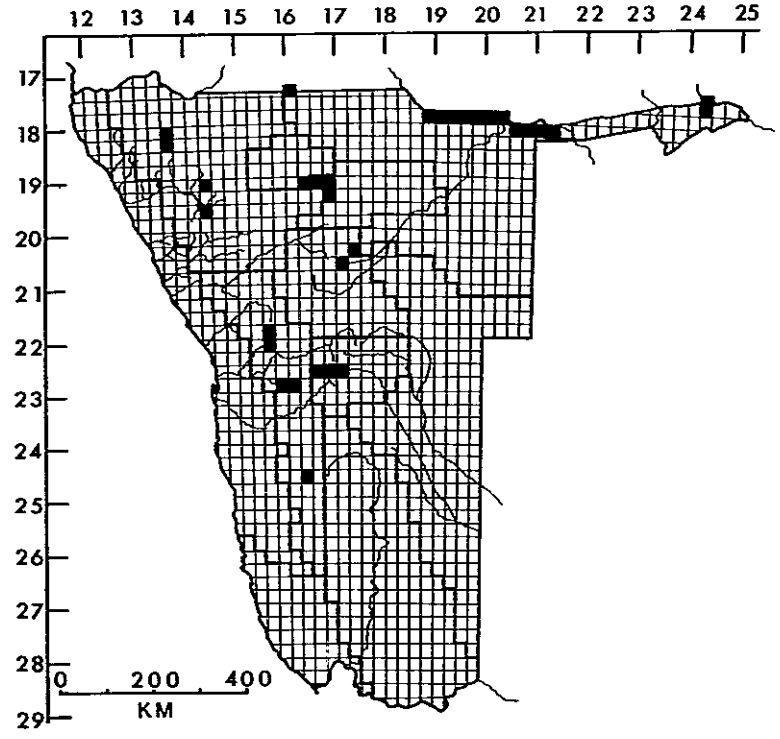


MAP 3. South West Africa/Namibia showing main place names mentioned in text.

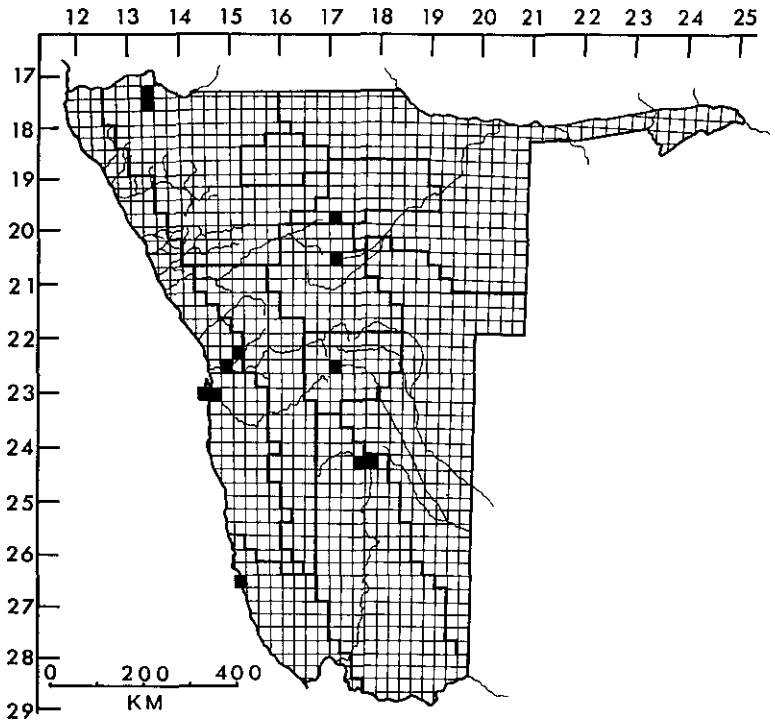




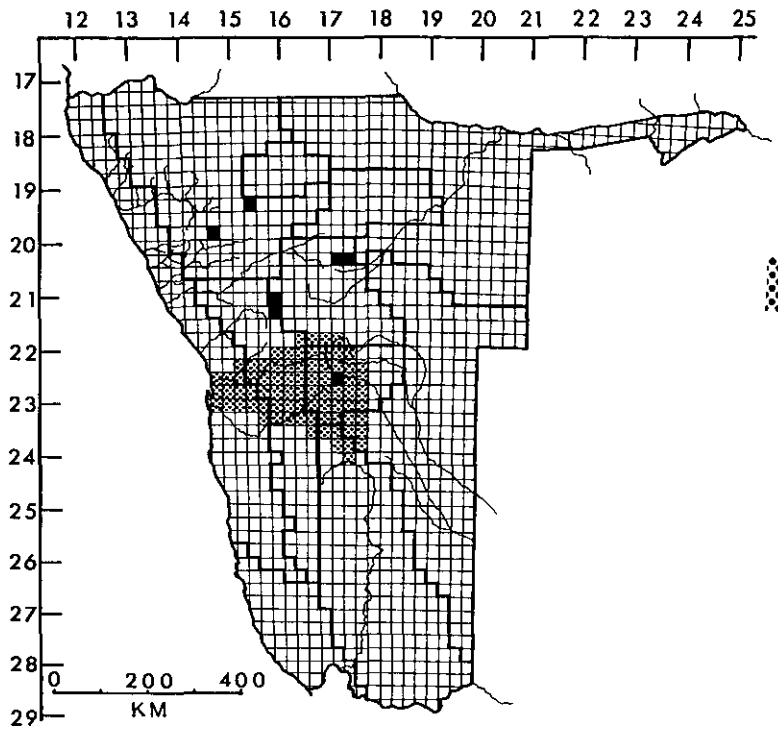
MAP 4. Distribution map of Argemone ochroleuca.



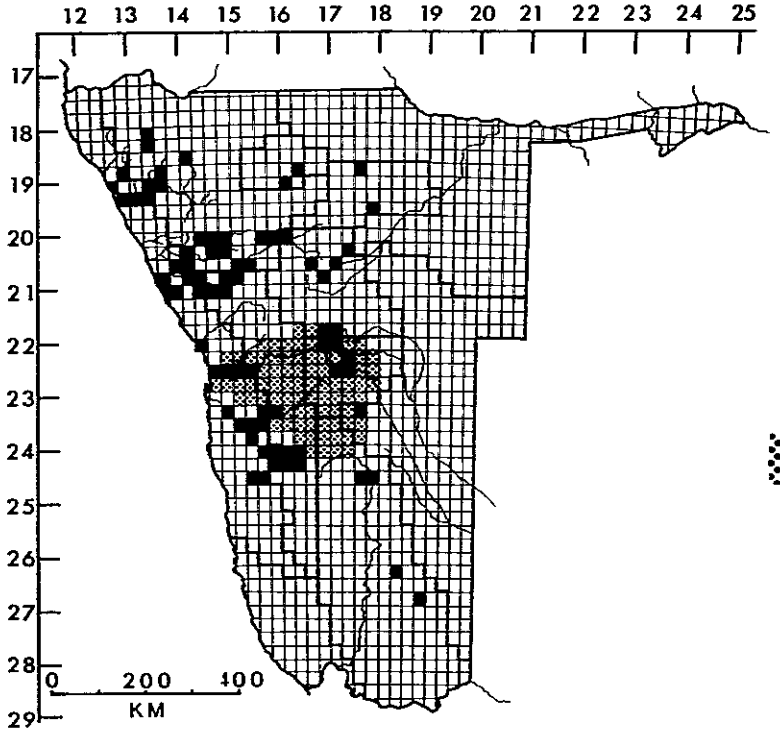
MAP 5. Distribution map of Bidens biternata.



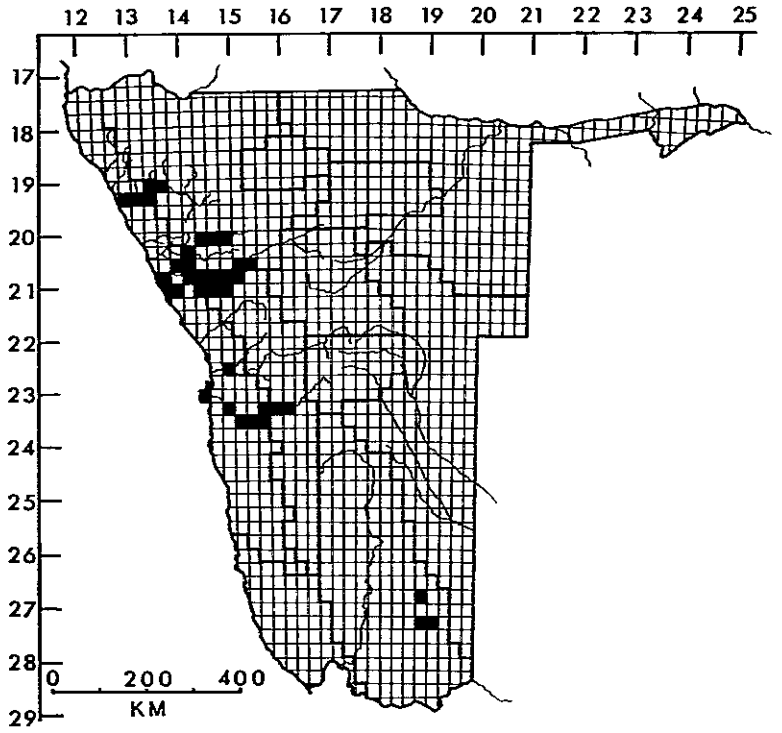
MAP 6. Distribution map of Chenopodium ambrosioides.



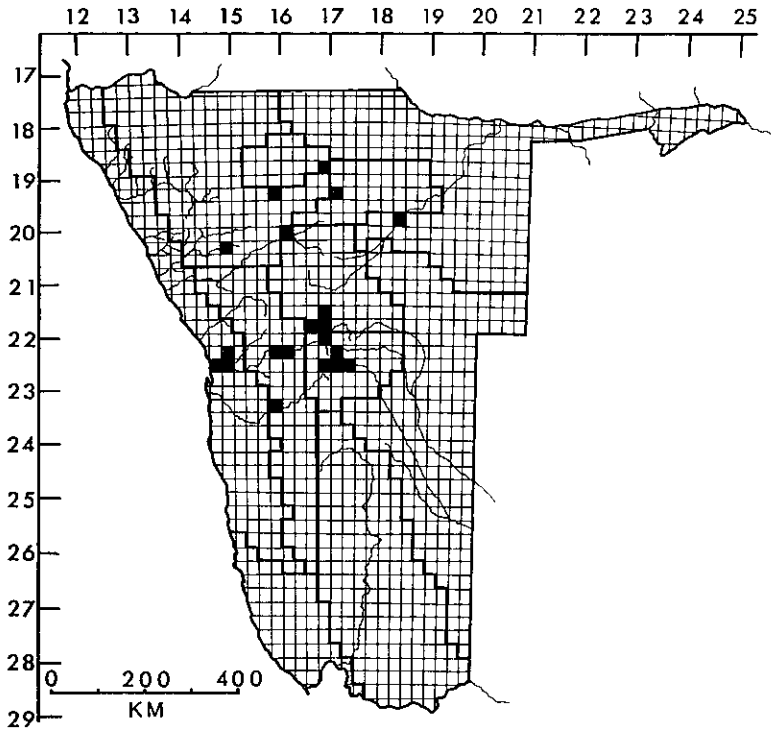
MAP 7. Distribution map of Datura ferox.



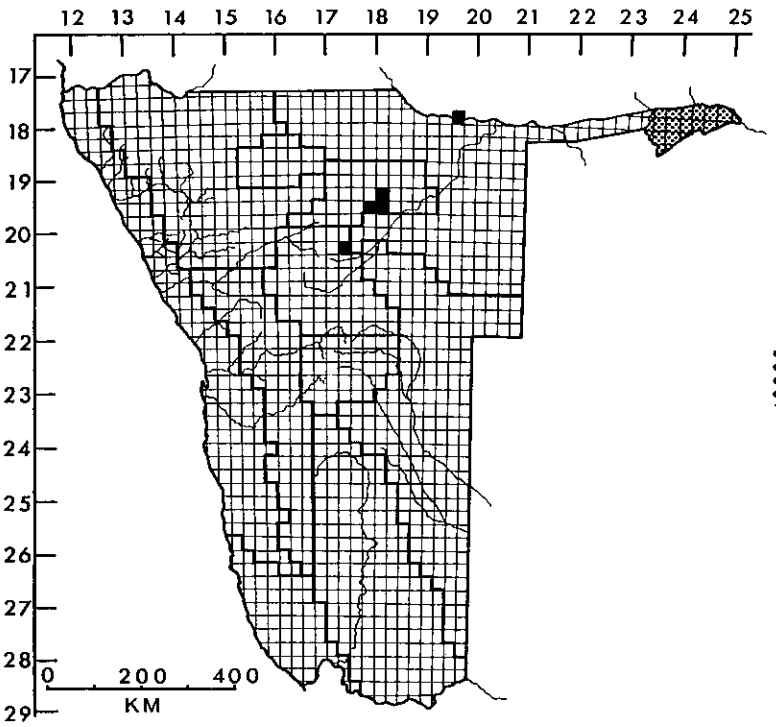
MAP 8. Distribution map of Datura innoxia.



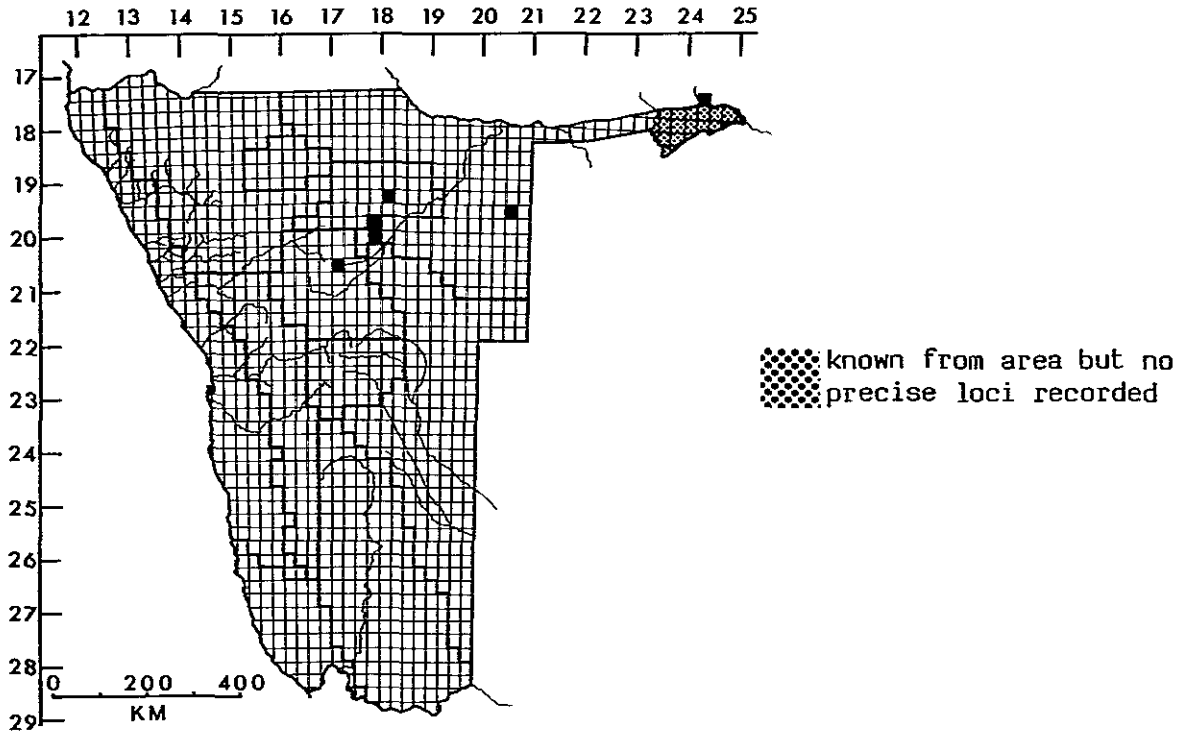
MAP 9. Distribution map of Datura stramonium.



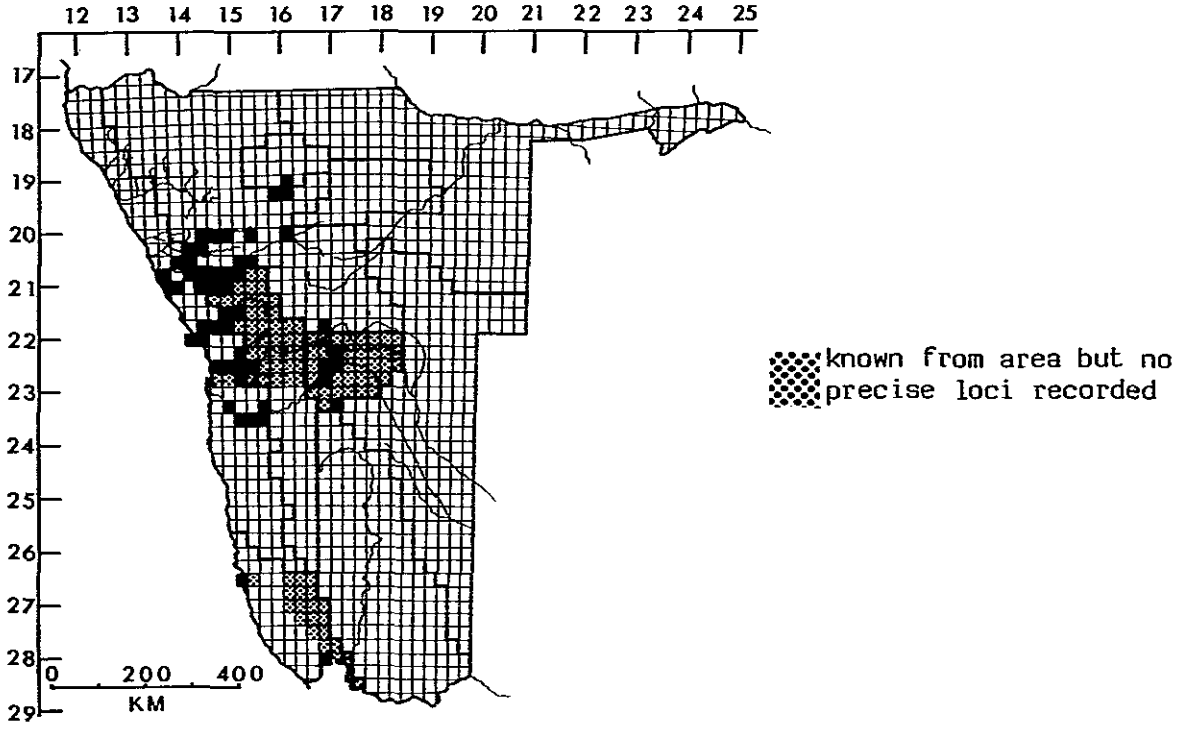
MAP 10. Distribution map of Flaveria bidentis.



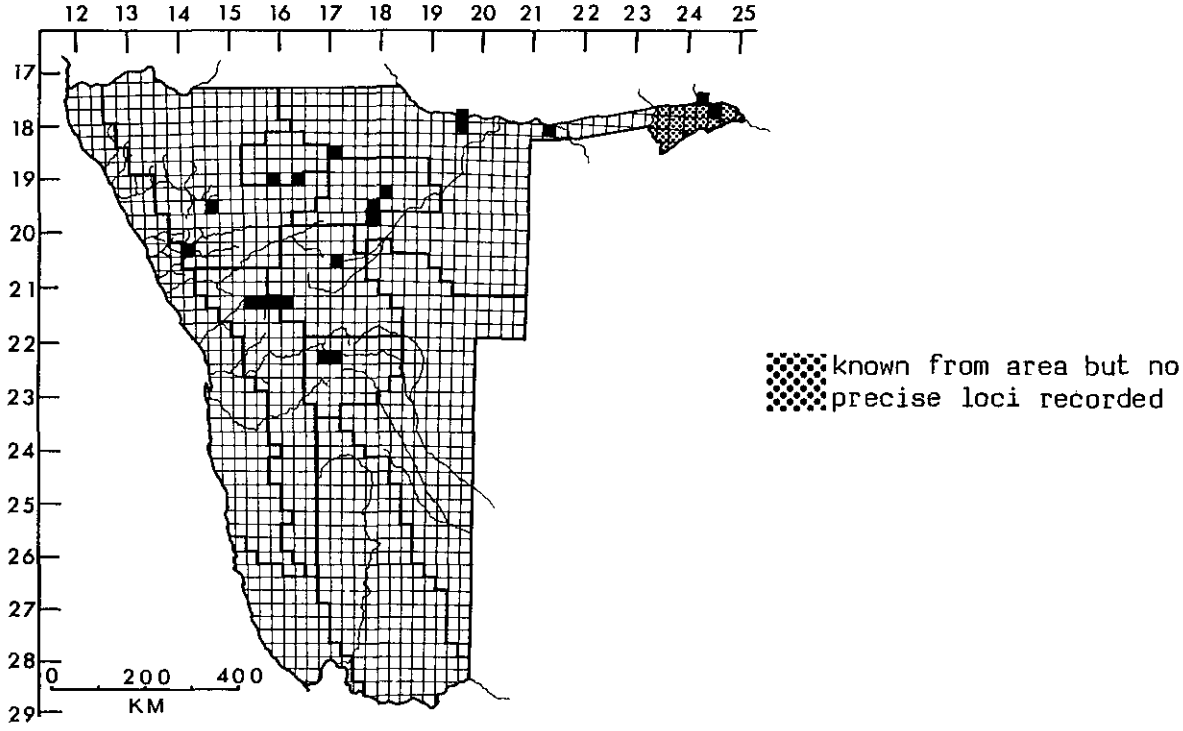
MAP 11. Distribution map of Lantana camara.



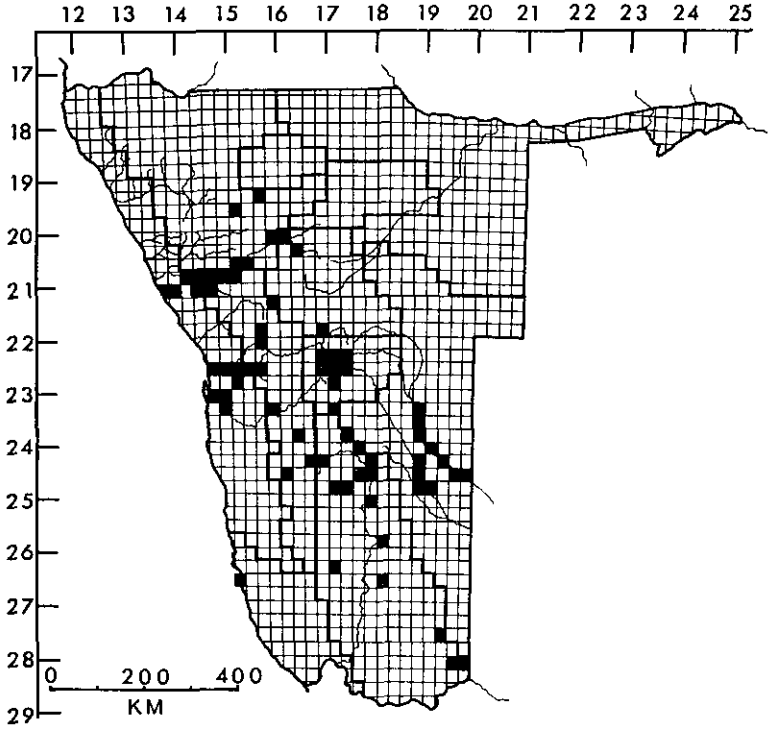
MAP 12. Distribution map of Melia azedarach.



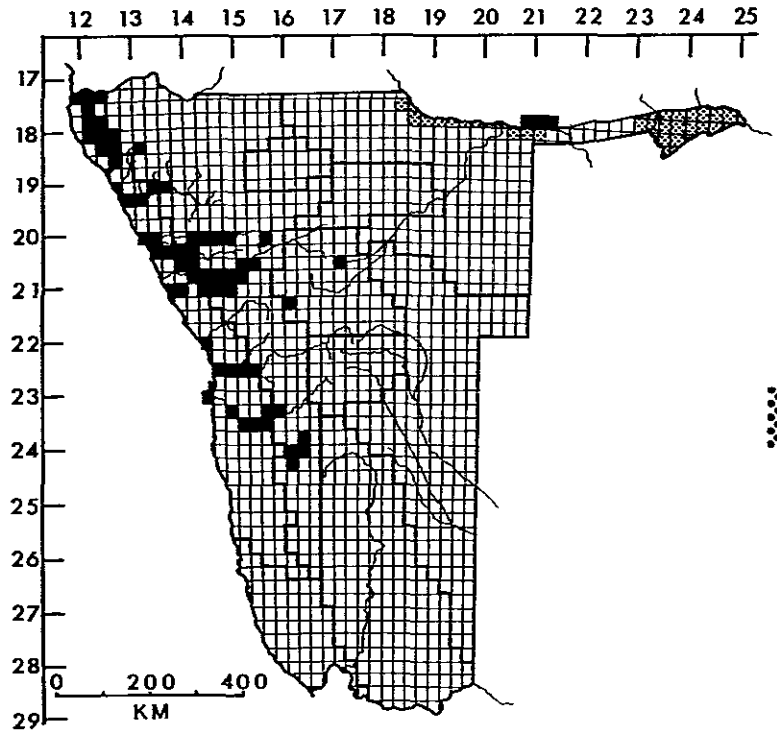
MAP 13. Distribution map of Nicotiana glauca.



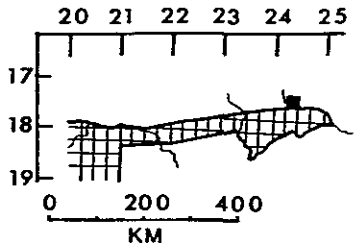
MAP 14. Distribution map of Opuntia ficus-indica.



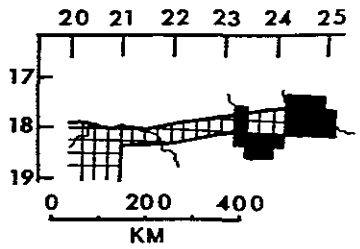
MAP 15. Distribution map of Prosopis spp.



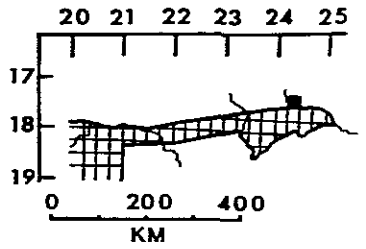
MAP 16. Distribution map of Ricinus communis.



Bambusa balcooa

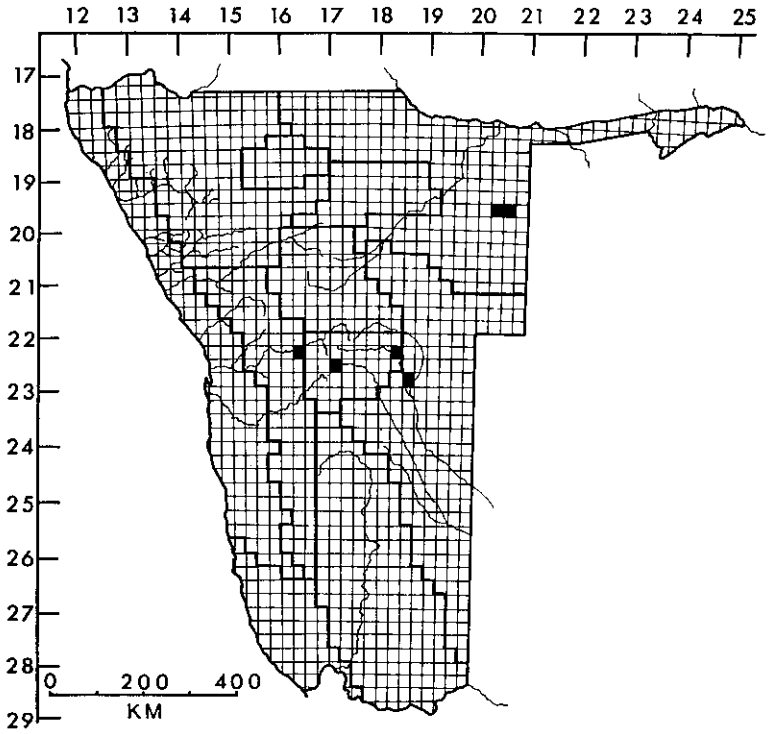


Salvinia molesta

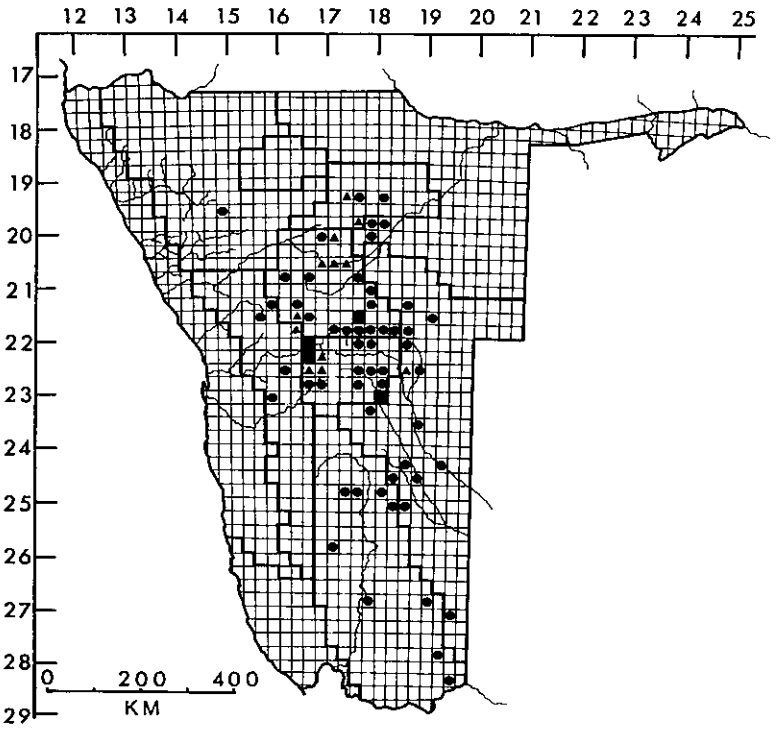


Solanum mauritianum

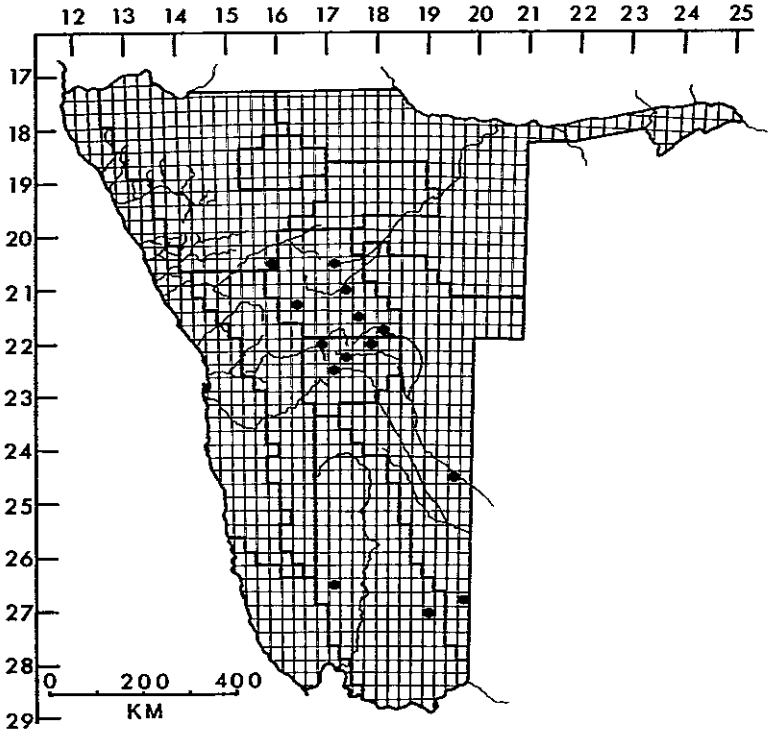
MAP 17. Distributions of three alien plant species known only from the Caprivi Strip.



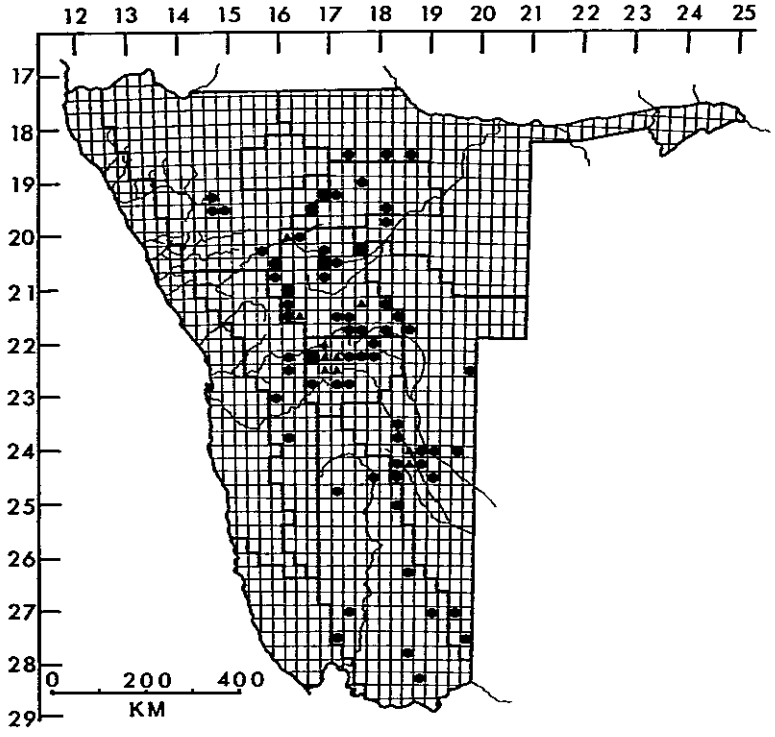
MAP 18. Distribution map of Xanthium spinosum.



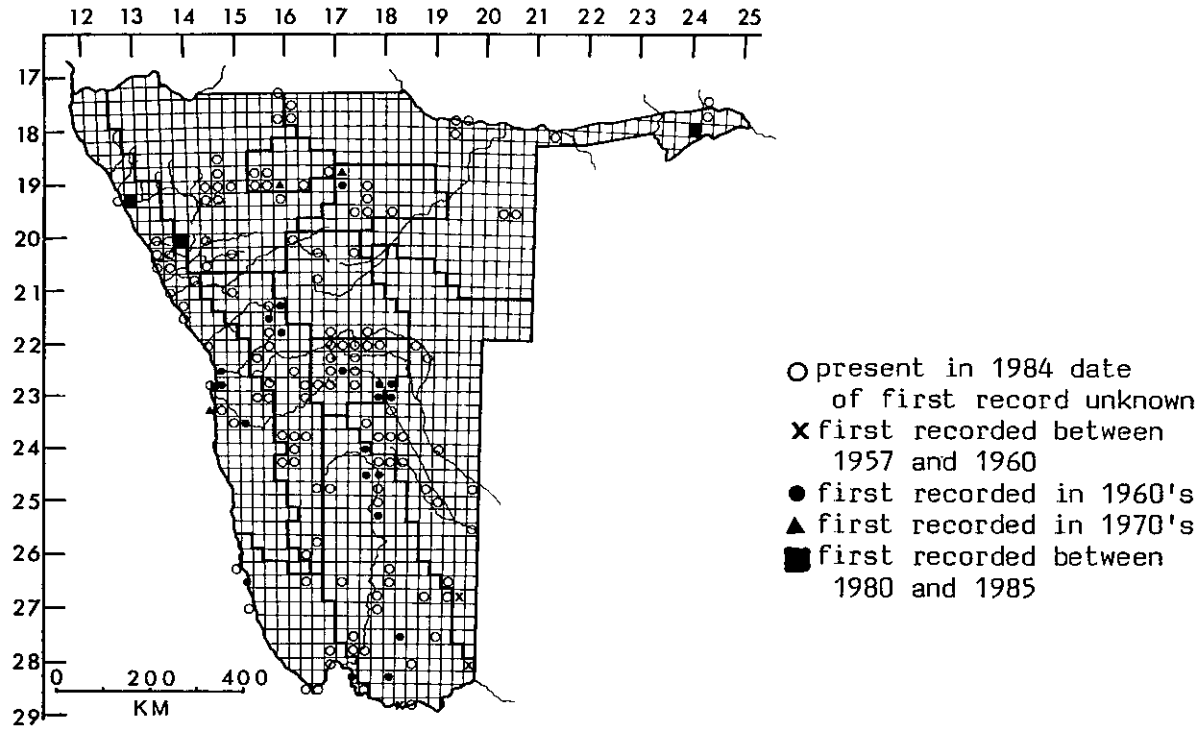
MAP 19. Distribution map of Cyprinus carpio.



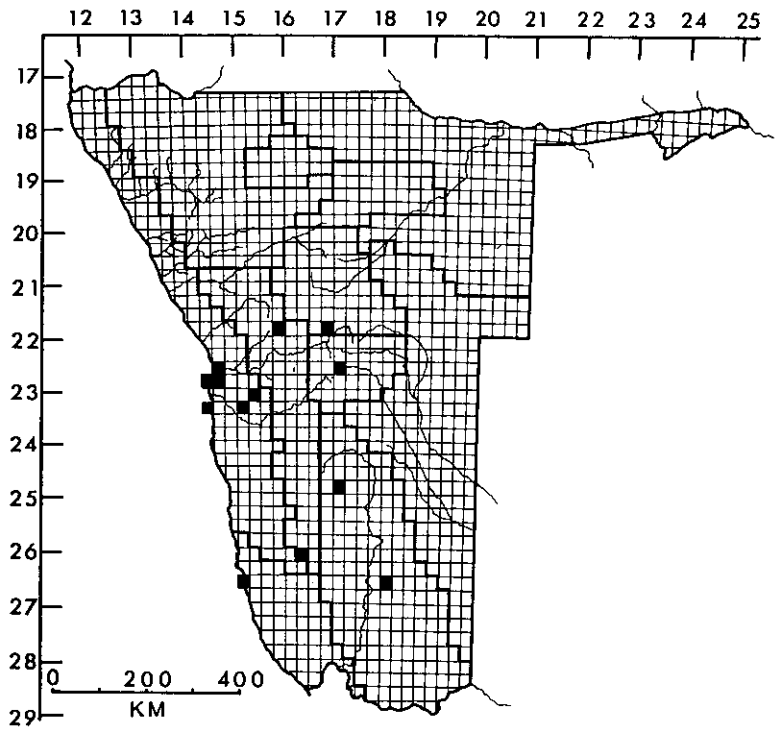
MAP 20. Distribution map of Micropterus salmoides.



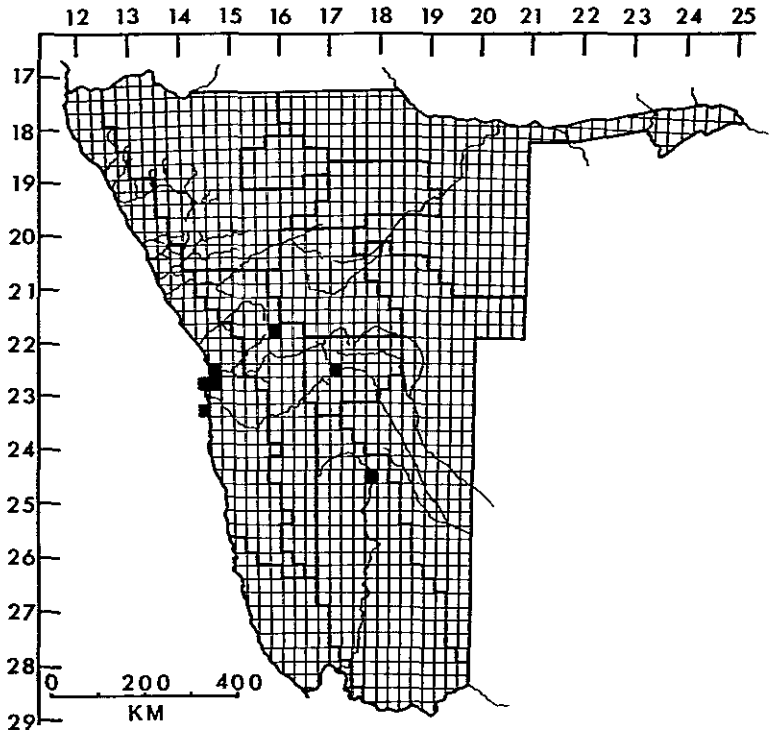
MAP 21. Distribution map of Oreochromis mossambicus.



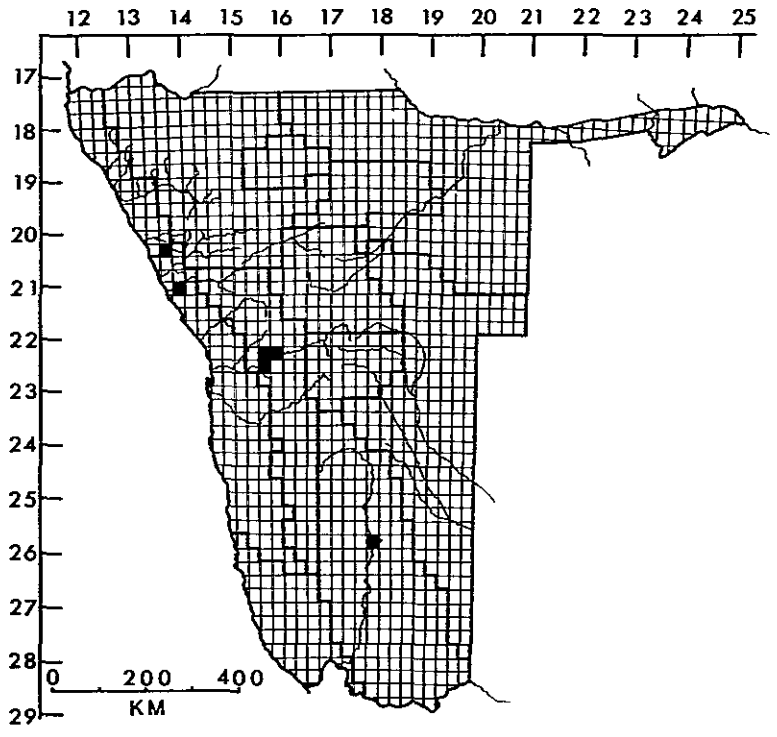
MAP 22. Distribution map of Passer domesticus.



MAP 23. Distribution map of Mus musculus.



MAP 24. Distribution map of Rattus rattus.



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