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THE DISTRIBUTION OF *COLOPHOSPERMUM MOPANE* (LEGUMINOSAE - CAESALPINIOIDEAE) IN AFRICA

I. MAPAURE

National Herbarium and Botanic Garden, Box CY 550, Causeway, Harare, Zimbabwe.

SUMMARY

The distribution of the vegetation types in which *Colophospermum mopane* is common or dominant is presented. These occur only in southern Africa mainly in valley bottoms of rivers and streams on heavy, calcareous, often sodic, soils. These areas often coincide with hot arid conditions, and mopane forms pure stands in some places. The largest expanse of mopane vegetation is found in Angola whilst the smallest is in Malawi. The main factors affecting the distribution of mopane are soil type, rainfall and altitude, but these vary in importance from country to country.

KEY WORDS: *Colophospermum* - mopane - Southern Africa.

INTRODUCTION

Colophospermum mopane (Kirk ex Benth.) Kirk ex J. Léonard, or mopane, is a tree or shrub belonging to the sub-family Caesalpinioideae of the family Leguminosae. It is only found in southern Africa where it is known by several names including mupani, mopani, balsam tree, butterfly tree, turpentine tree (general), musharu (Sabi valley, Zimbabwe), mutiati (Angola), mopanie (South Africa) and chanate (southern Mozambique). Its distribution is principally influenced by moisture availability expressed through altitude, rainfall and soil texture, and it can occur as a tree or shrub in woodland or savanna vegetation types. Mopane has a shallow but aggressive rooting system (Thompson, 1960), utilising moisture in the upper soil horizons. On shallow soils with impeded drainage the species remains a shrub, but grows quite tall on deeper soils where its height can be taken as an indicator of soil depth.

The distribution of mopane vegetation has been shown in Werger and Coetzee (1978) but the maps presented lack much detail. The map presented here gives the distribution of this vegetation type in its two physiognomic forms, woodland and savanna, at a more detailed scale.

METHOD AND RESULTS

The map of mopane vegetation (Figure 1), showing the distribution of the vegetation types in which mopane is common or dominant, divided into woodland and savanna, was produced by tracing the maps of the Flora Zambesiaca area (Wild & Barbosa, 1968), Angola (Barbosa, 1970), Namibia (Giess, 1971) and South Africa (Acocks, 1988). The Flora Zambesiaca map is quite detailed regarding the distribution of mopane in Zimbabwe, Zambia and Malawi but such level of detail is lacking for Botswana and Mozambique. The boundary of mopane vegetation at the border of Botswana does not directly join onto the boundaries of the same vegetation type in South Africa, and this is shown as a dotted line

on the map. The areas covered by mopane vegetation in each country were calculated using a dot planimeter and are shown in Table 1 below.

Table 1. The percentage of areas covered by mopane vegetation in each country.

Country	Area (km ²)	Proportion of country area (%)	Proportion of total mopane area (%)
Angola	112 500	9	20
Botswana	85 000	15	16
Malawi	10 000	9	2
Mozambique	98 000	13	18
Namibia	77 000	9	14
South Africa	23 000	2	4
Zambia	43 500	6	8
Zimbabwe	101 500	26	18
Total	550 500	89	100

NB. Area figures are rounded off to the nearest 500 km² or nearest percentage point.

DISCUSSION

Mopane is an ecologically and economically important plant species with an attractive, durable, termite-proof timber which has a resinous smell (van Wyk, 1972). However, the timber has mostly been used in mines and as fencing posts because it is hard to work and many boles are hollow. Mopane is claimed to produce the best firewood in Africa (National Academy of Sciences, 1980). It also provides good quality browse for livestock and game, and the leaves are nutritious even when dry (Guy *et al.*, 1979; Kelly & Walker, 1976).

Mopane is deciduous but differs from most miombo species in that no early flush of leaves occurs towards the end of the dry season. Its flowering time is in December to January and the fruits mature in April to May. It has an ecological predictive value as it is commonly found on non-alkaline, fertile, slightly acid, friable permeable soils (Thompson, 1960). However, Dye & Walker (1980) have shown that the A-horizon of many of the soils under mopane is shallow and non-sodic but the B-horizon is alkaline with a limited capacity to absorb and retain water.

Where mopane occurs grasses are often excluded, and the resulting woodland or shrubland has a low species diversity. Because of the poor grass cover the soils are susceptible to erosion, removing the richer topsoil and leaving the sodic soils exposed. These soils have often been regarded as infertile and intractable (Thompson, 1960), but this is not always the case. Studies in the the Chiswiti area of the Zambezi valley (Barrett *et al.*, 1990) have shown that some of these soils have good arable potential.

Low winter temperatures are thought to be important in determining the southernmost boundary of *Colophospermum mopane* vegetation (Werger & Coetzee, 1978).

The distribution of mopane within each country is discussed below in terms of possible major environmental factors.

Angola

Mopane occurs only in the south-western part of the country, lying between Lobito in the north and the Angola-Namibia border in the south, continuing into Namibia. Rainfall seems to play a major role in its distribution. It occurs on a variety of soil types, largely on granite, where the rainfall is above 100 mm per annum. In some areas mopane is found on compact soils and on what are called "black cotton soils" (Barbosa, 1970). Both mopane woodland and savanna are present.

Botswana

The area of mopane vegetation stretches from the Limpopo River in the east to the Makgadikgadi pans in the north, and receives an average of 400-600 mm of rainfall per annum. Mopane vegetation occurs as woodland and savanna, their distribution seemingly determined by rainfall. The species occurs on both young and old soils, the young consisting of sands, silts, clay loams and clays, and supporting mixed tree and bushland savanna. Mopane woodlands also occur on fersiallitic soils on uplands and on siallitic colluvial soils with impeded drainage (Mitchell, 1976). The height of mopane seems to depend on the depth of the soil on which it is growing - where there are impermeable subsoils mopane grows to only about 6-8 m (Mitchell, 1976). The species also occurs in drainage lines where soils are impervious clays with calcrete overlain by sand.

Malawi

Mopane is found in the lower Shire River valley south of Chikwakwa, the upper Shire valley, and around the southern shores of Lake Malawi. It is closely associated with compact, alkaline, dark grey sandy clays with free calcium carbonate (Werger & Coetzee, 1978), often referred to as "mopanosols". The soils in the upper Shire are deep and support mopane woodland, while the rest of the area is tree savanna. The altitude in these areas ranges from 450-500 m and rainfall is below 800 mm per annum. Altitude and soil type seem to be the major influences on distribution.

Mozambique

In Mozambique both mopane woodland and savanna are principally associated with the Zambezi, Limpopo and Save river valleys. These areas receive 400-700 mm of rainfall per annum, and rainfall seems to be the main influencing factor. In the Zambezi valley soils are relatively deep, compact, clayey and calcareous, derived from Karoo formations (Wild & Barbosa, 1967), and support both mopane woodland and savanna. The Save and Limpopo valleys are composed of Pleistocene lacustrine calcareous alluviums on which mopane savanna is found.

Namibia

Mopane stretches southwards from the Kunene River towards the Ugab and north-eastwards towards Namutoni. There are also small patches in the Caprivi Strip. It occurs on a variety of soil types and its distribution seems to be principally influenced by rainfall. In areas receiving less than 100 mm annual rainfall (e.g. parts of the Namib desert) mopane is only found as shrubs in small depressions (Werger & Coetzee, 1978). The remainder of the area under mopane receives 500-600 mm annually (Giess, 1971).

South Africa

A large mopane belt along the Limpopo valley culminates in the Soutpansberg range in the south and at the Limpopo-Luvuvhu confluence. Another belt occurs in the Kruger National Park. Its distribution appears to be influenced by altitude and rainfall, with the soil type affecting the physiognomy. The area under mopane north of the Soutpansberg range is at an altitude of 400-700 m (Acocks, 1988), is hot and receives about 250-400 mm of rainfall annually. The Limpopo valley supports mopane shrub and tree savanna on calcareous alluvial soils. In the Kruger National Park annual rainfall is over 400 mm and mopane occurs as a tree, suggesting deeper soils than those in the Limpopo valley. In the western part of the Park the soils are derived from granite, or from rhyolite in the Lebombo range to the east (van Wyk, 1972). Mopane also occurs on basalt plains where it is a multi-stemmed shrub.

Zambia

In Zambia mopane is principally associated with the Zambezi, Luangwa, Lukukashi and Lusemfw valleys. Its distribution strongly follows soil type. In the Zambezi valley however, altitude also appears to play an important role, and may be an important factor in the other valleys. The Lukukashi, Luangwa and Lusemfw valleys are composed of heavy fluvisol-vertisol soils impregnated with nodular concretions (Trapnell, 1953) interspersed by belts of recent alluvium without calcium concretions. These soil types only occur in these valleys and the distribution of mopane closely follows them. On fluvisol-vertisols mopane occurs as a woodland, but tends towards shrub savanna on alluvium. The valleys receive an annual rainfall of about 900 mm while the Lake Kariba region in the Zambezi valley receives about 700 mm. It therefore appears as if the distribution of mopane in Zambia is influenced more by soil type and altitude than rainfall.

Zimbabwe

Mopane is mostly distributed along the larger river valleys, e.g. Zambezi, Limpopo, Sabi and Shangani. Outside these areas in the higher rainfall zones it is only found in small patches. Altitude and rainfall play a major role in its distribution, with soils having a modifying effect. The Zambezi valley, at an altitude of about 400 m, receives 500-700 mm of rainfall per annum, the soils are deep, compact, clayey and calcareous, and support mopane woodland 12-14 m tall. Where the soils are shallower the height of the tree is arrested. The Sabi and Limpopo valleys are composed of relatively young and calcareous granitic alluviums (Ellis, 1950) at an altitude of about 400-750 m, with rainfall from 450-500 mm per annum (Acocks, 1988). In the highveld mopane is associated with sodic soils and old ant hills on granite (Ellis, 1950) where plant species other than mopane have difficulty in establishing themselves.

CONCLUSION

Colophospermum mopane vegetation is normally found in low altitude (400-700 m), low rainfall (200-800 mm per annum) areas, which often coincide with high temperatures. It is a xeric species found in low moisture sites, often on heavy, calcareous, sometimes sodic soils generally associated with river valleys. Introduced into India, mopane has regenerated from self-sown seeds under the arid conditions of Rajasthan (NAS, 1980).

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Figure 1

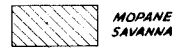
DISTRIBUTION OF COLOPHOSPERMUM MOPANE

I MAPAURE

To accompany "The distribution of *Colophospermum mopane* (Leguminosae-Caesalpinioideae) in Africa," Kirkia 15 (1): 1-5 (1994)



MOPANE WOODLAND



MOPANE SAVANNA



LAKE OR PAN

	AREA UNDER MOPANE (km ²)	% OF MOPANE AREA	% OF THE COUNTRY
ANGOLA	112 500	20	9
BOTSWANA	85 000	15	15
MALAWI	10 000	2	9
MOZAMBIQUE	98 000	18	13
NAMIBIA	77 000	14	9
SOUTH AFRICA	23 000	4	2
ZAMBIA	43 000	8	6
ZIMBABWE	101 500	18	26
TOTAL	550 500		

NB: AREA FIGURES ROUNDED TO NEAREST 500 km² OR NEAREST PERCENTAGE POINT

Scale
0 50 100 150 200 250 300 350 400 km.

