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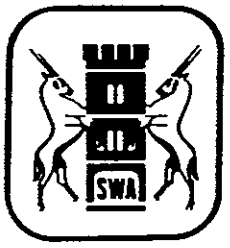

Invasive alien organisms in South West Africa/Namibia

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

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CHAPTER 2 INVASIVE ALIEN PLANTS IN BUSHMANLAND, OWAMBO, KAVANGO AND CAPRIVI

C J H Hines, C H G Schlettwein and W Kruger

INTRODUCTION

This chapter covers the extreme northern and eastern regions of SWA/Namibia (Map 3). These consist mainly of northern Kalahari sandveld and contain the only area of tree savanna or woodland in the country (Bioclimatic region 11, cf Map 2). Dominant tree species in the north include Baikiaea plurijuga and Pterocarpus angolensis while further to the south (near Tsumkwe) the woodland merges into open savanna with Combretum imberbe and Acacia species being dominant (Giess 1971). The western part of Owambo falls outside of the woodland vegetation type and into the mopani savanna (Bioclimatic region 9). Rainfall increases towards the east and north and covers the range of 400 to 700 mm per annum. Four perennial rivers occur in these regions; the Cunene on the extreme north-western corner of Owambo, the Okavango which runs along the northern border of Kavango and then cuts across into Botswana, and the Kwando-Linyanti-Chobe and Zambezi in eastern Caprivi. Two other systems, both episodic in character, are of importance. They are the Omatako system which rises on farmlands in north-eastern SWA/Namibia and crosses central Kavango to the Okavango River, and the Cuvelai system which rises some 300 km inside Angola, drains through central Owambo and ends in the Etosha Pan. The human population is very unevenly distributed in these regions with 44% of the total SWA/Namibia population of some 1 025 000 people living in Owambo. High population densities are also to be found in Kavango but confined to the edge of the Okavango River, and moderate (1-4 persons per km^2) human densities occur in eastern Caprivi. In the remainder of the area population densities are lower than one person per 4 km (van der Merwe 1983).

BUSHMANLAND

There are no alien plants in Bushmanland which are at present invasive. The following species are at present centred on human habitation, but pose a threat of potential invasion: 'Baster tsamma', Melia azedarach, and Xanthium spinosum.

SPECIES ACCOUNT

'Baster tsamma'. This melon is a cross between the indigenous tsamma (Citrullus lanatus) and another, non-indigenous species. The plant is

extensively cultivated by the Bushman in villages outside Tsumkwe, and is likely to be sought after by elephants Loxodonta africana and other game. Concern over this species is centred largely on contamination of the gene pool of the naturally occurring species.

Melia azedarach (Map 12). A number of trees have been planted in Tsumkwe and these could provide a potential source of infestation into surrounding areas.

Xanthium spinosum (Map 18). This species has recently been introduced into the area, with the establishment of an experimental farm, where about 300 cattle are kept. It was first found at a waterhole used by cattle when thousands of these animals were recently brought into Bushmanland by Hereros from Botswana. The recent occurrence of X spinosum in this area appears to be closely linked to the initiation of modern agricultural practices here.

Until recently Bushmanland has been relatively isolated from the activities of 'non-indigenous' man. This situation is changing rapidly, however, and a number of potential source points from which invasion of aliens could occur now exist. These are:

(1) The army camps now situated in Bushmanland. Gardens are a potential source of aliens such as Bidens formosa, Lantana camara, and others.

(2) Homesteads of Europeans in the Tsumkwe district, from which invasive species could also escape.

(3) Development projects, eg roads, experimental farms etc. Man-made disturbances in an area offer potential sites for invasion by aliens.

(4) Bushman villages. These are not considered a serious problem at present.

OWAMBO

No information is available on terrestrial alien plants in this area. The presence of a very dense human population, the large concentration of army camps and the extensive military movement in the area indicate the likelihood that invasive aliens probably do occur. This same military presence, however, makes assessing the situation almost impossible.

Two species of aquatic aliens have been recorded from the area. Myriophyllum aquaticum has been found in a man-made canal in Owambo (loci: 1714AD, BC and BD) and Pistia stratiotes has been recorded at Calueque (locus: 1714AD)

KAVANGO

The alien plants of Kavango are highly restricted in their distribution, and, at present, infestations can be regarded as light in all areas where these plants do occur. Species which have been recorded for this region

are Bidens pilosa, Lantana camara, Opuntia ficus-indica and Ricinus communis. The distribution of these species is restricted to areas of human habitation and to areas along the Okavango River.

Bidens pilosa. This species is at present limited to old agricultural lands, roadsides and other areas of disturbance.

Lantana camara (Map 11). This species has not yet been found along the river, but is very common in the town of Rundu, largely because it is sold by the Forestry nursery in the town. It has the potential to become a dangerous invader in this area.

Opuntia ficus-indica (Map 14). This species is restricted to old villages and areas of human habitation. It is not regarded as a potentially dangerous invader in this area as the habitat is not suitable for its spread. Present known distribution includes Mukwe, Andara area, the Fountain Omuramba and the Rundu area.

Ricinus communis (Map 16). The present distribution of this species is similar to that of Bidens pilosa, but also includes stretches of the river bank. Control measures should be initiated in the near future as this plant is potentially a very aggressive invader.

The potential source areas and routes for invasive alien entry into the Kavango are much the same as for Bushmanland. No aquatic aliens are known from Kavango.

CAPRIVI

The Caprivi has a number of invasive and potentially invasive aliens. Aquatic alien plants include Pistia stratiotes and Salvinia molesta.

SPECIES ACCOUNTS

Pistia stratiotes. One incidence of local infestation near Nkasa Island (locus: 1823BC) has been recorded. This infestation is light and currently is not considered to pose a threat. This species would probably be out-competed by Salvinia.

Salvinia molesta (Map 17B). This plant was first collected from the Zambezi River at Kazangula Island in 1948 (Mitchell 1967). It entered the Chobe River (a tributary of the Zambezi) in the early 1950's and by 1959 was considered to be abundant (Edwards and Thomas 1977). In 1965 S molesta was discovered in Lake Liambezi (Edwards et al 1972) and by 1967 it was found in the Linyanti River at Shaile, 43 km west of Lake Liambezi (Smith 1969). By 1972 it occurred continuously along the length of the Zambezi and Chobe Rivers in SWA/Namibia and had formed extensive mats on Lake Liambezi and the Linyanti River. By 1974 the upper Kwando River was infested (Edwards 1977). The infestation reached a peak in 1975 when 26% of the water surface of Lake Liambezi was covered (Seaman et al 1978).

Since 1975 the distribution of S molesta has not changed, but the density has fluctuated considerably.

During early stages of infestation this species has little influence on the aquatic habitat, but because of its exponential rate of proliferation it rapidly establishes an almost mono-specific dominance and displaces indigenous free-floating plants. The natural succession from aquatic to semi-aquatic and ultimately to a terrestrial ecosystem is considerably accelerated, particularly in areas such as Caprivi where the river gradients are small and where mats of Salvinia molesta hamper water flow and create permanent blockages that effect flood levels. Dense mats also effect water quality by excluding light, and the large accumulation of organic material results in anaerobic conditions and a change in the water pH (Schlettwein 1984).

Control methods were implemented in 1969. Two pools near Shaile and their surrounding areas were treated with Paraquat mixed with a wetting agent. After 24 days the pools were clear with only a few plants surviving near the edges (Smith 1969). In 1975 aerial spraying with Paraquat was attempted at Shaile, near Quega Island and a large reed-enclosed area at Kamantaudo on Lake Liambezi. Eight days after the first spraying, areas that had been missed were resprayed. Eight weeks later the whole area was resprayed to control regrowth. Four months after the treatment the water surface was open, but 16 months later abundant regrowth had occurred (Edwards and Thomas 1977). Between 1975 and 1979 an area of about 125 km^2 between Kongola Bridge and Lizuali Village was sprayed with Gramoxone and Paraquat. Good control was achieved, but abundant regrowth occurred (van der Waal 1979).

Biological control was initiated between 1972 and 1974 on the Chobe and Linyanti Rivers with the release of about 2 700 Paulinia acumniata and 1 300 Cyrtobagous singularis insects (Edwards and Thomas 1977). A second introduction of these two insect species was attempted by the Botswana Government, but attempts at recapture proved unsuccessful and it was assumed that neither species had become established. In 1981 C singularis were found on S molesta, but were not providing an adequate control; their natural host appears to be S anugularis (Schlettwein 1984). In 1982 the Department of Water Affairs, SWA/Namibia, imported 144 C salviniae insects, a species which has proved to be a successful control agent of S molesta in Australia. The breeding programme was unsuccessful, but in 1983 a further 500 insects were obtained. These bred successfully and by late 1984 some 7 000 individuals had been released at various localities in eastern Caprivi. They have become well established and it is hoped that by late 1985 the required control will have been achieved.

S molesta is a nutrient scavenger, capable of achieving high growth rates (3-8% per day), even in waters of low nutrient concentrations. It has no natural enemies and because of its floating nature, dispersal can be very rapid. For these reasons, every care should be taken to prevent its introduction to other water systems in SWA/Namibia, eg the Okavango River.

At present infestations of terrestrial alien plants are highly localized in the Caprivi. It should be noted, however, that a number of the species recorded are considered to have the potential to become extremely aggressive invaders. The reason for the present low incidence of alien infestation is that the Caprivi, like the Kavango and Bushmanland areas, has only

recently become affected by developments associated with the advance of western civilization. At present the most important potentially invasive plants are those associated with human habitation along the rivers. These include Argemone ochroleuca, Bambusa balcooa, Cannabis sativa, Erythrina spp, Ipomoea purpurea, Lantana camara, Mangifera indica, Melia azedarach, Opuntia spp, Psidium guajava, Ricinus communis, Sacchurum sacher, Solanum mauritianum and S seaforthianum.

SPECIES ACCOUNTS

Argemone ochroleuca (Map 4). This species has been recorded from isolated localities throughout the area where it invades disturbed areas such as old agricultural lands and roadsides. It is a potential threat, although it is not known how competitive this species is in areas where indigenous species are well established.

Bambusa balcooa (Map 17A). Two isolated populations are known to occur in the Zambezi River near Katima Mulilo. The potential threat of the species is difficult to assess.

Cannabis sativa. This species has been planted in some areas and can escape, but is unlikely to cause problems as escapees will probably always be utilized.

Erythrina spp. This genus does not occur naturally in the Caprivi, but has been planted around kraals and villages and has been noted to be growing 'wild' near some villages.

Ipomoea purpurea. There are widespread infestations of this species in the swampy areas.

Lantana camara (Map 11) and Melia azedarach (Map 12). These species are common in the gardens in the towns. So far no known infestations occur outside the towns, but the potential for invasion is high.

Mangifera indica. The present status of this species and its potential for invasion are closely linked to those of Psidium guajava. This species may be regarded as a particular threat along the river courses.

Opuntia ficus-indica (Map 14). Some localized infestations occur around human habitation. As in the Kavango, the potential threat is low due to the general lack of suitable habitat.

Psidium guajava. This species is restricted at present to areas of human habitation. The potential rate of spread of this species is extremely high. Once P guajava becomes successfully established it is extremely difficult to control as it is attractive to a wide variety of frugivorous

birds and other animals. P guajava can be a highly aggressive competitor. In Natal it has been known to take over large tracts of riverine bush, in association with Mangifera indica. There is considerable cause for concern with regard to this species.

Ricinus communis (Map 16). Small isolated populations occur througout the area. This species has spread with the advance of civilization in the area, being found along roads and in old agricultural lands as well as on the floodplains of the Zambezi, Chobe and Kwando Rivers. This species poses a serious threat because of the large areas which may potentially be infested, and because its control is difficult.

Sacchurum sacher. This species was planted by the local inhabitants along the banks of the malopos (isolated 'fingers' of fresh water), from whence it has been observed to spread along the shoreline. The potential for infestation of other areas is likely to be low, but the ecological threat to the malopos is considerable. This species is likely to be difficult to control.

Solanum mauritianum (Map 17C). This species is known from some gardens, and a population occurs within Katima Mulilo. Its invasive potential is high as its berries are a highly sought after food source for frugivorous birds.

Solanum seaforthianum. Commonly cultivated in gardens in the town. This species can be a real problem in riverine fringing vegetation. Its invasive potential is considerable.

DISCUSSION

One feature of all these areas is that there are few, if any, invasive species, and where these species do occur their incidence of occurrence is low. This situation exists for a number of reasons.

All these areas have been relatively isolated from the influences of urbanization, infrastructural development and expanding white populations for a long time. The areas have been relatively inaccessible and because of this alien plants have only relatively recently been introduced. Exceptions are the aquatic species, which have been transported by river rather than by man. These areas can therefore be said to be years behind the rest of the country as regards the introduction and spread of invasive aliens.

These areas are subject to high frequency fires. Up to 60% of their area burns every year and fires are of a random nature and probably of high intensity as ground cover is usually good. This fire regime has existed for hundreds if not thousands of years and the indigenous vegetation can therefore be expected to be highly fire-adapted. The competitive advantage usually afforded an invasive alien because of the absence of natural predators/pathogens can be considered to be negated by this fire regime. Fire can therefore be regarded as a major factor in the control of invasive plants in these areas.

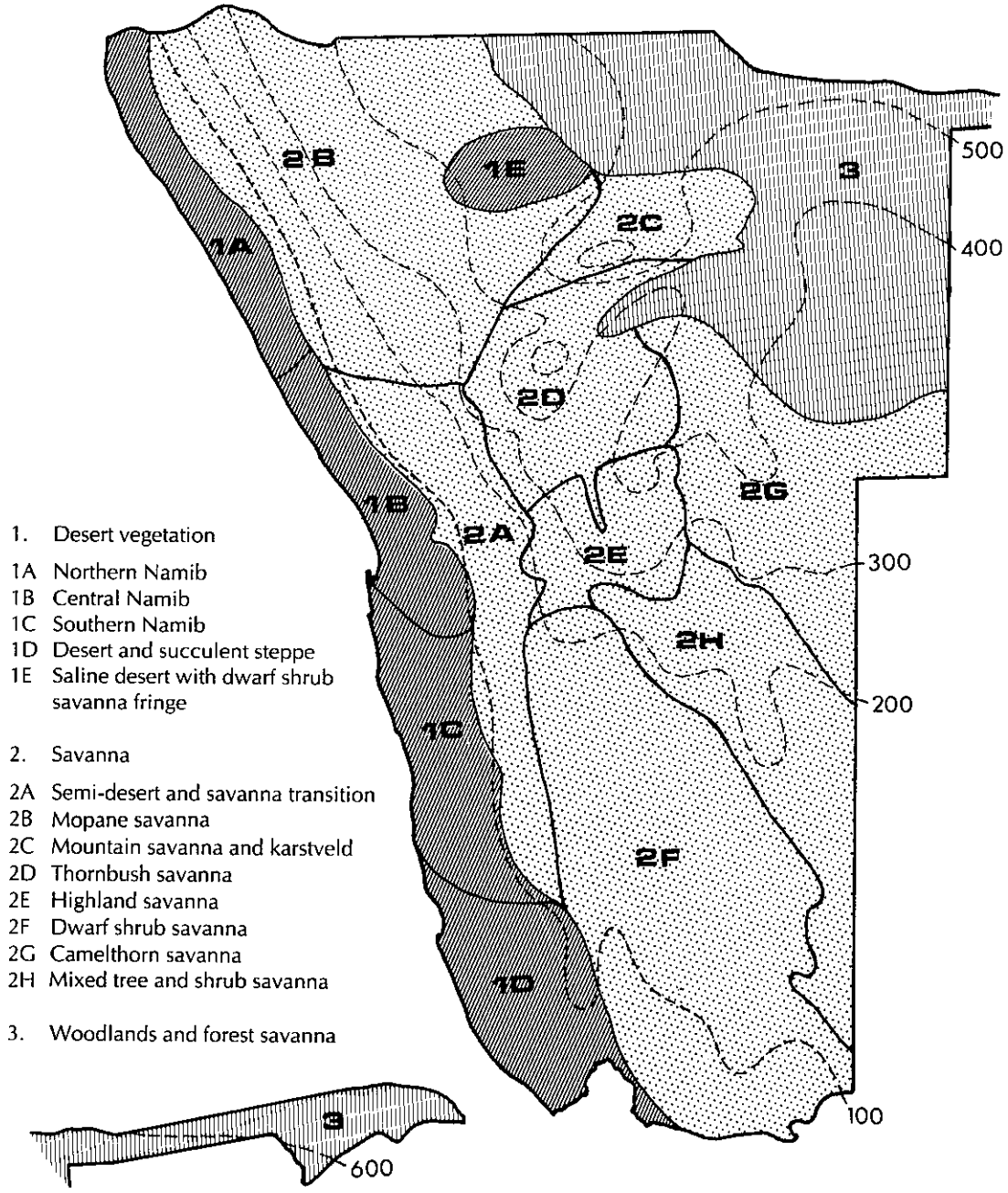
Bushmanland and the southern Kavango have always been extremely sparsely populated and because of this have never been subject to any intensive agriculture. These areas are isolated on a veterinary basis and there has therefore been no migration of potential alien invasives from the farming areas into Bushmanland/Kavango. This situation has recently changed in Bushmanland with the establishment of the experimental farm. Special attention is required to make sure that invasive alien plants are not introduced into the area in stock feeds.

Bushmanland and southern Kavango are unique in that there are no rivers or drainage systems in the area. Precipitation tends to be locally dispersed (into pans and omiramba) and there is no inflow and outflow of water in these systems.

CONCLUSION

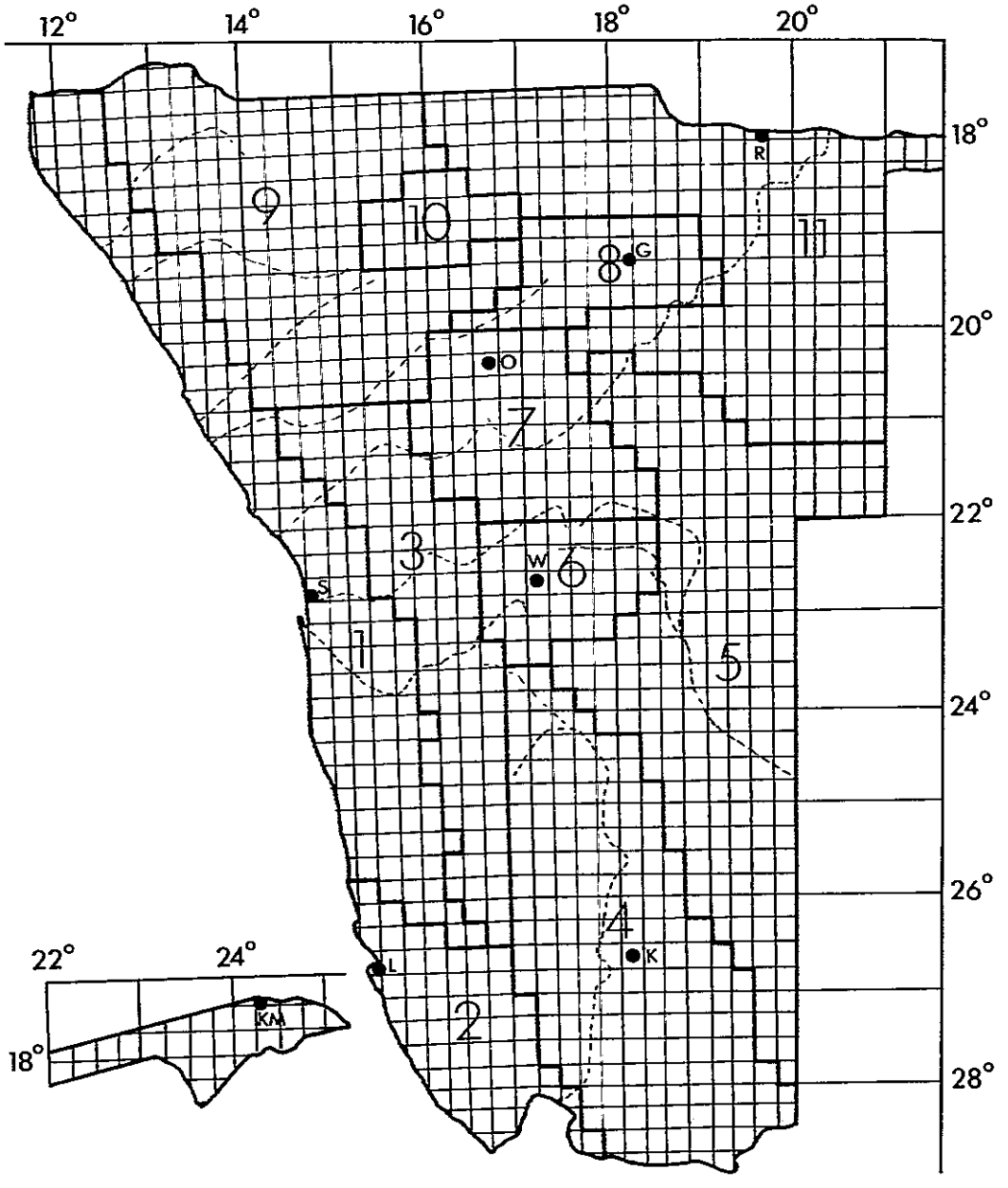
It is the conclusion of the authors that the situation which exists at present in Bushmanland, Kavango and Caprivi is unique. Large areas have no invasive aliens at present and other areas have extremely low levels of infestation. Special attention should be given to this situation in so far as the control of the importation of species, plant eradication and the sale of invasive aliens are concerned. It is a matter for concern that in both Kavango and Caprivi potential invasive aliens are sold by the Forestry departments. In the opinions of the authors this practice should be suspended immediately. It is also felt that the planting of alien species along river banks should be strictly controlled. An ordinance covering invasive alien plants is urgently required if this desirable situation is to be perpetuated. The situation in the more densely populated Owambo is uncertain and warrants more detailed investigation.

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

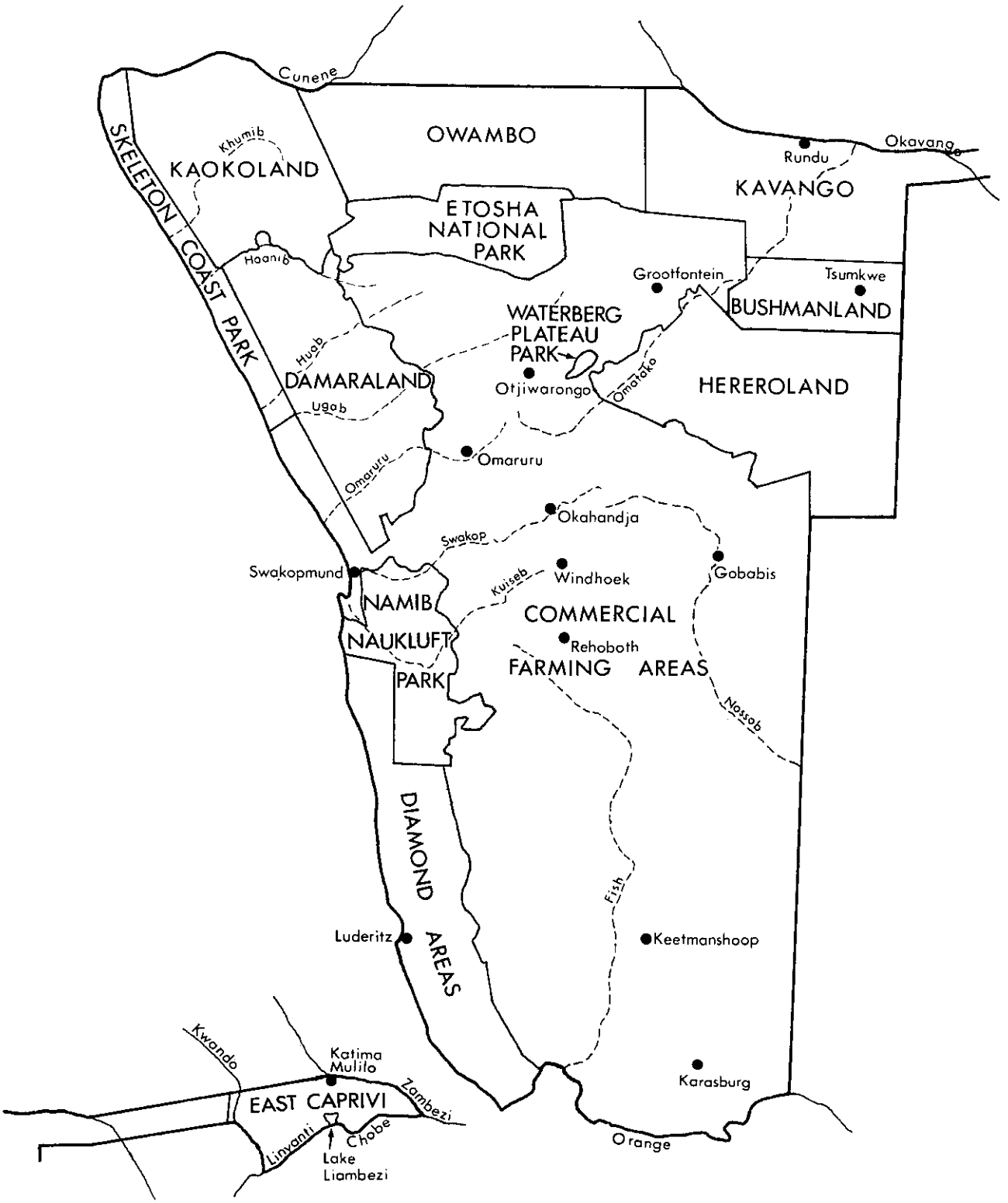


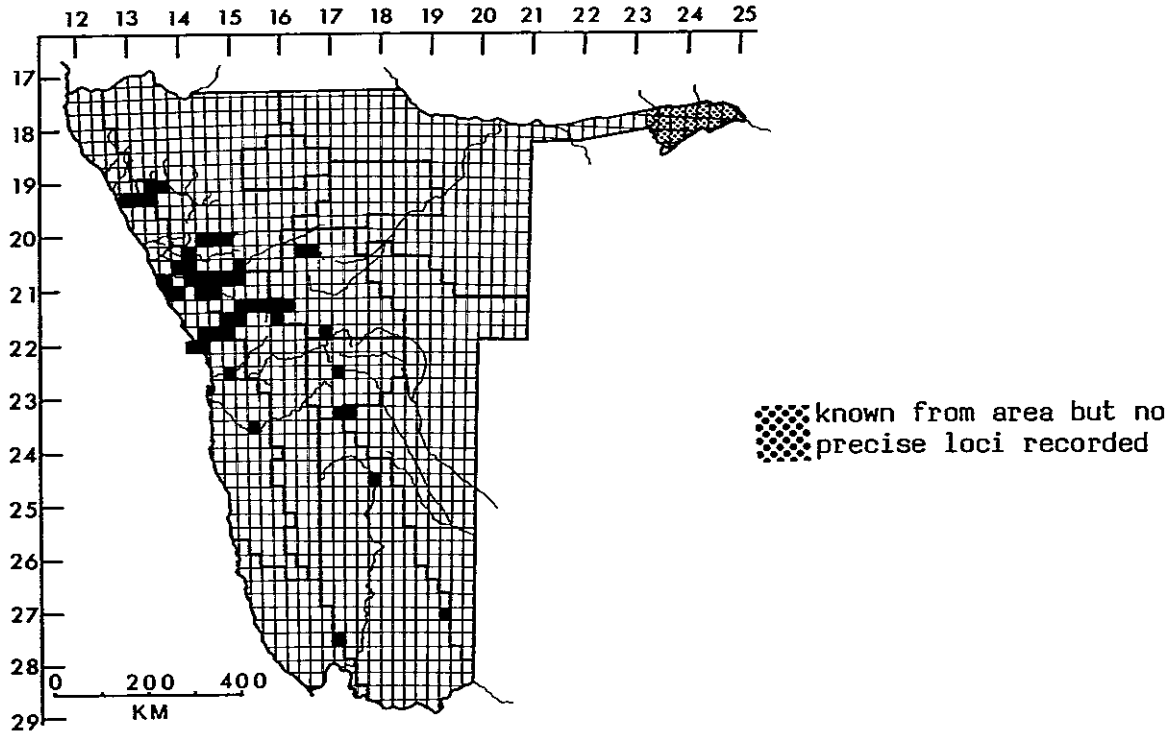
MAP 2. Bioclimatic map showing regions, quarter-degree squares, major rivers and major towns.

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

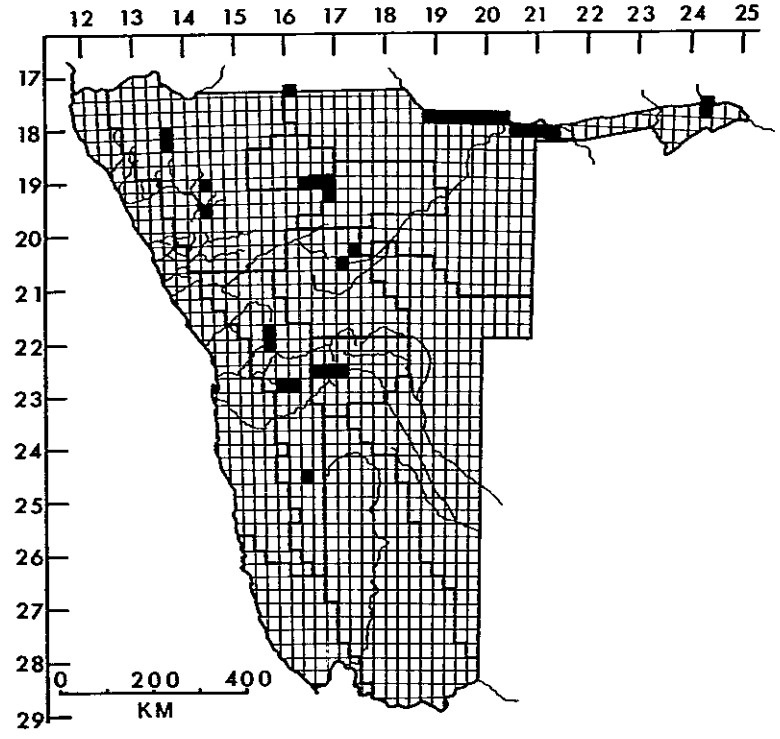


MAP 3. South West Africa/Namibia showing main place names mentioned in text.

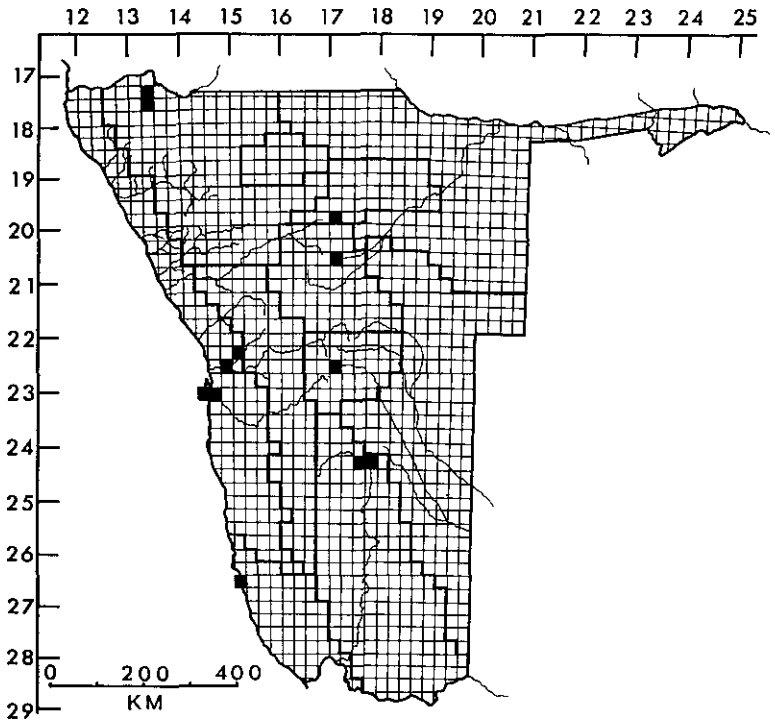




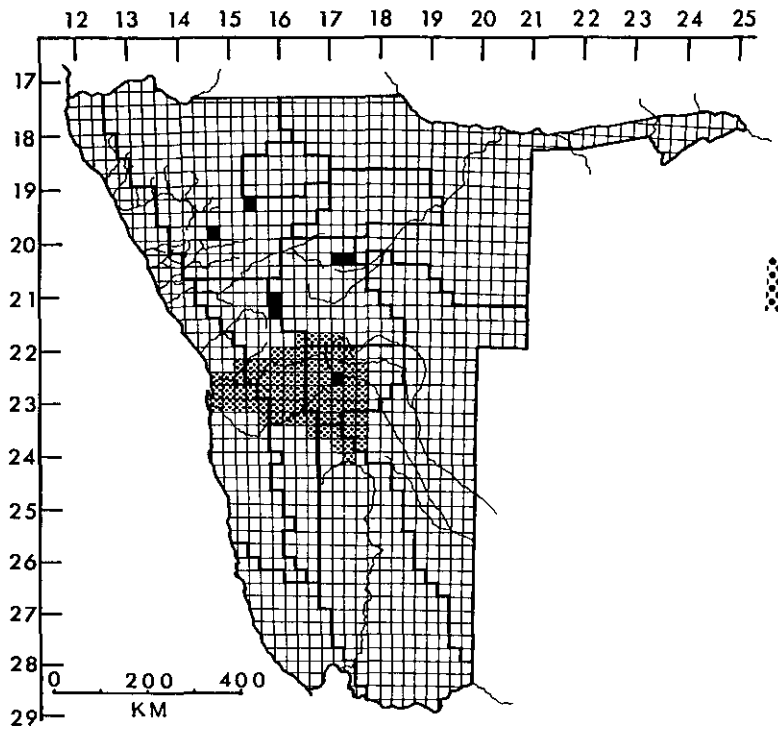
MAP 4. Distribution map of Argemone ochroleuca.



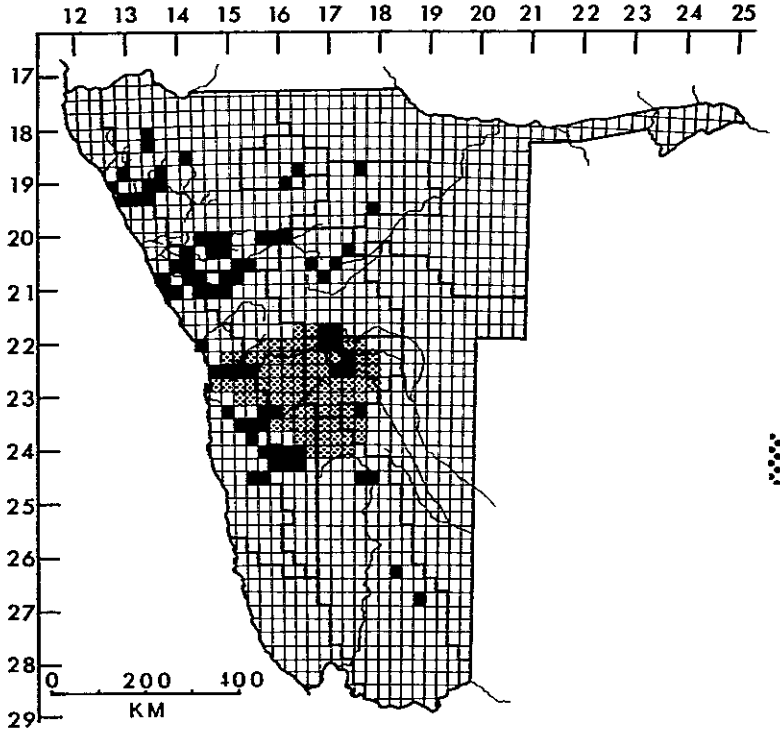
MAP 5. Distribution map of Bidens biternata.



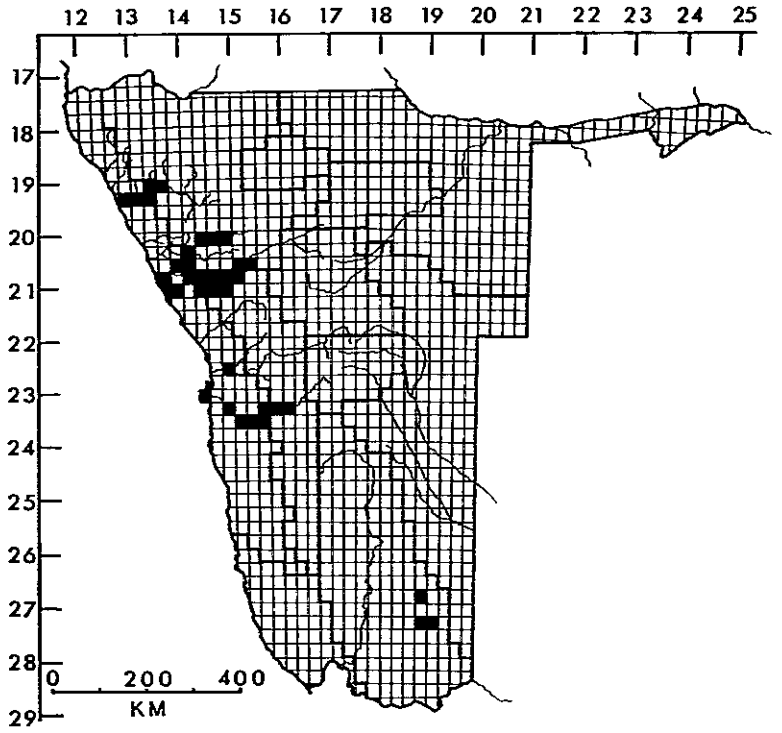
MAP 6. Distribution map of Chenopodium ambrosioides.



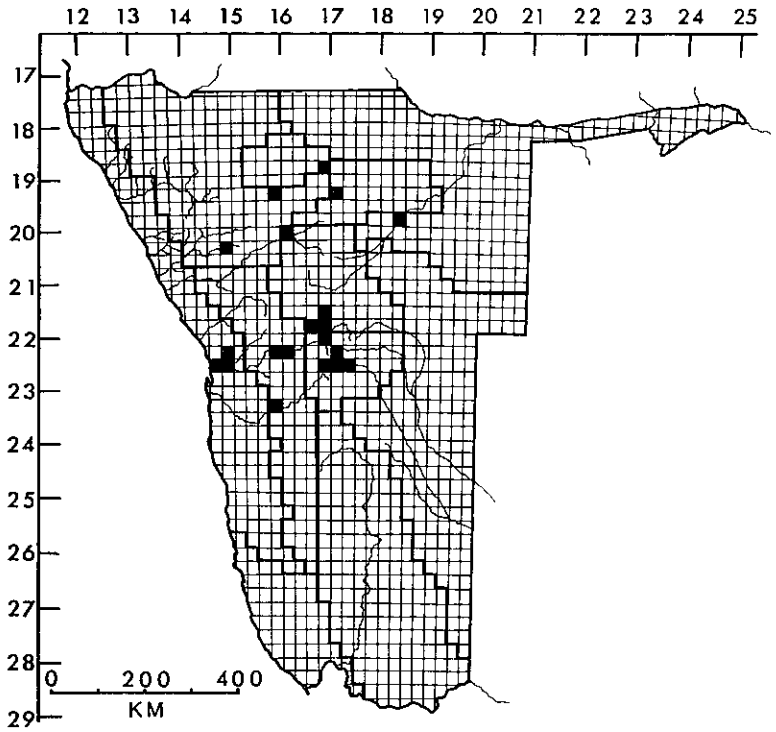
MAP 7. Distribution map of Datura ferox.



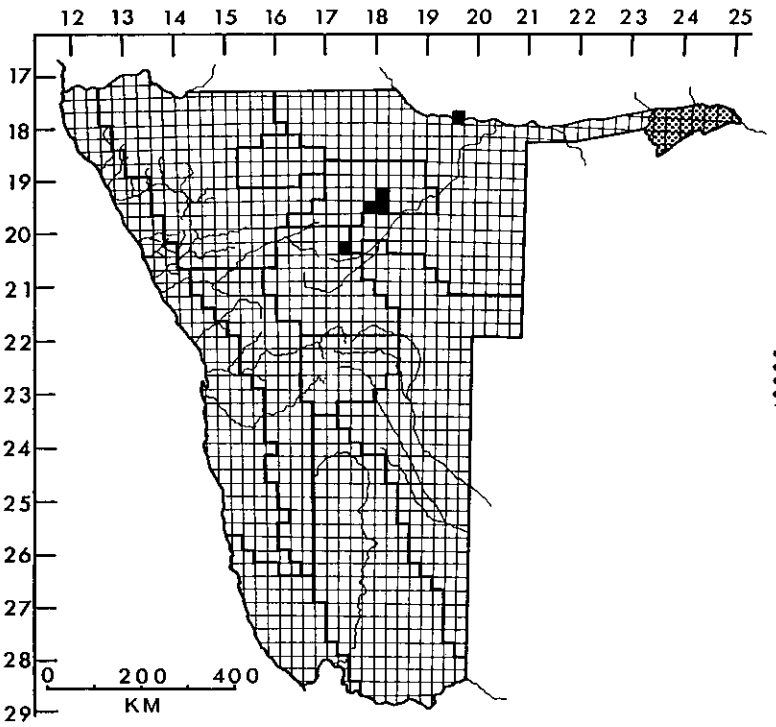
MAP 8. Distribution map of Datura innoxia.



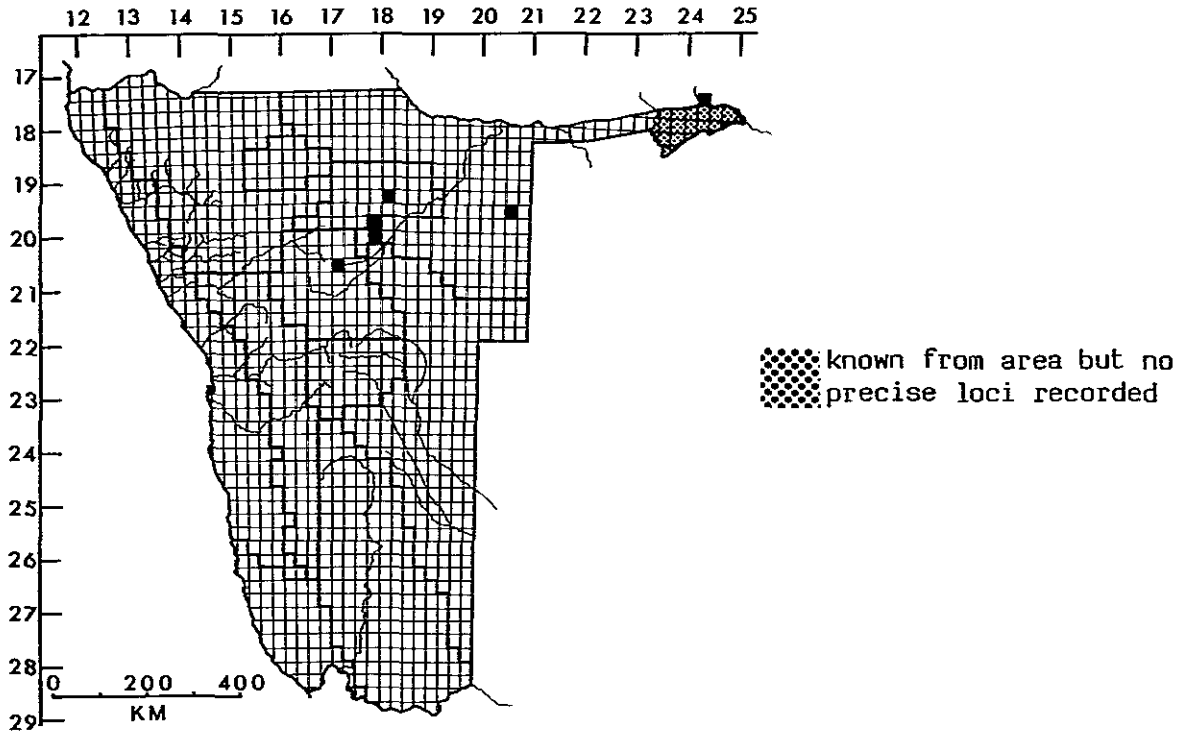
MAP 9. Distribution map of Datura stramonium.



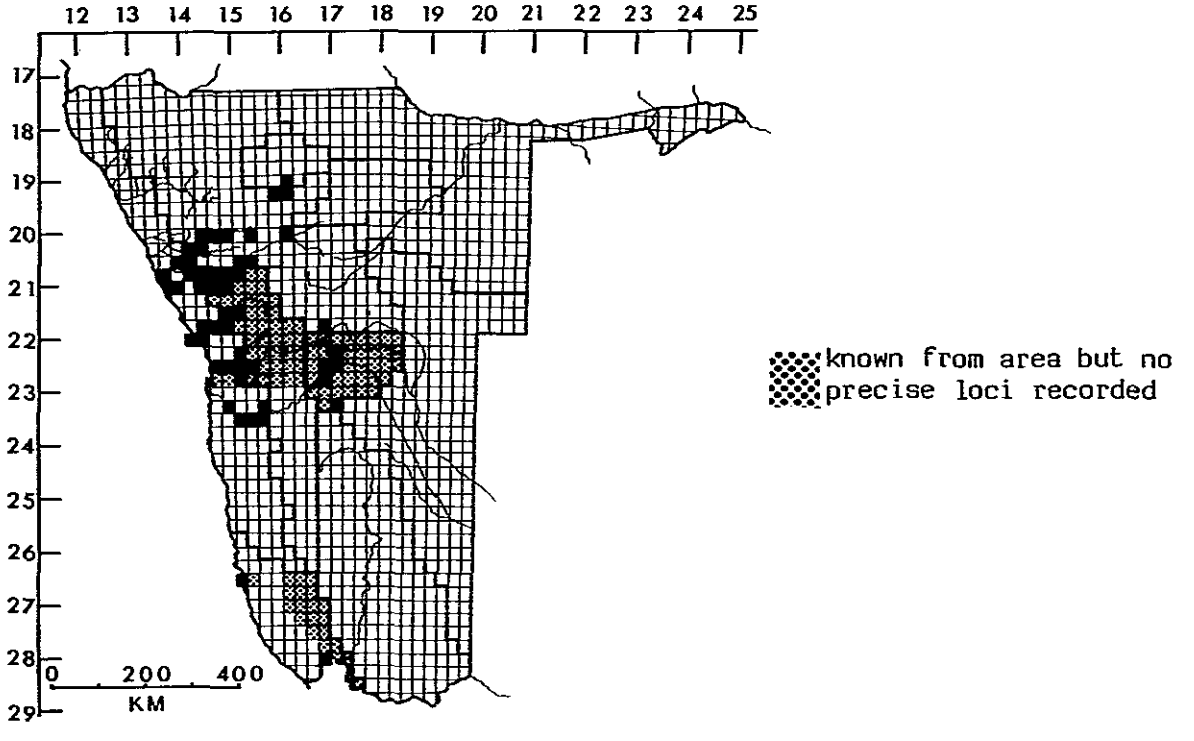
MAP 10. Distribution map of Flaveria bidentis.



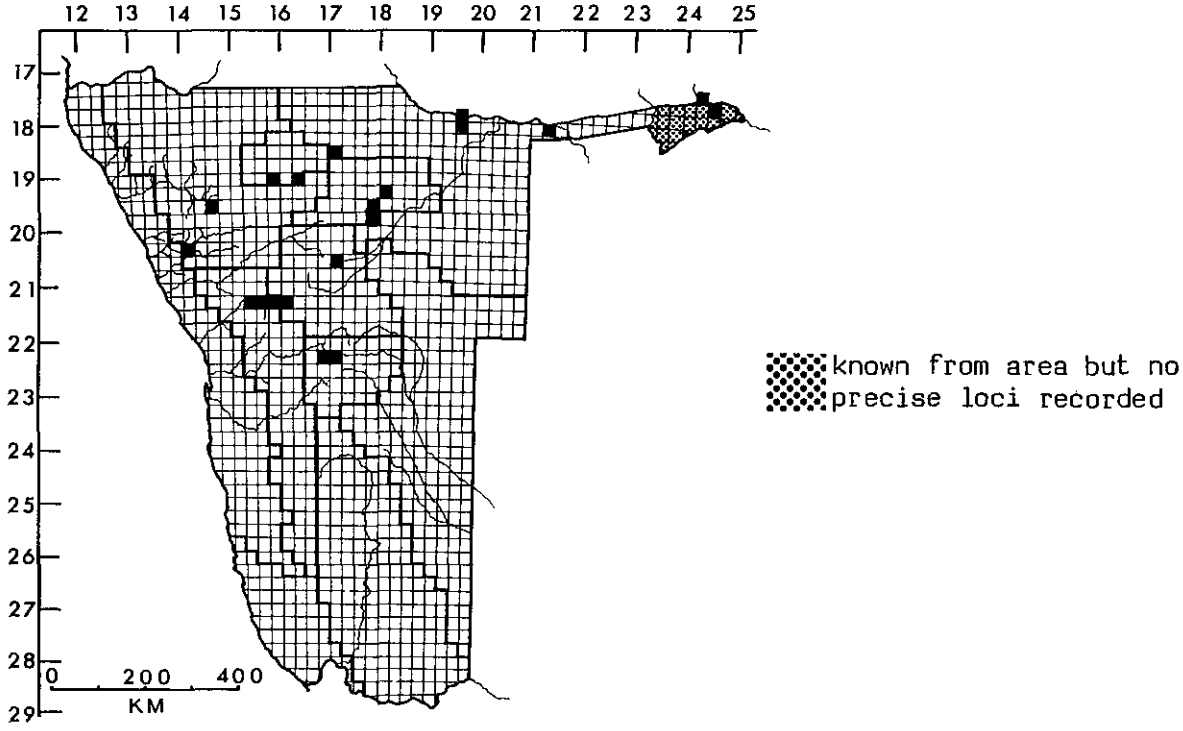
MAP 11. Distribution map of Lantana camara.



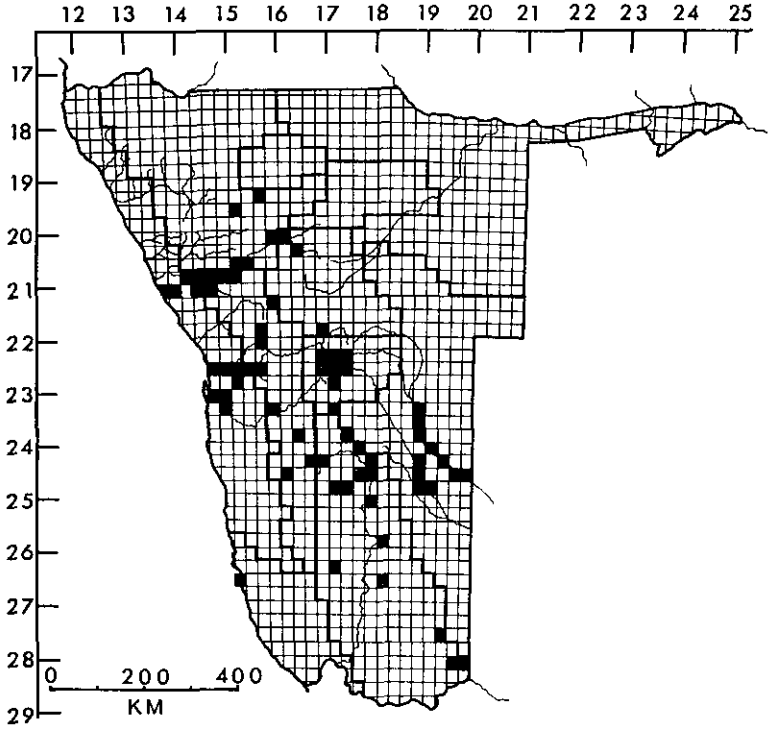
MAP 12. Distribution map of Melia azedarach.



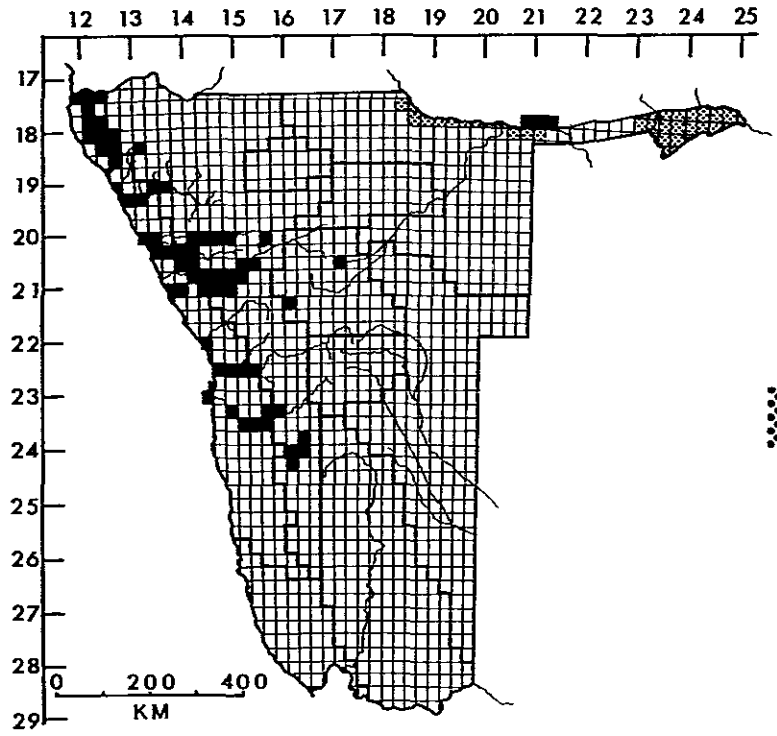
MAP 13. Distribution map of Nicotiana glauca.



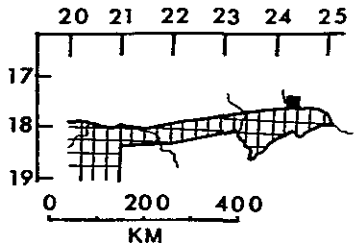
MAP 14. Distribution map of Opuntia ficus-indica.



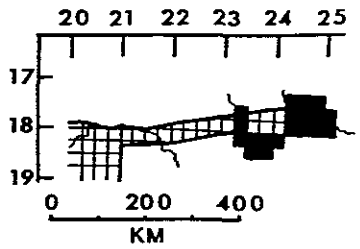
MAP 15. Distribution map of Prosopis spp.



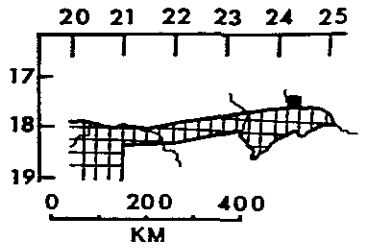
MAP 16. Distribution map of Ricinus communis.



Bambusa balcooa

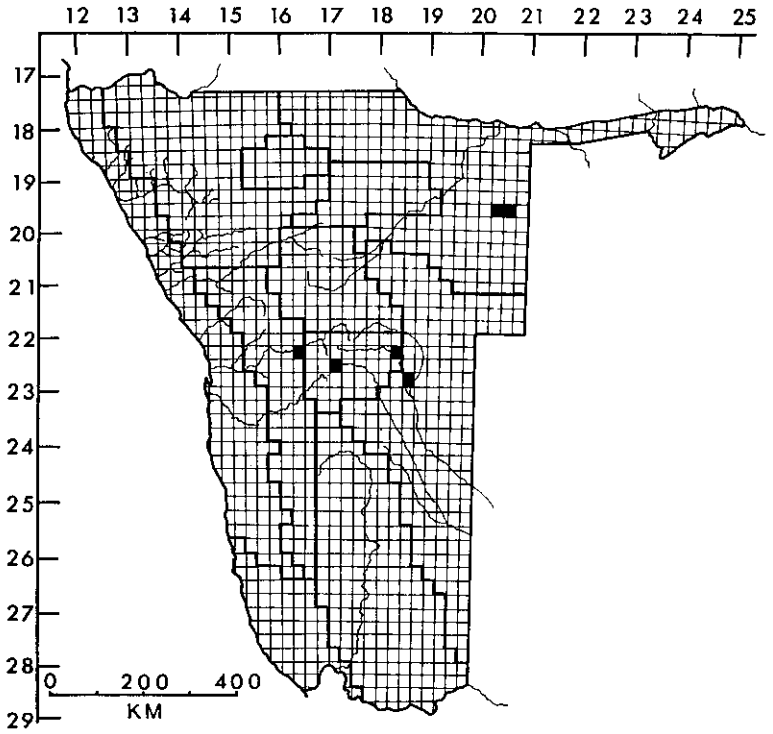


Salvinia molesta

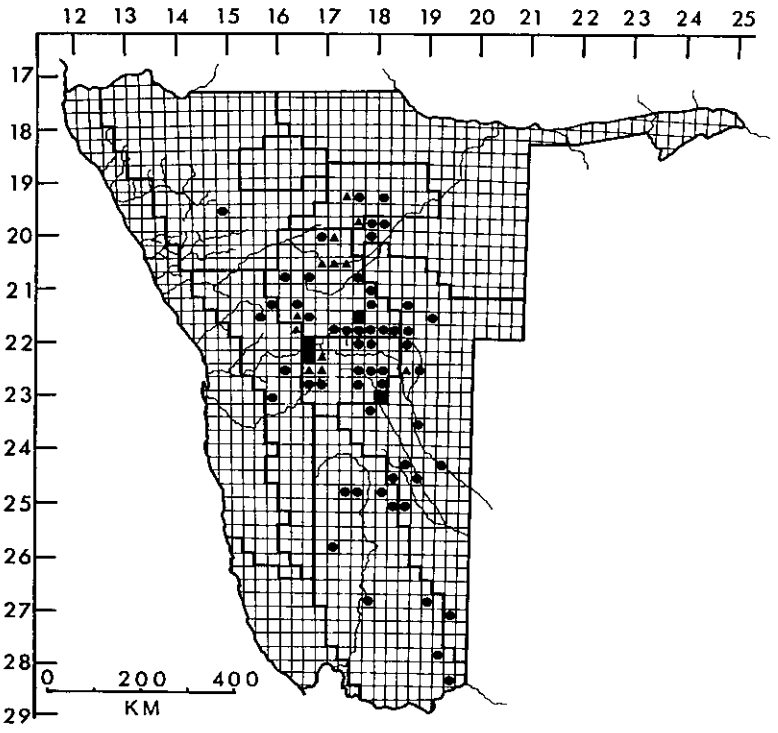


Solanum mauritianum

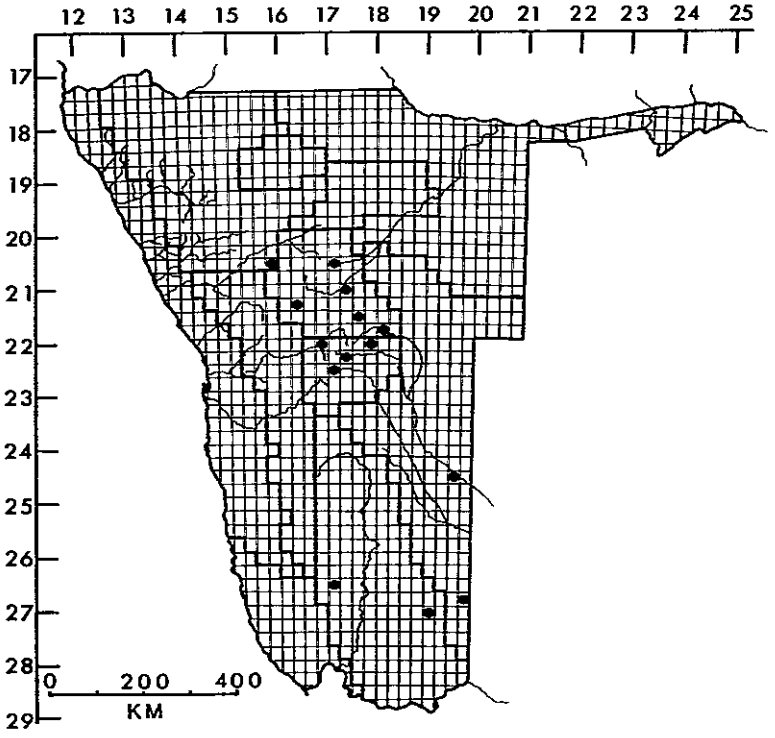
MAP 17. Distributions of three alien plant species known only from the Caprivi Strip.



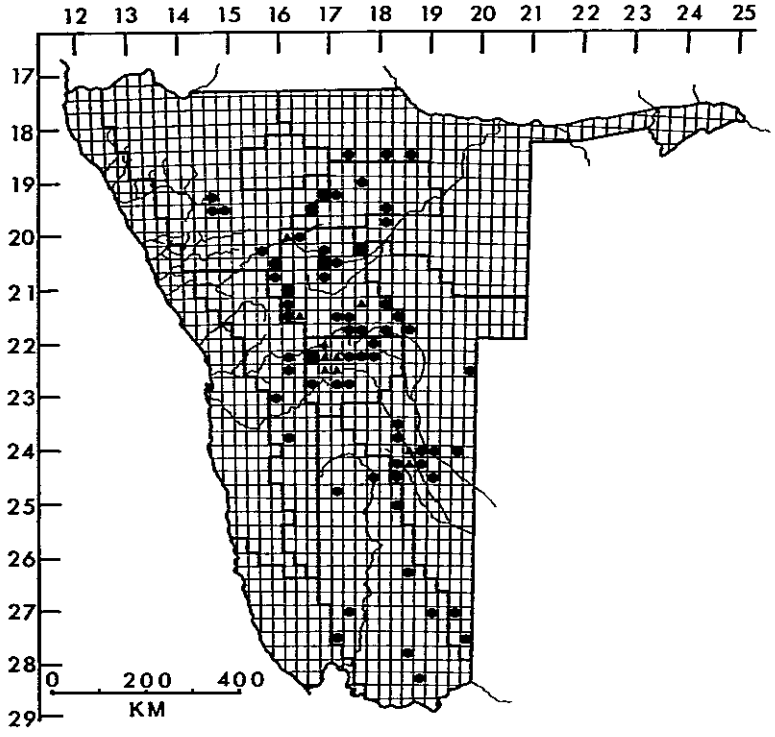
MAP 18. Distribution map of Xanthium spinosum.



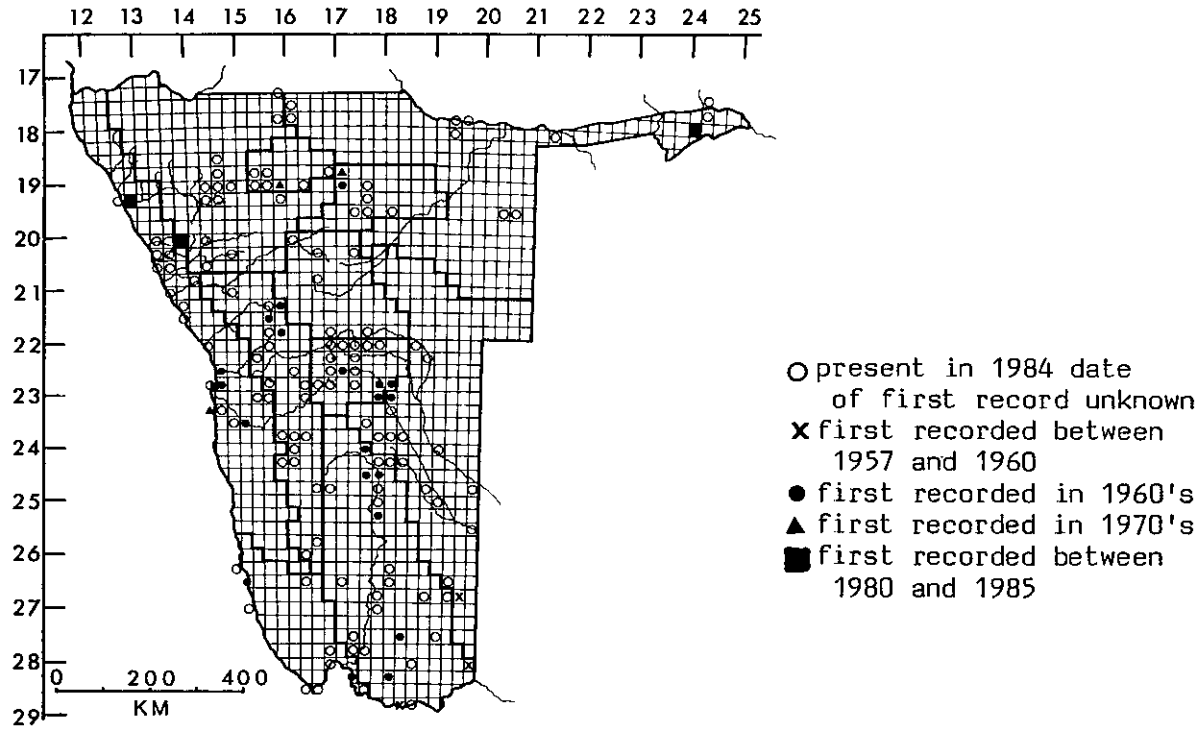
MAP 19. Distribution map of Cyprinus carpio.



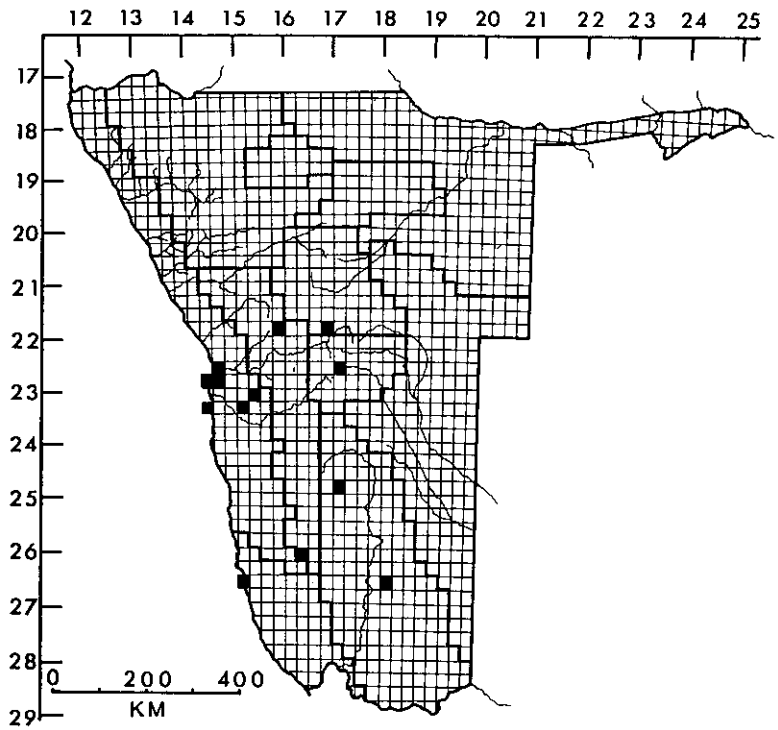
MAP 20. Distribution map of Micropterus salmoides.



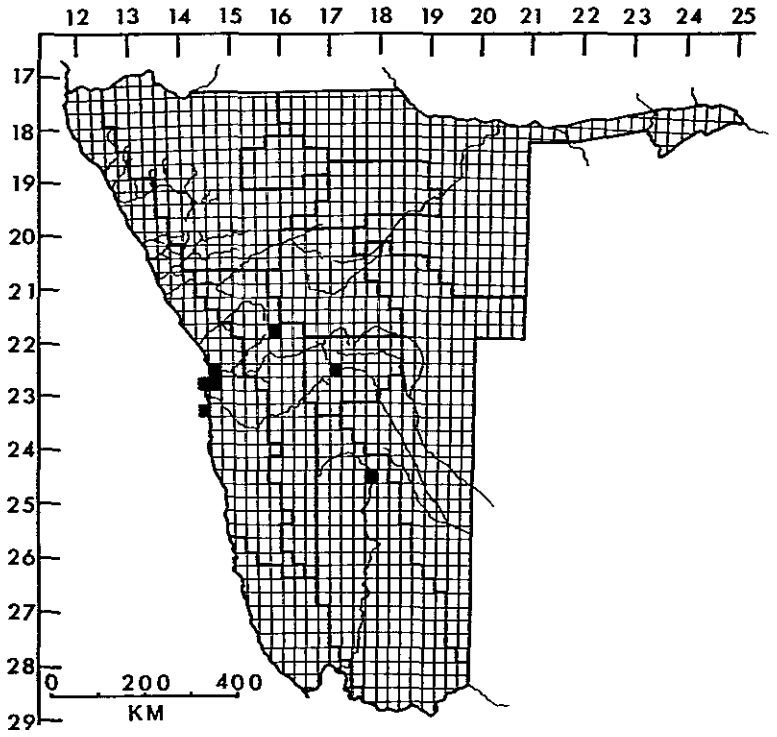
MAP 21. Distribution map of Oreochromis mossambicus.



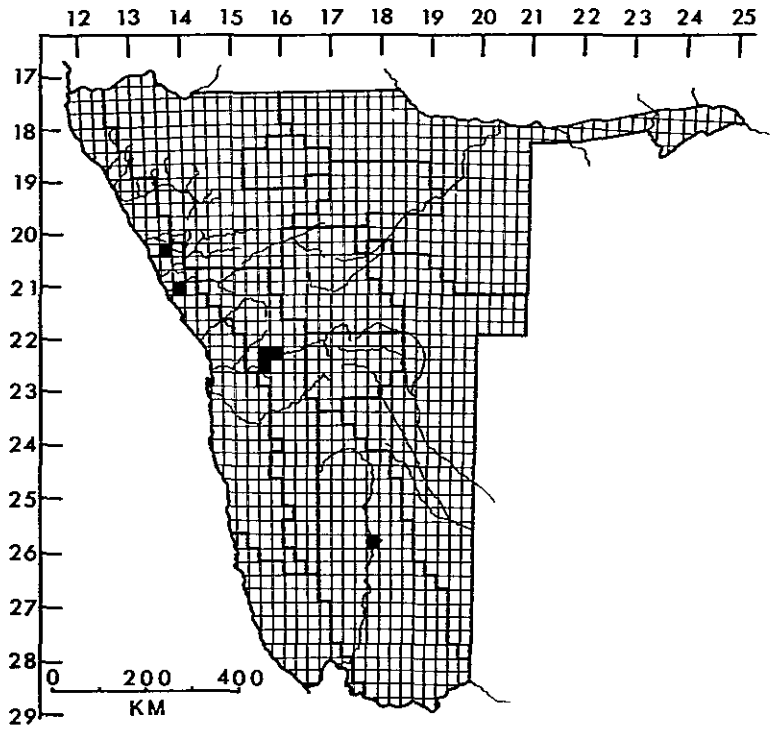
MAP 22. Distribution map of Passer domesticus.



MAP 23. Distribution map of Mus musculus.



MAP 24. Distribution map of Rattus rattus.



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