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FORAGE AND BROWSE PLANTS
FOR ARID AND SEMI-ARID
AFRICA

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Royal Botanic Gardens, Kew

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IBPGR Executive Secretariat
Crop Genetic Resources Centre
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations
Via delle Terme di Caracalla, 00100 Rome Italy

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INTRODUCTION

The selection of species

The information included here is mainly derived from the data base accumulated by the staff of The Survey of Economic Plants for Arid and Semi-Arid Tropics (SEPASAT) which is based at the Royal Botanic Gardens, Kew, and funded by the Oxford Committee for Famine Relief (OXFAM). Files are held on some 5000 plant species occurring in arid lands for which some use, no matter how insignificant, has been recorded. The material on geographical distribution, uses, habit and habitat is held on computer file.

This selection of species, even when the remarks on related species is taken into account, is only a small part of the range available.

Inevitably there is room for a great deal of argument about which species are included and which omitted. There are not many accounts of plant species eaten by animals although there are numerous casual observations. It is likely that virtually all plants are eaten at some stage by the less selective animals such as goats and camels. Particular weight has been given to observations which note the comparative palatability of different species, with remarks such as 'highly palatable' or 'much sought-after', or 'a favourite food of ...'; such observations are obviously relative to the other species available at that particular time.

A work of this kind would be of little use if it concentrated only on species which are well-known as forage plants. It is assumed that most pasture agronomists will already be familiar with well-known grasses such as Chloris gayana and Cenchrus ciliaris but condensed information on them has been included for the benefit of any who are unfamiliar with these grasses. It has been decided to cover some less well-known species, such as some of the shrubs and forbs, are often included on the basis of fairly slender evidence. This has been done to bring them to the attention of field workers in the hope that more work on them will permit more satisfactory and soundly based conclusions about their true usefulness.

Some of the species included here extend well beyond semi-arid areas as weeds of cultivation, where they find similar open habitats. They are important because of their wide distribution and adaptability; this implies considerable genetic diversity which may be applied to arid and semi-arid environments. The species of Aristida, for instance, are often weeds, yet they also provide an important desert fodder, not least because their sharply-pointed fruits prevent them from being grazed except in their early or late stages, so that they often survive to provide useful dry season pasture in the form of standing hay, albeit often of low protein content.

As a general rule, an annual rainfall of 600 mm is taken as the maximum for an area to be called 'semi-arid'. The species dealt with here can all grow with less than 600 mm of rain per year.

The accounts of the species

The information is laid out in a standard format by categories. The information included under each heading is as follows.

1.1 Accepted Name

This is the latin name that is in current use. For reasons discussed below, latin names change, and a species may appear in the literature under several latin names. All the names included in this book are contained in the index. Please make full use of the index to ensure that a species with which you may be familiar under one name is not being treated here under a presently accepted, different, name.

1.2 Synonyms

Latin names of species change, for a number of reasons; formerly used but now found to be incorrect (known as synonyms) are listed for each species. Not all are always included but an attempt has been made to include any that have been widely used in the literature. The two main reasons for name changes are firstly, the principle of priority, whereby the oldest name for any species is the one that must be used, and secondly, taxonomic revisions which lead to a better understanding of the variations of species. The two may combine. For instance, the plant long known in East Africa as Chloris myriostachya was found, as a result of a revision of the whole genus on a world-wide basis, to be the same as a species originally described from India, Chloris roxburghiana. The name C. roxburghiana was first published in 1824; C. myriostachya, in 1855. C. roxburghiana, being the older name, has priority and must be used. In theory, the number of name changes should decrease with time, but because there are too few working taxonomists, and because some areas are still poorly collected, the process is a very slow one.

1.3 Family

Most family names are well-known and of long standing, but it must be remembered that there are alternative names for some important families, eg Gramineae/Poaceae; Compositae/Asteraceae; Leguminosae/Fabaceae.

1.4 Vernacular Names

A selection of vernacular names from some of the more important languages used in the arid areas of Africa is given here. It must be remembered that, for a number of reasons, vernacular names are not a reliable means of identification, although they may provide a useful guide. To improve their usefulness they should be recorded systematically and checked by collecting a good specimen and having it named by a competent specialist. The specimens, with the vernacular name and the language recorded on the labels with the other necessary data, should be stored in a herbarium so that future workers can check the determinations and determine the exact application of a particular vernacular name.

Difficulties arise with vernacular names because many of the languages concerned have no recognised orthography, so that a name may be spelled in many different ways, particularly if it is collected by speakers of different languages - a Frenchman and an Englishman listening to an Arabic word will probably write it quite differently. A plant may, if it is economically important, have different names at different stages of growth, and there may also be names for the various parts of the plant. Finally, not all local people are expert botanists, and may make mistakes in identification, or may give a name which turns out to mean 'grass' or 'dry grass' or 'spiny tree'.

The languages used here are:

Peul/Fulani - widely spoken by pastoralists of the semi-arid belt of West Africa. The two languages intergrade but are not always mutually intelligible. Names may differ between the two.

Hausa - widely spoken in the same zone, but further west, extending to Sudan. Also widely spoken by traders. Most of the sources are in Nigeria and Niger.

Arabic - very widely spoken. Most of the names given here are in Sudanese Arabic, and it is not clear how widely current they are outside that country.

Tamachek - the language of the Touareg of the central Sahara. Not widely recorded.

Somali - spoken by the inhabitants of Somalia.

Turkana - the language of the Turkana people from the east of Lake Turkana (L.Rudolph) in northern Kenya.

Masai - the language of the Masai peoples of Kenya and northern Tanzania.

Swahili - the language of the east African coast and the official language of Tanzania. Widely spoken outside its original area as a 'lingua franca', but usually in a simplified form.

English, French - very few African forage plants have accepted and widely used name in these languages. The tendency has rather been to use a shortened version of the latin name, or to adopt a name from a local language.

Afrikaans - many plants of South Africa have established names in this language, many of them rather long and cumbersome - suggesting that they may be 'made-up-names' invented by the settlers, rather than true vernacular names in common use.

2 Description

This has been kept brief, and technical terms have been kept to a minimum. Technical terms, however, are a useful shorthand and save space, as long as they are used precisely and consistently.

Measurements are in metric units throughout. Remember always that plants of the arid and semi-arid zones are often extremely variable in size according to the site in which they are growing and the wetness of the particular season. Fairly wide ranges have been given in most cases for measurements but plant height and leaf length may well fall outside the ranges given in particularly good or bad seasons or sites. The size of floral parts varies less than that of vegetative ones.

3 Ecology

The vegetation types in which the species normally grows are given using the system of White (1983). This vegetation map and accompanying memoir are an extremely rich source of information on African vegetation and should be available to and consulted by all workers in this field.

Any additional information available is then given; this may be derived from published information or from the labels of specimens in the herbarium of the Royal Botanic Gardens, Kew.

4 Distribution

This is given by countries in Africa, with a general indication of the distribution outside Africa. It is derived mainly from the Flora of West Tropical Africa, Flora of Tropical East Africa, and from the collections at Kew. Some countries, particularly Guinea, Chad, Central African Republic, and Angola, are poorly represented at Kew. If the species concerned is found in adjacent countries to those listed but not recorded in that country, this should suggest its presence there, albeit unrecorded.

5 Uses

Particular attention has been given here to use as forage, and other uses are mentioned only briefly. In particular, no attempt has been made to give details of medicinal uses. In most cases these are held on file by SEPASAT and as this work primarily concerned with grazing and browse, such information is not recorded here.

Representative analyses are given, together with the place of origin, state of growth, and month of collection of the material analysed. Some figures are the averages of several analyses - this is noted when it occurs. All analyses are expressed as percentages of dry matter, as this allows comparisons between analyses made at different times and places. The following generally accepted parameters using standard methods, are given:

Crude Protein (CP): this is a figure derived by multiplying the percentage of nitrogen, determined by a Kjeldahl digestion, by a constant, usually 6.25. Not all this 'protein' can be used by the animal; digestible crude protein may be derived from total crude protein using a regression equation but such regressions are generally applicable only to grasses and cannot be used for other plants.

Crude Fibre (CF): this is obtained by digesting the material with an acid, sometimes with the addition of a detergent. It is reckoned to give an approximation to the percentage of indigestible material in the feed, and includes the lignin and most of the cellulose. Several methods are in use and do not give identical results.

Ether Extract (EE): this is a measure of material which can be dissolved out by boiling ether, and includes fats, oils and waxes. Although low this figure includes materials with a high energy yield on digestion and is therefore more important than it might otherwise appear.

Nitrogen-Free Extract (NFE): this figure is generally obtained by difference, being $100 - (CP + CF + EE + \text{Ash})$. It includes the digestible carbohydrates (sugars etc), which are important to the animal as a source of energy.

Ash: this is material which remains after the plant has been heated to 400°C in a furnace. It includes the mineral matter. In grasses a high proportion of it is often silica (SiO_2) which is useless to the animal; a second figure of silica-free ash (SFA) is thus often given.

Ca(Calcium) and P(phosphorus) are probably the two most important and widely analysed mineral elements in feeds. They are both very important to animals because they make up much of the structure of bone, and because they are used in various metabolic processes. Other mineral elements such as sodium (Na), potassium (K), sulphur (S), magnesium (Mg) are required in fairly large amounts, and other elements, the so-called trace elements are required in much smaller amounts. These latter include iron (Fe), selenium (Se), copper (Cu), cobalt (Co) and molybdenum (Mo). Analysis of these is often complex and requires careful precautions against contamination, so is not often carried out routinely. No mention of elements other than calcium and phosphorus is made here.

6 Seed Collections

Very little collecting of these crops in the region has been done. Details of collections are given if they are known. It would seem that priority should be given to collections from the region, and there is also perhaps a need for a site or sites where provenance and progeny trials can be carried out.

7 Potential for Improvement

Very few fodder plants of the arid and semi-arid zones have been improved in any way, and such work as has been carried out has either largely ceased (eg in Kenya) or is continuing outside Africa (often in Australia). There is little doubt that extensive and careful collection would reveal much greater variation in most grass species than is already available in collections; in the case of woody and herbaceous (non-grass) species virtually no work at all has been done and there is a real need for a site or sites where large numbers of samples of known provenances may be tested side by side. Such a project would require a permanent site and long-term funding.

8 Agronomy

In most cases very little is known of the conditions needed for successful cultivation of forage species; when it is, it is included. Once again, there is clearly a great need of even the simplest information on seed weights and conditions for germination, and on the conditions needed for the storage of seeds while retaining their viability.

9 Related Species

Under this heading are included two categories of related species. First there are species which are believed, on the basis of morphological similarity, to be closely related to the main described species. These are included with a view to their being used in programmes of plant breeding. Secondly this heading provides a place for the inclusion of information on species about which there is insufficient information for them to merit a full entry. Such species may thus have just as much potential value as those given a full entry, and should not be forgotten.

Illustrations

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The compiler would like to thank all the staff of SEPASAT who have abstracted the material making up the SEPASAT database and whose work forms the basis of this compilation. Particular thanks are due to Dr G E Wickens for advice and assistance throughout, and to Mrs C Mitchell for typing the whole work.

Trees and Shrubs

<i>Acacia albida</i>	<i>Entada leptostachya</i>
<i>Acacia bussei</i>	<i>Erythrina melanacantha</i>
<i>Acacia edgeworthii</i>	<i>Feretia apodanthera</i>
<i>Acacia ehrenbergiana</i>	<i>Grewia tenax</i>
<i>Acacia etbaica</i>	<i>Grewia villosa</i>
<i>Acacia karroo</i>	<i>Guiera senegalensis</i>
<i>Acacia senegal</i>	<i>Iphiona rotundifolia</i>
<i>Acacia tortilis</i>	<i>Leptadenia pyrotechnica</i>
<i>Balanites aegyptiaca</i>	<i>Maerua angolensis</i>
<i>Bauhinia rufescens</i>	<i>Maerua crassifolia</i>
<i>Boscia albitrunca</i>	<i>Piliostigma reticulatum</i>
<i>Boscia angustifolia</i>	<i>Platycelyphium voense</i>
<i>Cadaba farinosa</i>	<i>Portulacaria afra</i>
<i>Capparis decidua</i>	<i>Pterocarpus lucens</i>
<i>Celophospermum mopane</i>	<i>Rhigozum obovatum</i>
<i>Combretum aculeatum</i>	<i>Salvadora persica</i>
<i>Commiphora africana</i>	<i>Sclercarya birrea</i>
<i>Conocarpus lancifolius</i>	<i>Tamarindus indica</i>
<i>Cordeauxia edulis</i>	<i>Ximenia americana</i>
<i>Dichrostachys cinerea</i>	<i>Zizyphus mauritiana</i>

1 BOTANICAL

- 1.1 Accepted name Acacia albida Del.
- 1.2 Synonyms Faidherbia albida (Del.) A. Chev.; A. saccharata Benth.; A. mossambicensis Bolle; Acacia gyrocarpa Hochst.
- 1.3 Family Leguminosae-Mimosoideae
- 1.4 Vernacular Names Tchiaki, Tiaski, Tieski, Tieaki, Tjaiki (Peul); Assana, Atheus, Athous, Attekos, Habates, Hatess (Tamachek); Gao, Gawo (Hausa); Haraz, Hiraz, El Haras (Arabic-Sudan); Gurbi, Garbi, Ol-erai (Masai); Cad, Kad (French); Anaboom (Afrikaans); Apple-ring Acacia (English).

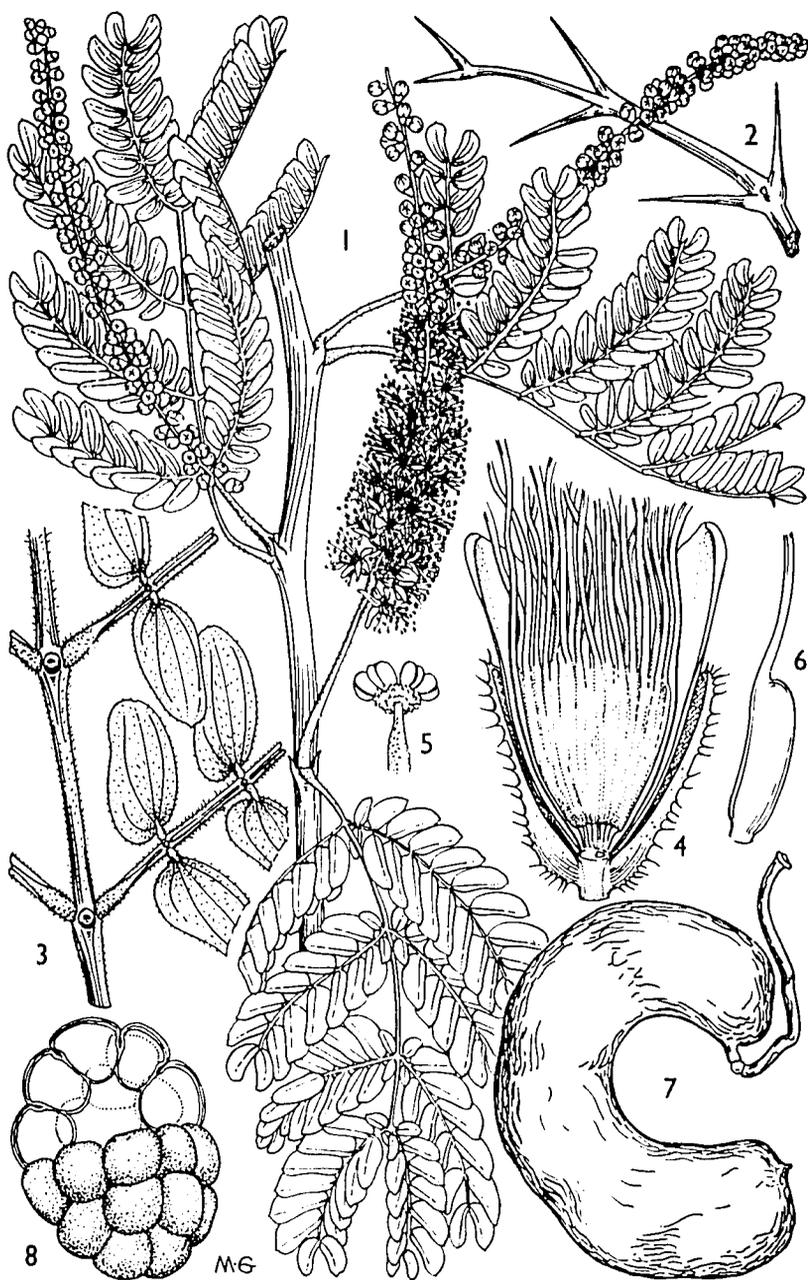
2 DESCRIPTION

A tree to 30 m high, usually with a single trunk to 2 m in diameter; branches spreading; crown rounded when mature. Bark rough, deeply fissured and scaly. Spines paired, straight, up to 2.3 cm long, white to grey, sometimes slightly swollen at the base but never forming a subspherical ant-gall. Leaves bipinnate; leaf-stalk 0.5-3.7 cm long; rachis 1.3-7.5 cm long with glands on the upper surfaces, one at each of the points of origin of the pairs of pinnae. Pinnae 2-12 pairs (with some geographical variation); rachillas 1.5-8.9 cm long with a gland at the junction of each leaflet pair. Leaflets grey-green, 4-23 pairs per pinna (with geographical variation), 2.5-14 x 0.7-5 mm, hairless or with a layer of short hairs on the lower surface or on both surfaces. Inflorescence a spike 3-15 cm long of very small yellow flowers with prominent stamens to 7.5 mm long. Pods usually orange when ripe; curved or curled into a circle or twisted, 6-35 cm long when straightened, indehiscent. Seeds 11-29 per pod, 6-12 x 4-8 mm, pale brown.

3 ECOLOGY

Acacia albida has a very wide geographical range and also occurs in a considerable range of habitats. In the southern part of Africa it is found mainly in communities bordering rivers and streams, seasonal or perennial, usually on sandy alluvial soils. In the northern parts of Africa, while it still occurs mainly in alluvial areas and seems to avoid clay soils in particular, it also occurs more widely, and this has led to suggestions that its distribution may be at least partly controlled by man in this northern area.

Acacia albida has the unusual habit of being leafless during the wet season, and flowering and producing a new leaf crop at the beginnings of the dry season. In regions with two dry and two wet seasons each year the tree can produce two sets of leaves and flowers in a year. The pods, with the seeds in them, are eaten by cattle and other animals and some of the seeds



Acacia albida - 1, habit; 2, part of stem showing spines; 3, upper view of leaf showing glands; 4, longitudinal section of flower to show anthers united at base, ovary removed; 5, glandular or anthers; 6, ovary; 7, pod; 8, pollen polyad.

survive passage through the ruminant gut with little loss of viability. This is presumed to be the main agency of dispersal. Seeds have been observed to germinate in cow dung but seedling survival was very low. A deep taproot is quickly produced by the seedling.

4 DISTRIBUTION

Egypt; Algeria; Mauritania; Senegal; Gambia; Guinea-Bissau; Mali; Upper Volta; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Mozambique; Zambia; Zaire; Malawi; Zimbabwe; Botswana; Namibia; South Africa; Lesotho.

5 USES

The tree is too tall, when mature, to be accessible to most animals, but camels browse any branches they can reach. There are conflicting reports of the palatability of the young accessible shoots of small trees. The branches of mature trees are often lopped to feed stock during the dry season. The pods are much sought-after by all animals both wild and domestic; they can be stored and do not deteriorate.

The wood is widely used as timber but is very difficult to season satisfactorily and tends to split after sawing into boards. There are various medicinal uses, particularly of the bark.

Since the tree is leafless during the wet season, crops can be grown beneath it at that time. Since the leaves are shed at the beginning of the rains they are easily incorporated into the soil, and this, together with the dung from the animals which gather to eat the pods, and perhaps a small contribution from nitrogen fixation in root nodules, can lead to considerable improvement in soil structure and nutrient content beneath stands of the species. This is sometimes exploited by local people but there is scope for its further use although the tree roots can make mechanised farming difficult.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Uganda; pods	10.53	0.94	27.55	57.06	3.92	3.58	0.51	1.51
Uganda; pods	12.36	0.68	40.73	42.67	3.56	3.55	n.d.	n.d.
Uganda; old pods	11.13	0.84	32.45	46.10	9.48	9.03	n.d.	n.d.
Uganda; green pods	10.19	0.49	30.36	54.94	4.02	3.79	n.d.	n.d.

Analyses cont.

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Whole pods	11.3	0.98	29.8	54.3	3.6	n.d.	n.d.	n.d.
Whole pods	15.5	0.5	22.9	56.9	4.1	3.7	n.d.	n.d.
Whole pods	10.6	1.4	26.7	57.7	3.6	3.4	0.7	0.2
Pods, without seeds	14.2	1.5	31.4	48.2	4.7	3.2	0.4	0.2
Young green leaves	17.1	2.3	59.7	12.4	8.4	7.8	n.d.	n.d.
Mature leaves	15.5	5.6	16.1	54.2	8.7	n.d.	2.0	0.11

There are also many determinations in Le Houérou (1980)

6 SEED COLLECTIONS

Not known

7 POTENTIAL FOR IMPROVEMENT

The tree is morphologically very variable over its extensive range but it is not clear to what extent this is genetically controlled nor is it very obvious that any of the variable parameters, with the exception of pod size, could be useful in increasing forage yield. The multiple uses of the tree make improvement of a single character of doubtful value.

8 AGRONOMY

Germination of the seeds is improved by increasing the permeability of the testa. This can be done in any of the usual ways (wet or dry heat, mechanical or acid scarification, passage through a ruminant). The seeds can be freed from the indehiscent pods by pounding them in a mortar, followed by winnowing. There are 11 500 to 19 000 seeds per kg. The seeds are very susceptible to attack by bruchid beetles. Seedling growth is slow, with a long taproot being produced below ground while above-ground progress is slower. In later life trees grow more rapidly; diameter increments of 13 to 18 mm per year have been recorded. Since the tree has such regular periods of growth in each year, there are distinct rings in the wood which permit age estimation.

9 RELATED SPECIES

Acacia albida is a taxonomically isolated species within the genus. Other useful Acacias are mentioned under the other species here treated in full.

REFERENCES

Andrews 1953; Peyre de Fabrègues 1965; Radwanski & Wickens 1967; Tothill 1948; Von Maydell 1983; Wickens 1969; Wilson & Bredon 1963.

1 BOTANICAL

- 1.1 Accepted name Acacia bussei Harms
- 1.2 Synonyms None in common use
- 1.3 Family Leguminosae-Mimosoideae
- 1.4 Vernacular Names Galol; Golol (Somali)

2 DESCRIPTION

A tree to 10 m high, usually with a single trunk but sometimes branched from the base; crown generally flat. Bark roughish, black or brown. Spines paired, straight, up to 9 cm long, white to grey, sometimes much enlarged below but always constricted at the base. Leaves bipinnate; leaf stalk 0.5-1.8 cm long often with a large gland on the upper surface; rachis 0.7-2.5 cm long without glands between the pairs of pinnae. Pinnae 2-8 pairs. Leaflets 10-18 pairs, 1.5--5 x 0.5-1.5 mm, almost hairless. Inflorescence a spike 1.8-5 cm long of very small cream-coloured flowers; stamens about 6 mm long. Pods brown, dehiscent, finely hairy, parallel-sided, 2-6.5 x 0.8-1.5 cm. Seeds 5 x 4-4.5 mm, brown.

3 ECOLOGY

A. bussei is a tree of the higher altitudes of the dry eastern parts of Africa, said to have its optimum development at c 1000 m. It descends to 300 m, however. It occurs in bushland and dry scrub with rainfall as low as 250 mm, mainly within Unit 42 (Somali-Masai Acacia-Commiphora deciduous bushland and thicket), and appearing as a secondary coloniser following degradation of Unit 16a (Zanzibar-Inhambane scrub forest).

It is a common tree in northern Somalia but has been much reduced by overgrazing and overstocking, which have probably acted not directly, but by removing the grass cover and compacting the soil so that less water infiltrates. The species has an extensive shallow root system as well as deeper roots.

4 DISTRIBUTION

Ethiopia; Somalia; Kenya; Tanzania.

5 USES

A tree which is extensively used in Somalia. The foliage is browsed when accessible and the tree is also lopped to provide grazing in dry seasons. The bark is fibrous and provides mats and ropes for camels; it also contains a dye and acts as a tanning agent. The roots provide the framework of the local huts.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

The species is inadequately known for many suggestions to be made, but there could be scope for selection of forms occurring at lower altitudes.

8 AGRONOMY

No information.

9 RELATED SPECIES

No closely related species appear to be much used.

REFERENCES

Brenan 1959; Dale & Greenway 1961; Gillett 1941; Glover 1951b; Hemming 1966; Ross 1979.

1 BOTANICAL

- 1.1 Accepted name Acacia edgeworthii T.Anderson
- 1.2 Synonyms A.socotrana Balf.f.; A.pseudosocotrana Chiov.; A.sultani Chiov.; A.humifusa Chiov.; A.erythraea Chiov.
- 1.3 Family Leguminosae-Mimosoideae
- 1.4 Vernacular Names Jerin, Gulu (Somali).

2 DESCRIPTION

A shrub reaching 2 m high and 4.5 m wide, flat-topped and usually lacking a single main stem. Spines paired, straight, 1-3.5 cm long or sometimes longer on young shoots (a feature of most straight-spined Acacia spp.), without large basal swellings. Leaves bipinnate; petiole 0.3-0.9 cm long; rachis 0.5-4.5 mm long, without glands; pinnae 4-10 pairs; leaflets 6-15 pairs, 0.8-3.5 x 0.5-1.5 mm, usually hairy. Inflorescence a spherical head c 7 mm in diameter of white flowers; stamens c 3 mm long. Pods curved or straight, thick and woody, eventually splitting open, 7-13 x 1.3-2.5 cm, covered with small hairs. Seeds almost circular, 9-13 mm in diameter.

3 ECOLOGY

A species of the dry areas of the Horn of Africa, with annual rainfall of 10-480 mm occurring in dry scrub, in Unit 42 (Somalia-Masai Acacia-Commiphora deciduous bushland and thicket), and Unit 54b (Somalia-Masai semi-desert grassland and shrubland).

4 DISTRIBUTION

Ethiopia; Somalia; Kenya.

Also in south Arabia.

5 USES

The young shoots are said to be relished by grazing animals, especially camels, but the plant is also said to be hard, tough and unpalatable in the dry season. Growth is rapid; young shoots can grow 5 cm in 3 days if not browsed. It is said to be very resistant to overgrazing and trampling - this may of course mean that it is relatively unpalatable. It is reported as forming pure communities on denuded sites. There is clearly a need for more information on the palatability of this species, and on its role in succession. It is very variable and some of the forms may have possibilities for sand-binding (see below).

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Palatable forms could be sought. A form which has been described as a separate species, and which is still treated as such by field workers, is A. humifusa which is prostrate, creeping across the ground surface. More information on the ecology of this form and its potential as a sand-binder and provider of fodder is needed.

8 AGRONOMY

No information

9 RELATED SPECIES

A. sieberiana DC. is a large tree, very widespread and variable, and usually found along watercourses. It occurs in regions with 6-700 mm of rain per annum or less. The foliage of young trees is heavily browsed and the pods are eaten by various species - baboons eat many when they are still green. A. stuhlmannii Taubert is a spreading bush or small tree of eastern and southern Africa. It is occasionally browsed by (eg) giraffe (CP 19.13; EE 1.68; CF 24.88; NFE 45.84; Ash 8.47; SFA 8.04; Ca 1.30; P 0.24 - all from young twigs and leaves from Kenya). It is sometimes said to be a good indicator of saline soils, occurring along the edges of mangrove swamps, but in other places forms low impenetrable and undesirable thickets. Acacia oerfota (Forsk.) Schweinf. (syn A. nubica Benth.) is widespread in north-eastern Africa. It is a shrub of dry country, often with a distinctive inverted cone shape. Both leaves and pods are eaten by camels where they occur, but are not liked by other stock because of their obnoxious smell.

Analyses (A. oerfota)

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Kenya; lvs	32.45	1.73	15.76	41.21	8.85	n.d.	1.71	0.44
Kenya; pods & seeds	15.17	1.91	37.42	38.04	7.46	n.d.	1.46	0.23

REFERENCES

Brenan 1959; Dale & Greenway 1961; Dougall, Drysdale & Glover 1964; Gillett pers comm.; Glover 1951b; Ross 1979.

1 BOTANICAL

- 1.1 Accepted name Acacia ehrenbergiana Hayne
- 1.2 Synonyms A.flava (Forsskal)Schweinf.; A.ehrenbergii Nees
- 1.3 Family Leguminosae-Mimosoideae
- 1.4 Vernacular Names Bakanichili; Djilouki; Thillovki (Peul); Tamat (Hausa); Selim; Salam; Delau; Tcha (Arabic-Sudan).

2 DESCRIPTION

A shrub with divergent branches from the base, attaining 6 m high. Bark green-brown, shiny, peeling in small yellow rolls, with many white horizontal lines (the lenticels). Spines paired, straight, up to 8 cm long, not enlarged at the base. Leaves bipinnate; leaf stalk 0.2-0.8 cm long; rachis 0-1.2 cm long, without glands, or sometimes with a gland between the top pair of pinnae; pinnae 1-4 pairs, leaflets 8-12 pairs, 1.7-5 x 0.7-1 mm, usually hairless. Inflorescence a spherical head of about 0.6 cm in diameter tiny yellow flowers; stamens about 2.5 mm long. Pods brown when ripe, reddish when young, long and narrow, 7-10 x 0.3-0.5 cm, constricted between the seeds. Seeds c 6 x 3 mm, brown.

3 ECOLOGY

This Acacia is probably the one which extends furthest into the deserts of northern Africa, occurring on sandy soils under rainfalls of 50 mm, and on clays under 150 mm. Its optimum, however, would seem to be in the 300-400 mm range. It often forms dense thickets. It occurs in Unit 54a (Sahel semi-desert grassland and the transition to the Sahara) and in Unit 71 (Acacia communities of wadis with the Sahara).

4 DISTRIBUTION

Egypt; Algeria; Mauritania; Senegal; Mali; Niger; Chad; Sudan; Ethiopia. Also in Arabia.

5 USES

There is some disagreement about the value of this species as browse. In West Africa, it is said to be cut regularly as fodder but only goats eat it willingly. In Sudan, however, it is reported to be one of the best browse species for camels. Its main value lies in its ability to survive in regions of very low rainfall.

Analysis

Source	CP	EE	CF	NFE	Ash	SPA	Ca	P
Sudan; leaves	22.5	2.3	20.1	50.1	5.0	n.d.	n.d.	n.d.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficiently known for useful suggestions to be made.

8 AGRONOMY

It has been reported to be nodulated.

9 RELATED SPECIES

Acacia seyal Del. is a very similar species, also with yellow flowers. It tends, however, to form a trunk, and also has a powdery, not flaking, bark which is often reddish. It occurs, in general, in regions of higher rainfall than those favoured by A.ehrenbergiana (generally above 450 mm) and is tolerant of seasonal waterlogging, often forming pure stands in seasonally flooded sites on black clays.

REFERENCES

Allen & Allen 1981; Andrews 1953; Keay 1958; Le Houérou 1981; Maxwell-Darling 1938; Peyre de Fabrègues 1965; Ross 1979; Tothill 1948; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Acacia etbaica Schweinf.
- 1.2 Synonyms -
- 1.3 Family Leguminosae-Mimosoideae
- 1.4 Vernacular Names Q'arad (Arabic-Sudan); Sugsug, Khansa, Yube (Somali); Osiyamalili, Osimanulie (Masai)

2 DESCRIPTION

A tree to 12 m high, usually with a single trunk and a flat or rounded crown; bark rough, brown or blackish. Spines paired, either short (to 7 mm) and hooked, or long (to 6 cm) and straight; the two spine types may be mixed, and the spine bases are never swollen. Leaves bipinnate; leaf stalk 0.3-1 cm long; rachis 0.4-5 cm long. Pinnae 1-9 pairs; leaflets 4-35 pairs per pinna, 0.5-4 x 0.25-1.25 mm, either hairless or minutely hairy. Inflorescence a spherical mass about 0.9 cm in diameter of tiny flowers; stamens about 4 mm long. Pods straight, 2-12 x 0.7-2.2 cm, either hairless or minutely hairy. Seeds about 8 mm in diameter, brown.

The species is variable and four subspecies have been recognised in Africa. They are distinguished by the hairiness or otherwise of the young parts, the width of the pods, and the mixing of the spine types. There is some geographical separation.

3 ECOLOGY

It occurs in dry bushland and dry woodland, sometimes along rivers, mainly within Unit 42 - Somalia-Masai Acacia-Commiphora deciduous bushland and thicket. In Somalia it occurs under annual rainfalls of 300-550 mm per annum.

4 DISTRIBUTION

Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania.

5 USES

It has the reputation in Somalia of remaining green well into the dry season, and is lopped to feed stock at this time.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Apart from there being very considerable variation within the species, little is known of the potential or possibilities of this species.

8 AGRONOMY

No information

9 RELATED SPECIES

A. elatior Brenan is a very similar plant but is always a large riverine tree; it always produces at least a few 'ant-galls' - the joined and swollen bases of a pair of spines. The bark and leaves have been noted as eaten by elephants in Kenya. There are two subspecies.

Analyses (A. elatior)

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Kenya; lvs	13.23	3.31	33.02	43.05	7.39	7.30	1.84	0.12
Kenya; bark	6.69	1.17	36.92	46.74	8.48	8.15	2.51	0.03

Range - Sudan; Uganda; Kenya.

REFERENCES

Andrews 1953; Brenan 1957; Dougal, Drysdale & Glover 1965; Gillett 1941; Hemming 1966; Ross 1979.

1 BOTANICAL

- 1.1 Accepted name Acacia karroo Hayne
- 1.2 Synonyms A.hirtella E.Meyer; A.natalitia E.Meyer;
A.dekindtiana A.Chev.; A.inconflagrabilis
Gerstner.
- 1.3 Family Leguminosae-Mimosoideae
- 1.4 Vernacular Names Mubayamhondoro (Shona); Isinga (Ndebele); Mooka,
Mookana (Tswana); Soetdoorn, Soetdoring
(Afrikaans); Mimosa Thorn, Sweet Thorn (English).

2 DESCRIPTION

A shrub or tree to 12 m or more high, with a rounded or flattened crown; bark reddish-brown to black and rough or sometimes pale greyish-white or greyish-brown and smooth. Spines paired, straight, 0.14-10 cm long but sometimes longer, sometimes slightly swollen at the base but never joined to form a single 'ant-gall'. Leaves bipinnate; leaf stalk 0.5-1.8 cm long, usually with a gland; rachis 1-5 cm long, with a gland at the junction of the pinnae pairs; pinnae 2-6 pairs; leaflets 5-12 pairs per pinna, 2.5-8 x 1-2.5 mm, usually without hairs. Inflorescence a spherical mass of tiny bright yellow flowers c 1.2 cm in diameter; stamens about 5 mm long. Pods 5-10 x 0.5-0.7 cm, usually curved and constricted between the seeds. Seeds 4.5-6.5 x 3-4 mm. An extremely variable species.

3 ECOLOGY

An extremely widespread and variable species which occurs in many different habitats in the Karroo-Namib and Zambebian regions, and in the Kalahari-Highveld regional transition zone. Some habitats are occupied by distinct ecotypes (summarized by Ross 1979).

4 DISTRIBUTION

Mozambique; Malawi; Zambia; Zimbabwe; Angola; Namibia; Botswana; South Africa.
Introduced to North Africa and India.

5 USES

The plant is regarded as excellent fodder. The foliage is eaten avidly by stock, as are the fallen withered flowers, which are eaten from the ground. The young pods are also a favoured food. There are however reports of two forms of the species, one palatable and the other not, known locally as 'sweet' and 'sour; mimosa thorn (Soetdoorn and Suurdoorn), which are botanically indistinguishable. The chemical difference between the two is not known.

There are number of medicinal and veterinary uses, mainly derived from the bark and roots. The inner bark yields a fibre for ropes and the bark can also be used for tanning.

The tree also yields a good-quality gum.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Not known, but there is clearly scope for the further investigation of the sweet/sour phenomenon, and for exploitation of the very wide range of variation displayed by the species.

8 AGRONOMY

It is reportedly nodulated. It can easily be grown from seed or root suckers. Scarify the seed before sowing, or give a hot water pre-soaking. It can reach 2 m in its first year.

9 RELATED SPECIES

No close relatives are used except A.ehrenbergiana which is treated here (see above).

REFERENCES

Allen & Allen 1981; Carr 1976; Drummond & Coates Palgrave 1973; Marloth 1924; Ross 1979.

1 BOTANICAL

- 1.1 Accepted name Acacia senegal (L.) Willd.
- 1.2 Synonyms Mimosa senegal L.; Acacia verec Guillemain & Perrottet; Acacia rupestris Stokes; A. trispinosa Stokes
- 1.3 Family Leguminosae-Mimosoides
- 1.4 Vernacular Names Debehi, Delbi, Patouki, Patourni, Patterlahi (Peul); Erwarwar (Tamacheq; also used for Acacia laeta R.Br. ex Benth.); Akarouba (Hausa); Hashab, Alloba, Subahi, Um Gebala (Arabic-Sudan); EJad, Adad, Adad Medu (Somali); Ekonoit (Turkana); Ol-Munishui (Masai); Kikwata (Swahili); Drievingerdoring, Gomdoring (Afrikaans)

2 DESCRIPTION

A tree or shrub, to 12 m high but usually less. Bark greyish, smooth at first but rough and scaly in old trees. Spines in threes near the nodes, up to 7 mm long, the laterals curved upwards, the central one curved downwards; the laterals are sometimes absent. Leaves bipinnate; leaf stalk 0.2-2 cm long, rachis 0.7-7 cm long with a gland between most of the pairs of pinnae, pinnae 2-6 pairs, 0.5-2.5 cm long; leaflets 8-20 pairs, 1-6 x 0.5-2 mm, hairy or not. Inflorescence a spike 2-10 cm long of very small white flowers; stamens about 5-7 mm long. Pods thin, like tough paper, grey to brown, 4-14 x 2-3 cm, each containing 3-6 seeds. Seeds almost circular, 8-12 mm in diameter.

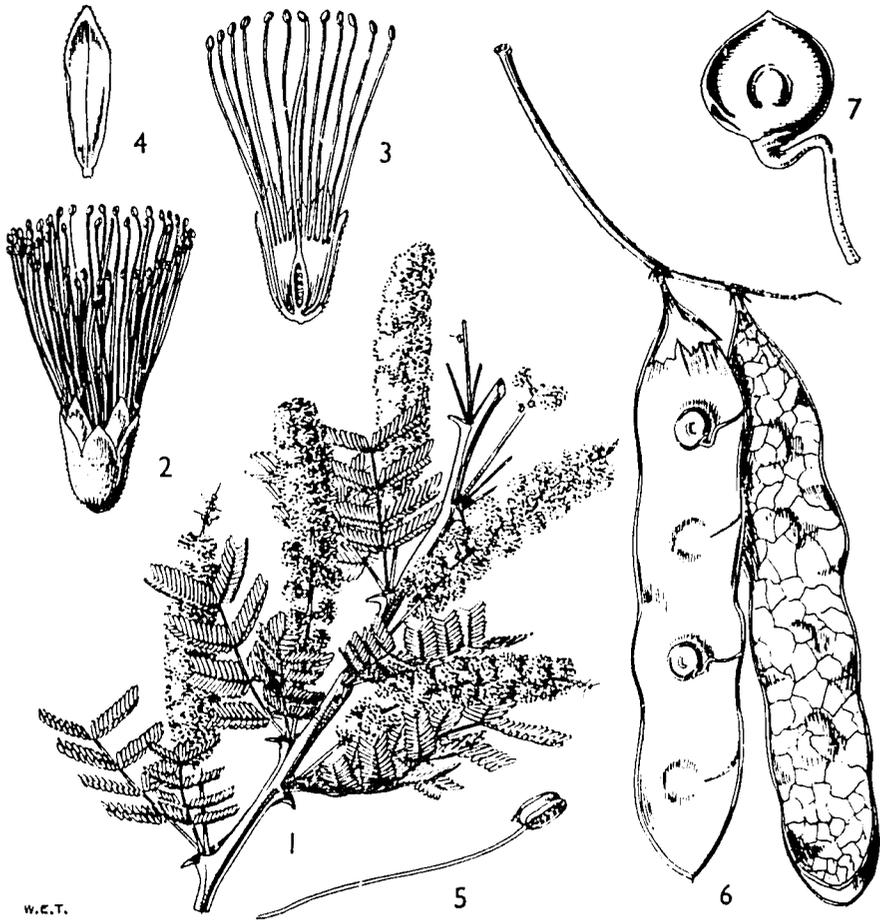
The species is very variable and four varieties have been distinguished in Africa on the basis of habit, inflorescence hairiness, pod shape and leaf size, but in the same work the need for additional research is emphasised.

3 ECOLOGY

In West Africa it occurs mainly between 11° and 16°N, in the zone receiving 100-800 mm of rain each year, probably preferring the zone with 300-450 mm. Here, and in the rest of Africa it occurs in various types of wooded grassland and bushland preferring sites on well-drained soils. Thus, in the southern Sudan it is absent from the seasonally flooded black clay soils but occurs in slightly higher sites on more sandy soils, its place being taken in the seasonally flooded sites by A. seyal Del. and A. polyacantha Willd. The root system is large, with a deep taproot and very extensive shallow laterals.

4 DISTRIBUTION

Mauritania; Senegal; Gambia; Mali; Ivory Coast; Upper Volta; Ghana; Niger; Nigeria; Chad; Cameroon; Sudan; Ethiopia; Somalia; Uganda; Kenya;



Acacia senegal - 1, flowering branch; 2, flower; 3, longitudinal section of flower; 4, calyx lobe; 5, stamen; 6, mature pod; 7, seed.

Tanzania; Zaire; Rwanda; Mozambique; Zambia; Zimbabwe; Angola; Botswana; Namibia; South Africa.

Also in Arabia and India.

5 USES

Acacia senegal is the main source of Gum Arabic and is extensively exploited for this, both wild stands and plantations being used. It is also browsed by animals to an extent that protection of young plantations is essential for successful establishment. The pods are also palatable and are eaten by animals in some parts of the range.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Uganda; green pods	22.03	0.96	39.02	30.93	7.06	5.22	0.81	1.07
Uganda; dry pods	19.65	2.14	29.64	43.26	5.31	4.74	1.00	0.78
Kenya; young twigs & lvs	20.26	2.56	27.72	42.67	6.79	6.60	1.40	0.17
Kenya; young twigs & lvs	20.51	2.20	27.74	41.29	8.26	7.61	1.37	0.24

Additional analyses given by Le Houérou are essentially similar.

6 SEED COLLECTIONS

2 samples in Sudan; 5 in Senegal (FAO/IBPGR)

7 POTENTIAL FOR IMPROVEMENT

If any selection has been made it is probably in the direction of high gum yield, as it is for this product that the tree is valued and planted, and not as a browse plant. However, since the factors causing gum production are unknown any selection based on yields alone must be unsatisfactory. It is not clear whether gum production from trees south of the Equator, outside the traditional producing areas, has been investigated.

8 AGRONOMY

The fruits mature in the dry season, and there are about 18 000 seeds per kilogram. The seeds are hard and must be scarified before sowing. Seedlings are usually raised in nurseries and planted out later but success has also been achieved using direct sowing - this is of course also very much cheaper. Young plantations need regular weeding, and grazing animals and fire have to be excluded. Gum is produced after five years, and careful grazing can begin at this time also; sheep damage the plantation least. Young seedlings develop a deep taproot in their first and second seasons while making relatively little growth above ground. This would suggest that direct sowing would be the best method of starting a plantation. Trees regenerate readily after coppicing. The tree is reported to be nodulated.

9 RELATED SPECIES

None appear to be useful.

REFERENCES

Andrews 1953; Brennan 1959; Dale & Greenway 1961; Dougal, Drysdale & Glover 1964; Hunting Technical Services 1964; Keay 1958; National Academy of Sciences 1980; Peyre de Fabregues 1965; Ross 1979; Tothill 1948; Von Maydell 1983; Wilson & Bredon 1963.

1 BOTANICAL

- 1.1 Accepted name Acacia tortilis (Forsskal)Hayne
- 1.2 Synonyms Acacia raddiana Savi; Acacia spirocarpa Hochst. ex A.Rich.; Acacia fasciculata Guillemin & Perrottet
- 1.3 Family Leguminosae-Mimosoideae
- 1.4 Vernacular Names Djelcki; Djilouki; Guanaki; Tili (Peul); Afadar; Afadjadj; Afaggag (Tamachek); Samr; Saganeib; Sayal; Ullaf (Arabic-Sudan); Kura (Somali); Eluwo, Etir, Ewoi (Turkana); Entepesi, Ol-Gorete (Masai); Mgunga (Swahili); Mosu, Mosunyana (Tswana); Sambreeldoring (Afrikaans)

2 DESCRIPTION

A tree to 20 m tall but usually smaller, usually with a flat or very broadly spreading crown. Bark grey to black, rough and fissured. Spines of two types, some short, c 5 mm long, hooked, others straight and whitish to 10 cm long; spines not swollen at the base. Leaves bipinnate. Leaf stalk 0.2-0.8 mm long, rachis up to 2 cm long, both often with glands; pinnae 2-10 pairs. Leaflets 6-19 pairs per pinna, tiny, 0.5-4 x 0.5 x 1 mm long or occasionally longer, sometimes hairy. Inflorescence a spherical head of many tiny cream or white flowers, about 1 cm in diameter; stamens long. Pods thin-textured, narrow, twisted, often into a spiral, 10-15 x 0.5 cm. Seeds 7 x 4.5-6 mm, brownish.

A very variable species. The most recent revision recognises 6 infraspecific taxa.

3 ECOLOGY

A wide-ranging species of the arid and semi-arid regions of Africa, not apparently particular as to soil type although it avoids seasonally waterlogged sites. Rainfall 50-1000 mm per annum. It is said to grow especially well on deep alkaline soils, on loams and sometimes on fossil dunes, though it avoids freshly blown sand. It is often the tree that extends furthest into the desert.

4 DISTRIBUTION

Egypt; Algeria; Senegal; Mali; Niger; Nigeria; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Mozambique; Zambia; Malawi; Zimbabwe; Botswana; Angola; Namibia; South Africa.

Also in Arabia and India.

5 USES

The leaves, young branchlets and, particularly, the fallen fruits are eaten by all species of wild and domestic animals and can at times be a very important component of the diet. However, it seems that at times the leaves may be toxic.

The tree yields an excellent firewood and charcoal. The bark is fibrous and also contains tannin. There are also medicinal uses, mainly of the leaves and bark. It has been tried as a dune stabiliser.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Kenya; twigs & leaves	6.46	2.83	34.09	47.78	8.84	8.52	3.14	0.13
Kenya; bark	13.97?	1.35	48.57	29.69	14.47	14.30	5.68	0.02
Kenya; pods & seeds	17.79	1.79	17.50	54.60	8.37	n.d.	1.34	0.36
West Africa; green pods mean (n = 7)	16.6	1.8	20.9	54.7	5.9	(5.4)	(0.72)	(0.25)
West Africa; dry pods mean (n = 8)	16.8	1.7	19.1	53.6	6.5	(5.4)	(0.83)	(0.23)

6 SEED COLLECTIONS

5 samples in Senegal (FAO/IBPGR); 4 in Sudan (FAO/IBPGR)

7 POTENTIAL FOR IMPROVEMENT

There are clearly considerable possibilities for selection in this wide-ranging and variable species. Plants with higher growth rates, particularly in the young stages, and whose leaves are free of any toxicity (a subject needing further investigation) should be particular objects of any search. The very vigorous spines must hinder utilisation and possibly forms with shorter spines, or even none, could be sought, although they would face very strong selection pressures!

8 AGRONOMY

There are 14 000-20 000 seeds per kilogram and mechanical or chemical scarification is needed before sowing to facilitate germination. Early growth may be slow but selection can improve this. Young plants need protection from browsing for at least three years and five if possible. Trees should be planted at wide spacing. Fuelwood plantations coppice well. The species can become a weed and should be introduced with caution.

9 RELATED SPECIES

Acacia nilotica (L.) Willd. ex Del. is a widespread tree, but occurs mainly in sites with an underground accessible water table, such as river banks. In such sites it has been planted in Sudan for timber. It is a useful browse species, and can also produce an excellent timber when the site allows it to attain a large enough size. The pods yield tannin, and there are a number of medicinal uses.

REFERENCES

Andrews 1953; Brenan 1959, 1983; Carr 1976; Dale & Greenway 1961; Dougal & Bogdan 1958; Dougal, Drysdale & Glover 1964; Keay 1958; Le Houérou 1980; Peyre de Fabregues 1965; Ross 1979; Timberlake 1980; Tothill 1948; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Balanites aegyptiaca (L.) Del.
- 1.2 Synonyms None in common use
- 1.3 Family Balanitaceae (formerly placed in Simaroubaceae)
- 1.4 Vernacular Names Galeteki, Tanni, Mourotoki (Peul); Tabarak, Tabarak (Tamahek); Aduwa (Hausa); Heglig (the tree), Lalob (the fruit) (Arabic, Sudan); Kullum, Ghut, Got (Somali); Arraronyit (Turkana); Ol Ngoswa (Masai); Mkonga, Mjunju (Swahili).

2 DESCRIPTION

Small tree to 12 m, sometimes remaining a shrub in drier areas or when heavily browsed. Bark thick, fissured and scaly, yellow-brown; trunk sometimes deeply grooved. Slash pale yellow. Crown flattened-spherical. Young branches green, with prominent axillary thorns, best-developed on young plants and on the basal shoots of older ones. Leaves with two leaflets, each broadest above the middle and rounded at the tip, hairless, very variable in size. Flowers in small clusters or short spikes in the leaf axils. Sepals 5, green. Petals 5, yellowish-green. Stamens 10. Ovary 5-locular with one ovule in each loculus. Fruit green, ripening yellowish and finally pale brown, 2.5-4 cm long, 1.5 cm in diameter, with a thin hard skin, yellowish sticky flesh, and a large hard ellipsoid stone.

This species is extremely variable in stature, leaf size, spininess and other features. Work in progress at Kew is likely to lead to the recognition of several varieties.

3 ECOLOGY

A tree of wide ecological tolerance, extending into desert regions although usually along watercourses. It occurs mainly in Units 29 - Undifferentiated woodlands, and 42-44 - Deciduous bushlands and thicket, but extends to 71 - Desert vegetation of wadis. Also highly resistant to seasonal flooding and commonly found bordering seasonally inundated black clay plains. In Nigeria it also occurs on shales and limestones. It often forms pure stands, but since it is often left when other trees are felled, because of its many uses, these stands may not be a natural feature.

A semi-deciduous tree, losing some leaves in the driest seasons. The flowers are produced just before the main rains, and the fruits are ripe at the beginning of the wet season. It is not clear if these fruits are derived from the flowers produced earlier in the same year, or if the fruits need more than a year for development.

4 DISTRIBUTION

Egypt; Mauritania; Senegal; Gambia; Mali; Guinea-Bissau; Guinea; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Zaire; Zambia; Zimbabwe.

Also in Arabia.

5 USES

The leaves are browsed by wild and domestic animals which may also eat the leaves which fall during the dry season. The protein content is quite high (see table (2 samples)). Young trees may be kept in a shrubby state by constant browsing, and in Kenya trees are shaped by constant giraffe browsing.

The wood is useful, and the bark produces a gum. The fruit has a sugary pulp which is eaten or made into a drink, and the kernels contain an edible oil. Most parts of the tree contain a saponin which is a molluscicide and also poisons the alternate host (Cyclops) of guinea-worm (Dracunculus).

Many analyses are available from both West and East Africa. Young leaves can contain up to 27% CP. Other components are similar to most tree and shrub species.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

There is very considerable variation and there could be possibilities for selection of high-protein, quick-growing strains, spineless forms (which have been seen) and forms with a high fruit yield and good drought tolerance.

8 AGRONOMY

Best regenerated from seed. Seeds collected from the dung of animals germinate best; germination is also improved by boiling the seed for 7-10 minutes and allowing to cool slowly. The tree is said not to withstand transplanting well because of its deep taproot.

9 RELATED SPECIES

B. glabra Mildbr. & Schlect. (Keddi, Kidi (Somali)) occurs in Somalia, Kenya and Tanzania. It may be heavily browsed at times. B. rotundifolia (Van Tiegh.)Blatter (B. orbicularis Sprague) (Kulan (Somali)) occurs in the horn of Africa. It is much browsed by domestic and wild animals. B. roxburghii Planch. (with which B. aegyptica has often been confused) occurs in India in dry habitats.

REFERENCES

Baumer 1975; Boudet et al 1969; Dale & Greenway 1961; Dalziel 1937; Dougal & Bogdan 1958; Dougal, Drysdale & Glover 1964; Le Houerou 1980; Peyre de Fabregues 1965; Sands 1983 and pers. comm.; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Bauhinia rufescens Lam.
- 1.2 Synonyms Piliostigma rufescens (Lam.) Benth.
- 1.3 Family Leguminosae-Caesalpinioideae
- 1.4 Vernacular Names Nambare, Namadi, Namali, Nemali (Peul); Tedeene, Tedehini, Tadayni (Tamachek); Dirga (Hausa); Kulkul (Arabic-Sudan)

2 DESCRIPTION

Small tree or shrub to 8 m. Branchlets often spine-tipped. Leaves alternate; blade up to 1.5 x 2.5 cm, deeply bilobed, each half ovoid to almost circular, rounded at the apex, glabrous; stipules c 2 mm long, narrow, falling early; petiole c 8 mm long. Flowers in few-flowered racemes. Sepals fused into single hood-like structure, c 1.5 cm long. Petals 5, spatulate, 15-20 mm long, whitish or pinkish. Stamens 10. Fruit linear, curved, 6-9 cm long, sometimes constricted between the seeds, dark red-brown when ripe, with 4-10 seeds.

3 ECOLOGY

In West Africa it is found in regions with from 400 to 1000 mm of rain, in the drier northern types of Sudanian woodland (Unit 29a), and in Sahelian wooded grassland (Unit 43). It grows on a wide range of soil types, often on stream banks and sandy ridges, and is uncommon in very dry sites. Flowers generally appear in the late dry season and the fruits ripen at the beginning of the rains but remain on the tree a long time. In moister sites the plant is evergreen. No information on pollination biology. Since the pods do not appear to dehisce, and are eaten by animals, (see below) it is likely that the seeds are animal-dispersed and may germinate better after passage through the gut.

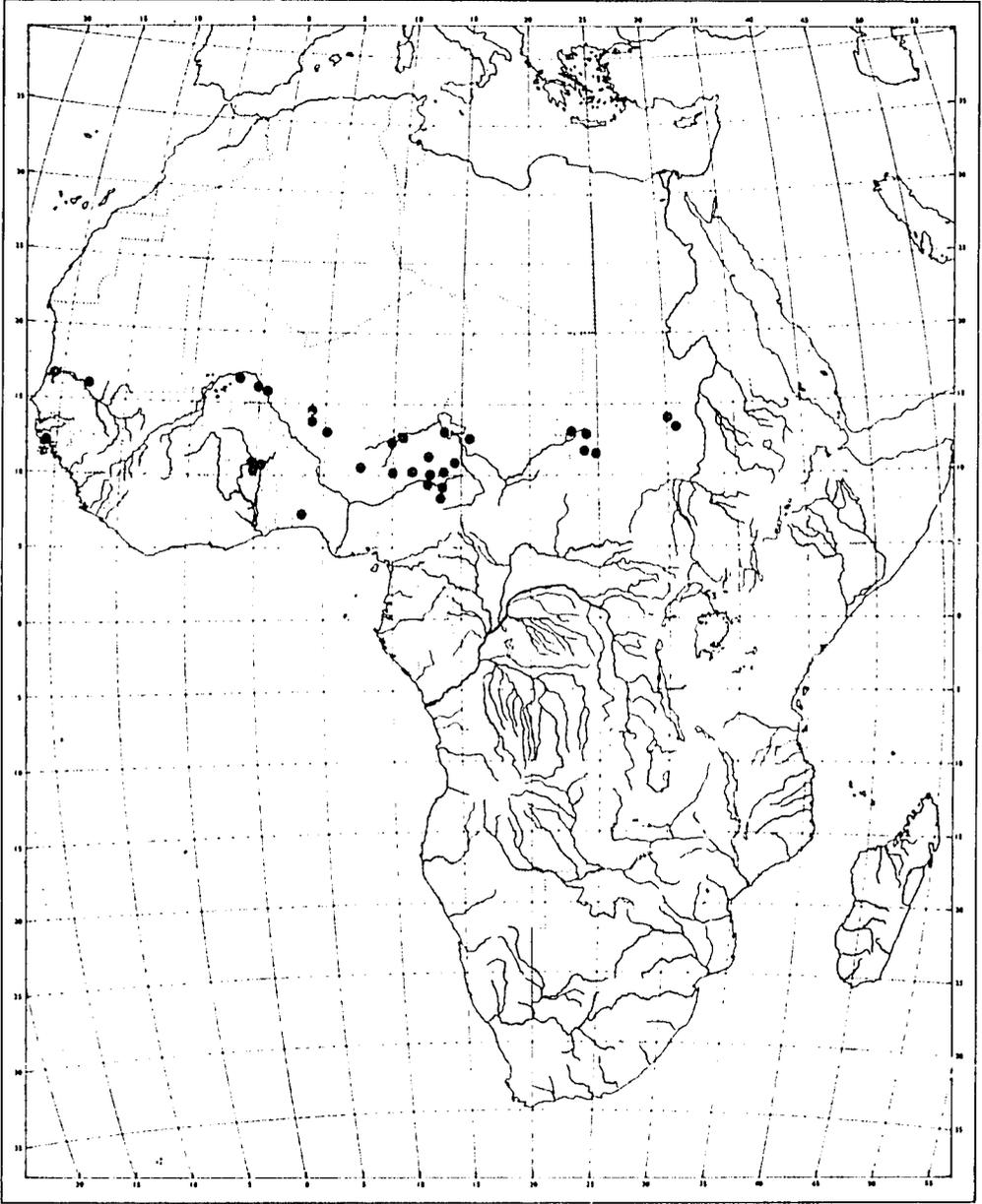
4 DISTRIBUTION

Mauritania; Senegal; Mali; Guinea-Bissau; Guinea; Sierra Leone; Ivory Coast; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia.

5 USES

An excellent forage, much sought-after by all domestic and wild species. The fruits are regarded by the camel-owners as the best food for camels (Sudan), and the whole plant is excellent for them. In Sudan the plant is often severely damaged and in West Africa it is reckoned to be in danger of disappearing in heavily grazed areas.

The wood is brown and fine-grained and good for carving if large enough. Good firewood.



Nautical Miles SCALE Kilometers
1 50 000 000 Miles

The bark provides fibres for plaiting into straps and bindings, and contains tannin. The roots, leaves and fruits have many medicinal uses.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Senegal; fruit & seeds	12.1	1.3	22.0	60.6	3.9	3.7	0.44	0.21
Ghana; fruit	14.6	n.d.	15.7	n.d.	7.5	n.d.	2.20	0.15
Upper Volta; fruit (dry)	11.0	2.4	28.4	54.2	3.9	3.88	0.50	0.19
Upper Volta; fruit (green)	13.7	2.3	23.2	56.1	5.8	5.7	0.60	0.27
Upper Volta; fruit (ripe)	13.5	1.7	21.9	58.3	4.5	4.1	0.60	0.20
Nigeria; fruit (dry)	11.1	1.5	33.6	49.3	4.4	n.d.	n.d.	n.d.
Senegal; shoots & young leaves	13.0	3.2	19.1	56.8	7.8	6.7	1.60	0.15
Upper Volta; green leaf	14.2	3.3	23.7	46.8	11.9	11.4	3.30	0.24
Upper Volta; young leaf	15.4	3.0	14.7	55.9	11.0	9.9	2.90	0.15
Chad; green lf.	16.9	2.4	16.5	55.2	8.9	n.d.	n.d.	n.d.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

This is clearly one of the more promising browse species for semi-arid areas and much more general information on variation, speed of growth, biology and phenology is needed.

8 AGRONOMY

There are about 9000 - 10 000 seeds per kg. Boiling for about 7 minutes, followed by slow cooling, is reported to improve germination. It is likely that mechanical or chemical scarification would also be effective.

9 RELATED SPECIES

B.tomentosa L. (Msaponi (Swahili); Engomomur (Turkana)) occurs in dry areas of Kenya and has been introduced to West Africa as an ornamental plant. B.taitensis Taubert also occurs in the arid parts of northern Kenya. Both need further study. Other species occur in dry areas of southern Africa.

REFERENCES

Andrews 1953; Baumer 1975; Brennan 1967; Dale & Greenway 1961; Peyre de Fabregues 1965; Tot Hill 1946; Von Haydell 1983.

1 BOTANICAL

1.1 Accepted name Boscia albitrunca (Burch) Gilg & C. Benedict

1.2 Synonyms -

1.3 Family Capparaceae

1.4 Vernacular Names Witgat (Afrikaans)

2 DESCRIPTION

An evergreen tree, often single-stemmed but very variable in habit and stature, to 5 m high. Bark pale grey or almost white. Leaves in clusters on short shoots, but alternate on young growth, grey-green. Leaf-stalk short; leaf-blade 2.5-5 x 0.5-1.1 cm. Flowers in dense clusters, or single, in the leaf axils, usually on the older wood, yellow, strongly scented. Sepals 4; petals absent. Stamens numerous. Fruit spherical, about 5 mm in diameter, few-seeded.

3 ECOLOGY

A tree, occurring in dry woodlands and shrublands of southern Africa. It is especially characteristic in Units 44 (Kalahari Acacia wooded grassland and deciduous bushland) and 56 (Semi-desert vegetation of the Kalahari/Karoo-Namib transition) but also extends northwards into various Zambesian woodlands and shrublands.

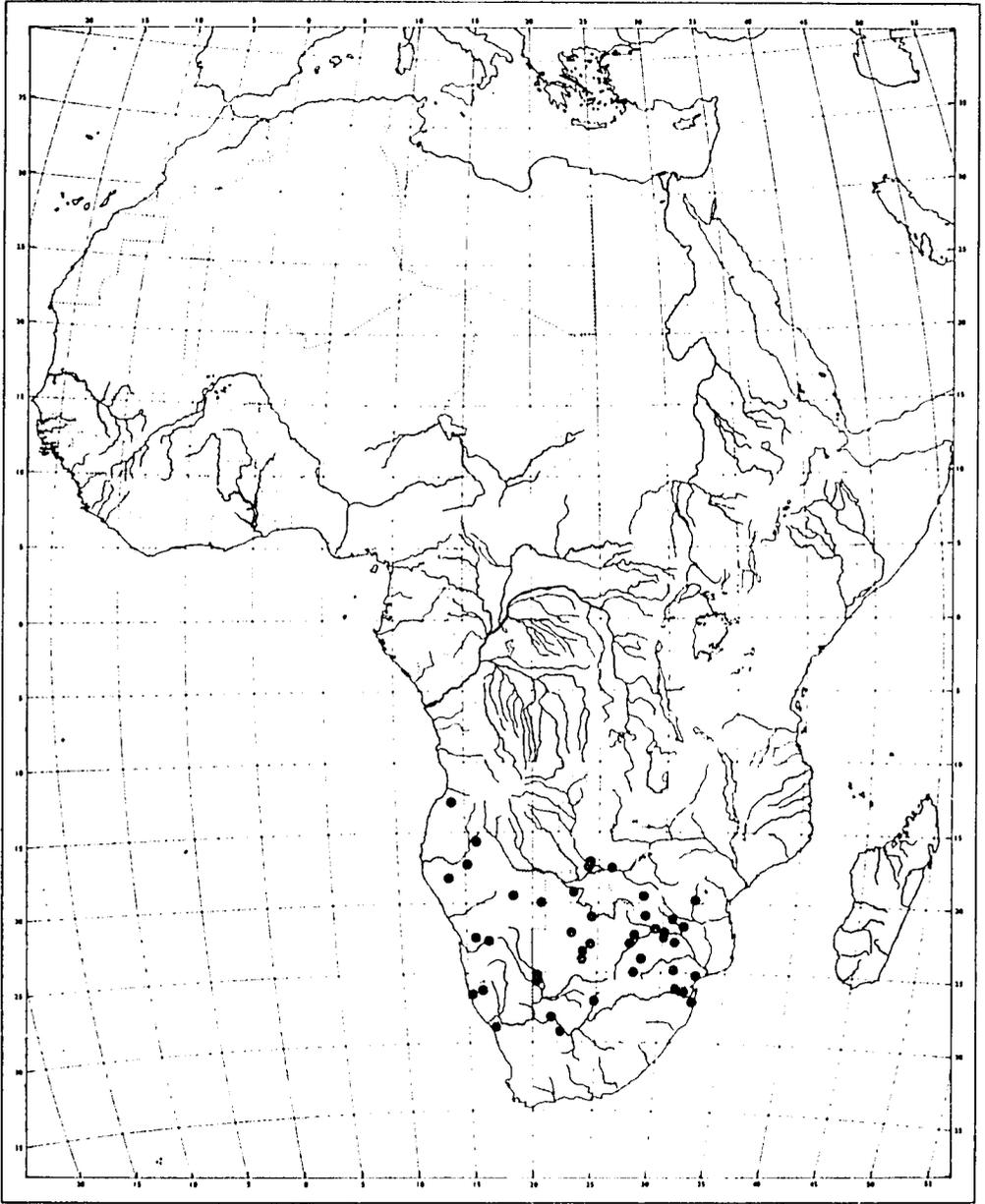
4 DISTRIBUTION

Mozambique; Zambia; Zimbabwe; Angola; Botswana; Namibia; South Africa.

5 USES

There is general agreement that this is an excellent fodder tree for all livestock and for game. The leaves and twigs are eaten, and in times of drought goats, horses and donkeys are recorded as eating the bark. Since most of the leaves remain on the tree throughout the year, the plant's value is enhanced. During drought the tree is often pushed over by the farmer to allow stock to reach the crown; the species often withstands this treatment and is not killed by it. It is possible to feed branches up to 3.5 cm in diameter by first breaking them up in a hammer mill. The flowers are rich in nectar. The fruits are eaten by birds. Analyses show 14.6% CP in the leaves and a high Vitamin A content is also claimed. The plant is said to taint the milk of cows fed on it.

A porridge can be made from the dried and beaten roots.



Scale 1:30 000 000

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Not known, but the plant has a wide distribution both latitudinally and altitudinally so there may be exploitable variation.

8 AGRONOMY

The species is said to grow well from seed and from root and shoot cuttings.

9 RELATED SPECIES

Boscia oleoides (Burch. ex DC.) Toelken from eastern Cape Province in South Africa is similar but occurs further south in a different climatic regime. It is used in similar ways to B. albitrunca.

Mørloth mentions that species of Boscia have large numbers of branched sclereids in the leaf which may help to retain leaf rigidity under water stress conditions.

REFERENCES

Erasmus 1965; Leistner 1967; Mørloth 1913; Palmer & Pitman 1972.

1 BOTANICAL

- 1.1 Accepted name Boscia angustifolia A.Rich.
- 1.2 Synonyms B.tenuifolia A.Chev.; B.patens Sprague & Green; B.corymbosa Gilg; B.fischeri Pax; B.caloneura Gilg; B.Dawei Sprague & Green; B.engleri Gilg
- 1.3 Family Copparaceae
- 1.4 Vernacular Names Amzagi, Danarehi, Karbaseji, Ngangahi (Peul); Tirehi, Tirza, Toucha (Dam.); Sereh*, Seheh (Arabic, Sudan); Chieh* (Somali)
* see also Maerua crassifolia

2 DESCRIPTION

Small tree or shrub to 10 m tall, with a rounded crown and pale grey smooth bark. Leaves alternate; blade oblanceolate to obovate, 1.5-7 x 0.8-2 cm; rounded or pointed at the tip, mucronate, rounded to cuneate at the base, leathery, usually glabrous, venation reticulate, midrib prominent below; stipules absent; petiole 3-7 mm long. Flowers in terminal and axillary racemes up to 6 cm long, scented. Sepals 4, ovate 2-5 mm long, hairy outside. Petals absent. Stamens 3-9. Fruits round, 0.7-1.3 cm in diameter, stalked.

3 ECOLOGY

In West Africa it occurs in regions with a rainfall of 400-800 mm; parts of its East African range probably receive more than this. It is found in deciduous woodland and bushland, and, in West Africa, is usually found in very dry sites such as hills, laterite outcrops and cliffs, but also in dry river beds. Most sites appear to be free-draining but there do not appear to be other special soil requirements.

Flowering usually takes place in the dry season.

4 DISTRIBUTION

Senegal; Mali; Niger; Nigeria; Central African Republic; Sudan; Ethiopia; Somalia; Kenya; Uganda; Tanzania; Zaire; Zambia; Zimbabwe; Malawi; Mozambique; Botswana. Also southern Arabia.

5 USES

The leaves, young shoots and the bark are eaten by wild and domestic animals. In West Africa and Sudan the plant is not very much sought after, but in the dry parts of Uganda and Kenya it is much used and is an important forage plant, to the extent that the true crown shape is not often developed because of constant lopping. It is of particular use in the dry season.

The seeds are cooked and eaten in Sudan, and the fruits are said to be edible though bitter. The bark is stripped and eaten either mixed with millet or as a soup in West Africa. There are various medicinal uses.

The wood is hard, and was formerly made into a good charcoal for gunpowder.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
(Uganda (	15.51	1.73	34.13	41.42	7.21	4.79	n.d.	n.d.
(Uganda * (	16.27	1.68	40.32	35.17	6.56	5.16	n.d.	n.d.
(Uganda (	24.96	3.18	10.30	45.93	15.63	15.21	n.d.	n.d.
(Kenya	19.29	1.33	39.25	33.03	7.10	n.d.	0.61	0.18
*All young branches and leaves.								
Senegal; leaves	21.9	n.d.	24.7	n.d.	6.6	4.7	0.80	0.07
Senegal; young leaves	18.1	2.6	25.2	44.1	9.9	5.4	1.24	0.06
Upper Volta; leaves	22.0	1.6	44.1	44.1	5.1	4.4	0.60	0.11
W.Africa ? seeds	23.8	1.8	1.9	68.7	3.8	n.d.	0.50	0.30

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

The wide range of the species, through a variety of altitudes, latitudes, and rainfalls, suggests that there must be considerable variation to be exploited. Two varieties, differing in the hairiness of the leaves, are recognised.

8 AGRONOMY

No information

9 RELATED SPECIES

B. salicifolia Oliv. is very similar but has longer and narrower leaves. It occurs from Senegal to the Red Sea, and south through East Africa to Botswana. In West Africa it is eaten by livestock.

B. senegalensis (Pers.) Lam. ex Poiré is a shrub or small tree occurring in the Sahelian Zone from Senegal and Mauritania to eastern Sudan and Ethiopia. Although very high protein contents have been reported (up to 35.13%), the plant is only casually browsed by camels and goats and sheep; cattle eat it only if desperate. The fruits are eaten by all animals, and man. The seeds are dried and cooked for human food. The plant has a strong and rather unpleasant smell which may deter most browsers. Boscia senegalensis. There are many analyses in Le Houérou (1980).

REFERENCES

Baumer 1975; Dougall & Bogdan 1958; Elffers, Graham & Dewolf 1964; Le Houérou 1980; Von Maydell 1983; Wilson & Bredon 1963.

1 BOTANICAL

- 1.1 Accepted name Cassia farinosa Forsskal
- 1.2 Synonyms C.mombassana Gilg & C.Benedict; C.adenotricha Gilg & C.Benedict; C.apiculata Gilg & C.Benedict
- 1.3 Family Capparaceae
- 1.4 Vernacular Names Bagabi, Balami, Sinsini (Peul); Abago, Abogou (Tamachek); Bagueï (Hausa); El Sarih Suriya, Surreigh el Sughajer (Arabic, Sudan); Nanmais, Allen ged (Somali); Eiva (Turkana); Molomoge (Masai); Kibalizi mwitu, Mvunja fumo (Swahili).

2 DESCRIPTION

Shrub, much branched and tangled and sometimes climbing, occasionally a small tree to 8 m. Young twigs whitish with mealy scales, becoming darker and glabrous when older. Leaves alternate; blade usually broadly elliptic, c 5-6 x 0.3-3 cm, apex and base rounded, sometimes mucronate, midrib prominent, grey-powdery when young; stipules absent; petiole up to 3 mm long. Flowers in small 5-6-flowered racemes at the ends of the branches, sepals 4, the outer two larger and enclosing the inner two. Petals 4, 10-13 mm long, yellowish, whitish or pinkish, very narrow. Stamens and ovary carried on a stalk 5-8 mm long; stamens 4-5. Fruits 4-6 cm long and c 4 mm in diameter, slightly constricted between the seeds, eventually splitting to display the black seeds embedded in yellow, orange or red flesh.

3 ECOLOGY

In West Africa it occurs in regions with an annual rainfall of 300-700 mm; in East Africa it can be found in sites with both more and less than this. It is found in deciduous bushland, grassland with scattered trees, and semi-desert scrub, and often occurs around termite mounds. In West Africa it is reported to prefer fine-textured soils and to require sites which are very wet during the rains. Heavy textured soils are also preferred in north-east Uganda.

It often flowers during the dry season, and the fruits ripen within 2-3 months. The seeds may be bird-dispersed. Pollination biology and seed germination and establishment condition unknown.

4 DISTRIBUTION

Egypt; Western Sahara; Mauritania; Senegal; Mali; Ghana; Nigeria; Niger; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Zaïre; Rwanda; Angola.

Also in Arabia and India.

5 USES

A valuable browse plant in East and West Africa, where it is eaten by cattle and goats as well as by game. In north-east Uganda it is reckoned to be the most important browse plant because of its abundance and wide distribution and also because it is green during the dry season. In Sudan it is stripped of leaves by camels, while goats and sheep eat it mainly in the wet season. Analyses show high levels of crude protein as well as high ash contents; the latter have been claimed to substitute for salt although an analysis from Kenya shows a level close to the average for all browse species. The leaves are edible. The leaves and roots have various medicinal uses.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Kenya; young branches with leaves	18.15	1.81	27.31	45.69	7.04	n.d.	0.39	0.17
Uganda; ? young shoots	26.72	3.09	17.05	38.76	14.38	13.32	n.d.	n.d.
	30.89	2.68	15.11	39.46	12.46	6.66	n.d.	n.d.
	27.74	3.29	11.03	43.32	14.72	14.24	1.15	0.5
	29.03	4.17	9.78	41.57	15.45	14.93	2.52	0.7
	26.05	2.92	11.59	41.78	17.66	17.28	n.d.	n.d.
	27.47	2.47	12.51	43.57	13.93	13.59	n.d.	n.d.
	27.89	3.94	10.79	43.94	13.44	13.01	n.d.	n.d.
Kenya; young branches with leaves	17.95	0.97	30.62	35.43	15.03	14.95	1.94	0.09
Senegal; leaves, fruit and flowers	23.20	n.d.	10.0	n.d.	15.8	15.3	1.70	0.20
Chad; flowers	23.8	7.6	8.9	42.2	16.4	n.d.	n.d.	n.d.

Analyses contd.

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Senegal; green leaves	19.1	3.1	24.6	45.4	9.8	9.5	0.87	0.08
Niger; green leaves	22.5	7.6	7.9	42.2	19.7	n.d.	n.d.	n.d.
Upper Volta; ?	26.5	5.0	8.7	39.3	20.6	19.4	1.80	0.12
W.Africa; green leaves	30.6	4.3	6.3	46.8	16.3	n.d.	2.40	0.12
Niger; leaves	30.6	1.8	9.3	42.9	15.4	n.d.	n.d.	n.d.
W.Africa; green leaves	17.5	2.7	15.3	32.6	31.9	n.d.	1.70	0.07

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

A wide-ranging species with considerable morphological variation. Desirable because of its high protein and mineral content; development should perhaps concentrate on the retention of these features while increasing leafiness, particularly during the dry season, and investigating the role of soil mineral content on leaf mineral content - the analyses show considerable variation, particularly in phosphorus content, which need explaining.

8 AGRONOMY

No information

9 RELATED SPECIES

C.glandulosa Forsskal extends from Mali to Somalia and Tanzania. It is regarded as good camel fodder in the Sudan, although somewhat purgative. In West Africa it grows on sandier soils than C.farinosa. There are eight species in the arid regions of northern Kenya and Somalia, mostly poorly known and of unknown browse value. In southern Africa C.aphylla (Thunb.)Willd. (syn C.juncea Harv.), (swart storm, blousteram - Afrikaans), occurs in the arid south-west and is browsed by goats and sheep.

REFERENCES

Andrews 1948; Baumer 1975; Dougal & Bogdan 1958; Dougal, Drysdale & Glover 1964; Elffers, Graham & DeWolf 1964; Marloth 1913; Palmer & Pitman 1972; Peyre de Fabrègues 1965; Tothill 1948; Von Maydell 1983; Wilson & Bredon 1963.

1 BOTANICAL

- 1.1 Accepted name Capparis decidua (Forsskal) Edgew.
1.2 Synonyms C. ophylla Hayne ex Roth
1.3 Family Capparaceae
1.4 Vernacular Names Tundub, Tuntub (Arabic, Sudan); Meringa (Somali)

2 DESCRIPTION

A tree to 7 m but more usually an untidy shrub or scrambler, or even a climber. Branches green, almost leafless, with pairs of recurved spines at the nodes. Flowers in small groups from the nodes; sepals 4, petals 4, irregular, pink. Fruits more-or-less spherical about 1 cm in diameter, on stalks 2-3 cm long with a joint in the middle.

3 ECOLOGY

In West Africa, occurs in areas with a rainfall of between 200 and 400 mm, and can be found in areas with as little as 100 mm. It is said to prefer fine-textured soils.

The plant is leafless for most of the year; leaves may be produced during rains. The flowers appear when the plant is leafless.

4 DISTRIBUTION

Egypt; Mauritania; Senegal; Niger; Nigeria; Chad; Sudan; Ethiopia; Somalia.
Also in Arabia and India.

5 USES

The leafy branches are browsed by camels, sheep and goats. In Sudan, it is said to be a major camel food, but to be taken only when little else is available as it is of low feeding value. The fruits are edible.

There are various medicinal uses.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Too little is known of the species for realistic suggestions to be made.

8 AGRONOMY

No information

9 RELATED SPECIES

C.tomentosa Lam. (C.polymorpha A.Rich.; C.persicifolia A.Rich.) (vernacular names: Dalevi, Goumi (Peul); Hekabit, Gulum, Maru, Mardu, Sharoba (Arabic-Sudan); Makayo, Mbeba, Mpapula-chui (Kiswhili); Gombor lik (Somali); Ekorokorait (Turkana).) is widespread in Africa in regions rather wetter than, or at the limits of, the semi-arid zone. It is of value because it is in leaf during the dry season, and makes most of its growth at that time. There are conflicting reports of its browse value. In West Africa it is stated to be good forage for camels but poisonous to other animals. In Sudan, on the otherhand, it is said to be toxic to camels. In Uganda it is eaten by elephant and buffalo particularly during the dry season. The fruits are eaten by birds, monkeys and elephants, and the seeds germinate in elephant dung. The plant sprouts readily from broken roots.

Other species of Capparis, such as C.corymbosa Lam., C.cartilaginea Decne, and some varieties of C.sepiaria L. extend into the semi-arid regions of E and NE Africa.

REFERENCES

Andrews 1948, 1950; Dale & Greenway 1961; Tothill 1948; Verdcourt & Trump 1969; Von Haydell 1983.

1 BOTANICAL

- 1.1 Accepted name Colophospermum mopane (J.Kirk ex Benth.)J.Kirk ex Leonard
- 1.2 Synonyms Copaifera mopane J.Kirk ex Benth.
- 1.3 Family Leguminosae-Caesalpinioideae
- 1.4 Vernacular Names Butterfly Tree (English); Mopane (Tswana - adopted into English).

2 DESCRIPTION

A tree to 20(-25) m high, sometimes larger. Bark rough, dark grey. Leaves made up of two asymmetric leaflets, each with a straight inner margin and a curved outer margin, the two together forming a cordate base, 4.5-10 x 1.5-5 cm. Leaf with transparent dots when held to the light, and with nerves which are prominent on both surfaces. Stipules inconspicuous, soon falling. Inflorescence racemose, slender and spike-like; flower-stalks 0.4-0.8 cm long. Flowers small; sepals 4; petals none; stamens about 20. Pods asymmetrical, more or less kidney-shaped, 3.5-5 x 2-2.5 cm. Seeds about 2.5 x 1.4 cm, kidney-shaped, deeply and irregularly furrowed and with many reddish sticky resin-glands.

3 ECOLOGY

Colophospermum mopane is a widespread tree of the drier parts of the Zambezian region, dominating a distinct vegetation type (28 - Colophospermum mopane woodland and scrub woodland). It occurs in regions with annual rainfall of 200-800 mm and is tallest under the upper part of this range. In areas of lower rainfall, it grows on most soil types, but under higher rainfalls it is found only on shallow soils, or in sites with an impermeable subsoil. Such soils often contain sodium ions whose effects on the clay cause impermeability, but mopane is absent from saline areas.

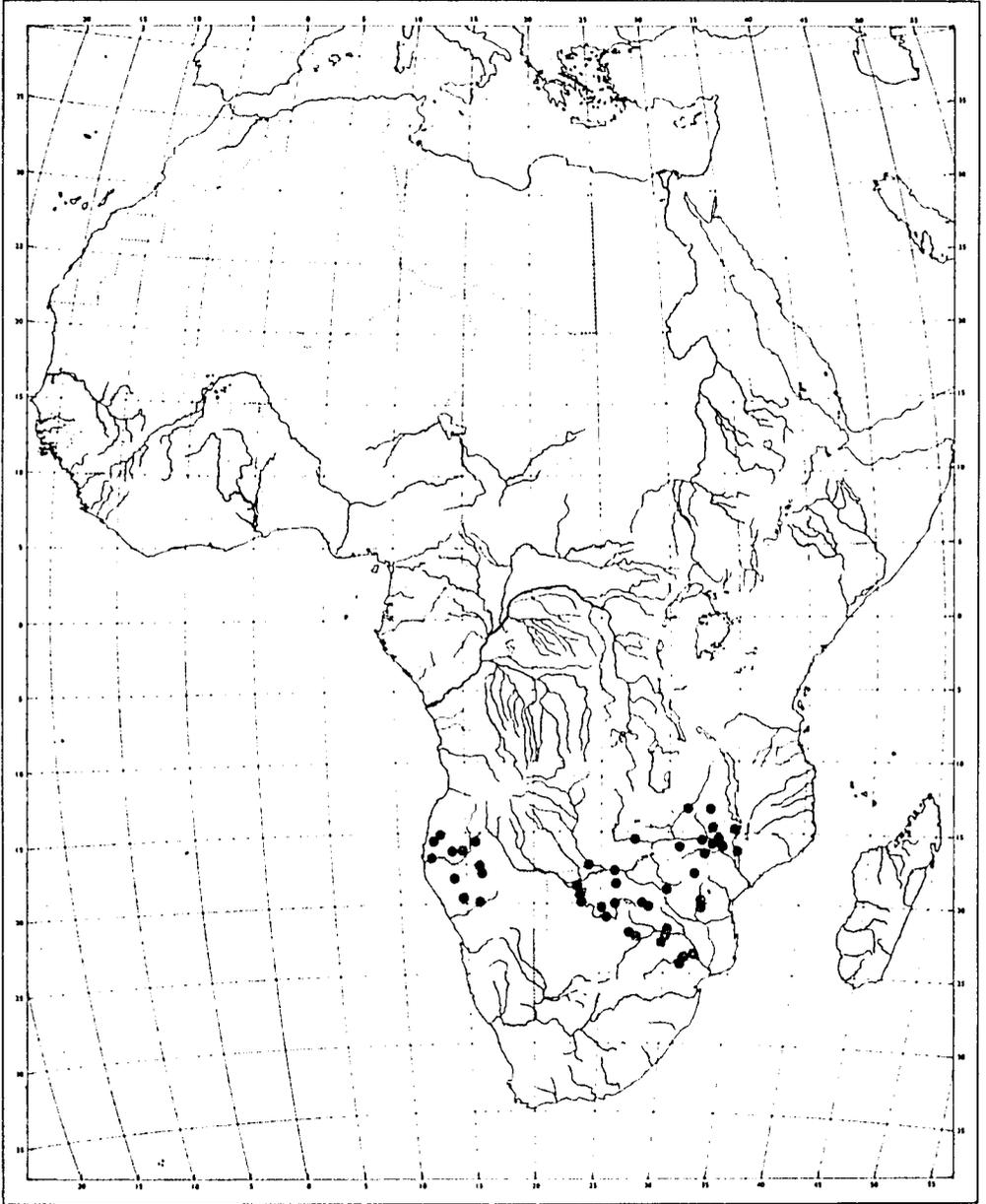
It is a tree of river basins, occurring in the valleys of the Luangwa, Zambezi, Save, Limpopo and Cunene.

It is deciduous to varying extents, being leafless for up to 5 months although usually for less.

4 DISTRIBUTION

Zambia; Malawi; Zimbabwe; Mozambique; Botswana; Angola; Namibia; South Africa..

Introduced to India and established.



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Scale 1:50,000,000
Scale 1:50,000,000

5 USES

A valuable browse species, eaten by both wild and domestic animals. Although scented, it does not taint the milk or the flesh. The foliage has a reasonably high protein content but is high in tannin when young. The old leaves are picked up from the ground and eaten. The wood is an outstanding firewood, being heavy, hard, and burning with great heat. Its hardness, however, makes it difficult to fell and cut into small sizes.

Analyses

Source	CP	CF	Ca	P
Zambia; leaves (mean of 6 samples)	13.1	n.d.	0.52	0.27
Zimbabwe; leaves	12.3	n.d.	n.d.	n.d.
twigs	5.0	n.d.	n.d.	n.d.
Transvaal, S. Africa; leaves				
Max	16.61	28.1	3.23	0.23
Min	8.4	21.9	1.15	0.12

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

There could well be exploitable variation in the extensive range of the species, but there could be a conflict between the use of the plant as a timber or firewood tree, and for forage. The former would require quick-growing strains which would rapidly become too tall to be browsed. However, even fallen leaves are said to be eaten, so that forestry and stock might not be entirely incompatible.

8 AGRONOMY

The species is said to regenerate well from seeds but the seedlings are susceptible to competition and must be kept free from weeds. Growth is best on deep rich alluvial soils but the plant can grow elsewhere, on shallower and poorer soils.

9 RELATED SPECIES

None

REFERENCES

Lawton 1968; National Academy of Sciences 1980; Palmer & Pitman 1972; Ross 1977; Walker 1980; White 1962, 1983,

1 BOTANICAL

- 1.1 Accepted name Combretum aculeatum Vent.
- 1.2 Synonyms C. leuconili Schweinf.; C. holstii Engl.;
C. denhardtiorum Engl. & Diels
- 1.3 Family Combretaceae
- 1.4 Vernacular Names Bularal; Laonadi; Laongi; Ookai; Talli (Peul);
Agersigil (Tamachek); Shuheit; Sogheit; Shihheit;
Sheibeit; Dablab (Arabic-Sudan).

2 DESCRIPTION

Shrub to 4 m high but scrambling if support is available and then taller. Leaves alternate or nearly opposite; leaf-blade up to 7 x 5 cm but usually less, hairy to varying degrees on both surfaces; petiole 0.1-1 cm long, persisting after the rest of the leaf has fallen and forming a recurved spine up to 1.7 cm long. Inflorescence in the axils of the leaves, spike-like, of small yellowish-white fragrant flowers. Petals 4-6 x 1-2 mm. Stamens 4-9 mm long. Fruit 5-winged, 1.5-2.2 x 1.5-2.3 cm; wings papery, yellow-brown; fruit-stalk 6-12 mm long.

3 ECOLOGY

Widespread in dry bushland in the semi-arid zone (Units 42 - Somalia-Masai Acacia - Commiphora deciduous bushland and thicket, & 43 - Sahel Acacia wooded grassland and deciduous bushland). In the Sahel it grows on a wide range of soil types and is said to withstand flooding, but in the seasonally flooded areas of the southern Sudan it is restricted to termite mounds which are generally above the flood level.

4 DISTRIBUTION

Mauritania; Senegal; Mali; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania.

5 USES

Much sought-after as browse by all animals, both wild and domestic. The green leaves and the young branches are most sought-after, but even the fallen leaves are eaten. The leaves are said to be excellent camel fodder.

The plant also yields firewood and charcoal but in small sizes.

It also has numerous medicinal uses.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Kenya; twigs and leaves	11.87	1.42	36.16	43.56	6.99	6.85	1.30	0.32
Upper Volta; young leaves	29.8	2.9	15.4	41.7	10.2	9.1	1.4	0.50
Upper Volta; green leaves	10.5	4.9	19.4	55.4	9.8	6.6	2.8	0.12
Upper Volta; young shoots	7.4	1.2	29.9	54.4	7.1	6.0	1.6	0.10
Upper Volta	17.3	2.3	19.1	49.7	11.6	8.1	1.7	0.21

6 SEED COLLECTIONS

None Known

7 POTENTIAL FOR IMPROVEMENT

Forms with rapid growth and high palatability are to be encouraged, but no work has, as far as can be ascertained, been carried out on these aspects.

8 AGRONOMY

There are about 17 000 seeds per kilogram. It has been shown that in other species in the genus the seed germinates on the soil surface and the plumule, enclosed between the partially fused stalks of the cotyledons, is pushed into a position below the soil surface where it has at least some protection from fire. It is not known if this species, coming as it does from drier areas than most species in the genus, behaves in the same way.

9 RELATED SPECIES

C. hartmannianum Schweinf. occurs in northern Sudan. It is said to be much sought-after at the end of the dry season because the new leaves are produced at this time. Branches are also lopped for fodder.

REFERENCES

Andrews 1953; Baumer 1975; Dougal, Drysdale & Glover 1964; Jackson 1974; Keay 1954; Le Houérou 1980; Tothill 1948; Von Maydell 1983; Wickens 1973.

1 BOTANICAL

- 1.1 Accepted name Commiphora africana (A.Rich.)Engl.
- 1.2 Synonyms Commiphora pilosa Engl.; Commiphora calcicola Engl.
- 1.3 Family Burseraceae
- 1.4 Vernacular Names Adaras, Adras (Tamachek); Badadi, Badaki, Badi (Peul); Dachi (Hausa); Gafal, Qafal, Mayakw; Angka (Arabic-Sudan); Dabba 'un 'un (Somali); Ekedille (Turkana); Mbambara (Swahili).

2 DESCRIPTION

A small tree, sometimes reaching 10 m but usually not more than 5 m high. Crown rounded, with the branches ascending and then curving downwards. Many of the branchlets end in spines. Bark grey-green, sometimes shiny, peeling in membranous scales; slash red, pleasantly scented, exuding a clear gum. Leaves 3-foliolate, leaflets cuneate at the base and with irregularly and bluntly toothed margins, shiny above with a sparse covering of hairs, more densely hairy below, up to 4 x 2.5 cm, the middle leaflet larger than the laterals. Flowers in axillary clusters of 4-10; petals four, red, not fused, but forming a tube about 6 mm long. Fruits reddish, 6-8 mm across but sometimes larger, almost stalkless made up of tough outer layer which splits when ripe to reveal a hard furrowed stone embedded in a red resinous flesh, sought-after by birds.

3 ECOLOGY

A very widespread species, although its range and ecology may be somewhat obscured by taxonomic confusion. It occurs in a wide range of soil types but appears to grow best on sands in the Sahel. It also grows on rocky escarpments. There is an out-lying population on sandy soil near the sea in Togo but this may be the result of introduction. Most of the range lies within an annual rainfall of 300-800 mm, and extends from sea-level to about 1600 mm.

The tree is deciduous and comes into leaf at or before the beginning of the wet season, losing its leaves at the beginning of the dry season. In exceptional years, when the rains are sparse or interrupted, two crops of leaves can be produced in one year. Flowers are produced in the first half of the dry season and are followed by the leaves and fruits. Flowering and fruiting is irregular and does not occur every year. The seeds are hard and are probably dispersed by animals and birds.

4 DISTRIBUTION

Mauritania; Senegal; The Gambia; Mali; Upper Volta; Ivory Coast; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Kenya; Uganda; Tanzania; Rwanda; Zaire; Mozambique; Zambia; Malawi; Zimbabwe; Angola; Botswana; Namibia.

5 USES

The foliage is eaten in many parts of its range, mainly at the beginning and end of the rains. Since the plant often produces leaves before the start of the rains, it is particularly valued at this time and to the north of Lake Chad it is extremely important to the local people, who move into small stands of Commiphora africana at this time; it is claimed to build up the strength of the camels before the main rainy season grazings are available.

The gum is used as a perfume, and the wood has the reputation of being termite-proof. There are numerous medicinal uses.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Young leaves	14.25	2.47	12.9	61.0	9.39	8.0	0.98	0.18
Fruit	6.40	4.5	21.3	58.8	7.00	5.4	0.88	0.16
Leaves	16.5	2.7	10.0	59.8	10.9	7.00	1.8	0.16

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Other than looking for material with quick growth and the minimum of spines, there would seem to be little scope for the improvement of this very useful species.

8 AGRONOMY

The plant is easily raised from stakes or large cuttings and is recommended for live hedges. There are about 8000 seeds per kilogram.

9 RELATED SPECIES

There are many species of Commiphora in Africa, particularly in the Somalia-Masai Region, but they are taxonomically poorly understood, mainly because of the difficulty of correlating flowering, fruiting and vegetative material in plants where leaves, flowers and fruits are hardly ever present at the same time. Many are eaten by both domestic and wild animals.

Species of Boswellia, some of which yield the scented gum frankincense are browsed in Somalia.

REFERENCES

Andrews 1952, 1953; Baumer 1975; Clanet & Gillet 1980; Dale & Greenway 1961; J.B. Gillet pers comm.; Keay 1958; Le Houérou 1980; Peyre de Fabrègues 1965; Tothill 1948; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Conocarpus lancifolius Engl.
1.2 Synonyms -
1.3 Family Combretaceae
1.4 Vernacular Names Damas, Damask, Hodeti (Somali)

2 DESCRIPTION

An evergreen tree to 20 (30) m high. Crown spreading. Bark dark grey, fissured. Leaves alternate, simple; leaf blade up to 12 x 2 cm, tapering at both ends, with entire margins; leaf stalk up to 1.5 cm long. Flowers in small spherical heads 0.5-0.6 cm in diameter, yellowish, the heads grouped into loose inflorescences at the ends of the branches. Fruiting heads c 0.6 cm in diameter. Seeds scale-like, curved, about 2 mm wide.

3 ECOLOGY

A plant of the sandy beds of intermittently-flowing rivers, and also near the coast where springs emerge or where water lies below the surface. It appears to be consistently associated with subsurface water, and cannot be cultivated without irrigation in sites where the water table is more than 8 m below the surface. It is somewhat salt-tolerant.

The seeds are dispersed by floods and germinate at the flood line. Survival is dependant on the seedling roots reaching, and remaining in contact with the water table.

4 DISTRIBUTION

Somalia

Introduced in southern Arabia, Djibouti, Sudan and Kenya.

5 USES

It is eaten by goats when they can reach it, and in times of drought the trees are lopped to provide fodder. This treatment can be fatal to the trees.

The wood is good for making charcoal and is also an excellent shade tree (in Mogadisho, for example). Good poles are also produced. There are also medicinal uses.

6 SEED COLLECTIONS

Two collections from Somalia (1983) are stored at the Royal Botanic Gardens, Wakehurst Place.

7 POTENTIAL FOR IMPROVEMENT

Little is known of variation in, for example, growth rate of material from different sites.

8 AGRONOMY

Seeds are easily collected. They are light (1 700 000 per kilogram). They germinate well if sown onto the surface of a moist substratum. Covering apparently inhibits germination. After germination regular watering is essential until the seedlings are well-established. The seedlings can be transplanted at 12-18 months, preferably during the coolest part of the year. Shallow planting followed by regular watering is often successful and planting in a deep hole, with removal of all leaves and soft shoots, is much more successful, and less watering is needed.

The tree grows best in well-fertilised sites and can grow rapidly, reaching a height of 11 m in 6 years.

9 RELATED SPECIES

The other species in the genus, C. erectus L., occurs in coastal sites in West Africa and tropical America.

REFERENCES

Bilaidi 1978; Boaler 1959; Howes 1951; Keay 1954.

1 BOTANICAL

- 1.1 Accepted name Cordeauxia edulis Hemsley
- 1.2 Synonyms None
- 1.3 Family Leguminosae-Caesalpinoideae
- 1.4 Vernacular Names Gub (the bush); Mukley (the tree); Yeheb, ye-eb, yi-ib (the fruit) (Somali). The correct official spelling in Somali is 'jicib'. Pronunciation is ye'eb.

2 DESCRIPTION

A shrub or perhaps occasionally a small tree to 3 m high, unarmed. Bark yellow-brown. Young shoots with numerous red or purple glands. Leaves pinnate, without a terminal leaflet; rachis with petiole up to 5 cm long, with many reddish glands; leaflets ovate to oblong-ovate, asymmetrical, with 1-6 (usually 4) pairs of leaflets, 3-4.5 x 1-3 cm, rounded at the tips, with numerous reddish glands. Stipules ovate-lanceolate, c 1.5 mm long, soon falling. Stipels absent. Flowers in terminal few-flowered corymbose inflorescences, bisexual; petals bright yellow, clawed, 17 x 6-10 mm; stamens 10. Fruit a dehiscent pod, slightly curved, 4-6 x 2 cm, containing 1-2 seeds, each 3.5-5 cm long.

It has been suggested that there may be two varieties in Somalia, distinguished by the size of their fruits and leaves.

3 ECOLOGY

A species of the plains of Somalia at altitudes of 300-1000 m. Annual rainfall is probably within the range 100-200 mm, and annual mean temperature are about 30°C. Frost do not occur. Soils are poor red sandy soils, sometimes overlying limestone. The vegetation type is Unit 42 - Somalia-Masai Acacia-Commiphora deciduous bushland and thicket.

There is no information on the flowering season, but the fruit is said to be ripe in June although this doubtless varies with rainfall. The fruits are reported to develop as a result of rain, with fertilised pods remaining undeveloped until further rain falls, and then maturing in 10-14 days.

4 DISTRIBUTION

Somalia

5 USES

The main use has been for food, with the seeds being an important component of the diet of some nomadic Somali peoples. However, the plant is also much browsed, and has the peculiar property of staining the bones red of animals which browse it.

The plant yields a useful purple dye. The seeds have a high protein content and also contain fats and starch. The protein in the seeds is methionine-deficient.

6 SEED COLLECTIONS

None known. It is now difficult to obtain viable seed as most is collected by local people before it is completely ripe, and immediately roasted.

7 POTENTIAL FOR IMPROVEMENT

Much more investigation of the variability, and its basis (genetic or environmentally induced), and of the problems of cultivation, are needed before improvement can usefully be considered.

8 AGRONOMY

The seeds lose their viability rather quickly - certainly within a year - and should be sown soon after gathering. Germination is rapid but subsequent growth is slow, at least above ground, although the root system develops more quickly. Transplanting is a problem because the tree is said to die if the taproot is broken. Seeds are produced in 3-4 years. The plant is intolerant of waterlogging, and, once established it is very drought-tolerant.

Yields of about 5 kg of nuts per tree have been reported.

9 RELATED SPECIES

C.edulis is the only species in the genus. Stuhlmannia moavi Taubert, which is found in north-eastern Tanzania, is closely related. It is a tree of dry forests (Unit 16a - Zanzibar-Inhambane undifferentiated Forest).

REFERENCES

Bally 1966; Brennan 1957; Greenway & Raymond 1947; Kazmi 1979; Wickens pers. comm.

1 BOTANICAL

1.1 Accepted name

Dichrostachys cinerea (L.)Wight & Arn.

1.2 Synonyms

D.glomerata (Forsskal)Hutch. & Dalz.; D.nutans (Pers.)Benth.; D.platycarpa Welw. ex Oliver; D.arborea N.E.Br.; Cailliea dichrostachys Guill. & Perr.; Mimosa glomerata Forsskal; Mimosa nutans Pers.; M.cinerea L.; Dichrostachys nyassana Taubert

1.3 Family

Leguminosae-Mimosoideae

1.4 Vernacular Names

Bourri, Patroulahi (Peul); Dundā (Hausa); Kadad, Kadada, Hegam; Hurgam; Hurgam (Arabic-Sudan).

2 DESCRIPTION

A shrub or small tree, sometimes to 12 m but usually much less, at least in the arid and semi-arid zones, sometimes forming thickets from root suckers. Bark on old stems rough and fissured, sometimes forming thick flakes. Young branches smooth, grey, bearing lateral spine-tipped short shoots which also bear leaves and inflorescences. Leaves bipinnate, grey-green, with 5-19 pairs of pinnae. Leaf-stalk and leaf-axis together 0.5-20 cm long, with one stalked gland between each pair of pinnae. Leaflets 9-41 pairs, 1-1 x 0.3-4 mm. Inflorescences cylindrical, 2-5 cm long, made up of many very small flowers, those near the base being sterile and pink or white and those towards the apex being fertile and yellow. Pods 2-10 x 0.5-2 cm, several together, usually twisted together into a subspherical mass.

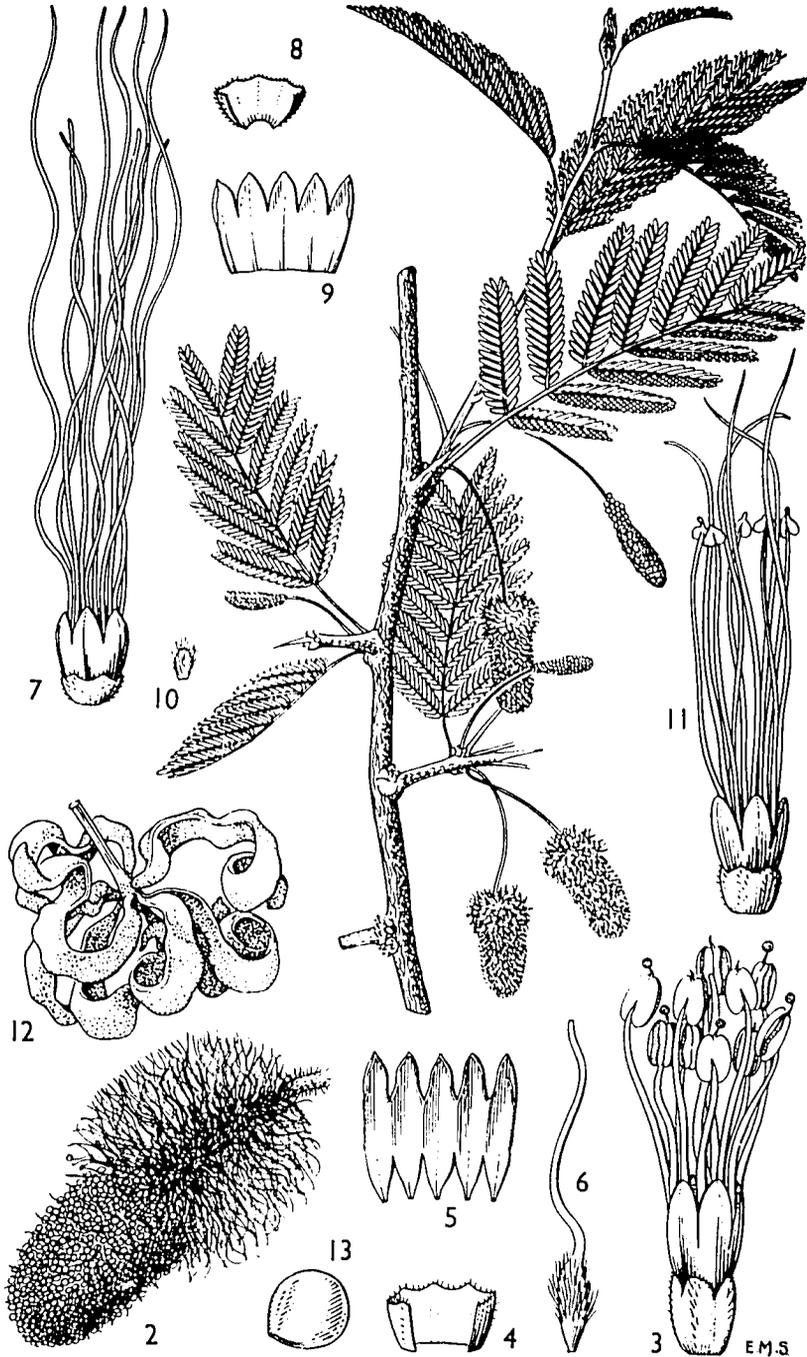
3 ECOLOGY

A plant of wide distribution, occurring from the dry forest belt through most woodland and shrubland types, reaching its limits in the zone of transition between the Sahel and the Sahara (Unit 43/54a). It is said often to colonise abandoned cultivation and to appear in overgrazed places. If not wanted, it is difficult to eradicate because of its abundant root suckers.

4 DISTRIBUTION

Senegal; Gambia; Mali; Guinea-Bissau; Guinea; Sierra Leone; Liberia; Ivory Coast; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Kenya; Uganda; Tanzania; Zaire; Mozambique; Malawi; Zambia; Zimbabwe; Angola; Namibia; South Africa.

Also in Arabia and tropical Asia and introduced to America.



Dichrostachys cinerea - 1, part of flowering branch; 2, inflorescence; 3, hermaphrodite flower; 4, calyx; 5, corolla; 6, ovary; 7, neuter flower; 8, calyx of neuter flower; 9, corolla of neuter flower; 10, rudimentary ovary of neuter flower; 11, neuter flower showing intermediate stage in reduction of stamens; 12, cluster of pods; 13, seed.

5 USES

A species that is usually regarded as a weed, but which can provide useful fodder. In the Sudan the leaves are eaten by camels and the pods are taken by sheep and cattle. In northern Uganda it is only sometimes eaten by cattle. In West Africa the importance of the pods as fodder is emphasised; the leaves and young shoots are also eaten.

The wood is hard and heavy but of small size which limits its usefulness. The flowers are much visited by bees. There are a number of medicinal uses.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Uganda	15.33	1.23	28.09	50.46	4.89	4.62	n.d.	n.d.
Kenya	17.00	1.61	27.65	41.76	7.98	7.68	0.87	0.17
Nigeria; fruit	11.4	1.2	25.6	56.4	6.5	n.d.	n.d.	n.d.
Upper Volta; young shoots	18.6	3.6	11.6	60.3	6.0	5.5	1.1	0.20
Upper Volta; green leaves	17.0	5.5	23.9	48.6	6.9	6.3	1.4	0.11

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Forms which produce no root suckers, and those which have few or no spines, and which grow quickly, could be sought. The species is extremely variable and ten subspecies (three from outside Africa) and numerous varieties have been described and discussed in some detail. At least some taxa occupy distinct habitats.

8 AGRONOMY

The species is very easily established from root or stem cuttings. There are about 39 000 seeds per kilogram; they are hard and would probably germinate more quickly and evenly if scarified by chemical or mechanical means. Research on this species, has, however, generally been more concerned with its eradication than its perpetuation!

9 RELATED SPECIES

There are several poorly known taxa of Dichrostachys in Africa, including D.kirkii Benth., from Somalia, and two from the arid regions of northern Kenya which are referred to only as D.sp. A & B in the Flora of Tropical East Africa. More information is needed. Prosopis africana (Guillemin & Perrottet) Taubert is a large tree which can grow in Sahelian woodland although it is commoner in moister regions. The young foliage and the fruit both provide forage, and the timber is of excellent quality.

REFERENCES

Andrews 1953; Brenan 1959; Brenan & Brummitt 1965; Dalziel 1937; Dougal, Drysdale & Glover 1964; Keay 1954; Le Hou  rou 1980; Peyre de Fabr  gues 1965; Tothill 1948; Von Maydell 1983; Wilson & Bredon 1963.

1 BOTANICAL

- 1.1 Accepted name Entada leptostachya Harms
- 1.2 Synonyms Entadopsis leptostachya (Harms) Cuf.
- 1.3 Family Leguminosae-Mimosoideae
- 1.4 Vernacular Names Foradere, Faradere, Kobogor (Somali); Mgambari (Swahili)

2 DESCRIPTION

A climber or shrub attaining 6 m. Leaves bipinnate, some, on climbing shoots, with modified and thickened pinnae which assist in climbing. Normal leaves also bipinnate, with 2-4 pairs of pinnae; leaflets 7-10 pairs, 0.9-2.5 x 0.3-0.9 cm, asymmetric at the base, almost hairless or with tiny hairs on both surfaces. Inflorescences spike-like, axillary, but often clustered on short axillary shoots. Flowers yellow or perhaps sometimes white, sweet-scented. Pods 17-23 x 4-8.5 cm, flat, the margins remaining when the membranous seed-containing central portion falls away in one or two-seeded fragments. Seeds c 11-14 x 9 mm.

3 ECOLOGY

A plant of the East African arid and semi-arid bushlands, occurring in Unit 42 - Somalia-Masai Acacia-Commiphora deciduous bushland. Altitudinal range in East Africa is 350-1500 m. It has also been recorded from bushland close to the seashore and could have some salt resistance.

4 DISTRIBUTION

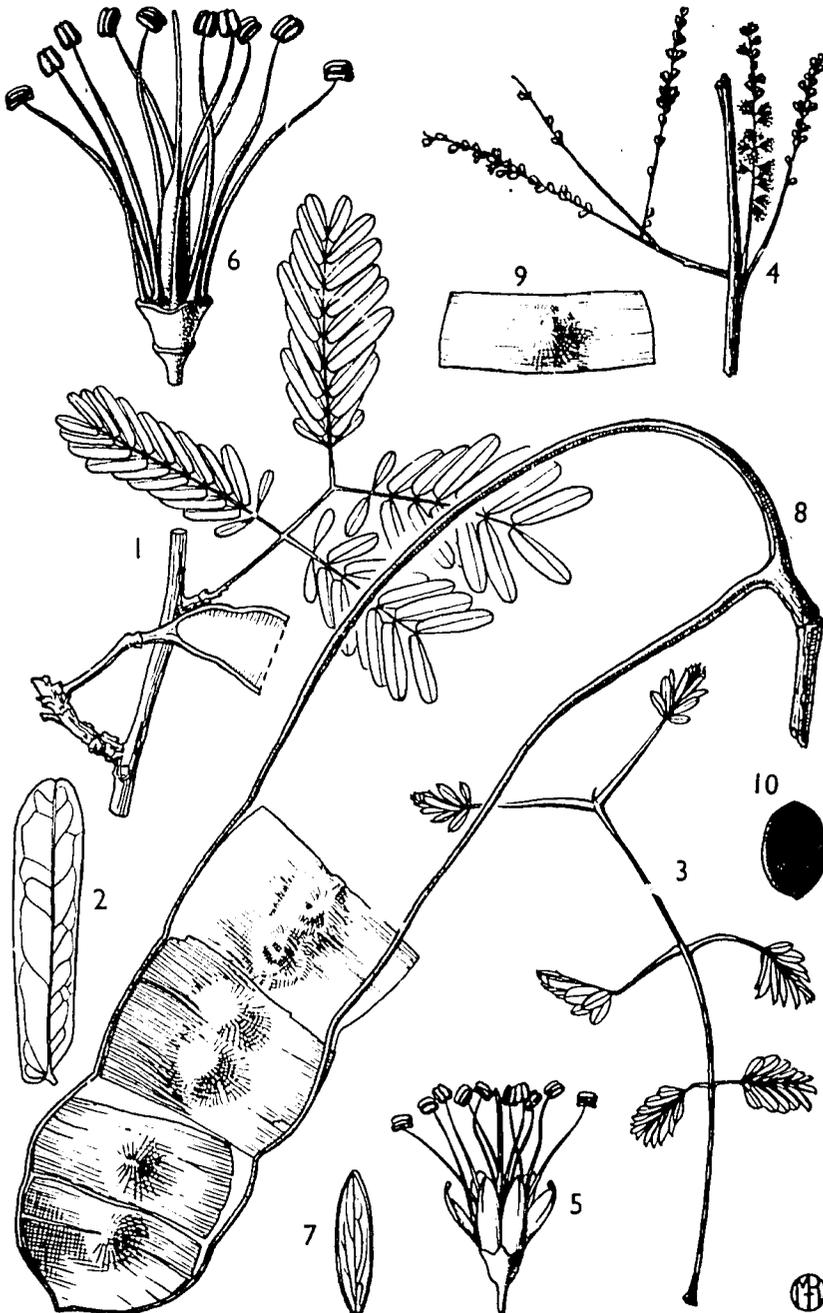
Ethiopia; Somalia; Kenya; Tanzania

5 USES

The leaves and young shoots are grazed by all stock. The roots are thick and water-containing, and are sought after in the dry season as a water source for stock. They have, however, an unpleasant astringent taste which makes them unsuitable for human consumption.

Analysis

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Young twigs & green leaves	19.91	1.52	28.21	44.08	8.28	8.07	1.51	0.18



Entada leptostachya - 1, part of branch with leaf; 2, leaflet; 3, leaf with thickened modified pinnae for climbing; 4, flowering shoot; 5, flower; 6, flower, calyx and petals removed; 7, petal; 8, pod, part fallen away; 9, envelope of endocarp containing seed; 10, seed.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Insufficient information for any useful judgement to be made.

8 AGRONOMY

No information

9 RELATED SPECIES

Entada rotundifolia Harms occurs in dry bushland in north-eastern Tanzania. It is reported to be an indicator of saline soil and occurs with such species as Salvadora persica.

The record on which much of the information on E.leptostachya was misidentified as E.flexuosa Hutch & Dalz. Material at Kew confirms that E.leptostachya is the correct name.

REFERENCES

Brenan 1959; Dale & Greenway 1961; Dougal & Sheldrick 1964; Glover 1951a.

1 BOTANICAL

1.1 Accepted name Erythrina melanacantha Harms

1.2 Synonyms E. rotundato-obovata Baker.f.

1.3 Family Leguminosae-Papilionoideae

1.4 Vernacular Names Yoho, Yo'oh (Somali)

2 DESCRIPTION

A tree attaining 20 m high, with a spreading crown. Bark with prickles borne on large corky lumps. Branches rough, with many scattered black recurved prickles. Leaves trifoliolate, alternate; leaflets almost circular, or broader than long, 2-9 x 1.5-12 cm, usually hairy beneath, the midrib sometimes prickly. Flowers usually produced when the tree is leafless, in spike-like racemes at the ends of the branches. Sepals completely united, splitting down one side when the flower opens. One petal large, 5-7.5 x 1.8-3.3 cm, dull red or scarlet, other petals much smaller and duller. Pods curved, 13-30 x 1.8-2.3 cm, containing 6-11 seeds. Seeds bright yellow or dull reddish, c 1.5-1.6 x 0.9-1.0 cm.

3 ECOLOGY

A tree of the dry bushlands of north-eastern Africa, occurring mainly in Type 42 - Somali-Masai Acacia-Commiphora deciduous bushland and thicket. It is sometimes planted.

4 DISTRIBUTION

Ethiopia; Somalia; Kenya; Tanzania.

5 USES

The leaves are browsed by sheep, goats and camels. The species is sometimes planted as an ornamental, and as a hedge.

6 SEED COLLECTIONS

Three collections from Somalia (1983) are stored in the Seed Bank, Royal Botanic Gardens, Wakehurst Place.

7 POTENTIAL FOR IMPROVEMENT

Thornless forms are obviously desirable although they might not survive uncontrolled grazing. There are two subspecies (ssp. melanacantha and spp. somala (Chiov.)J.B.Gillett, differing in seed and flower colour..

8 AGRONOMY

Most species of *Erythrina* root easily from large cuttings (stakes).

9 RELATED SPECIES

Several of the East African species occur in dry country. The most widespread is *E. abyssinica* DC., which is noted particularly for its fire-resistance, and is also used for dry season browse. Like *E. melanacantha*, it is easily propagated from large cuttings.

REFERENCES

Gillett, Polhill & Verdcourt 1972; Lazier & Mengistu 1984.

1 BOTANICAL

- 1.1 Accepted name Feretia apodanthera Del.
- 1.2 Synonyms Feretia canthioides Hiern
- 1.3 Family Rubiaceae
- 1.4 Vernacular Names Boraouhi, Burudehi, Taimelgore, Tobe, Tobida (Peul); Efaranfara (Tamachek); Kurukuru, Lallan suri (Hausa); Yasmin, Loar (Arabic, Sudan)

2 DESCRIPTION

A deciduous shrub, occasionally single-stemmed, attaining 5 m but usually only 3 m. Bark red-brown, scaly. Young branches reddish and hairy. Leaves in opposite pairs, 4-6 x 2-3 cm, usually broadest at or below the middle, hairy on the nerves beneath when young. Flowers in dense groups on short lateral shoots, appearing before or with the leaves. Sepals 5, fused, pink. Petals 1.5-2 cm long, fused into a tube below, the free parts white inside and partly white and partly pink outside. Anthers projecting from the flower. Fruit spherical, black when ripe about 8 mm in diameter.

3 ECOLOGY

A species occurring in Unit 43 (Sahel Acacia wooded grassland and deciduous bushland). It extends into moister regions also. It occurs on various soil types, and appears able to withstand temporary flooding or waterlogging.

Flowering occurs at the beginning of the wet season, probably as a response to rainstorms, as many bushes flower simultaneously in the same area. A similar response is known in other Rubiaceae such as Coffea.

4 DISTRIBUTION

Senegal; Gambia; Mali; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Nigeria; Cameroon; Chad; Central African Republic; Sudan; Ethiopia; Somalia; Kenya; Uganda; Tanzania.

5 USES

The green leaves are eaten by all species, both early in the wet season and at the beginning of the dry season, and the dry leaves are eaten as they fall.

There are various medicinal uses.



Feretia apodanthera - 1, stipules; 2, flowers; 3, pistil; 4, habit of fruiting-shoot; 5, fruit.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficient information

8 AGRONOMY

There are about 93 000 seeds per kilogram.

9 RELATED SPECIES

Several species of Gardenia just reach regions dry enough to qualify for this work, and most are browsed when available. The young shoots are produced early in the wet season. The decorative flowers are also produced at this time.

REFERENCES

Andrews 1953; Baumer 1975; Dalziel 1937; Hepper 1963; Rees 1964; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Grewia tenax (Forsskal) Fiori
- 1.2 Synonyms Chadara tenax Forsskal; Grewia chadara Lam.;
G. populifolia Vahl; G. betulaeifolia A.L.Juss.
- 1.3 Family Tiliaceae
- 1.4 Vernacular Names Jingehi, Kaltohi, Yengohi (Peul); Gyrsemum, Tarakat, Tarhak (Tamachek); Um Ageda, Gaddem, Gaddeim (Arabic, Sudan); Damak, Dekah, Defarur, Duferu (Somali); Engomo, Ongomoh (Turkana)

2 DESCRIPTION

A shrub to 2 m, usually rounded but generally battered and untidy due to browsing. Bark smooth, grey, very fibrous so that twigs are hard to break. Leaves alternate, almost circular in outline, 1.5-4 cm in diameter, toothed at the margin, often hairy, particularly beneath, with star-shaped hairs. Stipules inconspicuous, falling early. Flowers solitary or in pairs in the leaf axils, petals white, about 1 cm long; sepals longer, recurved. Fruit red at maturity, made up of one to four almost spherical lobes.

3 ECOLOGY

A species which occurs in the driest savannas at the desert margin, but which also extends, at least in southern Sudan, into regions of higher rainfall, where it grows on thickets on termite mounds in otherwise seasonally flooded country. In the Sahel it grows in rocky places on hills and slopes, in regions with 100-600 mm of rain per annum, and is reported to be very drought-resistant.

4 DISTRIBUTION

Algeria; Morocco; Western Sahara; Mauritania; Senegal; Mali; Upper Volta; Niger; Nigeria; Chad; Sudan; Ethiopia; Djibouti; Somalia; Kenya; Uganda; Tanzania; Zimbabwe; Namibia; South Africa.

Also in India.

5 USES

Much sought after as browse while it is green during the July-November wet season in northern Sudan. The dead leaves are eaten also, but only while they remain on the plant; they fall in December to January in this area. In the Sahel it is eaten by camels, sheep and goats.

The bark is used as string in building. The fruits are edible.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficiently known for useful suggestions to be made.

8 AGRONOMY

There are about 21 000 seeds per kilogram.

9 RELATED SPECIES

Grewia similis Schumann is similar to G. tenax but is rather larger and has mauve flowers. It is an important browse plant in north-eastern Uganda.

Grewia flavescens A.L.Juss. (Simeima, Umm Khalatot, Gaddeim' Yabelayus (Arabic, Sudan); Kama n'moa (Hausa)) is a scrambling shrub with four-angled stems and yellow flowers. It occurs in moister habitats than G. tenax, and is reported as being little browsed in the Sahel, but to be readily eaten by camels in the Sudan.

Grewia flava DC. occurs in the dry regions of southern Africa; it is browsed by wild and domestic animals and the fruits are eaten by men and animals.

REFERENCES

Andrews 1948; Baumer 1975; Dale & Greenway 1961; Keay 1958; Lebrun 1977; Leistner 1967; Peyre de Fabrègues 1965; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Grewia villosa Willd.
- 1.2 Synonyms G.corylifolia Guillemin & Perrottet
- 1.3 Family Tiliaceae
- 1.4 Vernacular Names Goursohi, Nyadohi (Peul); Goursoumi (Hausa); Tamr el Abid, Tukku, Gereighan, Mutrak (Arabic-Sudan); Kobbish, Kubbish, Koppish, Gomesha (Somali); Epikoo, Epongae (Turkana).

2 DESCRIPTION

A shrub attaining 4 m, multistemmed and untidy. Bark grey-black with longitudinal and transverse fissures, very fibrous so that the twigs are difficult to break. Leaves almost circular in outline, up to 12 cm in diameter, wavy and/or toothed at the margin, hairy on both surfaces. Stipules small, falling off early. Flowers in small groups in the leaf axils; petals red or red-brown, about 4 mm long; sepals much longer. Fruits made up of 1-4 spherical lobes, brownish, hairy.

3 ECOLOGY

A common plant of the Sahel zone of West Africa and south to Zambia, occurring usually in well-drained sites on rocky, sandy or gravelly soils. Sometimes in temporarily flooded sites. It occurs in several types of wooded grassland and deciduous bushland. There is an outlying population in the plains of southern Ghana; here the plant occurs in thicket clumps on clay soil in a climate with two wet seasons each year, close to the sea.

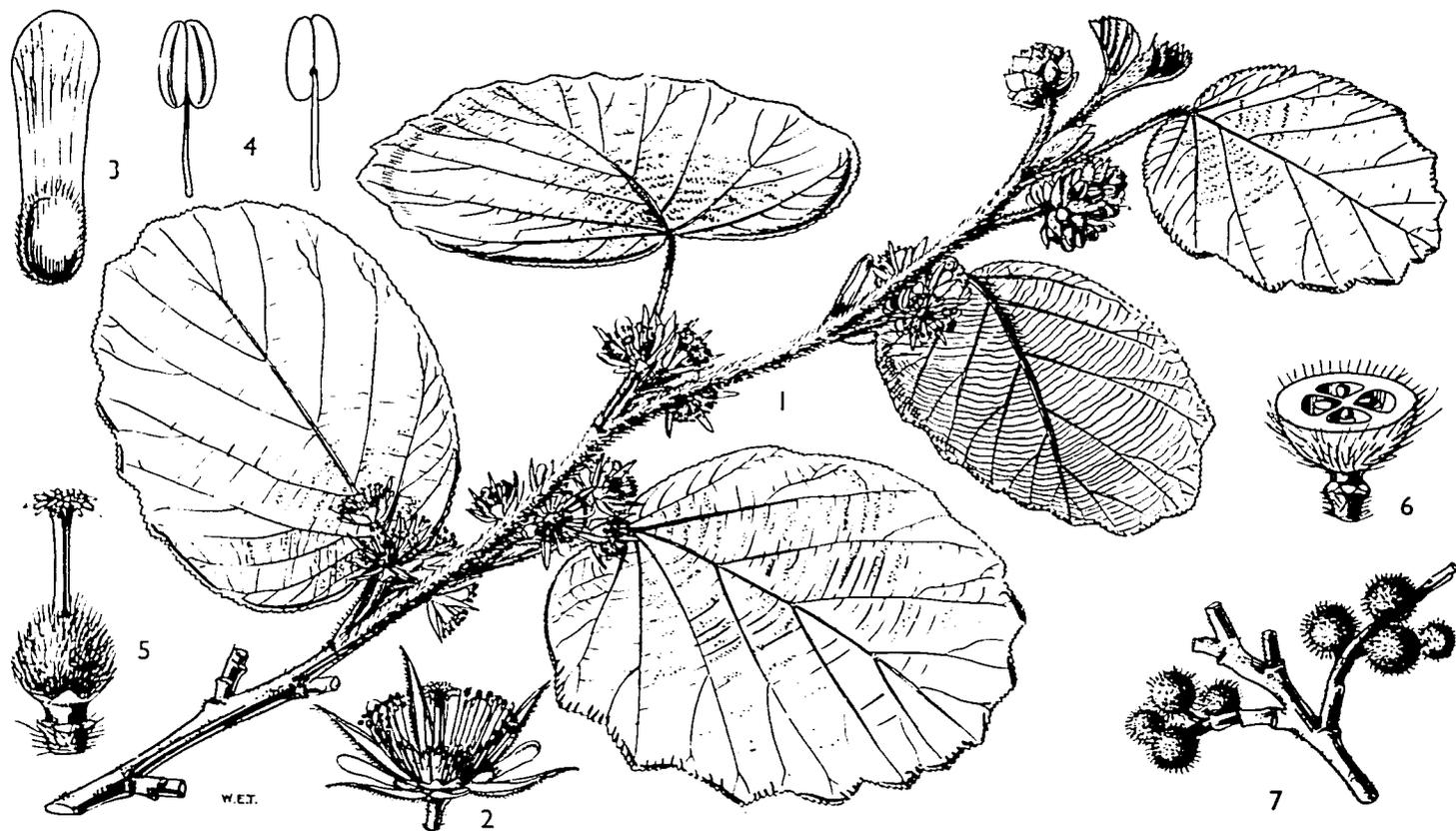
4 DISTRIBUTION

Senegal; Mali; Ivory Coast; Ghana; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Kenya; Uganda; Tanzania; Zaire; Mozambique; Zimbabwe; Botswana; Angola; Namibia; South Africa.

5 USES

The green leaves are widely reported to be eaten by most domestic animals, whenever they are available. The fruits are eaten by people.

The bark is used as string, and the wood for various purposes where its springiness is of value. There are various medicinal uses.



Grewia villosa - 1, flowering branch; 2, flower; 3, petal, inner face; 4, stamens, front and back view; 5, ovary with style; 6, cross-section of ovary; 7, fruits.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
12/57	18.50	2.59	20.06	48.09	10.76	9.25	1.26	0.80
3/58	22.17	2.83	19.74	43.65	11.61	9.83	n.d.	n.d.
8/58	17.68	1.58	20.87	39.99	19.88	7.41	n.d.	n.d.
8/58	11.71	3.09	20.88	45.77	18.55	10.18	n.d.	n.d.
11/58	15.77	3.07	17.91	56.67	6.58	5.87	2.73	0.64
1/59	14.85	3.71	20.25	50.55	10.64	9.44	n.d.	n.d.
Upper Volta; green leaves	14.5	3.0	19.9	51.3	11.4	9.1	2.2	0.16
Kenya; shoots & leaves	10.85	1.82	34.67	42.33	10.33	10.28	2.52	0.17
Kenya; shoots & leaves	11.87	2.06	29.82	46.53	9.72	9.68	2.02	0.22

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

This species seems well-liked wherever it occurs and appears to have a high nutrient content. While provenance trials to seek material with good drought resistance would be desirable, it would seem a plant sufficiently promising to justify some preliminary planting trials.

8 AGRONOMY

There are 16 000 seeds per kilogram.

9 RELATED SPECIES

Grewia bicolor A.L.Juss. occurs in zones generally rather wetter than those being considered here but extends into the Sahel. The dried fallen leaves are eaten by animals in the Sudan, and in north-east Uganda it is readily browsed throughout the year. (Keile, Leloko, Tjelle (Peul); Djedje, Didie (Tamachek); Basham (Arabic-Sudan); Tebi, Debi, Depi (Somali); Ekali (Turkana); Mkone, Mfukufuku (Swahili)).

Analyses - G.bicolor

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Kenya; young branches and leaves	12.73	3.50	22.99	54.73	6.05	n.d.	1.60	0.30
Kenya; hard twigs & leaves	11.70	2.35	30.92	46.60	8.43	7.52	1.97	0.12
Kenya; leaves	14.23	2.15	31.75	44.17	7.70	7.66	1.60	0.17
Kenya; twigs	6.55	1.15	50.86	33.38	8.06	7.96	2.06	0.08

REFERENCES

Andrews 1948; Dale & Greenway 1961; Dougall & Bogdan 1958; Keay 1958; Wilson & Bredon 1963; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Guiera senegalensis J.Gmelin
- 1.2 Synonyms None
- 1.3 Family Combretaceae
- 1.4 Vernacular Names Assubara, Inaraf-Malan, Sobara, Touhila (Tamachek); Geloki, Gelohi, Leloki, Leloko, Jelouki, Lekolo, N'Dieloki (Peul); Sabara, Chalaba (Hausa); Gubeish, El Gibaish (Arabic, Sudan).

2 DESCRIPTION

A shrub up to 3 m high with grey bark. Small twigs with small soft hairs. Leaves in opposite or almost opposite pairs, 2.5-6 x 1.5-3 cm, rounded at the base and with a small apical point, softly hairy on both surfaces with scattered black glands beneath. Flowers clustered in almost spherical heads which are covered when young by four bracts. Petals very narrow, yellow; stamens 10, yellow. Fruits in clusters, elongated, 3-4 cm long, covered with abundant long silvery-pink hairs.

3 ECOLOGY

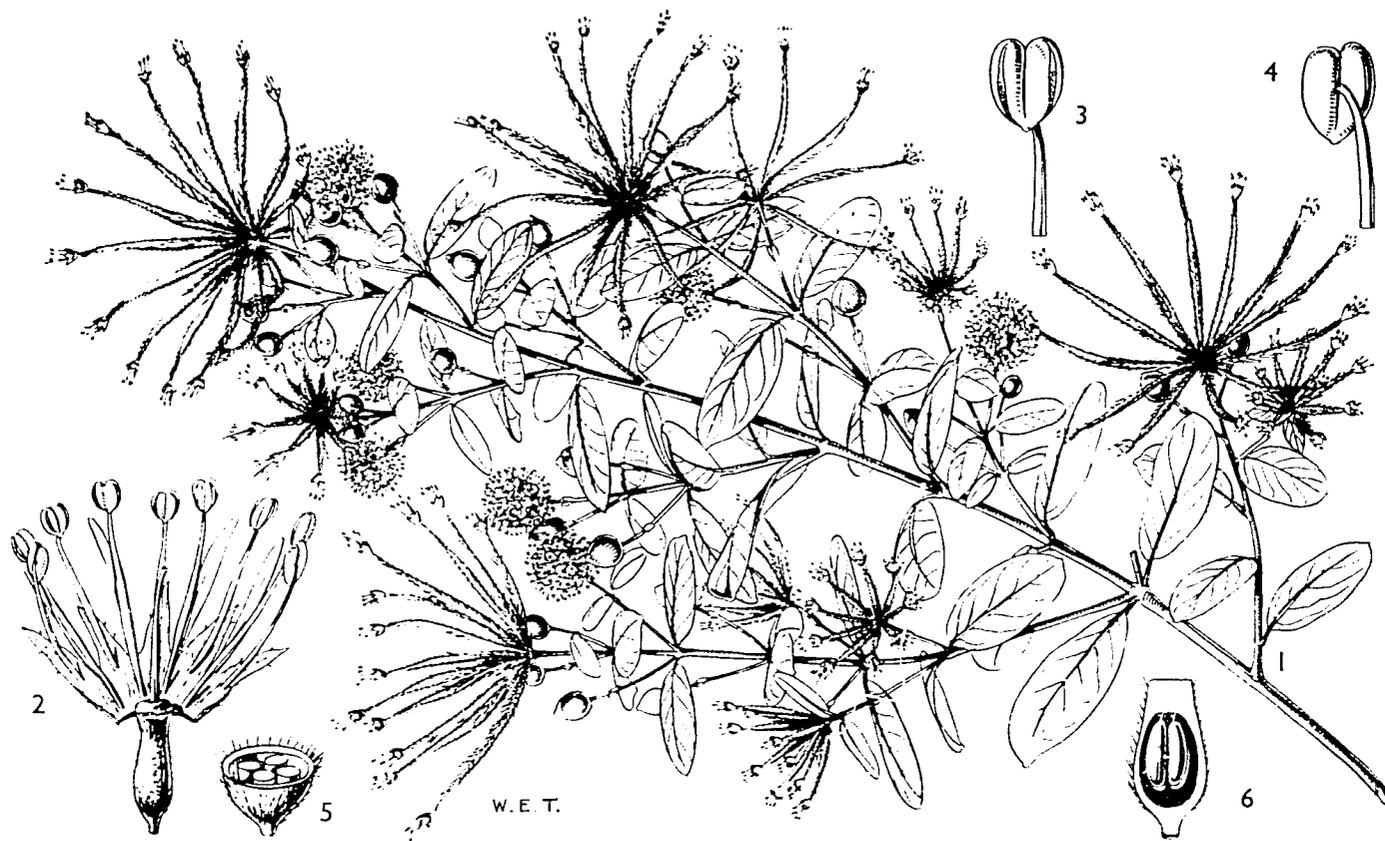
Occurs in the Sahel Zone of West Africa, on light soils, where it forms greyish thickets. It can tolerate flooding. It occurs in sites with 400 to 800 mm of rain each year. It perhaps grows best in sites with sandy soil such as old fixed dunes; in the parts of such sites where under ground water is available it produces leaves before the end of the dry season. It is said to be an indicator of overgrazing, and of abandoned cultivation.

4 DISTRIBUTION

Senegal; Gambia; Mali; Guinea-Bissau; Guinea; Ghana; Upper Volta; Niger; Nigeria; Cameroon; Chad; Sudan.

5 USES

A plant which is not grazed very much but which can be useful at the end of the dry season, when plants which have water available to them begin growth before the start of the rains, providing a valuable early feed. Use is thus mainly at this time, when camels and cattle will eat it. The fruits are eaten by sheep and goats. The species has many medicinal and some veterinary uses.



Guiera senegalensis - 1, shoot bearing flowers and fruits; 2, flower partly laid open; 3, stamen - front view; 4, stamen back view; 5, cross-section of ovary; 6, vertical section of ovary.

Analysis

	CP	EE	CF	NFE	Ash	SFA	Ca	P
Shoot tips & flowers and young fruit	11.65	3.79	25.05	54.41	5.10	n.d.	0.48	0.17

Also many analyses in Le Houérou.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

An aggressive plant which is sometimes considered as a weed. It would be desirable to discover the reasons for its comparative unpalatability and to look for more palatable strains.

8 AGRONOMY

The seeds are reported to be dispersed by animals. It can be reproduced by cuttings.

9 RELATED SPECIES

None

REFERENCES

Andrews 1948; Baumer 1975; Boudet et al 1969; Keay 1954; Le Houérou 1980; Peyre de Fabrègues 1965; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Iphiaea rotundifolia Oliver & Hiern
- 1.2 Synonyms -
- 1.3 Family Compositae
- 1.4 Vernacular Names Gegabod, Gogobot (Somali)

2 DESCRIPTION

A small shrub, usually to 1 m or less but up to 2 m when supported by other shrubs, strongly aromatic. Stems grey-brown, young growth buff. Leaves alternate, c 1.5 x 1 cm or less, rounded at the apex and narrowing gradually at the base into the 0.3-0.5 cm long leaf stalk, margins with prominent and irregular pointed teeth. Flowering heads in groups at the ends of the smaller branches, c 0.6 cm long, purplish or pinkish. Seeds with a tuft of hairs c 0.6 cm long at one end.

3 ECOLOGY

Occurs in Somalia over a wide altitudinal range (s.l.-1000 m) under very low rainfall of perhaps 50-150 mm per annum. It is reported to be very resistant to being covered by wind-blown sand, and to trampling and overgrazing.

4 DISTRIBUTION

Somalia

5 USES

The leaves and young shoot are grazed by all stock, but the strong scent may mean that the plant is eaten only when there is little else available.

There are various medicinal uses.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Insufficient information

8 AGRONOMY

No information

9 RELATED SPECIES

Other species occur in South Africa and in the arid south-west of Madagascar, as well as in eastern Sudan and in Arabia.

REFERENCES

Andrews 1956; Glover 1951a; White 1983.

1 BOTANICAL

- 1.1 Accepted name Leptadenia pyrotechnica (Forsskal)Decne
- 1.2 Synonyms L.spartium Wight; Cynanchum pyrotechnicum Forsskal
- 1.3 Family Asclepiadaceae
- 1.4 Vernacular Names Kaloumbo (Hausa); Marakh, Merakh (Arabic-Sudan);
Mirug, Moroh (Somali)

2 DESCRIPTION

A virtually leafless shrub to 3 m, with green rather succulent stems bearing branches in opposite pairs, and with transparent latex. Flowers in small groups on stalks 3-6 mm long, about 4 mm across, with five yellowish petals which are fused at the base. Fruits single or paired, 6-12 x 0.6-0.8 cm, smooth or with closely spaced narrow grooves. Seeds with a tuft of long silky hairs 2.5-3 cm long from one end.

3 ECOLOGY

A plant of sandy soils, often on fixed or active dunes. It extends from the Sahel (Unit 43 - Sahel Acacia wooded grassland and deciduous bushland) through the transition to the desert (Unit 54a - Semi-desert grassland and shrubland of the northern Sahel), and on dunes and in wadis within the desert itself (Units 70 and 71). It can grow in areas with up to 450 mm of rain, on well-drained sites such as stable dune crests. In some areas it can indicate excessive past cultivation.

4 DISTRIBUTION

Egypt; Libya; Algeria; Mauritania; Senegal; Mali; Niger; Nigeria; Chad; Sudan; Ethiopia; Djibouti; Somalia.

Also in Arabia and Pakistan.

5 USES

Browsed by camels, less so by goats and sheep, but is usually avoided by cattle. The bark yields a useful fibre which is, however, difficult to extract. There are some medicinal uses.

It can be useful for dune stabilization as buried stems produce adventitious roots.

6 SEED COLLECTIONS

None recorded

7 POTENTIAL FOR IMPROVEMENT

There is insufficient information for useful suggestions to be made.

8 AGRONOMY

No information

9 RELATED SPECIES

L.arborea (Forsskal)Schweinf. (Luweis (Arabic, Sudan)) is a twining plant which is reported to be excellent camel food, also eaten by other species.

REFERENCES

Andrews 1952, 1953; Baumer 1975; Dalziel 1937; Hepper 1963; Le Houérou 1980; Tothill 1948; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Maerua angolensis DC.
- 1.2 Synonyms M.tomentosa Pax; M.bukobensis Gilg & C.Benedict
- 1.3 Family Capparaceae
- 1.4 Vernacular Names Yelafitahi (Peul); Rønerau, Raurau, Shagar el Dud, Shagar el Zeraf, Surreh el Ziraf, Shejerat Um Duda (Arabic-Sudan); Hamaloshi; Alakala; Galangal (Somali); Mutunguru, Mlala-ambuzi (Swahili); Ol-Amaaki (Masai); Erreng (Turkana); Bead Maerua (English, SA); knoppiesboontjie (Afrikaans).

2 DESCRIPTION

Shrub or small tree to 10 m tall. Bark pale, smooth, with white lenticels. Leaves alternate; blade ovate or elliptic, 3-10 x 1.5-5 cm, usually rounded at the tip and rounded to cordate at the base, usually glabrous; stipules absent; petiole 1-3 cm long. Flowers in small racemes at the end of the main branches or short side branches. Sepals 4, greenish, c 15 mm long. Petals absent. Stamens many, whitish, 1.5-4 cm long, spreading. Fruits up to 22 cm long but usually much less, cylindrical but constricted between the seeds so as to appear like a string of beads.

3 ECOLOGY

In West Africa found in regions with rainfall between 500 and 700 mm. Very wide-ranging in eastern Africa and certainly occurring in sites with both higher and lower rainfall totals than these. Occurs on sea shores in East Africa so may have some salt-tolerance. Otherwise, no particular soil preference are recorded.

4 DISTRIBUTION

Mauritania; Senegal; Gambia; Mali; Ivory Coast; Upper Volta; Ghana; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Zaire; Rwanda; Burundi; Mozambique; Zambia; Malawi; Zimbabwe; Botswana; Angola; South Africa.

5 USES

The leaves are much sought-after as forage in West Africa. The bark, however, is toxic to camels, and the roots and fruit are also said to be toxic. South African reports state that the plant is not eaten by wild animals.

The wood is heavy and hard and polishes well.

The leaves are used in preparing soups and sauces, and also have various medicinal uses.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Clearly a wide-ranging and variable plant with a number of uses. Analyses are needed, as are provenance trials to explore drought resistance and foliage yield.

8 AGRONOMY

Sometimes planted for ornament in West Africa; no details known.

9 RELATED SPECIES

M.schinzi Pax, from Namibia, Botswana, and Angola, is reported to be browsed.

REFERENCES

Andrews 1948; Baumer 1975; Dale & Greenway 1961; Elffers, Graham & DeWolf 1964; Palmer & Pitman 1972; Verdcourt & Trump 1969; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Maerua crassifolia Forsskal
- 1.2 Synonyms Maerua rigida R.Br.; M.senegalensis R.Br. ex A.Rich.; M.trichocarpa Gilg & Benedict; M.uniflora Vahl; M.meyeri-johannis Gilg; M.uquenensis Gilg; M.hirtella Chiov.
- 1.3 Family Capparaceae
- 1.4 Vernacular Names Hassou, Sogui, Tirohi (Peul); Adiar, Agar, Tagart, Tahidjiart (Tamachek); Jiga Balakani (Hausa); Kowage, Sereh*, Sarha (Arabic, Sudan); Jieh medu, Jieh*, Jea koranjo, Dukhow, Chir (Somali); Jieh, Emején (Turkana)
- * see also Boscia angustifolia

2 DESCRIPTION

Small evergreen tree up to 10 m tall and 25 cm in diameter; bark smooth, grey. Young twigs hairy. Leaves alternate, very variable in size and shape but usually broadest above the middle, 1-5.2 x 0.4-3.3 cm, rounded and sometimes mucronate at the apex, usually finely hairy on both surfaces; petiole up to 7 mm long; stipules absent. Flowers 1-4 together in the leaf axils, pleasantly scented; pedicels 3-10 mm long; sepals 4, green, 7-9 mm long; petals absent; stamens numerous, c 15 mm long. Fruits cylindrical, constricted between the seeds, up to 5 cm long, finely hairy.

3 ECOLOGY

In West Africa it is found in regions with rainfall between 300 and 700 mm, but can extend into drier areas. It is found in similar sites in East Africa. It occurs on both sandy and clay-rich soils, usually in dry sites. In East Africa it occurs in deciduous bushland and semi-desert scrub.

In West Africa the flowers open in the dry season, and the fruits develop quickly, ripening in the late dry season or at the beginning of the rains. Pollination, seed and seedling biology unknown.

4 DISTRIBUTION

Egypt; Libya; Algeria; Morocco; Western Sahara; Mauritania; Senegal; Mali; Niger; Nigeria; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania.

Also in Arabia and east to Pakistan.

5 USES

The tree is browsed by all domestic and wild animals to the extent that many trees in the Sahel are stunted and mutilated. In Sudan camels strip the leaves from the twigs.

The wood is hard and very strong. It is not a good firewood because it smells unpleasant when burning.

The fruits are edible. The leaves are eaten, and are used medicinally for stomach complaints.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Clearly a very variable species but it is not clear how much of the variation is genetically controlled. Experimental cultivation is needed.

8 AGRONOMY

No information

9 RELATED SPECIES

Several species occur in the drier parts of northern Kenya and Somalia (eg M.sessiliflora Gilg, M.parvifolia Pax and M.kaessneri Gilg & C.Benedict), but nothing appears to be recorded of their grazing value. M.oblongifolia (Forsskal)A.Rich. is more widespread, occurring from Senegal to Somalia and Kenya; Kenyan material, eaten by elephants, contained 15.68% CP.

Some small species with a large woody rootstock, formerly placed in the genus Courbonia, are definitely poisonous and avoided by animals, even goats.

REFERENCES

Andrews 1948; Baumer 1975; Dougal, Drysdale & Glover 1964; Elffers, Graham & DeWolf 1964; Peyre de Fabrègues 1965; Tothill 1948; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Piliostigma reticulatum (DC.) Hochst.
- 1.2 Synonyms Bauhinia reticulata DC.; Bauhinia benzoin Kotschy; B. glabra A.Chev.; B. glauca A.Chev.
There has been some confusion between this species and P. thonningii (Schum.) Milne-Redh. (see below), so that references to P. thonningii in semi-arid areas should be treated with caution.
- 1.3 Family Leguminosae-Caesalpinioideae
- 1.4 Vernacular Names Barkei; Barkelehi; Maerkehi (Peul); Tafarabrat; Tafararat (Tamachek); Kalgo (Hausa); Abu Khamira; Alluba; Harub; Kharrub; Kharrum; Khuf el Jemal (Arabic-Sudan).

2 DESCRIPTION

A bush, occasionally a small or even a large tree with a round crown, up to 9 m high. Bark fibrous, dark grey to brown; slash dark red. Leaves alternate, 6-12 x 5-11 cm, shallowly bilobed at the apex, deeply cordate at the base, grey-green, hairless, tough, with about 9 principal nerves radiating from the base. Stipules absent. Flowers in racemes 4-5 cm long in the leaf axils, the male and female flowers carried on separate plants. Petals five, 2.5-3 cm long, whitish or pinkish. Pod indehiscent, up to 25 x 4 cm, hairless, tough, brown, containing many seeds scattered in a pale powdery mass.

3 ECOLOGY

A species of bushland and woodland, mainly in Units 43 (Sahel Acacia wooded grassland and deciduous bushland) and 29a (Drier parts of undifferentiated Sudanian woodland). It is capable of resisting seasonal flooding, on various soil types. It produces shoots from the roots and so often persists in cultivated areas and can become abundant after cultivation ceases. The hard seeds are dispersed by cattle and other animals which eat the pods. The seedling hypocotyl grows down into the soil and the cotyledons come to lie almost on the surface. Damage to the shoot by fire leads to proliferation from the swollen root crown.

4 DISTRIBUTION

Senegal; The Gambia; Mali; Ivory Coast; Upper Volta; Ghana; Niger; Nigeria; Cameroon; Chad; Central African Republic; Sudan; Zaire.

5 USES

The pods are eaten by most domestic animals; they fall towards the middle of the dry season. The young leaves, which appear before the end of the dry season in northern Sudan, are much liked by all species. The roots and fruits are used for dyeing, and there are many medicinal uses.

Analyses (Niger)

Source	CP	CF	EE	NFE	Ash	Ca	P
Young leafy shoots	13.77	16.35	n.d.	n.d.	4.26	0.38	0.22
Partly dried pods	6.92	16.40	n.d.	n.d.	4.32	0.37	0.14

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

The pods would appear to be the most useful product, but the dioecious habit makes cultivation a doubtful proposition - although one could imagine a plantation in which most of the male plants are lopped for fodder and allowed to coppice, while the females are preserved for the pods.

8 AGRONOMY

There are 11 000 to 14 500 seeds per kilogram, and germinability is said to be poor. The seeds are difficult to separate from the pods. Germination is quickened by soaking the seeds overnight in hot water.

9 RELATED SPECIES

P.thonningii (Schum.)Milne-Redh. is a very similar species which occurs in regions of higher rainfall. Hybridisation is suspected where the ranges overlap. It has finely hairy pods and undersides to the leaves, larger leaves with more main nerves, and a branching inflorescence. It can be used in similar ways.

REFERENCES

Andrews 1953; Baumer 1975; Boudet et al 1969; Brennan 1967; Jackson 1974; Keay 1958; Peyre de Fabregues 1965; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Platycelyphium voense (Engl.) Wild
1.2 Synonyms P. cynanthum Harms
1.3 Family Leguminosae-Papilionoideae
1.4 Vernacular Names Sabansabadoh, Savan sohdo, Sabansableh (Somali)

2 DESCRIPTION

Small tree to 7.5 m but sometimes with several stems from the base, and then shorter. Bark pale grey to yellowish-green, peeling in papery sheets when old. Leaves imparipinnate, with 3-7 alternate to almost opposite leaflets. Leaflets ovate-lanceolate to ovate-elliptic, 3.5-7.5 x 2.5-4 cm, rounded at the base, sometimes hairless but usually with some short hairs on the lower surface at least. Stipules hair-like, falling early. Inflorescence racemose, appearing before the leaves, 3-13 cm long with 8-16 or sometimes more flowers on slender flower-stalks 1-3.3 cm long. Petals 1.5-2 cm long, violet to deep blue, sweet-scented. Fruit oblong-elliptic, somewhat asymmetric, 5-7.5 x 2-3.7 cm, papery, with a single rather small seed.

3 ECOLOGY

A plant of the Somalia-Masai Acacia-Commiphora deciduous bushland and thicket (Unit 42), where there are often two very unreliable rainy seasons in each year. No particular soil preferences are recorded. The root system has been described. Simultaneous flowering over a wide area has been noted in Kenya.

4 DISTRIBUTION

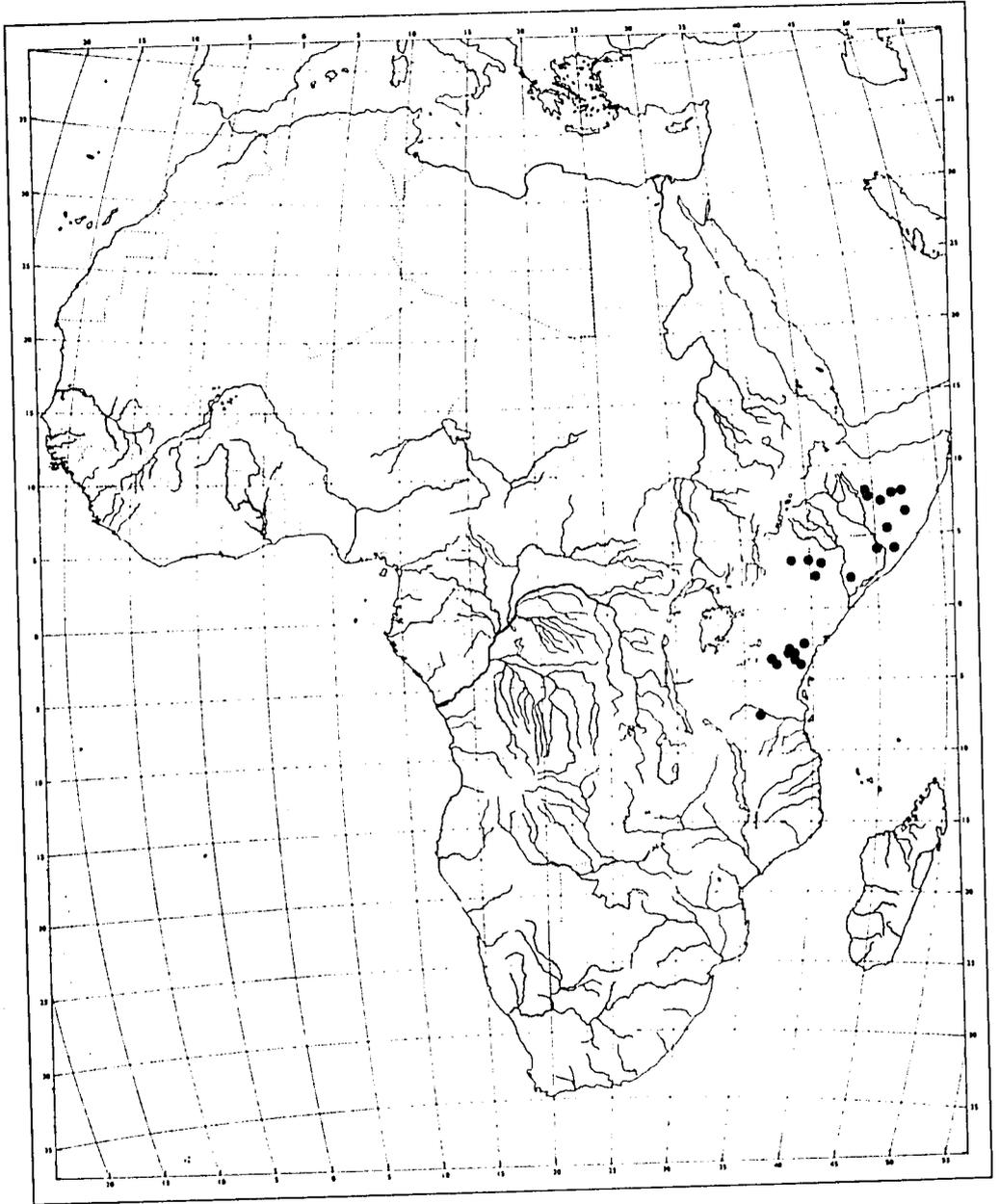
Ethiopia; Somalia; Kenya; Tanzania

5 USES

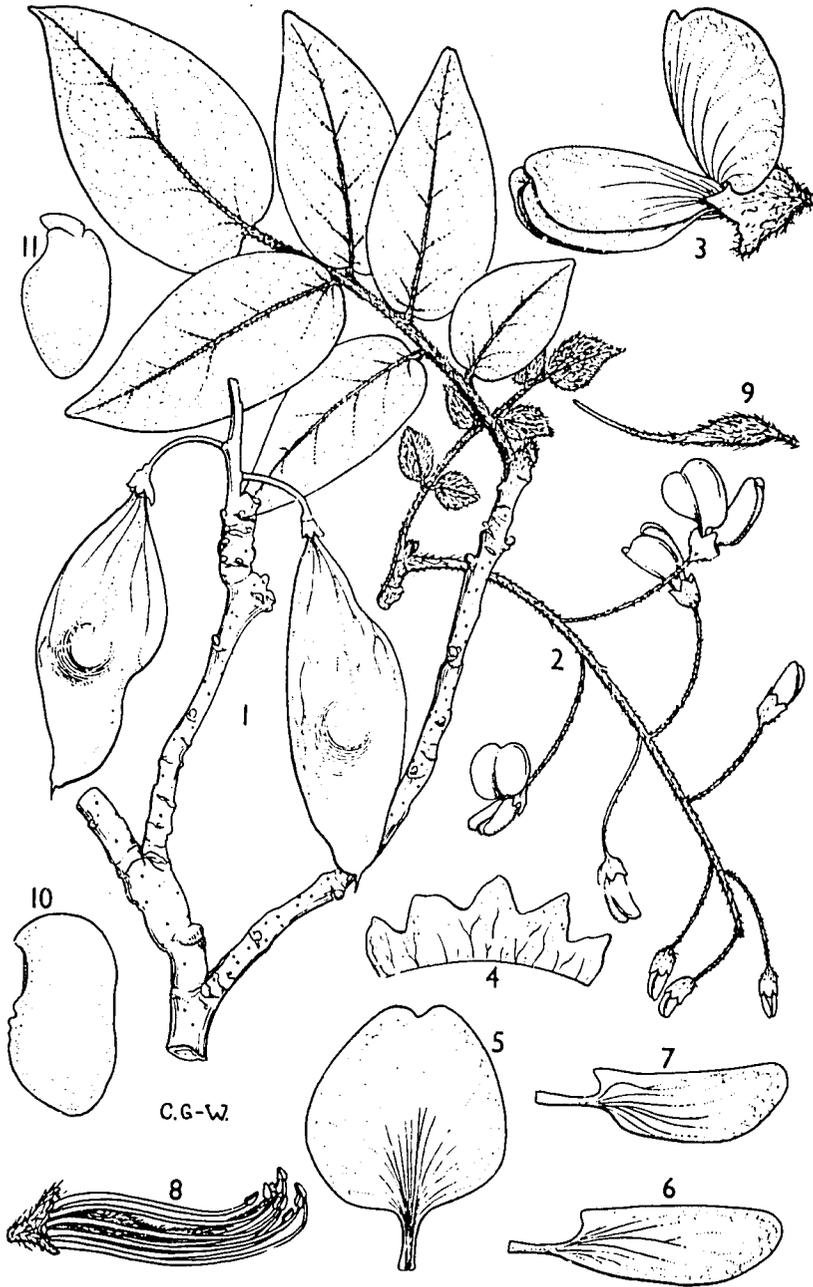
The leaves are reported to be much sought-after by stock, and the stems are cut in Somalia during the dry season to provide fodder for stock. However, in south-eastern Kenya the species is reported to be avoided by elephants so that it is often the most obvious large woody plant in areas devastated by them. This may, however, be a function of its reported resistance in Somalia, to cutting and fire. In Somalia the long straight stems are used in the construction of shelters. The wood is hard and heavy and is used for making gun stocks.

6 SEED COLLECTIONS

None known



Scale 1:30 000 000



Platycelyphium voënce - 1, branch in fruit; 2, inflorescence; 3, flower; 4, calyx opened out; 5, standard; 6, wing petal; 7, keel-petal; 8, stamens with ovary and style; 9, ovary and style; 10, seed, 11, embryo.

7 POTENTIAL FOR IMPROVEMENT

There is some variation, summarised in the Flora of Tropical East Africa, but it is not known if this correlated with useful features such as palatability and the ability to produce long straight shoots.

8 AGRONOMY

No information

9 RELATED SPECIES

This is the only species in the genus, which occupies a rather isolated position in the family.

REFERENCES

Dale & Greenway 1961; J.B. Gillett pers. comm.; Gillett, Polhill & Verdcourt 1971; Glover 1951b.

1 BOTANICAL

1.1 Accepted name Portulacaria afra Jacq.

1.2 Synonyms -

1.3 Family Portulacaceae

1.4 Vernacular Names Spekboom (Afrikaans).

2 DESCRIPTION

A shrub to 4 m. Branches opposite, smooth, succulent, greyish. Leaves succulent, in opposite pairs, broadest towards the apex, 0.8-1.2 cm long, hairless. Flowers in scattered clusters on young shoots at the ends of the branches, on stalks 4-6 mm long. Petals pink, about 2 mm long. Fruit 3-angled, with wings along the angles, one-seeded.

3 ECOLOGY

A species of the drier regions of southern Africa, occupying steep mountain slopes with an annual rainfall of 250-300 mm in the southern and eastern Cape. The species gives its name to a Veld type.

4 DISTRIBUTION

Swaziland; South Africa.

Introduced to Kenya, Mozambique and Zimbabwe.

5 USES

A useful fodder, readily eaten by most species, valuable both as food and also for its high water content. It is, however, weakly rooted, and this produced problems in East Africa, where it has been introduced as a feed for time of drought, as cattle tended to uproot the plants. Further problems arose from its high palatability - wild animals tended to feed on it at all times, reducing the amount available for domestic stock in critical periods. It regenerates well after browsing.

Analysis

	CP	CF	NFE	Ash	SFA	Ca	P
Whole plant, cultivated Kitale, Kenya	10.67	11.86	54.53	19.13	n.d.	1.40	0.12

Note that the analysis refers to plants growing at an experimental station with a considerably higher rainfall than the optimum for the species.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

The plant would seem to have considerable potential already and no useful suggestions for improvement can be made at present.

8 AGRONOMY

The plant is very easily established from cuttings. Seed is also produced in quantity, although in Kenya few flowers or seeds were produced, perhaps because of daylength effects.

9 RELATED SPECIES

None of any significance.

REFERENCES

Acocks 1975; Oakes 1973.

1 BOTANICAL

- 1.1 Accepted name Pterocarpus lucens Lepr. ex Guillemin & Perrottet
- 1.2 Synonyms P.abyssinicus Hochst.
- 1.3 Family Leguminosae-Papilionoideae
- 1.4 Vernacular Names Tami; Tani; Tiami (Peul); Alebonis; Alibunes (Tamachek); Taraya (Arabic-Sudan).

2 DESCRIPTION

A bush to 4 m tall, but sometimes becoming a tree and reaching 18 m. Bark dark grey-brown, scaly; slash yellowish to purplish red producing a sticky red exudate. Leaves deciduous, alternate, imparipinnate with 1 to 11 leaflets, usually 5 or 7. Leaflets opposite or nearly so, elliptic to lanceolate, 4-10 x 2.4-4.8 cm, green and shiny above, much paler below with a coating of fine appressed hairs. Stipules 2-3 mm long, falling off early. Inflorescence a spike-like raceme borne in the axils of the leaves (or of fallen leaves), few-to many-flowered; flowers on long peduncles (8-15 mm), yellow. Pods elliptic to almost circular in outline, flat and papery, 4.5-6.5 x 2-3 cm, pale brown, with 1 or 2 seeds, remaining on the tree for a long time.

3 ECOLOGY

A plant of well-drained sites in the semi-arid regions of West Africa, occurring on hills with stony, gravelly or lateritic soils, and sometimes forming pure stands but also often associated with Combretum micranthum and Dalbergia melanoxylon. (Drier parts of Unit 29a - undifferentiated Sudanian woodland, and Unit 43 - Sahel Acacia wooded grassland and deciduous bushland).

4 DISTRIBUTION

Senegal; Mali; Guinea; Ivory Coast; Ghana; Nigeria; Cameroon; Central African Republic; Zaire; Sudan; Ethiopia; Uganda.

5 USES

The leaves are very palatable and are browsed by camels and goats, as are the fruits. Branches may be lopped for fodder. The wood is used for small carpentry and is a good firewood. There are some medicinal uses.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

The species is insufficiently known for useful suggestions to be made. There is some variation in leaf size, number of flowers in each inflorescence, and vigour, but it is not clear how these are correlated with useful characteristics for browsing.

8 AGRONOMY

There are about 5000 fruits per kilogram. Other species in the genus are said to regenerate well. It is nodulated.

9 RELATED SPECIES

P. antunesii (Taubert) Harms occurs in southern Africa and has sometimes been treated as a subspecies of P. lucens. P. angolensis DC. is a valuable timber tree of the woodlands of southern Africa. P. erinaceus Poiret occurs in the Guinea and Sudan zones of West Africa and just reaches the semi-arid Sahel. Like P. angolensis it yields a valuable timber, termite-resistant, durable and with an attractive reddish-brown heartwood. The dried exudate from the bark is a resin ('Kino') which is used as a red dye for leather. The leaves are cut and sold as forage; their protein content is high.

REFERENCES

Andrews 1953; Gillett, Polhill & Verdcourt 1971; Keay 1958; Penning de Vries & Djiteye 1983; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Rhigozum obovatum Burchell
- 1.2 Synonyms
- 1.3 Family Bignoniaceae
- 1.4 Vernacular Names Wildegranaat, Berggranaat, Geelberggranaat (Afrikaans).

2 DESCRIPTION

A shrub or small tree to 4 m high. Trunk and branches smooth or furrowed, grey; smaller branches spine-tipped. Leaves trifoliate, in small groups, up to 0.8 x 1.3 cm, finely hairy but becoming hairless when older, usually with a short leaf-stalk. Flowers in small groups of 2-3 on the branches, where leaves arise. Petals 5, joined into a tube, bright yellow. Fruit 2.5-3.8 x 0.8-1.8 cm, splitting open when ripe. Seeds with thin papery wings.

3 ECOLOGY

A species of the Karoo-Namib region, and of the southern parts of the Zambezi region. It occurs in dry bushland, often on rocky hills. The flowers are produced after rain.

4 DISTRIBUTION

South Africa; Namibia.

5 USES

A very popular browse plant with both wild and domestic stock, particularly liked by sheep and goats, so much so that it needs protection during good seasons if it is to provide a reserve in time of drought. Both leaves and the young shoots are taken readily.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficient information.

8 AGRONOMY

No information

9 RELATED SPECIES

R. trichotomum Burchell occurs in Namibia and South Africa and is also a very valuable source of browse, being particularly liked by sheep and goats.

R. zambesiacum Baker ('Zambezi Gold') occurs in Zimbabwe, Mozambique and South Africa. It is palatable to animals and also extremely decorative when in flower. The flowers are bright yellow.

R. somalense Hall.f. (Benin (Somali)) occurs in northern Somalia and Ethiopia, sometimes forming extensive groups. It is heavily browsed. The yellow flowers appear soon after rain.

REFERENCES

Leistner 1967; Marloth 1913; Palmer & Pitman 1972; Plowes & Drummond 1976.

1 BOTANICAL

- 1.1 Accepted name Salvadora persica L.
- 1.2 Synonyms S.cyclophylla Chiov.
- 1.3 Family Salvadoraceae
- 1.4 Vernacular Names Gudi (Peul); Talakia Baboul (Hausa); Shau; Miswak; Arak; El Arak; El Rak (Arabic-Sudan); Ade (Somali); Ethokou, Esekou (Turkana); Eremit (Masai); Mswaki (Swahili).

2 DESCRIPTION

A shrub forming large thickets, or sometimes a small tree to 6 m high, normally evergreen. Bark fairly smooth, grey. Terminal flowering branches often hanging downwards. Leaves in opposite pairs, leathery, lanceolate to almost circular in outline, 2-10 x 1.5-7 cm; leaf stalk about 1 cm long. Stipules absent. Flowers small, greenish-white, in large masses up to 10 cm long at the ends of the branches and in the leaf axils. Fruit fleshy, with a single seed, purplish or reddish when ripe, about 5 mm in diameter.

An extremely variable species with three name varieties in East Africa.

3 ECOLOGY

The species occurs on river banks and in seasonally wet sites, often on alkaline or saline soils, usually clay-rich. One variety (var. cyclophylla (Chiov.) Cuf.) occurs only on coral rock near the sea. It extends from the arid regions of the central Sahara to regions with 1000 mm or more of rain each year.

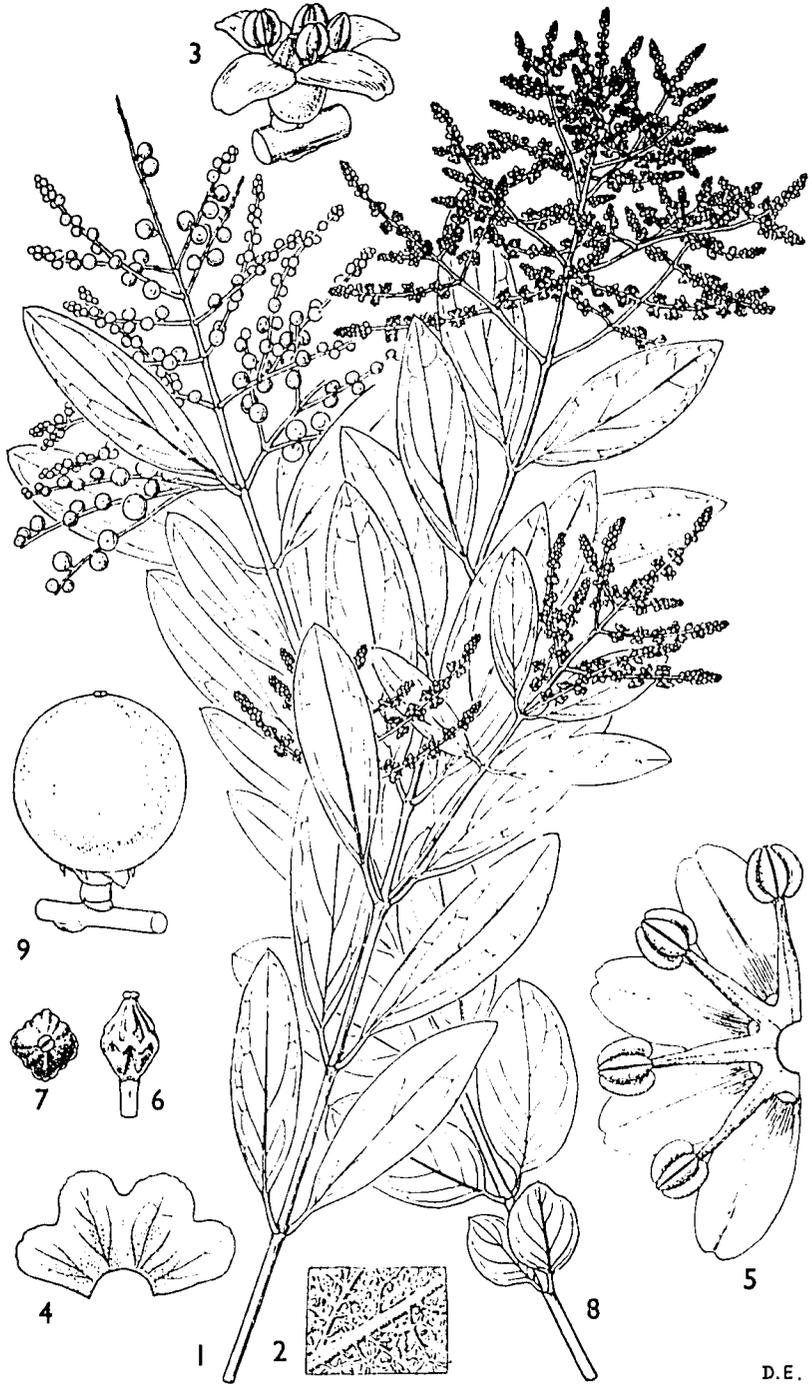
4 DISTRIBUTION

Egypt; Libya; Algeria; Mauritania; Senegal; Mali; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Mozambique; Zambia; Malawi; Zimbabwe; Angola; Namibia.

Also in Arabia and India.

5 USES

Browsed by all species, particularly during the dry season when it tends to grow when few other species are green. The young shoots and leaves produced at this time are particularly well-liked. During the dry season in the Sudan, some camels eat little else. It has been reported, though, that camels bred and reared on it are generally inferior in type - though it is not clear that this is a real causal relationship. The high salt content taints the milk of animals feeding on the plant.



Salvadora persica - 1, flowering branch; 2, detail from lower surface of leaf; 3, flower with pedicel and small segment of rachis; 4, calyx, opened out; 5, corolla and stamens, opened out; 6, ovary, stigma and pedicel, side view; 7, same viewed from above; 8, fruiting branch; 9, fruit.

In many parts of Africa the twigs of this species are popular with local people as toothbrush sticks. It also has numerous medicinal uses. The wood is sometimes used for firewood and charcoal. The fruits are eaten both raw and cooked. Salt is sometimes extracted from the ashes of the plant.

Analyses - *Salvadora persica*

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Kenya; twigs and leaves	7.84	0.43	27.50	41.53	22.70	20.84	n.d.	n.d.
Kenya; twigs and leaves	12.08	2.45	27.21	37.87	20.39	14.40	5.71	0.18

The second sample contained 6.22% of potassium - a very high figure. Note generally very high ash content.

Samples from West Africa quoted by Le Houérou also have as high or higher ash contents and also show high magnesium contents, not analysed in the Kenyan material. One Kenyan sample analysed for sodium showed levels similar to those in other species from the same area.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

The species shows such great variation and such a wide distribution and range of habitats that it is likely that there is variation which could be usefully exploited. There is clearly a need for provenance trials.

8 AGRONOMY

No information

9 RELATED SPECIES

Azima tetraantha Lam., in the same family, is eaten by elephants and nibbled by other animals in spite of its formidable spines. It occurs mainly on alkaline or saline soils at lake margins. Dobera glabra (Forsskal) A.L.Juss. ex Poiret (Kharas, Garas (Somali)) is another member of the family widespread in the drier parts of Africa. The fruit is edible.

REFERENCES

Andrews 1953; Baumer 1975; Dale & Greenway 1961; Dougal, Drysdale & Glover 1964; Keay 1958; Le Houérou 1980; Peyre de Fabrègues 1965; Tothill 1948; Verdcourt 1968; Von Maydell 1983.

1 BOTANICAL

1.1 Accepted name Sclerocarya birrea (A.Rich.) Hochst.

1.2 Synonyms Spondias birrea A.Rich.; Poupartia birrea (A.Rich.) Aubrev

1.3 Family Anacardiaceae

1.4 Vernacular Names Beri, Edi, Eri, Hedehi, Hedi, Kede, Here (Peul); Tauila'h, Touhila (Tamashek); Dan'a, Dania (Hausa); Homeid, Hameid, El Hamaidai (Arabic, Sudan); Olmangwai (Masai).

2 DESCRIPTION

A deciduous tree up to 15 m high with a rounded crown. Bark grey-brown, rough, falling away as thick scales. Slash red. Leaves alternate, often crowded at the tips of the branchlets, pinnate with a terminal leaflet, rachis 10-15 cm long with 5-10 pairs of opposite or almost opposite leaflets, each about 3.5 x 2 cm, with a small terminal point. Male and female flowers on separate trees, small, yellowish, in spikes 5-8 cm long at the tips of the branchlets. The flowers appear when the tree is leafless, and the fruit, which is almost spherical, 3-4 cm in diameter, orange when ripe, and with a single seed, ripens in the late dry season, before the leaves appear.

3 ECOLOGY

It is found in the drier woodlands and bushlands of the northern half of tropical Africa, being replaced in southern Africa by the closely related and ecologically similar S. caffra (see below). It occurs in drier types of Sudanian Woodland, and in the drier woodlands and bushlands of the Sahelian and Somalia-Masai regions. (Units 29a, 42, 43). It is often taller than surrounding species, behaving as an emergent.

4 DISTRIBUTION

Senegal; Mali; Guinea-Bissau; Gambia; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Uganda; Kenya; Tanzania.

5 USES

The leaves and young branches are eaten by stock, particularly camels, although there are suggestions that the leaves may be somewhat toxic. Trees may be lopped for fodder in times of scarcity. The fruit is eaten by all animals, and by man; the kernel of the seed yields an edible oil. The wood is of fair quality although tending to split badly on seasoning. There are many medicinal uses.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Several possible lines of selection can be envisaged; large seeds with a high oil content; small-seeded fruits with a high proportion of edible flesh; and foliage which is less toxic and more palatable. Since the tree is leafless at the time of greatest scarcity, and the fruits appear at this time, it would seem best to look for forms with better quality and quantity of fruit.

8 AGRONOMY

The seeds are large (400 per kg); they are best soaked overnight before sowing. Cuttings can also be used.

9 RELATED SPECIES

The closely related species, Sclerocarya caffra Sonder, occur in the southern half of Africa; both species occur in Kenya. Some consider them to be only subspecifically distinct. S. caffra produces a fruit very similar to that of S. birrea, known in Botswana as the Mongongo Nut; here it is an important item in the economy of local people. The fruit is also eaten by animals.

REFERENCES

Andrews 1952, 1953; Baumer 1975; Bouclet et al 1961; Dalziel 1937; Keay 1958; Peyre de Fabrègues 1965; Tothill 1948; Von Maydell 1983.

1 BOTANICAL

1.1 Accepted name Tamarindus indica L.

1.2 Synonyms None

1.3 Family Leguminosae-Caesalpinoideae

1.4 Vernacular Names Dabe; Ngatabbi; N'jabi; N'jame; Yammere (Peul); Basoro; Bassasu; Bochocho; Tchimia (Tamachek); Samia (Hausa); Aradeib; Ardeib; Tamr Hindi (Arabic, Sudan); Hamar (Somali); Epeduru (Turkana); Ol-Masamburai (Maasai); Mkwaju; M sisi (Swahili).

2 DESCRIPTION

Tree to 25 m high with a rounded crown. Bark rough, grey. Leaves pinnate; without a terminal leaflet; leaf-stalk together with leaf axis 5-16 cm long; leaflets in 10-18 pairs, 1.2-3.2 x 0.3-1.1 cm, almost parallel-sided, rounded at both ends and asymmetrical at the base. Flowers in racemes 1-15 cm long; flower stalks 3-14 mm long. Buds red; petals yellow; 10-13 mm long. Pods sausage-like, curved or straight, 6.5-14 x 2-3 cm, rough and brownish outside. Seeds 11-17 x 10-12 mm, dark brown, embedded in a brown fibrous pulp.

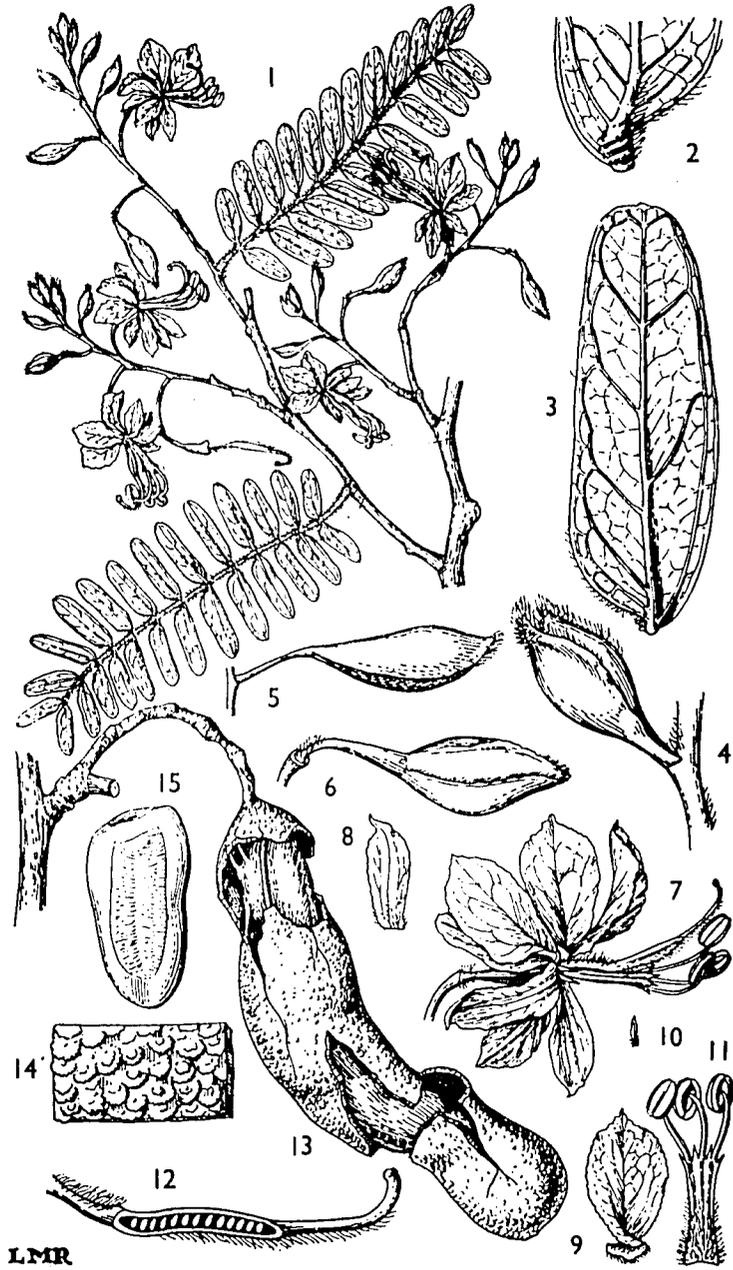
3 ECOLOGY

A tree of wide distribution, extending by deliberate and accidental introduction. It occurs in woodland and bushland, and is usually absent from seasonally flooded or waterlogged sites although it may occur on raised mounds such as termite mounds in such places. Occurs on many soil types, perhaps preferring sandy or alluvial soils with water at depth. It is widespread in woodland and bushland units in tropical Africa. The large hard seeds are dispersed by animals and by man, the fruit pulp being used to make drinks and in cooking.

4 DISTRIBUTION

Senegal; Niger; Guinea-Bissau; Guinea; Sierra Leone; Liberia; Ivory Coast; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Uganda; Kenya; Tanzania;

Probably present, naturally or as an introduction, in all African countries. Also in tropical Asia.



Lamarindus indica - 1, part of flowering branch; 2, lower surface of leaflet - base; 3, upper surface of leaflet; 4, bud with bract and bracteoles; 5, bud after fall of bract; 6, bud after fall of bract and bracteoles; 7, flower; 8, sepal; 9, upper petal; 10, lower petal; 11, stamens; 12, section of ovary; 13, mature pod; 14, pod surface; 15, seed.

5 USES

The foliage is browsed by camels, goats and sheep but may be poisonous to horses. The pods are much liked by sheep and cattle, but are also very popular with people and few are left for animals. The fruit pulp is used for preserves, and in cooking and to make a pleasant drink.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Improvement work to date has concentrated on fruit quality; most has been done in India, and in tropical America. There could be scope for mixed-use plantations of this species, primarily as a source of fruit and with browsing as a secondary use, the animals taking low shoots from the trunks of the trees, fallen leaves and fallen and sub-standard fruits.

8 AGRONOMY

There are about 2000-2500 seeds per kilogram. They generally have a high viability which is well retained if the seeds are stored dry. Germination occurs quite quickly after sowing but can be speeded by pretreatment with hot water. Vegetative multiplication of this species is possible by cuttings and by grafting. This propagation of high-yielding strains and also tends to produce smaller trees which are more easily harvested. Young trees are very sensitive to root damage during transplanting. Shading and extra water after sowing and after transplanting increase establishment. Trees begin fruiting when 8 to 12 years old.

9 RELATED SPECIES

None

REFERENCES

Andrews 1953; Baumer 1975; Brennan 1967; Dale & Greenway 1961; Peyre de Fabrègues 1965; Tothill 1948; Von Maydell 1983.

1 BOTANICAL

- 1.1 Accepted name Ximenia americana L.
- 1.2 Synonyms none in general use
- 1.3 Family Olacaceae
- 1.4 Vernacular Names Tabburli, Tene, Tiaboule, Tiaboute (Peul); Abu Khameir, Ankwi, Kaltu, Kelto, Homeid Abiad (Arabic-Sudan); Mtundakula (Swahili)

2 DESCRIPTION

A shrub or small tree up to 8 m high but usually less, apparently sometimes semi-parasitic, having haustoria on the roots. The branchlets may form spines; this is a very variable tendency. Leaves alternate, blade 3-7 cm long and up to 3 cm broad, without marginal teeth, variable in texture from thick and semi-succulent to thin and shining. Flowers borne in the axis of the leaves in 4-6-flowered groups, sweet-scented; petals 4, 1-1.5 cm long, whitish, densely hairy on the inner surface. Fruits spherical to ellipsoid, 1.5-2.5 cm long, yellow, tough-skinned, with a single hard seed.

3 ECOLOGY

A widespread species, occurring in many types of drier woodland and bushland in Africa. Often along watercourses, and on clayey or gravelly soils.

4 DISTRIBUTION

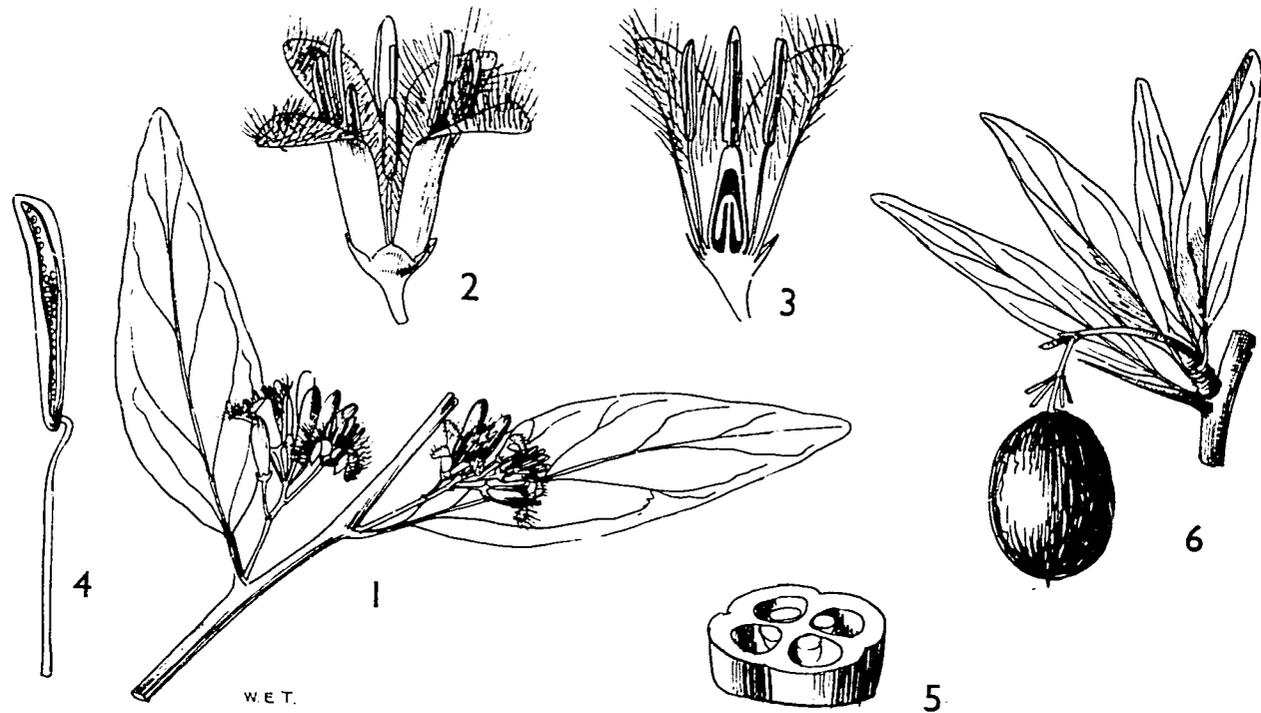
Senegal; Gambia; Mali; Guinea-Bissau; Guinea; Sierra Leone; Liberia; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Uganda; Kenya; Tanzania; Zaire; Rwanda; Burundi; Mozambique; Zambia; Zimbabwe; Angola; Botswana; Namibia; South Africa.

Also in tropical America.

5 USES

The foliage is occasionally browsed. The fruits are eaten by men and animals even though they may have some cyanide content. The kernels contain an edible oil, and can also be eaten; although there are conflicting reports of their edibility, some regarding them as excellent, some as purgative, and some as poisonous. It seems likely that there is considerable local variation.

There are a number of local medicinal uses. The tree is well suited to cultivation as a hedging plant.



Aimenia americana - 1, flowering branch; 2, flower; 3, longitudinal section of flower; 4, stamen; 5, cross-section of ovary; 6, fruit.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

There is clearly considerable scope for investigation of the nature and variation of the poisonous principle in the kernels, and for development of more palatable varieties. The variation in leaf texture, and in the spininess of the plant, are also worthy of investigation.

8 AGRONOMY

There are about 1400 seeds per kilogram, and germination is satisfactory. In good sites fruit is produced three years after sowing. It is not known if a host plant is necessary or whether the parasitism of the species is facultative.

9 RELATED SPECIES

Ximenia caffra Sonder is a species of southern Africa where it grows in dry woodlands, including those dominated by Colophospermum mopane. The fruit is similar to that of X.americana.

REFERENCES

Andrews 1952, 1953; Dale & Greenway 1961; Dalziel 1937; Keay 1958; Von Maydell 1983; Wilson & Bredon 1963.

1 BOTANICAL

- 1.1 Accepted name Zizyphus mauritianus Lam.
- 1.2 Synonyms Z. jujuba (L.) Lam.; Z. orthocantha DC.
- 1.3 Family Rhamnaceae
- 1.4 Vernacular Names Labiforu, Gulijabi, Gulunjababi (Peul); Tabakat (Tamachek); Magarya, Magaria (Hausa); Habbak el Fil, Nebak, Nebbek, Siddir, Sidr (Arabic, Sudan); Gub, Cup, Gob (Somali); Ekolali (Turkana); Mkumazi (Swahili).

2 DESCRIPTION

A shrub or tree, attaining 12 m high but usually less. The bark is grey. Branches tending to curve downwards; branchlets pale and covered with tiny hairs, with pairs of sharp spines of which one is straight and the other is recurved. Leaves simple, alternate, very variable in size, 2-7 x 1-3 cm, lightly toothed at the edges, pale beneath and covered with small hairs, with three principal nerves diverging from the base. The cream-coloured flowers about 4 mm across, arise in dense clusters in the leaf axils. The fruits are 1-2 cm in diameter, reddish brown when ripe, with a single seed.

3 ECOLOGY

A species which is sometimes said to be introduced to Africa from the arid parts of Asia but which behaves as a native plant although sometimes also cultivated. It occurs in regions with annual rainfall between 150 and 500 mm, on a wide variety of soil types, mostly well-drained, although it can withstand temporary flooding.

4 DISTRIBUTION

Mauritania; Senegal; Gambia; Mali; Guinea; Sierra Leone; Upper Volta; Ghana; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Mozambique; Zaire; Zambia; Malawi; Zimbabwe; Angola.

Also in Asia, and introduced to southern Europe and to America, where it is cultivated.

5 USES

The green leaves are much sought-after by camels, and are also eaten by sheep and goats but are generally rejected by cattle, perhaps because of the spines. Goats are particularly fond of the young leaves. The fruits are eaten by all animals, and are also collected and eaten by men, either fresh or after washing in water.

The tree is also suitable for hedges and windbreaks. There are a number of medicinal uses.

6 SEED COLLECTIONS

None known, but as the plant is widely cultivated in Africa and elsewhere, there has probably been some selection, but in the direction of fruit size and palatability rather than browse value. It is not clear how much of the genetic potential has been sampled. In India and Pakistan a number of named cultivars are recognised.

7 POTENTIAL FOR IMPROVEMENT

The species clearly has potential, although this lies mainly as human food. Spineless forms would clearly be more easily eaten by animals but could well not survive without careful management. Such forms are reported from Assam.

8 AGRONOMY

There are 4000-7000 seeds per kilogram. Germination is good. The tree can also be multiplied by cuttings, and grafting is also possible. Application of a mixed fertiliser high in phosphorus is recommended. Fruits may be expected in the fourth year and by the tenth year the tree is fruiting at its maximum.

9 RELATED SPECIES

There are several other species in the arid and semi-arid areas of Africa; they are closely related and hybridisation has been suspected. Z. mucronata Willd. is palatable to goats and cattle; both will also eat the fallen leaves, as well as the fallen fruits. It occurs widely in the dry regions of Africa. Z. spina-christi (L.) Desf. is also widespread; it is browsed by stock, and is an important source of pole timber.

REFERENCES

Andrews 1946; Baumer 1975; Boudet et al 1969; Dale & Greenway 1961; Dougal & Bogdan 1958; National Academy of Sciences 1980; Peyre de Fabrègues 1965; Von Maydell 1983.

Grasses

<i>Andropogon gayanus</i>	<i>Enneapogon desvauxii</i>
<i>Anthephora pubescens</i>	<i>Enteropogon macrostachyus</i>
<i>Aristida adscensionis</i>	<i>Eragrostis curvula</i>
<i>Aristida mutabilis</i>	<i>Eragrostis lehmanniana</i>
<i>Aristida sieberiana</i>	<i>Eragrostis superba</i>
<i>Cenchrus biflorus</i>	<i>Eragrostis tremula</i>
<i>Cenchrus ciliaris</i>	<i>Lasiurus scindicus</i>
<i>Cenchrus setigerus</i>	<i>Panicum laetum</i>
<i>Centropodia glauca</i>	<i>Panicum turgidum</i>
<i>Chloris gayana</i>	<i>Paspalidium desertorum</i>
<i>Chloris roxburghiana</i>	<i>Pennisetum violaceum</i>
<i>Chrysopogon plumulosus</i>	<i>Schmidtia pappophoroides</i>
<i>Coelachyrum yemenicum</i>	<i>Schoenefeldia gracilis</i>
<i>Cynodon dactylon</i>	<i>Sporobolus helvolus</i>
<i>Dactyloctenium aegyptium</i>	<i>Sporobolus ioclados</i>
<i>Dactyloctenium scindicum</i>	<i>Stipagrostis uniplumis</i>
<i>Dichanthium annulatum</i>	<i>Tetrapogon villosus</i>
<i>Digitaria macroblephara</i>	<i>Trichoneura mollis</i>
<i>Diplachne fusca</i>	<i>Urochloa mossambicensis</i>
<i>Echinochloa colona</i>	

1 BOTANICAL

1.1 Accepted name Andropogon gayanus Kunth

1.2 Synonyms A. infrasulcatus Reznik; A. reconditus Stapf;
A. tridentatus Hochst.; A. tomentellus Steudel

1.3 Family Gramineae

1.4 Vernacular Names dad'e, ran'ere, tak'e (Poul): Gamba (Hausa); Abu Rikhis, El Gebleisha (Arabic, Sudan); Gamba Grass (English).

2 DESCRIPTION

A perennial, forming large tussocks. Culms 1.5-3 m high. Leaf-blades up to 60 x 0.4-2 cm, often narrowed to leave only the midrib at the base; this tendency may be carried to the stage where the false leaf stalk thus formed is longer than the leaf-blade; ligule short, membranous, yellowish. Inflorescence very large, leafy and complex, made up of a large number of pairs of spike-like racemes 4-9 cm long. Spikelets in pairs within the racemes, the stalkless (sessile) one 5-8 mm long, without awns; the stalked one 5-8 mm long, the lower glume with an awn 1-10 mm long.

The species can be divided into a number of varieties on the basis of the distribution of hairs within the inflorescence. These varieties, while often having similar distributions, show some ecological segregation and it is therefore important to distinguish between them. The most useful variety for drier regions is var. bisquamulatus (Hochst.) Hackel which has the internodes, the spikelet stalks and the pedicelled spikelets all hairy. There are three other varieties in West Africa; var. tridentatus Hackel also extends well into drier regions.

3 ECOLOGY

The var. bisquamulatus is common in many types of site in the West African savannas, often in disturbed ground, roadsides, and abandoned cultivation but also in undisturbed savannas where it is often found at the margins of forest and woodland. Of the other varieties, var. gayanus occurs mainly in sites which are seasonally flooded. Var. polycladus (Hackel) W.D. Clayton (var. squamulatus (Hochst.) Stapf) is more widespread but also has a tendency to occur in seasonally wet sites.

4 DISTRIBUTION

(of var. bisquamulatus)

Mauritania; Senegal; Gambia; Mali; Guinea-Bissau; Guinea; Ivory Coast; Upper Volta; Ghana; Benin; Nigeria; Cameroon; Chad; Central African Republic; Sudan.

The species as a whole occurs throughout tropical Africa, and has been introduced to South America.

5 USES

It is a useful grazing grass, being very productive as well as palatable, although it becomes very stemmy at the end of the wet season at flowering time. During the dry season the shoot bases remain palatable and are pulled out and eaten by horses and other animals. It is tolerant of poor soils, and combines well with legumes. The stems and leaves are used for thatching and for plaiting into mats. The species is said to be resistant to drought, flood, burning and continuous grazing.

Analyses

Source	CP	CF	EE	NFE	Asl.	SFA	Ca	P
Niger; green lvs.	6.78	34.80	1.38	45.45	11.59	n.d.	0.23	0.08
Niger; older lvs & fls. on stems	4.33	35.10	1.25	52.40	6.92	n.d.	0.36	0.13
Niger; basal lvs.	6.44	32.25	n.d.	n.d.	9.03	n.d.	0.32	0.07
Nigeria; whole plant								
4 weeks	10.1	29.7	1.1	49.0	n.d.	6.0	n.d.	n.d.
7 weeks	8.5	32.1	1.1	48.3	n.d.	5.5	n.d.	n.d.
13 weeks	7.5	34.0	1.2	49.8	n.d.	4.5	n.d.	n.d.
17½ weeks early fl.	6.1	33.7	1.6	51.6	n.d.	3.5	n.d.	n.d.
24½ weeks full fl.	4.8	32.2	0.9	55.4	n.d.	3.2	n.d.	n.d.

6 SEED COLLECTIONS

None known, but the species has been introduced to South America as a grazing grass and is becoming established there.

7 POTENTIAL FOR IMPROVEMENT

Drought resistance is the property most to be sought in strains to be used in the arid and semi-arid zones. Although at present the species reaches the limits of its range in the semi-arid zone, its high productivity combined with good palatability up to the time of flowering makes it a most desirable species for further selection work.

8 AGRONOMY

At present this species is usually established from seed, which is easily collected, but since 1 hectare of land produces only enough seed to plant another few hectares at best, propagation by splits is a better proposition where labour is cheap. The mature tussocks can be very large (50-80 cm in diameter), so that few plants are needed to produce a respectable cover.

Work already carried out on the species is extensive and cannot be covered here; the reviews by Bowden (1963, 1964) and Jones (1979) should be consulted.

9 RELATED SPECIES

The genus is a large one, with a number of species extending into the drier regions in various parts of Africa. One species, A. kelleri Hackel (syn. A. cyrtocladus Stapf) (Somali: Dur), is worthy of special mention. It is a Somali endemic which forms very large tussocks up to 3 m in diameter with culms up to 4 m high in good conditions. The stem bases are swollen and up to 2 cm in diameter. The young shoots produced soon after rain are much liked by stock. It is often burned to stimulate new growth but this damages the plant severely.

REFERENCES

Andrews 1957; Baumer 1975; Boudet et al 1969; Bowden 1963, 1964; Clayton & Renvoize 1982; Gillett 1941; Glover 1951; Hepper 1972; Peyre de Fabrègues 1965; Rose Innes 1977.

Jones (1979) has produced a major review of the potential of the species for the moister regions of tropical America.

1 BOTANICAL

- 1.1 Accepted name Antheophora pubescens Nees
- 1.2 Synonyms A.hochstetteri Hochst.; A.kotschyi Hochst.;
A.abbyssinica A.Rich.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Borselfjiesgras (Afrikaans)

2 DESCRIPTION

A perennial, forming tussocks. Culms 30-100 cm high. Leaf-blades 3-40 x 0.2-0.6 cm, often hairy; basal leaf sheaths often very hairy; ligule membranous, 3-8 mm long. Inflorescence spike-like, 5-25 cm long, bearing almost stalkless clusters of 3-11 spikelets arranged along a wavy axis. Spikelets broadest below the middle, 6-11 mm long; lower glumes tough, hairy, facing outwards and forming a cup-like structure around the spikelets; lemmas with long hairs which project from the spikelet.

3 ECOLOGY

A grass of dry sandy acid to neutral soils in semi-arid to arid regions (rainfall 175-500 mm). Also on rocky slopes. It occurs in Colophospermum mopane woodland (Unit 28) and also in Karoo-Namib Shrubland (Unit 51). One collector in South Africa notes that this species is the first to flower after burning.

4 DISTRIBUTION

Mali; Sudan; Ethiopia; Somalia; Uganda; Kenya; Mozambique; Zimbabwe; Botswana; Angola; Namibia; South Africa.
Also in Iran.

Introduced into Australia and showing promise.

5 USES

In the dry areas of South Africa, regarded as a valuable grazing grass although it is reported to contain cyanide at times. It is also recorded as being grazed by cattle in the dry parts of Uganda.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Too little is known for useful suggestions to be made.

8 AGRONOMY

No information

9 RELATED SPECIES

Most of the members of the genus in Africa seem to be regarded as useful fodder from time to time. A. argentea Goossens (Rondomgras-Afrikaans) is said to be a valuable grazing grass in the eastern Kalahari, disappearing wherever heavy grazed occurs. A. nigritana Stapf & Hubb. (A. elegans Schrader) is mentioned as good fodder in Sudan, but is said not to be grazed in Chad.

REFERENCES

Broun & Massey 1929; Clayton & Renvoize 1982; Gillet 1961; Leistner 1967; O'Donnell & Smith 1975; Strickland 1972; Tothill 1948.

1 BOTANICAL

- 1.1 Accepted name *Aristida adscensionis* L.
- 1.2 Synonyms *A.submucronata* Schum.; *A.curvata* (Nees)Trin. & Rupr.; *A.quineensis* Trin. & Rupr.; *A.mauritiana* A.Rich.; *Aristida caerulescens* Desf.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Sekö (Peul); Fari n'Tchaoua, Tsuntsujar dutsi (Hausa); Gau, Hemra, Um Hiraibu, El Gaw um Asabie (Arabic, Sudan); Balbirhet, Bille, Birreh, Harfo, Madweid, Ebateetee (Somali); Atamos, Aitamusi (Turkana); Ol'nyoil (Masai)

2 DESCRIPTION

Annual or occasionally perennial, forming loose tufts. Culms 10-100 cm high. Leaf blades up to 20 cm x 3 mm, flat or folded; ligule a fringe of hairs. Inflorescence up to 30 cm long, composed of a number of loose racemes. The inflorescence varies considerably in the degree of contraction or looseness. Spikelets 1-flowered, with linear-lanceolate to lanceolate unawned glumes, the lower 1-3 mm shorter than the upper; lemma 5-13 mm long, usually 1-2 mm longer than the upper glume, rough, passing into the awn without any clear joint or constriction; central awn 7-25 mm long, the laterals similar or sometimes shorter.

This is a very variable and wide-ranging species. The shape of the inflorescence, and the relative lengths of the awns are the main morphological variables but within the range of the species there must be substantial physiological variation as well.

3 ECOLOGY

The species is widespread in dry areas and extends into dry microsites in regions of higher rainfall, such as roadsides and abandoned cultivation. It extends from tropical to mediterranean arid and semi-arid areas. It tolerates slightly alkaline soils. A prostrate ecotype occurs in coastal grasslands in Ghana.

The species is an annual, growing and flowering quickly. Nothing appears to be known of its germination requirements or seed biology, although it is likely that the long pointed seeds with backward-directed hairs can lodge in crevices and soil cracks.



Aristida adscensionis - 1, habit; 2, spikelet; 3, lower glume; 4, upper glume; 5, floret; 6, flower.

4 DISTRIBUTION

Egypt; Libya; Tunisia; Algeria; Morocco; Mauritania; Senegal; Mali; Ivory Coast; Upper Volta; Ghana; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Zaire; Burundi; Mozambique; Zambia; Malawi; Zimbabwe; Botswana; Angola; Namibia; South Africa.

Pantropical, extending into regions of mediterranean climate also.

5 USES

A useful fodder grass in the very arid areas where it grows. It is highly palatable when young and green, and again later when it dries to give a useful standing hay, but in the interim, while the seeds are ripening and before they fall, it is avoided because of the unpleasantly sharp points of the seeds. These can penetrate the hides and flesh of grazing animals, particularly sheep. In Sudan it is collected and carried to the towns as a dry season stock food.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Niger; fl.	6.23	1.53	41.25	43.15	7.84	n.d.	0.30	0.12
Niger; dry	5.16	1.14	39.50	44.56	9.64	n.d.	0.25	0.11
Kenya; fl.	8.90	1.73	36.84	41.09	11.44	4.86	0.33	0.30

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Such a wide-ranging species must contain a very large reserve of variation and it should be possible to select plants suitable for many different climatic regimes. Possible lines of investigation are high-protein strains, and also those which retain high protein levels when dry. Plants with a high ratio of leaf to stem, and those which root readily at the basal culm nodes, so producing a better soil cover, should also be sought.

8 AGRONOMY

Nothing recorded. It should be said that the awns, and long brittle seeds, of all species of Aristida would make them very difficult to adapt to any kind of mechanical seed handling or sowing.

9 RELATED SPECIES

A.kenyensis Henr. is an annual, very similar but with the spikelets clustered at the ends of the branches of the inflorescences. It occurs in Uganda, Kenya, Tanzania and Ethiopia. A.submucronata Schum. and A.curvata (Nees) Dur. & Schinz are part of the same complex. A.funiculata Trin. & Rupr., another annual species, but with a long twisted projection (the column) at the tip of the lemma below the awns, occurs from Senegal to Somalia and is said to be much sought after by animals when dry. A.effusa Henr. is a similar species from Namibia. There are very many Aristida species, differing in small points of morphology; many are similar in their ecology and the genus is probably the most characteristic of arid lands.

REFERENCES

Boudet 1969; Boughey 1957; Clayton 1970; Clayton 1972; Edwards & Bogdan 1951; Launert 1971.

1 BOTANICAL

1.1 Accepted name Aristida mutabilis Trin. & Rupr.

1.2 Synonyms A.meccana Trin. & Rupr.; A.tenuis Hochst.;
A.schweinfurthii Boiss.; A.cassanellii Torr.

1.3 Family Gramineae

1.4 Vernacular Names Sekö (Peul); Fari n'Tchaoua (Hausa); Mileisa, Dunbalab, Gau umshara (Arabic, Sudan), Gau (Arabic, Sudan), a group name; Aduare (Turkana). (Note that the names in Peul and Hausa also apply to A.adscensionis)

2 DESCRIPTION

Annual, forming loose tufts. Culms usually 30-70 cm high. Leaf-blades 6-14 cm long, narrow or rolled; ligule c 0.5 mm long, membranous, with a tuft of hairs beside it. Inflorescence 12-20 cm long, narrowly ovate, usually fairly dense with the spikelets packed together at the ends of the main branches. Spikelets 1-flowered, with lanceolate glumes of which the lower is 4-5 mm long and the upper 6-7 mm long, either acute or very shortly awned; lemma cylindrical, 4-5 mm long, rough towards the tip with a projection 2-5 mm long which is jointed just below the origin of the three awns which are each 10-30 mm long.

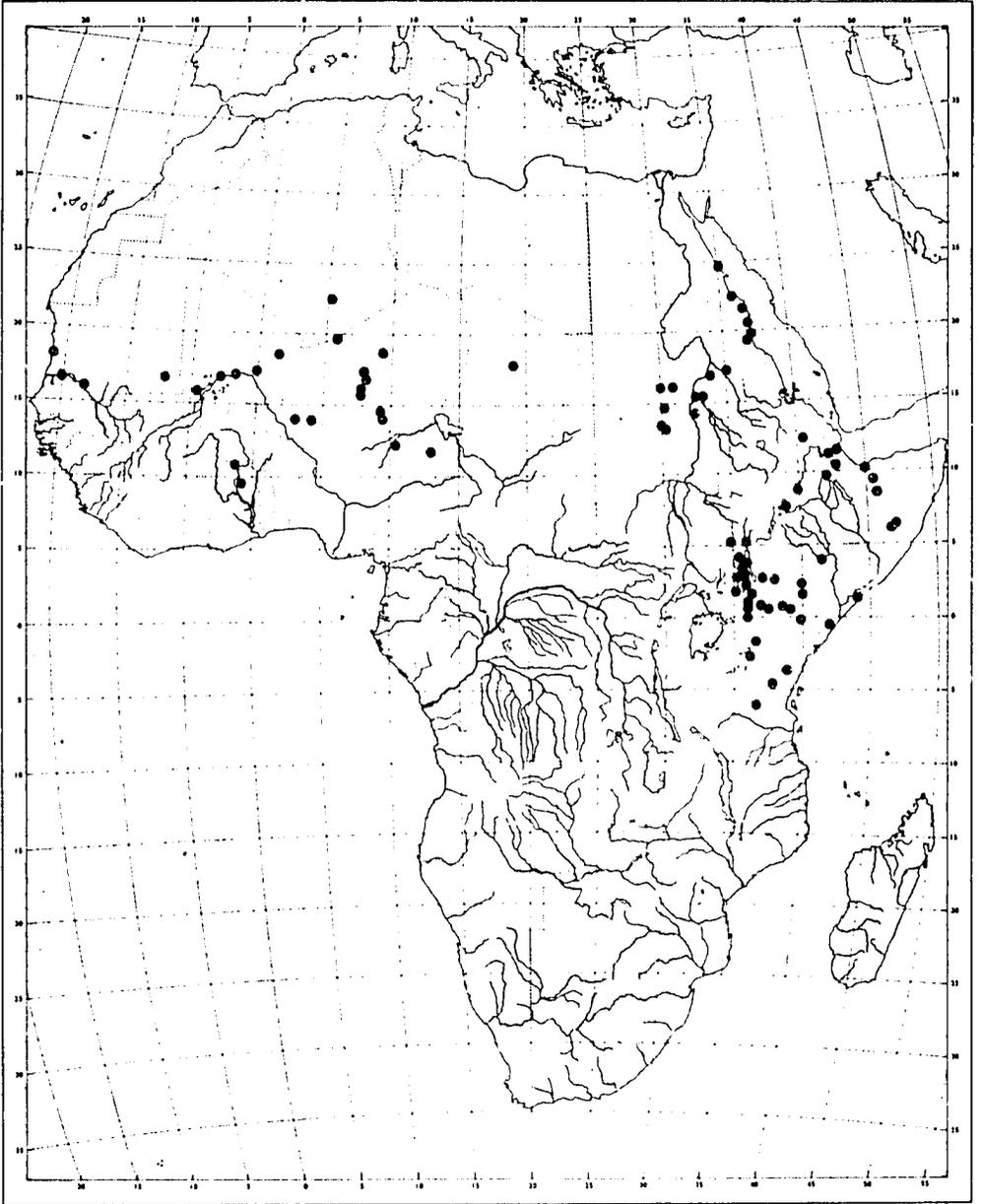
3 ECOLOGY

A widespread species of dry areas, occurring in bushland and semi-desert on a wide range of soil types. It is an annual, often forming dense and almost pure populations in suitable sites. A pioneer species of bare ground in arid and semi-arid areas of Kenya, and in Sudan it often increases in heavily grazed areas, near watering points, for example. Seed 4-8 months old germinates rapidly, particularly in alternating temperatures, and in the field germination occurs within a few days of sufficient rainfall.

4 DISTRIBUTION

Egypt; Libya; Algeria; Western Sahara; Mauritania; Senegal; Mali; Ghana; Niger; Nigeria; Chad; Cameroon; Sudan; Ethiopia; Djibouti; Somalia; Uganda; Kenya; Tanzania.

Also in Arabia, and east to India (where it may be introduced).



Scale Miles 1 20 40 60 80
Scale Kilometers 0 20 40 60 80

5 USES

Much grazed by animals. In Sudan it is said to be the species of Aristida most eaten at all stages by all animals, but, like other species, it is avoided when it carries seeds. After these fall it dries well and stands through the dry season, during which time it is much sought-after by animals. Some say, however, that it is only grazed at this time because there is little else.

Analyses (ranges at various stages, compiled from several sources).

	Vegetative	Flowering	Fruiting	Dry
Crude Protein	12.6	7.7-9.1	2.85-6.81	0.9-5.29
Ether Extract	n.d.	3.8	1.09-1.99	0.5-1.60
Crude Fibre	33.65	31.1-34.5	34.45-41.70	32.43-44.3
Nitrogen-free Extract	n.d.	47.50	45.73-51.0	39.51-50.8
Ash	14.1	8.5-8.9	6.1-11.02	3.4-10.05
Silica	10.1	0.8-5.4	4.6-6.8	3.83-7.72
Calcium	0.53	0.29-1.18	0.20-1.41	0.26-1.30
Phosphorus	0.19	0.18-0.19	0.08-0.19	0.04-0.14

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

The remarks under A.adscensionis apply equally here as the two species are rather similar in their ecology and habit. There are, however, two perennial species closely related to A.mutabilis (see below).

8 AGRONOMY

There are about 2 000 000 seeds per kilogram.

9 RELATED SPECIES

Aristida congesta Roemer & Schultes, which occurs in eastern Africa from Egypt to South Africa, and A.barbicollis Trin. & Rupr., which grows from Kenya and Tanzania to South Africa, are perennial species which are both morphologically very similar to A.mutabilis. They differ from one another in inflorescence shape.

REFERENCES

Baumer 1975; Bourreil 1967; Clayton 1970; Clayton 1972; Dougall 1960; Dougall, Drysdale & Glover 1964; Naegele 1977; Peyre de Fabregues 1965; Tothill 1948.

1 BOTANICAL

- 1.1 Accepted name Aristida sieberana Trin.
- 1.2 Synonyms A.longiflora Schum.; A.pallida Stapf;
A.stipiformis Lam.; A.paoliana (Chiov.)Henr.;
A.schebehlensis Henr.
- 1.3 Family Gramineae
- 1.4 Vernacular names Katsaura (Hausa); Um Sumeima, Simeimi (Arabic,
Sudan); Bile, Birreh, Marchain (Somali)

2 DESCRIPTION

Perennial, forming loose tussocks. Culms 30-100 cm high. Leaf-blades 5-30 cm long and up to 2 mm wide but usually rolled. Ligule a line of hairs c 0.5 mm long, with a tuft of longer hairs at each side. Inflorescence elongated but loose, 8-25 cm long. Spikelets 1-flowered, with a lanceolate lower glume 8-15 mm long and a linear upper glume 15-20 mm long, both with awns; lemma cylindrical, 9-12 mm long, smooth, surmounted by a column 10-30 mm long; awns 3.5-8 cm long, the laterals a little shorter than the middle one.

3 ECOLOGY

A perennial plant of dry sandy soils in semi-arid areas, extending into wetter areas on dry microsites such as river sandbanks. In the Sudan it is dominant of large areas on the sandy soils of old fixed dunes and sand sheets.

Some Senegal, Ghana and Togo localities are coastal and such populations could have salt resistance.

4 DISTRIBUTION

Tunisia; Algeria; Mauritania; Senegal; Mali; Guinea; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Kenya.

Also in Tunisia and Israel.

5 USES

Apparently sometimes grazed, but not as well liked as the annual species, perhaps because it retains its seeds longer and is stiffer owing to its perennial habit. Some parts may remain green throughout the year.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficiently known for useful suggestions to be made.

8 AGRONOMY

No information

9 RELATED SPECIES

A.stenophylla Henr. from Somalia and Ethiopia is shorter and more tussocky; it has shorter glumes and lemmas. A.somalensis Stapf is very similar but lacks the joint at the base of the column; this places it in a different section of the genus. A number of other perennial species occur in northern Kenya and Somalia; they include A.kelleri Hackel, A.mollissima Pilger, and A.hemmingii W.D.Clayton. A similar list could probably be drawn up for Botswana and Namibia. Most of these species are poorly known. A.kelleri (Machen, Machaan (Somali)) is reported to be dominant in large areas of semi-desert grassland on red calcareous soils in northern Kenya, Somalia and Ethiopia.

REFERENCES

Clayton 1970; Clayton 1972; Edwards & Bogdan 1951; Tothill 1948

1 BOTANICAL

- 1.1 Accepted name Cenchrus biflorus Roxb.
- 1.2 Synonyms C.barbatus Schum.; C.catharticus Del.;
C.niloticus Figari & De Notaris; C.annularis
Andersson; C.leptacanthus A.Camus;
C.perinvolucratus Stapf & Hubb.
- 1.3 Family Gramineae
- 1.4 Vernacular names 'ebbere kebbe (Peul); Karanguia (Hausa);
Haskaneit, Danab el Kalb, El Gaw, Koreib (all
Arabic, Sudan); Baldole (Somali); Cram-cram
(probably originally Wollof but adopted into
English and French).

2 DESCRIPTION

An annual, forming small tufts. Culms 5-90 cm high, upright. Leaf-blades 2-25 x 0.2-0.7 cm; ligule a line of hairs. Inflorescence spike-like, 2-15 cm long, made up of a number of clusters of spikelets surrounded by spiny bristles 4-11 mm long, joined for 2-4 mm at the base to form a disc enclosing 1-3 spikelets 3.5-6 mm long. The inner spines are stiff, sharp, and covered with tiny recurved barbs so that they cling to fur or clothing.

3 ECOLOGY

A plant of dry sandy soils, under annual rainfalls of 200 mm or more, occurring as an unpleasant weed of abandoned cultivation and roadsides in moister areas, but forming extensive pastures in drier zones with less than 300 mm of rain. In north-eastern Nigeria, it is particularly associated with sandy soils and is absent from the seasonally waterlogged areas between. It is sometimes suggested as an indicator of overexploitation.

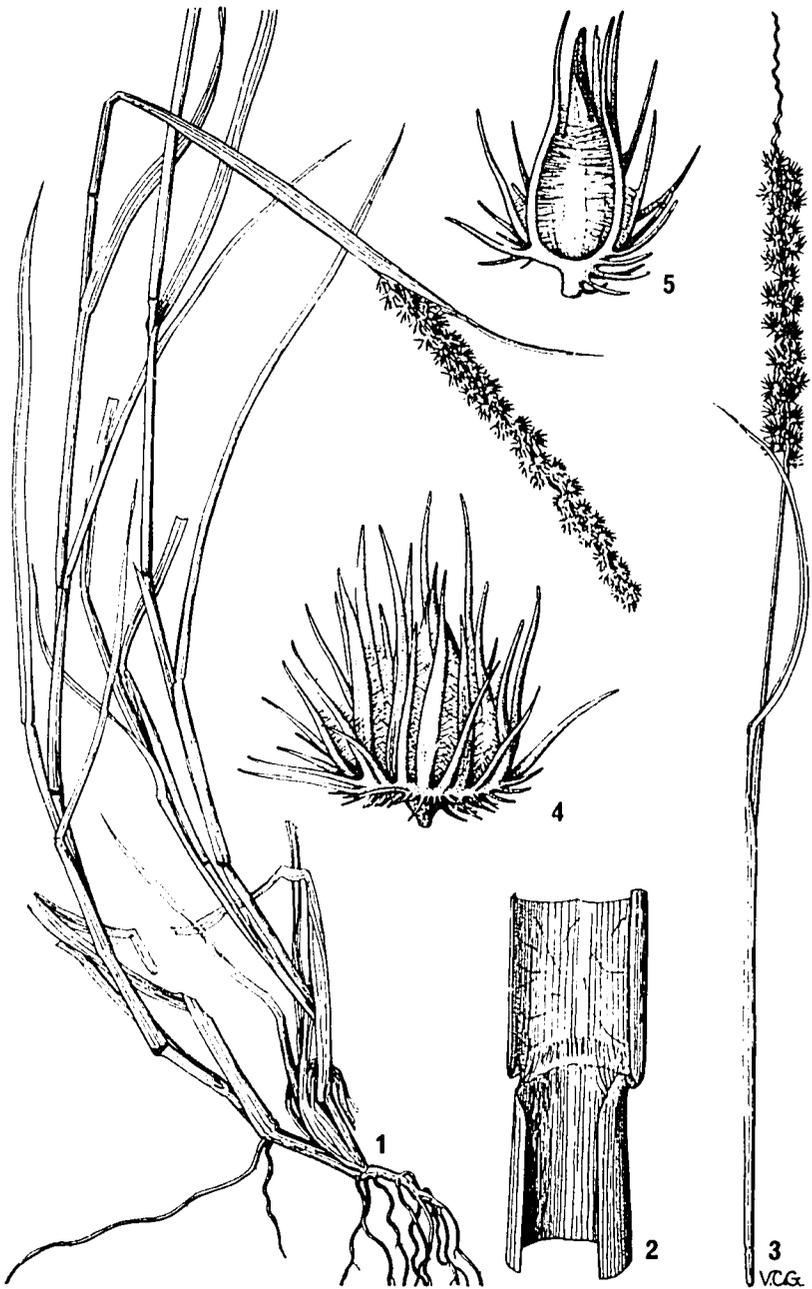
4 DISTRIBUTION

Egypt; Algeria; Mauritania; Senegal; Gambia; Mali; Guinea-Bissau; Upper Volta; Ghana; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Kenya; Zaire; Gabon; Mozambique; Tanzania; Zambia; Zimbabwe; Angola; Botswana; Namibia.

Also in Arabia and India.

5 USES

Considered either as valuable grazing or as a noxious weed, according to where it is growing. It is useful when green, before flowering, but becomes less attractive (although still eaten) while the spiny burrs are still on the plant, and is still palatable when dry. It can be used to



Cenchrus biflorus - 1, habit; 2, ligule; 3, florets; 4, spikelet; 5, longitudinal section of spikelet.

produce a good hay if cut at the early flowering stage before the spines have hardened. It can also be made into silage, the process softening the spines and making the material easier for animals to eat. In Chad, it is often associated with legumes such as Tephrosia bracteolata, and with them forms an excellent pasture. In moister regions it is an unpleasant weed of roadsides, and cultivation.

The seeds are sometimes collected and eaten.

Analyses

Source	CP	CF	EE	NFE	Ash	SFA	Ca	P
Niger; fl.	8.28	36.00	2.12	44.32	9.28	n.d.	0.39	0.17
Niger; fr.	5.35	38.95	1.40	44.87	9.43	n.d.	0.47	0.13
Niger; dry	3.69	40.00	1.51	45.64	9.16	n.d.	0.50	0.11

For additional data see Naegele 1977

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Little known. There is a form with blunt inner spines and few or no outer spines which has been called C.leptacanthus. If this trend could be developed to produce a form completely lacking spines, the plant would be very valuable as forage, and also easier to handle. The seeds (burrs) of the wild type would be virtually impossible to handle by machinery because of the way they stick to one another.

8 AGRONOMY

There are about 400 000 seeds per kilogram. Germination occurs very rapidly and the vegetative period lasts 20-30 days before flowering. If conditions are favourable, vegetative growth continues after flowering has started.

9 RELATED SPECIES

C.prieurii (Kunth)Maire is an annual which grows in very dry desert areas. In the northern Sudan it is eaten at all stages by all species, mainly because it can grow in semi-desert areas where little else can. Its seeds are collected by nomads as food. It occurs in Mauritania, Senegal, Mali, Niger, Nigeria, Chad and Sudan.

REFERENCES

Andrews 1957; Baumer 1975; Boudet et al. 1969; Clayton 1972; Clayton & Renvoize 1982; Naegele 1977; Penning de Vries & Djiteye 1982; Peyre de Fabregues 1965; Tothill 1948.

1 BOTANICAL

- 1.1 Accepted name Cenchrus ciliaris L.
- 1.2 Synonyms Pennisetum ciliare (L.)Link; C.longifolius Steudel; Pennisetum rangei Mez; P.oxypyllum Peter
- 1.3 Family Gramineae
- 1.4 Vernacular names Haufato (Hausa); Danab el Kalib (Arabic, Sudan); lyah makarri, Gudomad, Arapsur, Agar, Irdug, Gurde agar (Somali); Amerukwa (Turkana); Enkopikedongoi, Oloju (Masri); Buffelsgras (Afrikaans); Buffel Grass (English).

2 DESCRIPTION

A perennial, forming clumps which may be shrubby; some forms are also stoloniferous. Culms 10-150 cm, spreading and then erect, wiry or almost woody at times. Leaf-blades 3-25 x 0.2-1.3 cm; ligule a line of hairs. Inflorescence spikelike, cylindrical in outline, 2-14 x 1-2.6 cm, made up of a series of clusters of spikelets each surrounded by whorls of bristles; the bristles of the inner whorl are joined at their bases, and are longer than the spikelets. The bristles are wavy, thread-like and stiff but not prickly. Spikelets 1-4 in each cluster, 2-5.5 mm long.

3 ECOLOGY

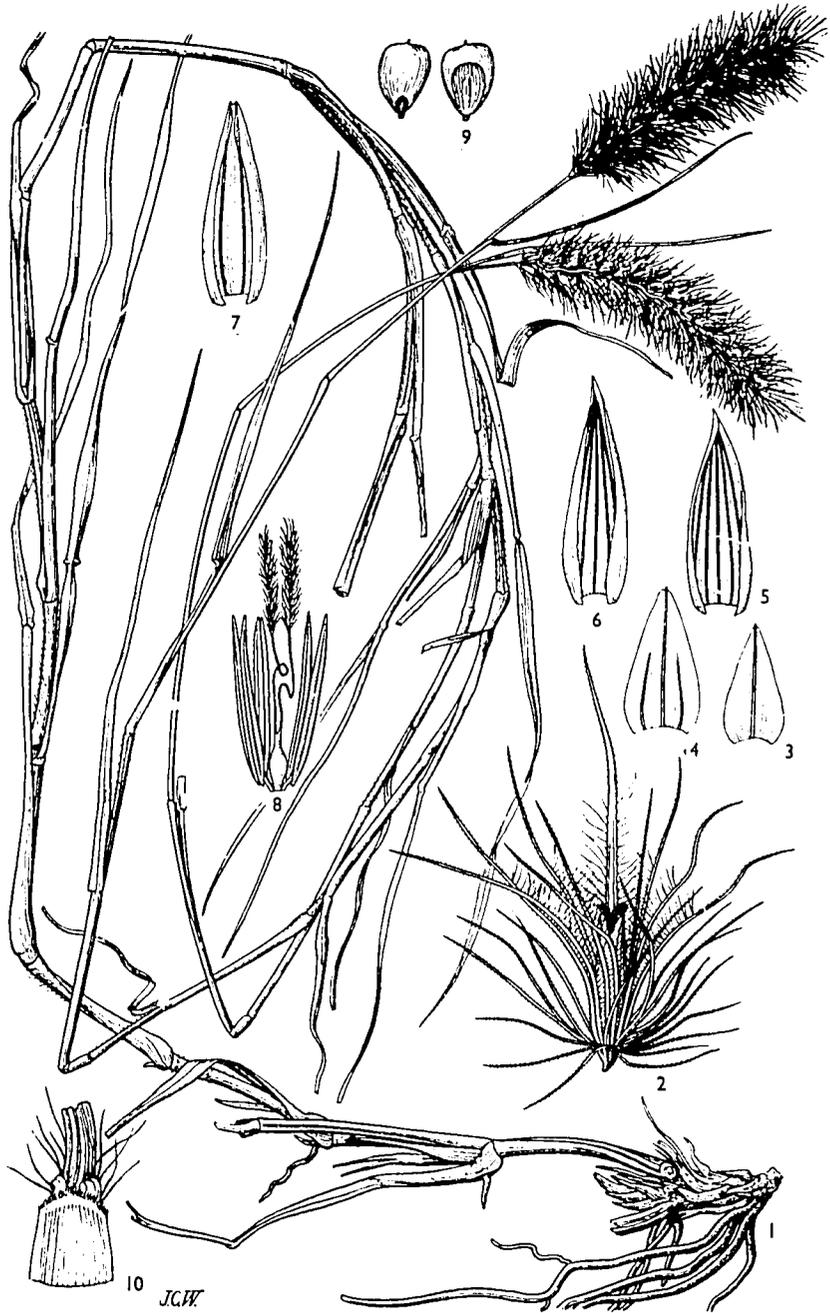
A perennial species occurring in dry grasslands and bushlands, usually on open-textured soils which are well-drained. Various soil types are recorded, including ones developed on quartz sands, limestones and coral rock. It does not withstand waterlogging well. The minimum rainfall requirement is variously stated to between 350 and 550 mm but there is doubtless considerable variation between strains, of which there are many.

4 DISTRIBUTION

Mauritania, Senegal; Mali; Ghana; Niger; Nigeria; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Mozambique; Zambia; Zimbabwe; Botswana; Angola; Namibia; South Africa.

5 USES

This species is widely recognised as a very valuable grazing grass for the dry tropics, and a large number of varieties have been selected, propagated and distributed widely. Some of these are upright and suitable for harvesting as hay others are more prostrate, with creeping stolons which form a good ground cover. In Sudan, all species eat it when it is young, but refuse it later if anything else is available. However, in time of scarcity and in more barren sites it is eaten at any time.



Cenchrus ciliaris - 1, habit; 2, spikelet; 3, lower glume; 4, upper glume; 5, lower lemma; 6, upper lemma; 7, palea; 8, flower; 9, grain; 10, ligule.

Very many analyses have been published. Protein ranges from 3% in the whole plant in the dry season, to 6-16% in green herbage. NFE ranges from 45-50% of DM. Phosphorus levels are from 0.15-0.65% which is generally nutritionally adequate.

6 SEED COLLECTIONS

131 samples in Kenya (National Agricultural Research Centre); 24 in South Africa (Division of Plant and Seed Control)

A collection of cultivars was reported to exist (Sept 1959) at the Institut de Recherche Agronomique de Madagascar, Alaotra, Madagascar (c/o J Birie-Habas).

7 POTENTIAL FOR IMPROVEMENT

A great deal of work has already been done on this species, on a scale too extensive to report here. There is a good deal of morphological variation, mentioned above; there is also some variation in chromosome number ($2n = 32, 36, 40, 54$). The structure of the spikelets gives rise to problems in the harvesting, processing and sowing of the seeds, in addition low germination rates (below 40%) have been reported in East Africa.

Tests in Kenya suggested that the species reproduces apomictically.

8 AGRONOMY

There are 350 000 - 400 000 seeds per kilogram, so that 2.5-3 kg of seed per hectare are needed to give 100 seeds per m^2 . A sowing method which immediately covers the seeds is desirable as otherwise they are liable to be blown away by the wind. It can be combined with legumes such as Stylosanthes humilis to raise the protein content of the grassland.

9 RELATED SPECIES

Cenchrus pennisetiformis Steudel is close to C.ciliaris but differs in its smaller stature, annual habit, and in the inner bristles being joined for 1-2.5 mm at their base to form a cup. It occurs in drier regions than C.ciliaris, in Sudan, Ethiopia, Somalia and Kenya, and eastwards to India. It has been introduced into Australia for use in arid areas.

REFERENCES

Andrews 1957; Baumer 1975; Clayton & Renvoize 1982; Edwards & Bogdan 1951; Leistner 1967; Peyre de Fabrègues 1965; Pratt & Gwynne 1977; Purseglove 1972; Tothill 1948; Whiteman 1980.

1 BOTANICAL

- 1.1 Accepted name Cenchrus setigerus Vahl
- 1.2 Synonyms Cenchrus ciliaris L. var. setigerus (Vahl)Maire
- 1.3 Family Gramineae
- 1.4 Vernacular Names Heskaneit (Arabic, Sudan); Garbi (Somali);
Birdwood Grass (English-Australian).

2 DESCRIPTION

A perennial, forming clumps, rhizomes absent. Culms 5-80 cm high, spreading and then upright. Leaf-blades 2-20 x 0.2-0.7 cm. Ligule a line of hairs. Inflorescence spike-like, 2-12 cm long, made up of a series of clusters of spikelets surrounded by bristles 3-7 mm long; the inner ring of bristles are joined for $\frac{1}{4}$ - $\frac{1}{2}$ their length to form a cup containing 1-3 spikelets each 3-5 mm long. The bristles are usually almost hairless.

3 ECOLOGY

A tufted perennial, found in arid and semi-arid regions in bushland and grassland, often on alluvial silts and black clays. The minimum rainfall needed is variously stated to be 200 to 450 mm. In some place in India it occurs in weakly saline sites.

4 DISTRIBUTION

Egypt; Sudan; Ethiopia; Somalia; Kenya; Tanzania..
Also in Arabia and India.

Introduced to other parts of Africa and to the drier tropics of the Americas.

5 USES

A useful grazing grass for the driest regions. In Kassala Province, Sudan, it is described as one of the most important dry season grazing plants, better than all other grasses in the area. It is not rhizomatous and so does not spread, but it produces seed very quickly - only 6-8 weeks after sowing - so can spread itself in this way. It has been used in Australia for the reclamation of denuded pastures. It can also be combined with legumes such as Stylosanthes humilis.

It is an important forage plant in the dry regions of India.

6 SEED COLLECTION

None known.

7 POTENTIAL FOR IMPROVEMENT

Much of the work on this species has been carried out in India and it remains to be seen how these results can be applied in Africa, using both African and Indian material.

8 AGRONOMY

Seed weight is similar to that of C.ciliaris, with about 350 000 seeds per kg, so that a seeding rate of 3 kg/ha is needed to give 100 seeds per m². There may be a water-soluble inhibitor in the glumes, as free seeds germinate better than those enclosed in the glumes, and soaking in water before sowing improves germination.

9 RELATED SPECIES

See under C.ciliaris.

REFERENCES

Andrews 1957; Bogdan 1977; Clayton & Renvoize 1982; Lahiri & Kharabanda 1962; Pratt & Gwynne 1977; Tothill 1948; Whiteman 1980.

1 BOTANICAL

- 1.1 Accepted name Centropodia glauca (Nees)Cope
- 1.2 Synonyms Asthenatherum glaucum (Nees)Nevski; Danthonia glauca Nees; D.suffrutescens Stapf
- 1.3 Family Gramineae
- 1.4 Vernacular name Ghagras (Afrikaans).

2 DESCRIPTION

A perennial grass with stout rhizomes. Culms 15-60 cm high, from a much branched woody base which is covered in tough papery scales. Leaf-blades up to 9 x 0.7 cm, usually flat, rather stiff, bluish- or whitish-green, with sharp tips. Ligule a dense fringe of hairs about 1.5 mm long. Inflorescence a dense erect panicle 2.5-11 cm long and up to 2.5 cm wide. Spikelets 7-10 mm long, 2-4-flowered; glumes narrow and pointed, about 8 mm long; lemma very distinctive, deeply divided into two sharp-pointed lobes with an awn arising from between the lobes.

3 ECOLOGY

A grass of very dry areas on sandy soils and on sand dunes, often in deep red sands. The thickened base contains reserves which allow growth to start quickly. It is capable of considerable upward growth if covered by blown sand. Most of its distribution lies within Unit 56 - Kalahari/Karoo-Namib transition, in highly wooded grassland - grassland mosaic with less than 300 mm of rain.

4 DISTRIBUTION

Kenya; Namibia; South Africa.

5 USES

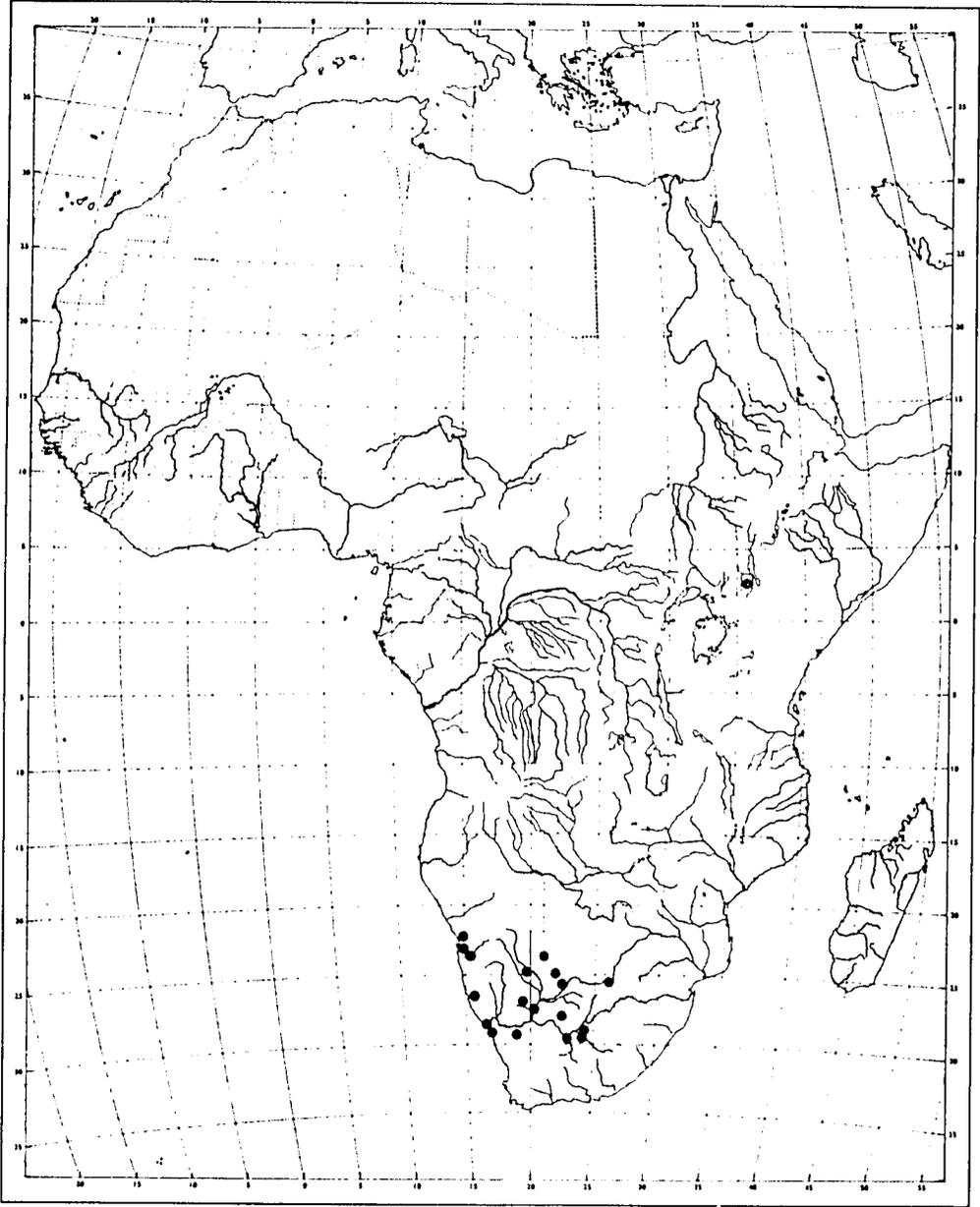
In the dry areas of South Africa this is regarded as an extremely valuable grazing grass; the thickened basal nodes contain reserves which are useful in winter, although it must be presumed that the plant would be weakened by the regular use of these.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Together with its northern sibling species (see below) this must be regarded as having some potential for the driest areas. Progeny trials



Scale 1:30 000 000

are needed using material from throughout the range. The species has only been collected once in Kenya and collection of material from this population, which must be adapted to rather different climatic conditions than the populations further south, must be a high priority.

8 AGRONOMY

No data

9 RELATED SPECIES

Centropodia forskalii (Vahl)Cope (Asthenatherum forskalii (Vahl)Nevski) occurs in North Africa, and extends to the Middle East. It differs in its smaller anthers and in the shallower lobing of the lemma. It is a Saharian species which can exist in regions with less than 150 mm of rain; it tends to occur on the sandy crests of dunes.

REFERENCES

Clayton 1970; Clayton 1972; Leistner 1967; Peyre de Fabrègues 1965.

1 BOTANICAL

- 1.1 Accepted name Chloris gayana Kunth
- 1.2 Synonyms C.abbyssinica A.Rich.; C.glabrata Andersson
- 1.3 Family Gramineae
- 1.4 Vernacular Name Abu raseyn (Arabic, Sudan); Erigaru, Ol'piripiri-andoi (Masai); Rhodes Grass (English)

2 DESCRIPTION

A perennial grass forming loose tussocks, sometimes with stolons. Culms 0.5-2 m high, erect, but sometimes partly decumbent and rooting at the lower nodes. Leaf-blades flat, 25-50 x 0.3-0.9 cm, apex pointed; ligule membranous, short, sometimes with a tuft of hairs beside it. Inflorescence of 1-20 spikes, usually radiating from a single point. Spikelets 3-4 flowered, each with two awns; lower glume 1.5-2.5 mm long, upper glume 2-4 mm long including the awn; lemmas hairy on the margins and on the keel; only the lowest floret is usually fertile and seed-bearing.

3 ECOLOGY

A widespread grass, most of whose range lies in regions of higher rainfall than that covered here. However, some forms certainly occur within the semi-arid belt. It occurs in open grassland, and also in bushed and wooded grasslands; it is generally commoner and more widespread in East Africa than in West. Some forms, from eastern and north-eastern Africa, certainly have some salt and/or alkali tolerance; in western Uganda it forms a zone around salt lakes but further from the water than truly halophilous species such as Sporobolus spicatus and Psilolemma jaegeri.

4 DISTRIBUTION

Senegal; Mali; Guinea; Niger; Nigeria; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Zaire; Rwanda; Mozambique; Malawi; Zambia; Zimbabwe; Botswana; Angola; Namibia; Swaziland; South Africa. Widely introduced as a pasture grass, and sometimes becoming naturalised.

5 USES

A valuable grazing grass, easily established from seed and much used in tropical pastures. Many strains have been selected with different characteristics (see below). Its stoloniferous habit means that it quickly forms a dense sward, and it withstands grazing and cutting well. It has been tried as a sand-binder in Australia, with some success. It has some promise as a grass for mildly saline soils. It can be made into hay, but silage made from it in northern Nigeria was very low in protein although otherwise of good quality.



Chloris gayana - 1, habit; 2,3, portion of spike; 4, glumes; 5, lower glume; 6, upper glume; 7, florets; 8, lower lemma; 9, palea; 10, second and third florets; 11, flower; 12, grain; 13, ligule.

Analyses

6 SEED COLLECTIONS

220 samples in Kenya (National Agricultural Research Centre)

Collections of cultivars exist (or existed) at Brisbane, Australia, and Alactra, Madagascar.

7 POTENTIAL FOR IMPROVEMENT

Numerous cultivars have already been selected, and in some cases named. A few are commercially available. There is a need for the widely scattered information on this species to be collected and summarised; it is on a scale beyond the scope of this publication. Strains vary in leafiness, drought-resistance, height, number of stolons, etc, and there is clearly considerable scope for the selection of strains which are suited to particular environments.

8 AGRONOMY

It is easily established from seed. There are 450 000-550 000 seeds per kg. A seeding rate of 2 kg/ha gives 100 seeds/m². In tests on germination from different depths of planting of seeds, emergence was best from depths of 1-2.5 cm. Virtually no seeds emerged from seeds planted 5 cm deep. Swards can also be established using splits or chopped stolons, and for small areas this may be more reliable.

9 RELATED SPECIES

The genus contains a number of species of forage value, but many of them are annuals. Chloris ferruginea Renvoize, known from one collection in arid northern Kenya, is a perennial and deserves further investigation. Chloris robusta Stapf is a West African species extending east to Sudan and Uganda; it occurs in sandy river beds and can provide useful grazing in these sites during the dry season. C.longiaristata Napper and C.amethystea Hochst. are other East African perennials occurring in dry areas.

REFERENCES

Bogdan 1961, 1969; Clayton, Phillips & Renvoize 1974; Dougall 1960; Edwards & Bogdan 1951; Miller, Blair Rains & Thorpe 1963; Pratt & Gwynne 1977; Rose Innes 1977.

1 BOTANICAL

- 1.1 Accepted name Chloris roxburghiana Schultes
- 1.2 Synonyms C.polystachya Roxb. non Lagasca; C.myriostachya Hochst.
- 1.3 Family Gramineae
- 1.4 Vernacular Names lamakari, Arho ane Kudug (Somali); Ekopir (Turkana); Eneporori (Masai)

2 DESCRIPTION

A perennial grass, forming loose tussocks. Culms up to 1.5 m tall but usually less, erect. Leaf-blades flat, folded when dry, 10-40 x 0.2-1 cm, tapering to the rather broad apex; leaf sheaths flattened and forming two very marked rows at the base, so that the culm base appears flattened. Inflorescence a whitish, purplish or yellowish fluffy head of numerous spikes 3-8 cm long carried on an axis 6-18 cm long. Spikelets 3-4-flowered, with 3-4 awns 10-20 mm long; lower glume 1-1.5 mm long; upper glume 2-2.8 mm long; lowest florets larger than the rest, with hairy margins to the lemma.

3 ECOLOGY

In East Africa, a common and important perennial grass of the semi-desert regions of Kenya. It is reported to need a minimum of 500 mm of rain, and to prefer loams and loose sands.

4 DISTRIBUTION

Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Zaire; Mozambique; Malawi; Zimbabwe; Angola; Botswana; South Africa.

5 USES

Reported to be an important grazing grass in the semi-desert regions of East Africa. In the arid parts of eastern Kenya it made up nearly 50% of the diet of oryx in some months. In south-eastern Sudan it is eaten by all stock throughout the year.

Analyses

Source	CP	CF	EE	NFE	Ash	SFA	Ca	P
Kenya; whole plant 9/62	6.80	36.97	1.17	46.28	8.78	1.76	0.18	0.08
Kenya; whole plant 1970-71 - mean of 10 samples	6.37	35.40	1.33	45.63	11.22	2.33	n.d.	n.d.
Kenya; early fl.	16.12	30.79	0.90	43.41	8.78	n.d.	0.36	0.20

6 SEED COLLECTIONS

None noted

7 POTENTIAL FOR IMPROVEMENT

This perennial species appears to be drought resistant and worthy of further work. There is obviously considerable variation in size and form, and there could be scope for looking for forms higher in protein and lower in silica than those whose analyses are given above. The introduction and testing of Indian material is another possibility.

8 AGRONOMY

The species has very small seeds. One kg contains between 6 million and 13 million seeds, so that sowing rates to obtain 100 seeds/m² are only 0.1-0.2 kg/ha.

9 RELATED SPECIES

The species is relatively distinct from the rest of the genus; other species are discussed under Chloris gayana.

REFERENCES

Clayton, Phillips & Renvoize 1974; Dougall & Bogdan 1959; Edwards & Bogdan 1951; Field 1975; Pratt & Gwynne 1977.

1 BOTANICAL

1.1 Accepted name Chrysopogon plumulosus Hochst.

1.2 Synonyms Chrysopogon quinqueplumis A.Rich.; C.aucheri (Boiss.)Stapf var. pulv'natus Stapf Andropogon aristioides Steudel; (OTE: some references in the literature of Uganda grasses to C.aucheri var quinqueplumis refer to Chrysopogon serrulatus Trin., and not to the present species, which is not recorded from Uganda in the Flora of Tropical East Africa).

1.3 Family Gramineae

1.4 Vernacular Names Agarab, Teerab (Arabic, Sudan); Daremo, Baremho (Somali); Esidokomom (Turkana); Esangash (Masai)

2 DESCRIPTION

A perennial, forming loose clumps. Culms 10-90 cm high, more-or-less erect. Leaf-blades 1-15 x 0.1-0.3 cm, bluish-green, hairy or not; ligule very short membranous. Inflorescence paniculate, 3-7 cm long, the fine branches brown-hairy at the tips. Spikelets in threes, with a central stalkless (sessile) spikelet, and two lateral stalked spikelets. The sessile spikelet is 4-6 mm long; the upper glume bears a hairy awn 7-15 mm long and the lemma bears a shortly hairy awn 2-3 cm long. The stalked spikelets are 4-7 mm long, and the glumes (or at least one of them) bears a hairy awn up to 15 mm long.

3 ECOLOGY

A species of semi-arid and arid grassland and bushland under rainfalls of 130-640 mm, occurring either on sandy soils, limestones, or black clays; it is possible that there are different ecotypes in these two habitats. Minimum rainfall is said to be 350 mm. In Somalia the plant occurs on plains, with Andropogon cyrtocladus, and is damaged by burning to produce a green flush. Under this treatment the plant has declined considerably in Somalia in the last 30-40 years. The root system has been described.

4 DISTRIBUTION

Sudan; Ethiopia; Somalia; Kenya; Tanzania.
Also in Arabia.

5 USES

A valued grazing grass in Somalia and Sudan, particularly when green; when dry it is also eaten avidly by most species. The plant is often damaged by being burned to stimulate a green flush.



Chrysopogon plumulosus - 1, habit; 2, spikelet triad; 3, tip of upper lemma.

6 SEED COLLECTIONS

None known.

The species has been tested in Australia from seed collected in Somalia.

7 POTENTIAL FOR IMPROVEMENT

Not known.

8 AGRONOMY

There are 450 000-550 000 seeds per kilogram, so that 2 kg/ha must be sown to give 100 seeds per m². Multiplication by offsets may be a more reliable method of pasture establishment.

9 RELATED SPECIES

C.plumulosus is a member of a group of closely related species which are separable only by small morphological features and which tend to replace each other geographically as well as showing some intergradation. C.serrulatus Trin. occurs in eastern Africa from Ethiopia to South Africa as well as in north India, Burma and Madagascar. C.aucheri (Boiss.)Stapf occurs mainly in the Middle East. C.fulvus (Sprengel)Chiov. (= C.montanus Trin.) occurs in southern India, and has been the subject of some research and development in India. All are fairly similar in ecology and should be studied together in any further programme.

REFERENCES

Andrews 1957; Clayton 1972; Clayton & Renvoize 1962, Glover 1951; Naegele 1977; Pratt & Gwynne; Rattray 1960

1 BOTANICAL

- 1.1 Accepted name Coelachyrum yemenicum (Schweinf.)S.Phillips
- 1.2 Synonyms Eragrostis yemenica Schweinf.; E.diplostachya Peter; Cypholepis yemenica (Schweinf.)Chiov.
Leptochloa appletonii Stapf
- 1.3 Family Gramineae
- 1.4 Vernacular Names Enaibiloetana (Masai)

2 DESCRIPTION

Perennial, forming dense tussocks. Culms erect, to 100 cm high. Leaf-blades usually flat, 7-32 x 0.25-0.55 cm, without hairs except towards the base; ligule membranous, 0.5-1 mm long, hairy on the margin and the outer surface. Inflorescence 3.5-19 cm long, made up of 2-8 well-separated erect spike-like racemes which lie close to the main axis. Spikelets 7-12 flowered, like tiny flattened pine-cones, 5-10 mm long; glumes nearly equal, 2.1-4 mm long. Grain flattened, with one convex and one concave face, 1.2-1.4 mm long.

3 ECOLOGY

A species of semi-arid and arid areas, usually on shallow soils and often in rocky or stony places.

4 DISTRIBUTION

Ethiopia; Somalia; Kenya; Tanzania; Botswana; South Africa.
Also Yemen.

5 USES

It has been suggested as a suitable species for reseeding bare, rocky ground. In Kenya, the species is said to be liked by grazing animals in spite of being rather stemmy. Its crude protein content is high; although the single analysis is of plants cultivated well outside their normal range, under higher rainfall, the protein content was higher than that of other species grown under the same conditions.

Analyses

Source	CP	CF	EE	NFE	Ash	SFA	Ca	P
Kenya-Kitale; cultivated; early fl.	15.53	37.93	1.79	36.93	7.82	n.d.	0.33	0.16

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Insufficient information.

8 AGRONOMY

No information.

9 RELATED SPECIES

Coelachyrum includes other species from semi-arid and arid areas, such as C.poaeflorum Chiov. (Ethiopia, Somalia) and C.stoloniferum C.E.Hubb. (Somalia). which are perennial. C.brevifolium Nees (Mali, Niger, Nigeria, Chad, Sudan) is reported to be very good grazing for all animals.

REFERENCES

Clayton, Phillips & Renvoize 1974; Dougall & Bogdan 1958.

1 BOTANICAL

- 1.1 Accepted name Cynodon dactylon (L.) Pers.
- 1.2 Synonyms C.glabratus Steudel; C.polevansii Stent
- 1.3 Family Gramineae
- 1.4 Vernacular Names Lalamne t'ëna (Peul); Nagela, Nagil, Nagila, Burtit, Difrat (Arabic, Sudan); Domar, Domar Mädu, Harfo, Hrari (Somali); Ejem (Turkana); Olaimoruwai (Masai).

2 DESCRIPTION

A perennial, forming dense mats with both surface stolons and slender underground rhizomes. Culms 8-40 cm high, slender. Leaf-blades flat, usually short and narrow, 1-12 x 0.2-0.4 cm, usually almost hairless; ligule very short, membranous, fringed with hairs. Inflorescence made up of usually 4-6 slender spike-like racemes, 2-6 cm long, usually spreading horizontally in a single whorl. Spikelets 2-2.5 mm long, fairly narrow and pointed, without awns.

3 ECOLOGY

Cynodon dactylon is one of the most widespread plant species, occurring throughout the tropics and warm temperate zones of the world, and being found in a wide range of habitats. However, its habitats generally share two common factors - disturbance and a degree of nutrient enrichment. Pathsides, abandoned cultivation, old cattle herding grounds, lake edges (including somewhat saline and alkaline sites) and maritime grasslands are typical habitats. It is a drought resistant species, able to continue some growth at the height of the dry season, but this ability varies between strains. Some of the older ecological literature does not distinguish between C.dactylon and its close relatives C.nlemfuensis, C.plectostachyus and C.aethiopicus (see below).

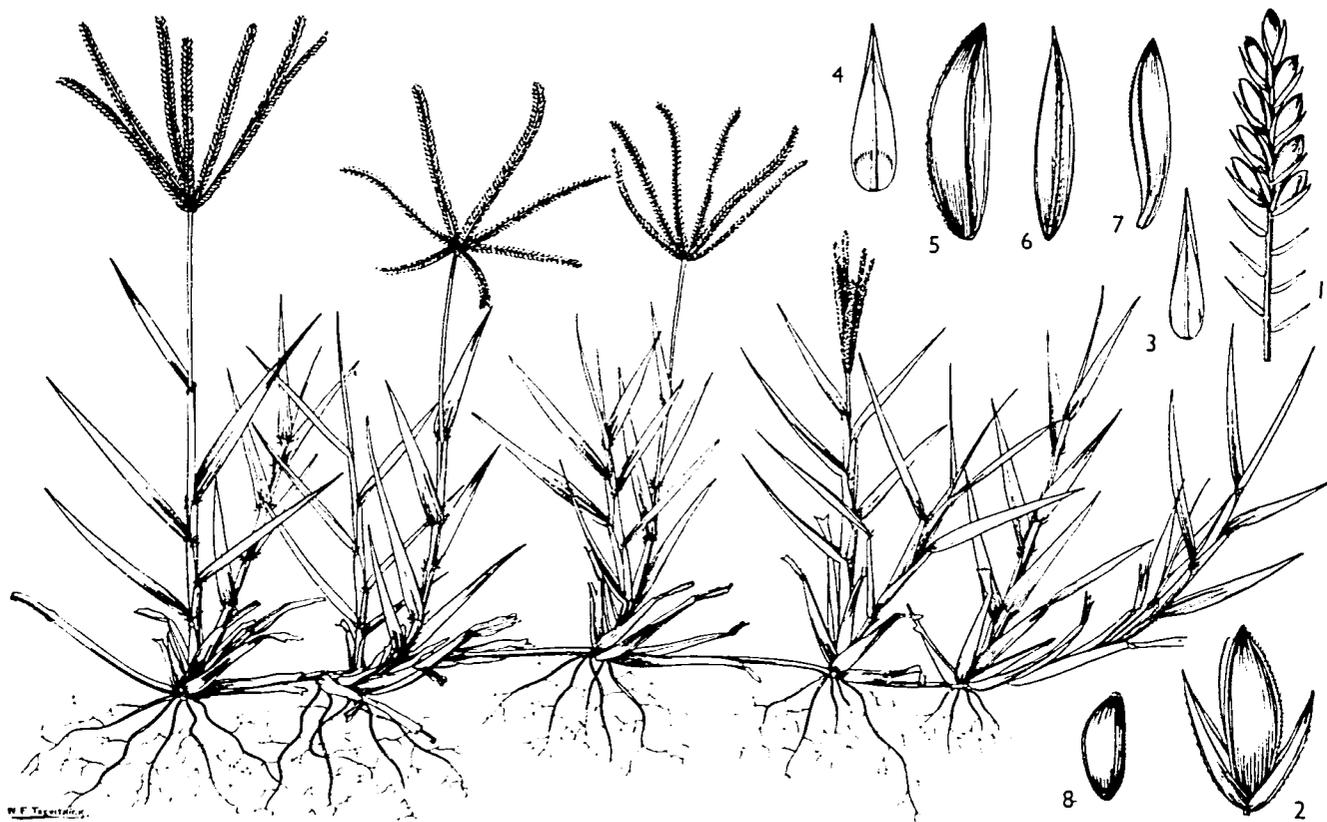
4 DISTRIBUTION

There can be little doubt that the species occurs in all countries of Africa, and no list is therefore given.

5 USES

It is generally reported to be much liked by animals and to be grazed wherever it occurs. It is usually regarded as excellent fodder.

Because of its rapid spread it is a useful species for stabilising eroded lands. It is also very widely used for lawns, but tends to become sparse and brown in long dry seasons although rapidly regenerating from the base when the rains start.



Cynodon dactylon - 1, portion of spike with persistent lower glume; 2, spikelet; 3, lower glume; 4, upper glume; 5, lemma, side view; 6, lemma, back view; 7, palea; 8, grain.

Analyses

Source	CP	CF	EE	NFE	Ash	SFA	Ca	P
Kenya; leafy regrowth after burning	28.34	20.29	2.24	35.06	14.07	8.44	0.99	0.36
Kenya; ditto	19.85	25.37	2.42	37.26	15.10	8.87	0.73	0.43
Kenya; early fl.; whole pl.	11.40	29.82	1.93	45.66	11.19	4.96	0.50	0.26
Kenya; full fl.	9.59	28.71	2.83	45.62	13.23	6.79	0.61	0.33
Kenya; leafy regrowth after burning	16.20	24.65	2.69	43.94	12.52	7.01	0.52	0.31
Sudan; green regrowth (mean of 3)	11.5	36.3	1.3	36.6	14.2	n.d.	0.64	n.d.
Sudan; leaf (mean of 4)	13.4	40.9	1.8	33.5	9.4	n.d.	0.85	n.d.
Sudan; stem (mean of 5)	6.5	44.9	1.6	39.3	7.7	n.d.	0.29	n.d.

In the Sudan samples, levels of magnesium, manganese, copper, zinc, and cobalt were all close to the average levels in all grass species in the area.

The analyses, which are examples from a large available range, show that the young regrowth of Cynodon dactylon is generally an excellent fodder. It is, however, not a very productive species, and is said to be slow-growing. Both C.dactylon and C.plectostachyus have sometimes been reported to be cyanogenic.

6 SEED COLLECTIONS

75 samples in Kenya (National Agricultural Research Centre)

7 POTENTIAL FOR IMPROVEMENT

The species has already been the subject of considerable research and selection, although mostly with a view to the production of large leafy highly productive forms ('Giant Star Grass' - a name also used for C. plectostachyus) rather than the selection of strains highly resistant to drought, salinity and alkalinity. There can be little doubt that such forms exist and selection for them should not be difficult.

8 AGRONOMY

Although seed is produced abundantly (approx 2 200 000 seeds per kg; thus 0.5 kg/ha for 100 seeds per m²), pastures of this species are usually produced using vegetative material. The rhizomes and stolons can be cut into short lengths, scattered over the area to be planted, and then disced lightly into the soil. For large scale operations, the rhizomes can first be ploughed out, shaken clear of soil by hand, chopped in a chaff-cutter or similar instrument, and then scattered mechanically followed by disking. Irrigation helps establishment but the rhizomes have a good deal of drought resistance and the plants spread rapidly after establishment. However, the pasture should be given plenty of time for establishment before grazing, as the young spreading stolons are easily uprooted by grazing cattle.

Both diploid ($2n = 18$) and tetraploid ($2n = 36$) forms are known. Surprisingly, the diploid is said to be more vigorous. Both are extremely variable.

9 RELATED SPECIES

The species of Cynodon tend to be rather similar in their ecology. However, it is Cynodon dactylon which appears to reach the most arid sites. Other species include C. plectostachyus, which is usually much more robust than C. dactylon, has very small glumes, and lacks rhizomes, C. nlemfuensis, very similar to C. dactylon but lacking rhizomes, and C. aethiopicus, which is another robust species, usually with the racemes in 2-5 whorls. C. plectostachyus has $2n = 18$; the other species have both diploid and tetraploid forms ($2n = 18, 36$), which cannot be distinguished morphologically.

REFERENCES

Andrews 1957; Boudet et al 1969; Chippindall 1955; Clayton & Harlan 1970; Clayton, Phillips & Renvoize 1974; Dougall, Drysdale & Glover 1964; Mefit Babbie 1984; Pratt & Gwynne 1977; Tothill 1948; Verdcourt & Trump 1969.

1 BOTANICAL

- 1.1 Accepted name Dactyloctenium aegyptium (L.)Willd.
- 1.2 Synonyms D.mucronatum (Michaux)Willd.; D.figareii De Notaris; D.mpuetensis De Wild.; D.ciliare Chiov.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Ndanguel, burgue boguel, burguel (Peul); Gude-Gude, kutukku, kurtu (Hausa); Koreib, Umm Asabi (Arabic, Sudan); Sadeho (Somali); Akaududu (Turkana); Enguruma-Ondaritik (Masai).

2 DESCRIPTION

Annual, forming loose tufts, the culms often semi-prostrate and rooting from the lower nodes, up to 70 cm high. Leaf-blades flat, 3-25 x 0.25-0.75 cm, usually fringed with eye-lash-like hairs. Inflorescence made up of (1-)3-9 spikes 1.2-6.5 cm long radiating horizontally from the top of the culm. Spikelets flattened and closely packed together in the inflorescence, 3-4-flowered, broadly ovate, 3.5-4.5 mm long; glumes nearly equal, 1.5-2.2 mm long, the upper bearing an awn $\frac{1}{2}$ -2 times as long as the glume. Grain about 1 mm long, almost circular in outline, transversely ridged.

3 ECOLOGY

A weedy grass of open and often disturbed ground, which is common on sandy soils, and often found near the sea. Minimum rainfall need said to be 400 mm, but certainly occurs under lower rainfalls. In the semi-arid zone it can be an important constituent of wet season grazing lands. It can withstand considerable soil salinity.

4 DISTRIBUTION

Mauritania; Senegal; The Gambia; Mali; Guinea-Bissau; Guinea; Sierra Leone; Liberia; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Central African Republic; Sudan; Ethiopia; Somalia; Djibouti; Uganda; Kenya; Tanzania; Zaïre; Rwanda; Burundi; Mozambique; Malawi; Zambia; Zimbabwe; Botswana; Angola; Namibia; South Africa.

Old World Tropics; introduced to America.

5 USES

It is generally said to be a much-sought-after species in the semi-arid zone, and is particularly important because it is palatable throughout its

growing season (unlike species of Aristida which are unpalatable when fruiting). It does not persist into the dry season, tending to break up as it dries, and there are also some reports that it is rich in cyanogenic glycosides.

The seeds are collected as human food at times in the northern Sudan and in West Africa.

Analyses

Source	CP	CF	EE	NFE	Ash	SFA	Ca	P
Kenya; fl. whole pl.	15.62	27.91	1.51	41.31	13.65*	12.07	0.73	0.30
Sudan; fl. whole pl.	7.1	38.5	n.d.	44.1	10.3	n.d.	0.74	n.d.
Sudan; fl. whole pl.	10.2	40.0	3.0	35.1	11.7	n.d.	0.42	n.d.
Sudan; infl. only	9.3	33.2	2.7	47.8	7.0	n.d.	n.d.	n.d.

* Correlated with high soil mineral content of Marigat (Kenya) soil.
This is a selection from a large number of available analyses.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

There are possibilities for the selection of quick-growing leafy strains. Some forms grow close to the sea and may therefore have some salt-resistance - testing is needed. See 'Related Species'.

8 AGRONOMY

There are approximately 2 400 000 seeds per kilogram, and a sowing rate of 0.5 kg/ha gives 100 seeds/m². If whole spikelets are used, then 1.0 kg/ha is a suitable seeding rate giving a similar seed density.

9 RELATED SPECIES

D.giganteum Fisher & Schweick. occurs in Kenya, Tanzania, Mozambique, South Africa and Namibia. It is a larger species, similar in its ecology, best distinguished by its larger anthers 1.3-2.1 mm long; in D.aegyptium 0.25-0.8 mm. D.ctenioides (Steudel) Bosser differs from D.aegyptium in its granular, not ridged, seed; it is a prostrate plant of sea coasts of East Africa and the Indian Ocean islands. D.pilosum Stapf and D.aristatum Link are other species of this habitat and range. For perennial species in the genus see under D.scindicum below.

REFERENCES

Andrews 1957; Baumer 1975; Broun & Massey 1929; Clayton 1972; Clayton, Phillips & Renvoize 1974; Dalziel 1937; Dougall, Drysdale & Glover 1964; Leistner 1967; Mefit Babbie 1984; Peyre de Fabregues 1965; Pratt & Gwynne 1977; Tothill 1948.

1 BOTANICAL

- 1.1 Accepted name Dactyloctenium scindicum Boiss.
- 1.2 Synonyms D.glaucophyllum Courb.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Kuschon (Arabic, Sudan); Sadeho (Somali).

2 DESCRIPTION

Perennial, forming spreading mats by creeping stolons; culms erect, 7-45 cm high. Leaf-blades usually flat, rather tough and with a whitish sheen, 1-11 cm x 1.5-3 mm, with scattered long stiff hairs. Inflorescence made up of 3-4 spikes 0.8-2 cm long, slightly curved and radiating from the top of the culm from which they fall easily at maturity. Spikelets 3-9-flowered, broadly lanceolate to ovate, 4-8 mm long; lower glume 1.7-2.5 mm long, the upper 1.5-2.3 mm long bearing an awn $\frac{1}{2}$ -1 times the length of the glume. Grain 0.7-1 mm long, transversely ridged.

3 ECOLOGY

A grass of dry grassland and open bushland in semi-arid areas, often in damp hollows in such places. Many localities are recorded as being on limestone.

4 DISTRIBUTION

Egypt, Sudan; Ethiopia; Somalia; Kenya.
Also in Arabia and north-west India.

5 USES

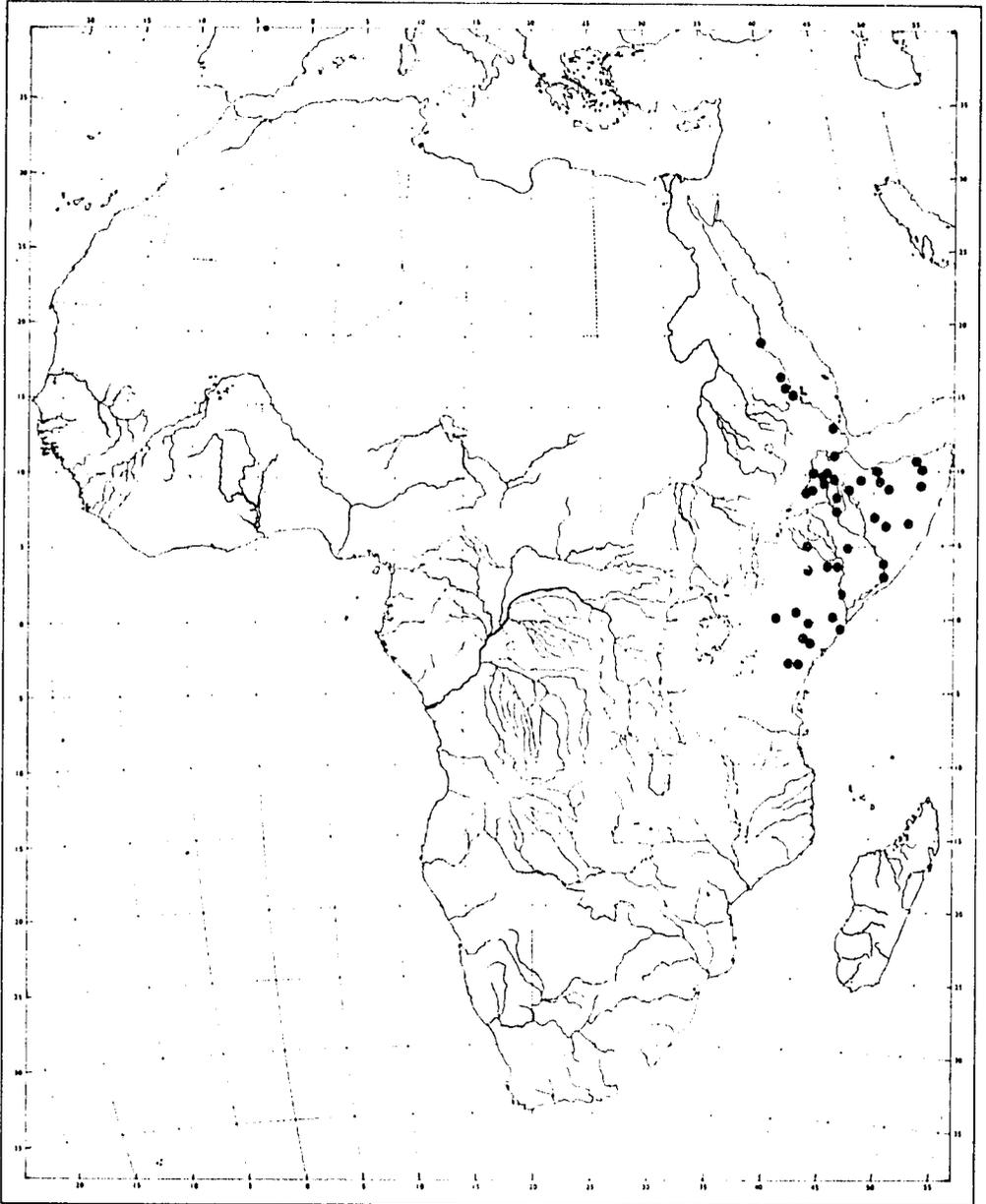
Generally said to be a useful fodder, readily eaten by cattle, sheep and goats, but also reported to be dangerous to horses if eaten in quantity, causing acute irritation of the bladder and kidneys.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Too little is known of the species for sensible suggestions to be made.



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Scale 1:50,000,000
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8 AGRONOMY

Nothing known. The seed dimensions suggest that seed weight would be the same as, or a little less than in D.aegyptium so that seeding rates would be similar.

9 RELATED SPECIES

D.geminatum Hackel is a coastal species of eastern Africa. D.australe Steudel occurs in Kenya and Tanzania, and in eastern South Africa. A form from South Africa is cultivated as a lawn grass and sand binder ('Durban Grass'), but occurs naturally in areas with too high a rainfall for it to have much promise in semi-arid areas. D.bogdanii S.Phillips occurs in Kenya, Tanzania, Sudan and Ethiopia on dry alluvial soils, sometimes highly alkaline; it occurs in semi-arid areas, and may have some promise. D.robbechii (Chiov.)Chiov. is a peculiar shrubby perennial species, very common in northeastern Somalia; its leaves are stiff and sharp-pointed, and it is regarded by many as characteristic of overgrazed areas and as being relatively unpalatable.

REFERENCES

Broun & Massey 1927; Clayton, Phillips & Renvoize 1974; Gilliland 1952; Tothill 1948.

1 BOTANICAL

- 1.1 Accepted name Dichanthium annulatum (Forsskal) Stapf
- 1.2 Synonyms Andropogon annulatus Forsskal; A. nodosus (Willemet) Nash; Dichanthium papillosum (A. Rich.) Stapf
- 1.3 Family Gramineae
- 1.4 Vernacular Names Malhi, Malhi el Zeraf (Arabic, Sudan); Aiyah macareh, Darer adili (Somali).

2 DESCRIPTION

A perennial, forming loose tufts. Culms 25-100 cm high, bent at the base and then erect or nearly so. Leaf-blades 3-30 x 0.2-0.7 cm; ligule membranous. Inflorescences made up of 2-15 spikelike racemes each 3-7 cm long, arising from the top of the culm, or close to it. Each raceme is made up of a series of pairs of spikelets. In each pair, the lower spikelet is stalkless (sessile) and the upper is stalked. The sessile spikelets are 2-6 mm long, hairy, bearing an awn 8-25 mm long. The variety papillosum (A. Rich.) de Wet & Harlan has a distinct fringe of bulbous-based hairs below the tip of the lower glume of the sessile spikelet.

3 ECOLOGY

A plant of dry open grasslands, often grazed or otherwise disturbed, in the Sahelian, Somalia-Masai and Zambebian Regions. It can survive in areas with as little as 150 mm rainfall but only in favourable sites. The variety papillosum is more restricted, usually occurring in moist depressions, often on black clay soils.

4 DISTRIBUTION

Egypt; Tunisia; Algeria; Morocco; Mauritania; Senegal; Mali; Niger; Sudan*; Ethiopia*; Somalia*; Uganda*; Kenya*; Tanzania*; Mozambique; Malawi*; Zambia*; Zimbabwe*; Botswana*; South Africa*.

Var. papillosum occurs in the countries marked with an asterisk and also in Angola and Namibia.

Widely introduced elsewhere.

5 USES

In Sudan, regarded as a useful grazing grass when green; it also sprouts after fires and is then eaten eagerly by all species. The dry leaves are eaten by gazelles in Sudan; in West Africa it is said to be eaten by all species even when dry. It is very highly regarded in the arid areas of India, where it is grazed green and also cut for hay.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
D.annulatum Kenya; early fl.	8.53	1.14	38.98	44.46	6.89	n.d.	0.30	0.15
D.annulatum var. papillosum Kenya; early fl.	8.88	1.65	38.61	43.54	7.32	n.d.	0.25	0.10

6 SEED COLLECTIONS

None known.

Extensive collections of this and other Dichanthium spp. have been made, however. Collections exist, or existed at:

Regional Experimental Station, Gatton, Queensland, Australia
and

Botanical Section, College of Agriculture, Poona, Bombay, India.

7 POTENTIAL FOR IMPROVEMENT

This is clearly a species with considerable potential for semi-arid regions in Africa. Indian work needs to be applied to the African situation, with exchange of plant material.

8 AGRONOMY

Seeding rates of 2-3 kg/ha have proved effective if the soil is thoroughly worked beforehand. It can also be established by planting rooted fragments.

Grazing tends to lead to its disappearance because it is taken preferentially. Cutting for hay at a height of 15 cm at 30 day intervals gives the highest yields. It can be combined with legumes.

9 RELATED SPECIES

D.foveolatum (Del.)Roberty is widespread in the drier areas of western and northern Africa.

REFERENCES

Andrews 1957; Baumer 1975; Bogdan 1977; Clayton 1972; Clayton & Renvoize 1982; Dalziel 1937; Dougall & Bogdan 1960; Paroda & Mann 1979; Roy et al 1975.

1 BOTANICAL

- 1.1 Accepted name Digitaria macroblephara (Hackel) Stapf
- 1.2 Synonyms D. brevipes Mez
- 1.3 Family Gramineae
- 1.4 Vernacular Names Apinaite (Turkana); Ol'piripiri-Andoi, Brigalo, Emurua (Masai). (The first Masai name is also used for Chloris gayana).

2 DESCRIPTION

A perennial, forming open clumps. Basal sheaths more or less covered with silky hairs. Culms 15-100 cm high, more or less upright but often bending over and forming creeping stolons. Leaf-blades 3-15 x 0.1-0.5 cm, narrowing to the thread-like tip; ligule short, membranous. Inflorescence of 2-11 spike-like racemes arising from the tip of the culm or from the top 3 cm at most; racemes 2-20 cm long, axes 3-angled, not flattened. Spikelets narrow, 2.2-3.5 mm long; upper glume $\frac{2}{3}$ - $\frac{3}{4}$ as long as the spikelet; lower lemma and upper glume hairy with long fine pale hairs which extend slightly beyond the tip of the spikelet.

3 ECOLOGY

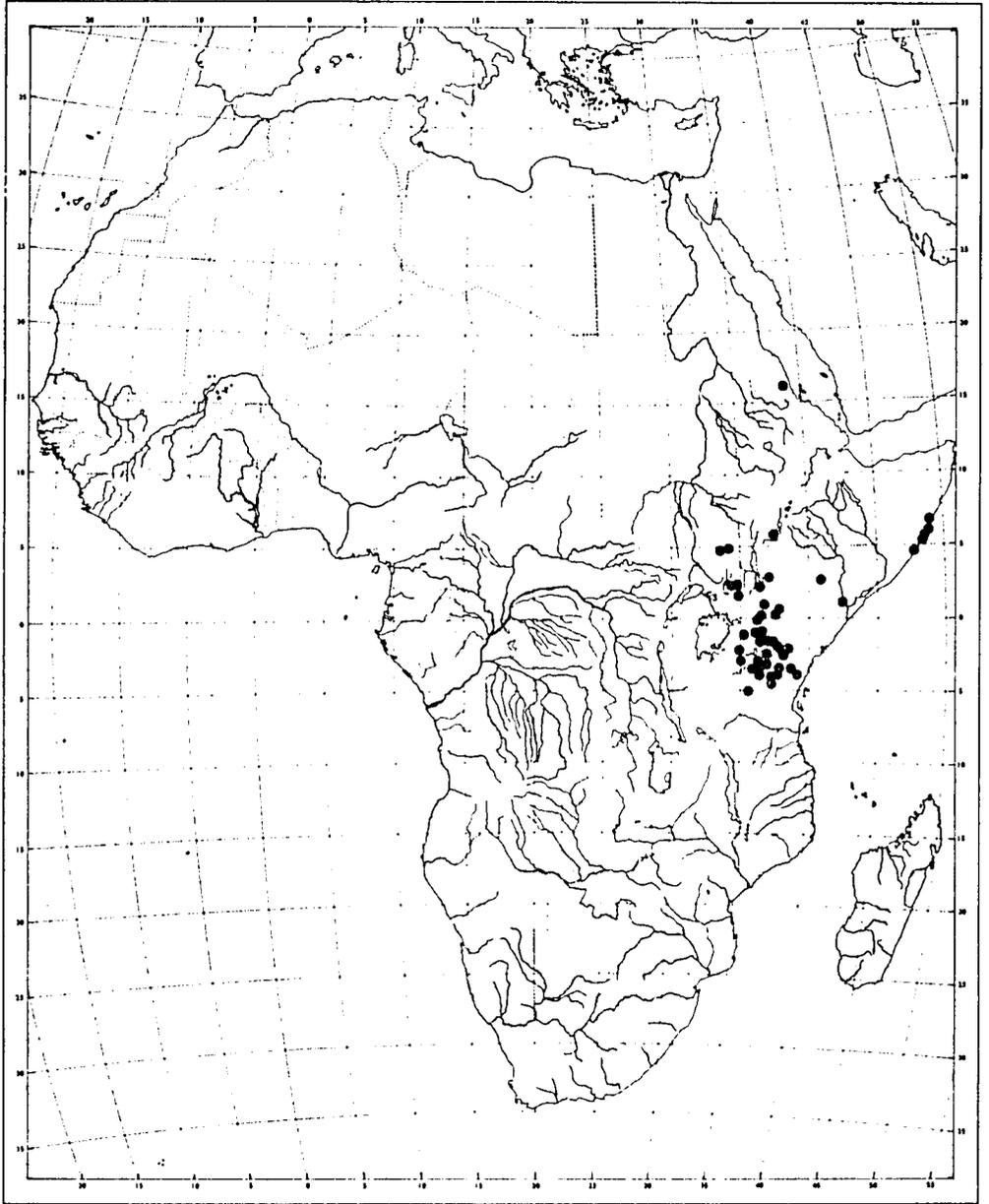
A grass of the Somalia-Masai Acacia-Commiphora deciduous bushland and thicket (Unit 42), often in areas of clay-rich dark soils, with rainfall less than 500 mm.

4 DISTRIBUTION

Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania

5 USES

It is much valued as a pasture grass in the arid and semi-arid parts of Kenya, where it is a useful protein source. It is grazed by all species. It is also used for thatching. Its long stolons allow it to spread over denuded land.



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1 30,000,000

Analyses

Source	CP	CF	EE	NFE	Ash	SFA	Ca	P
Kenya; cult. at Kitale; early fl.	12.34	32.16	1.79	42.49	11.22	n.d.	0.44	0.18
Kenya; mature	5.81	31.82	1.20	44.32	16.85	2.95	0.80	0.09

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

There could be scope for the selection of strains which have all or some of the following characteristics: high protein; good seed setting ability; strong stolon development; leafiness; drought resistance.

8 AGRONOMY

No information for this species. Related species often produce rather few seeds and must be propagated vegetatively by cutting and planting of stolons, from which a sward develops quite quickly because of rapid stolon growth.

9 RELATED SPECIES

A number of species in the genus have been used to some extent as pasture grasses although most need rather more moisture than the upper limit set here. D.swazilandensis Stent is a perennial with thin creeping stolons which forms a low sward; it is propagated vegetatively, although flowers and seeds are produced. Various forms of D.milanjiana (Rendle) Stapf such as D.setivalva Stent and D. 'Umfolozi' have been introduced in a number of places with varying success; their main drawback is that they usually need to be propagated vegetatively. All are perennials. There are also a large number of annual species, most of them small weeds but including D.exilis Stapf ('Hungry Rice', 'Fonio') which is widely cultivated in the savanna zones of West Africa, but generally where the rainfall exceeds 400 mm. The grains are tiny (c. 2000 per g). Yields are generally 600-800 kg/ha, and time to maturity ranges from 90-130 days according to variety.

REFERENCES

Bogdan 1977; Clayton & Renvoize 1982; Dougall & Bogdan 1959; Dougall, Drysdale & Glover 1964; Edwards & Bogdan 1951; Purseglove 1972.

1 BOTANICAL

1.1 Accepted name Diplachne fusca (L.)P.Beauv. ex Roemer & Schultes

1.2 Synonyms Leptochloa fusca (L.)Kunth; L.neuroglosse Peter; Diplachne capensis (Nees)Nees; D.livida Nees; D.pallida Hackel

1.3 Family Gramineae

1.4 Vernacular Names Bus, Likh (Arabic, Sudan); Aasse (Turkana); Brack Swamp Grass/Brakvleigras (Zimbabwe, South Africa)

2 DESCRIPTION

Rhizomatous perennial or biennial. Culms 60-150 cm high, rooting from the lower nodes. Leaf-blades tough, 25-55 cm long and to 5 mm wide, inrolled or nearly flat, grey-green with a broad white central nerve; ligule 3-8 mm long, pointed. Inflorescence 20-35 cm long, racemes 10-30, slender, 7-15 cm long. Spikelets 6-11-flowered, narrowly elliptic to elliptic, 8-15 mm long, grey-green or olive-green. Lemma narrowly oblong, 3.2-6 mm long, 2 or more toothed and with a fine point or awn 0.3-1.8 mm long arising between the teeth. Caryopsis elliptic-oblong, 1.6-1.8 mm long. Salt glands present.

A variable species. The length of the rhizomes and the height and thickness of the culm are the main variables likely to be of agronomic significance but inflorescence form and spikelet structure also vary considerably.

3 ECOLOGY

Diplachne fusca is a plant of permanently or seasonally wet or flooded sites, often saline or sodic. It occurs over a wide range of rainfall and temperature regimes, from humid tropical and equatorial to subtropical arid areas. It does not seem to have any particular soil textural preferences. Its local dominance is probably due to its tolerance of extreme soil conditions as in less saline conditions it does not compete well with other species.

Perennial, flowering continuously when conditions are favourable. In regimes with a cold season it grows mainly in the hotter periods. Seeds are said to germinate in water but little is known of the precise conditions needed for germination and seedling establishment, although poor germination on salt-affected soils has been reported.

4 DISTRIBUTION

Senegal; The Gambia; Niger; Nigeria; Chad; Central African Republic; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Zaire; Burundi; Mozambique; Malawi; Zambia; Zimbabwe; Botswana; Namibia; South Africa. Also southern Asia, Indonesia, and Australia.

5 USES

A perennial forage crop, used in Somalia, Ethiopia and southern Africa, as well as in Asia and Australia. Opinions vary as to its value as a forage, but its ability to grow in sites where other grasses do not flourish makes it useful. It is regarded as palatable but further data are needed both on the relative palatability to different animal species, and also on its nutritional qualities. It can be made into hay. Yields of 19-40 t/ha/yr have been obtained using various cutting regimes. An average protein content of 8.6% DM has been reported; it is also reported that increase in soil salinity is correlated with a decline in protein content, and with an increase in ash content.

It has been claimed that this species can be used as a biological desalinator since it absorbs salts from the soil. However, these are excreted by the salt glands so that the salts would be washed back into the soil unless removed by grazing or harvesting. It is likely that the ability of the species to grow on highly saline soils, and hence its improvement of the permeability of the soil by root growth, and encouragement of infiltration by forming a dense cover, together leading to increased leaching, may be the most important factor in its reported ability to act as a desalinator.

Diplachne fusca can be a noxious weed of irrigation channels and ricefields.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Too little is known of variation patterns for many suggestions to be made, but there must be scope for selection of particularly salt and soda-tolerant strains, for tufted or highly rhizomatous strains, and possibly for cold-tolerance.

8 AGRONOMY

Seeding is possible but the seed is very small and difficult to handle. Rooted slips give the best establishment but stem cuttings may also be used.

9 RELATED SPECIES

Diplachne gigantea Launert, from Zambia and southern Tanzania, is larger and occurs in fresh water. It is rare. The genera Diplachne and Leptochloa are close, and in the future all the species may fall into the latter genus.

REFERENCES

Baumer 1975; Chippindall & Crook 1976; Clayton, Phillips & Renvoize 1974; Islam-ul-Haq & Khan 1971; Qureshi & Abdullah 1981; Sandhu et al 1981.

1 BOTANICAL

- 1.1 Accepted name Echinochloa colona (L.) Link
- 1.2 Synonyms Panicum equitans A. Rich.; Echinochloa equitans (A. Rich.) C. E. Hubb.; E. divaricata Andersson
- 1.3 Family Gramineae
- 1.4 Vernacular Names Katabaria (Hausa); Difra, Defera, Difera, El Difra el Barda, El Difra el Kubara (Arabic, Sudan); Belbetet (Somali); Amuriat (Turkana).

2 DESCRIPTION

Annual, forming small tufts. Culms 10-100 cm high, erect or bent at the base, and then upright. Leaf-blades 5-30 x 0.2-0.8 cm, soft and flat; ligule absent, hairless. Inflorescence paniculate, 1-15 cm long, made up of several spike-like racemes up to 3 cm long each made up of four rows of spikelets, usually appressed to the axis. Spikelets ovate to almost spherical, 1.5-3 mm long.

3 ECOLOGY

An annual, behaving as a weed in moister zones but an important pasture constituent in drier areas, but always in sites which are seasonally very wet or flooded usually on clay-rich soils. Some strains have salt-tolerance.

4 DISTRIBUTION

Egypt; Libya; Morocco; Mauritania; Senegal; Gambia; Mali; Guinea; Sierra Leone; Ivory Coast; Upper Volta; Ghana; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Rwanda; Burundi; Zaire; Mozambique; Zambia; Malawi; Zimbabwe; Botswana; Angola; Namibia; South Africa.

Widespread in the Old World tropics; introduced to the New World tropics.

5 USES

Much esteemed as a grazing grass where it occurs in arid and semi-arid areas; regarded as one of the best fodder species in Sudan, grazed by all species in the wet season and still sought-after during the dry season in spite of its rather tough straw. In Chad and Niger it is one of the species most sought-after by cattle during the rains. It is palatable throughout its life-cycle, having no awns or spines at any stage.

The seeds are collected as a famine food. Outside arid and semi-arid areas it is less esteemed and is often a weed, particularly of rice.

D.E.



Echinochloa colona - 1, habit; 2,3, portion of raceme; 4-6, spikelet; 7, lower glume; 8, upper glume; 9, lower lemma; 10, lower palea; 11, upper lemma; 12, upper palea; 13, flower; 14,15, grain; 16, ligule.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Not clear.

8 AGRONOMY

No information. It can be a serious weed of rice.

9 RELATED SPECIES

It intergrades with E. crus-galli (L.)P.Beauv., a species of the warm temperate zone which hardly reaches Africa; this is another weedy species. A cultivated annual species, E. frumentacea Link. (Japanese Barnyard Millet, Sanwa Millet) is also closely related and may have been derived from E. colona. It is used as a forage crop in the USA, and is grown for its grain in India, China and Japan, growing extremely quickly and producing a crop in as little as six weeks, yielding 700-800 kg of grain and 1000-1500 kg of straw per hectare.

E. haploclada (Stapf)Stapf is another species very similar to E. colona, but is perennial, with usually smaller spikelets which often bear a short awn. It occurs in east tropical Africa.

Analysed through the year in southern Sudan, this species showed protein contents in its early flush of up to 26.1%, falling to 4.4% at the end of the wet season.

The genus Echinochloa is a complex one and the species tend to intergrade and to show a wide range on variation within each. This may be related to an apomictic mode of reproduction and, in the larger perennial aquatic species, to extensive vegetative spread.

REFERENCES

Andrews 1957; Baumer 1975; Broun & Massey 1929; Clayton 1972; Clayton & Renvoize 1982; Gillet 1961; Mefit Babbie 1984; Peyre de Fabregues 1965; Pursglove 1972; Tothill 1948.

1 BOTANICAL

- 1.1 Accepted name Enneapogon desvauxii P.Beauv.
- 1.2 Synonyms Pappophorum brachystachyum Jaub. & Spach;
P.fasciculatum Chiov.; Enneapogon brachystachyus
(Jaub. & Spach)Stapf; P.wrightii S. Watson;
E.lophotrichus Chiov.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Enkonyoyo (Masai); Ag-dae-gras (Afrikaanus)
(means 8-day grass - an allusion to its rapid
growth).

2 DESCRIPTION

Tufted perennial. Culms 3-40 cm high, the bases often covered by the fibrous remains of old leaf sheaths. Leaf-blades 10 cm long and 2 mm broad but usually rolled. Inflorescence a broad spike, 2-8 cm long. Spikelets 3-flowered, with ovate glumes, the lower 2.5-5 mm long, bearing about 9 hairy awns each 2.5-5 mm long; upper lemmas smaller with reduced awns.

3 ECOLOGY

A plant of dry bushland and semi-desert, on rocky or sandy, often calcareous soils.

A perennial. Nothing is known of the seed biology.

4 DISTRIBUTION

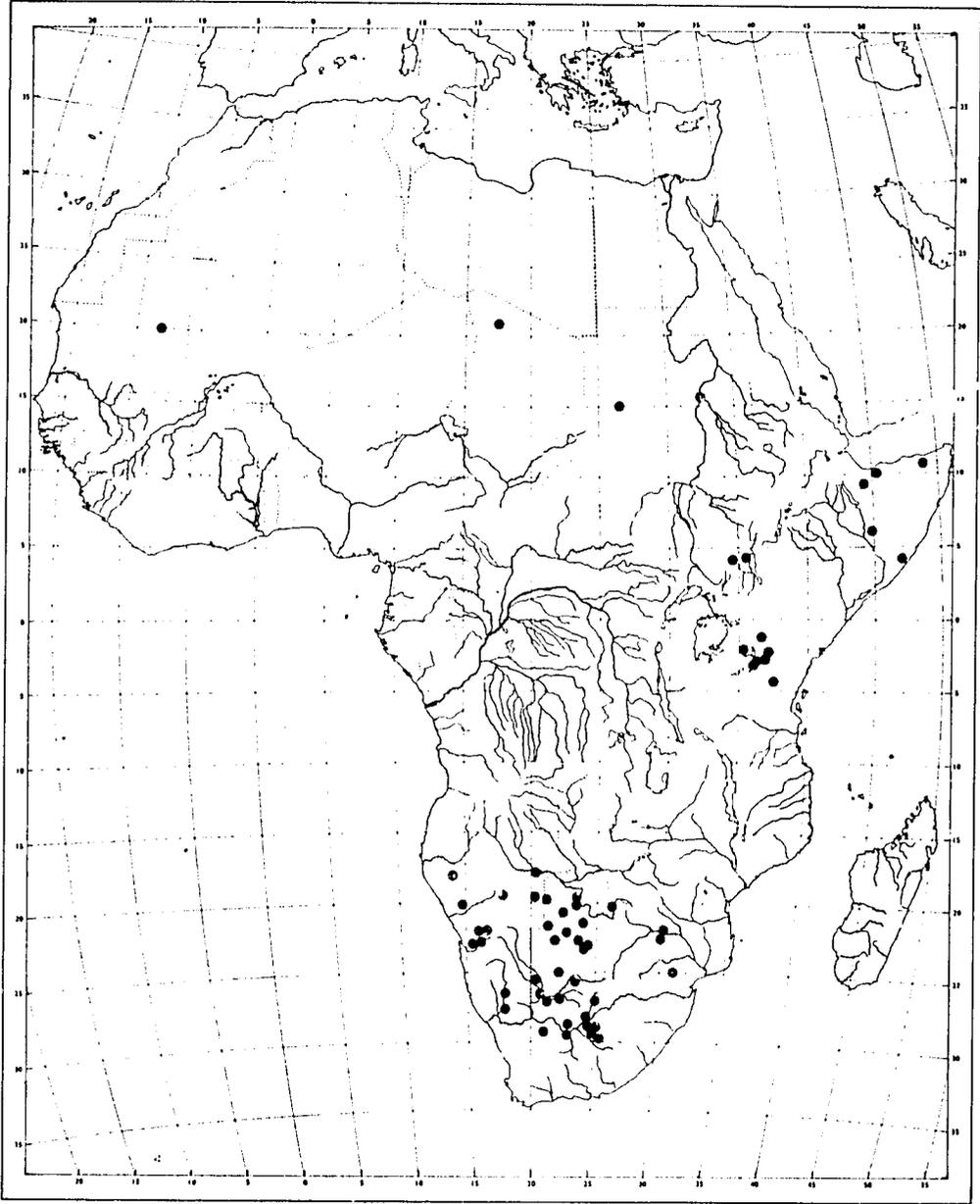
Egypt; Algeria; Mauritania; Niger; Chad; Sudan; Ethiopia; Somalia; Kenya; Tanzania; Zimbabwe; Angola; Botswana; Namibia; S. Africa. Throughout Africa; Arabia; India; China; also Central & South America.

5 USES

In South Africa, stated to be highly palatable with high nutritive value, greatly favoured by sheep, springbok and locusts. Stated to germinate rapidly, whence its common name. However, since this species is a perennial, it must be assumed either that it sprouts rapidly after rain, or that an annual species such as E.cenchroides (see below) was meant, but see the note under 8 below.

6 SEED COLLECTIONS

None known.



Scale in Miles SCALE Scale in Kilometers
1 : 30 000 000

7 POTENTIAL FOR IMPROVEMENT

No useful suggestions can be made.

8 AGRONOMY

A species that produces cleistogamous spikelets within the enlarged basal leaf sheaths. The caryopses of these are larger than those of normal spikelets and are not shed, finally germinating within the sheaths. One collector describes the species as a pseudoperennial, implying that growth each year results from the germination in situ of the basal cleistogamously-produced seeds.

9 RELATED SPECIES

E.cenchroides (Roemer & Schultes)C.E.Hubb. is an annual species occurring in East Africa from the Sudan to South Africa. E.schimperanus (A.Rich.)Renvoize (E.elegans (Steudel)Stapf) (Umm asabi; Masabigh - Arabic-Sudan) is a perennial ranging from Mali, Niger, Sudan and Uganda north to Egypt and eastwards through Arabia to India. It has been recorded as being good fodder in the Sudan.

REFERENCES

Andrews 1957; Broun & Massey 1929; Clayton 1972; Launert 1971; Leistner 1967.

1 BOTANICAL

- 1.1 Accepted name Enteropogon macrostachyus (A.Rich.) Benth.
- 1.2 Synonyms Chloris macrostachya A.Rich.; E.simplex (Schum.) A.Chev.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Aus Gorrof (Somalia); Kosim-etuko (Turkana).

2 DESCRIPTION

Perennial, forming dense tussocks. Culms up to 1 m high, erect. Leaf-blades narrow, 10-60 cm long, flat or rolled inwards, without hairs; ligule a small ridge bearing a fringe of hairs. Inflorescence a single spike (very occasionally two), 8-20 cm long. Spikelets 3-flowered, lanceolate; glumes lanceolate with a tiny terminal point, the lower 3-3.5 mm, the upper 5.5-7.5 mm long; lemma of lower floret with an awn 10-18 mm long. The middle floret usually produces a seed about half the length of that of the lowest floret. The upper floret is male only.

3 ECOLOGY

A species which is said to be common and sometimes dominant in the semi-desert grasslands of northern Kenya. It also occurs in wetter regions but in dry microsites - thus in western Uganda it occurs on steep eroding sandy slopes. It is said to need a minimum rainfall of 600 mm and to grow best on loose sands and loams, but certainly occurs in areas with less rainfall.

4 DISTRIBUTION

Ghana; Sudan; Somalia; Uganda; Kenya; Tanzania; Zaire; Mozambique; Zambia; Malawi; Zimbabwe; Angola; Botswana; Namibia; South Africa.

5 USES

The species is said to be an important constituent of the grazing in the dry sites where it occurs. It may be most useful when green, when it is said to be grazed by all stock in southern Sudan.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

There is insufficient information for useful suggestions to be made.



Enteropogon macrostachya - 1, habit; 2, ligule; 3, spikelet.

8 AGRONOMY

There are about 180 000 seeds per kg; 5.5 kg/ha of seeds is needed to give a seeding rate of 100 seeds/m². It is probable that the 'seeds' referred to are in fact spikelets. There are generally two seeds in each spikelet, both of which are capable of germination although the larger seed in the lower floret germinates more quickly than the smaller seed from the middle floret, and obviously has more reserves to withstand unfavourable conditions after germination.

9 RELATED SPECIES

There are six species in the genus, of these, E.barbatus C.E.Hubb. from Somalia, Ethiopia and Kenya, E.rupestris (J.A.Schmidt)A.Chev. which grows from Mauritania to Somalia and Kenya, and E.monostachyos (Vahl)Schumann, found in Tanzania, Mozambique and South Africa, with another subspecies in India, are all plants of fairly arid country. E.sechellensis (Baker)T.Durand & Schinz is a plant of the East African coast and the Indian Ocean Islands.

REFERENCES

Clayton 1972; Clayton, Phillips & Renvoize 1974; Edwards & Bogdan 1951; Lockers comm. 1984; Pratt & Gwynne 1977; Rose Innes 1977.

1 BOTANICAL

- 1.1 Accepted name Eragrostis curvula (Schrader) Nees
- 1.2 Synonyms Poa curvula Schrader; Eragrostis chloromelas Steudel; E. jeffreysii Hackel
- 1.3 Family Gramineae
- 1.4 Vernacular Names Weeping Love Grass (English); Bloussaad gras (Afrikaans).

2 DESCRIPTION

A densely tufted perennial grass. Culms 30-120 cm high, usually erect. Basal leaf sheaths hard, yellowish, with prominent ridges formed by the nerves. Leaf-blades narrow, up to 30 x 0.3 cm, usually rolled. Inflorescence a panicle, usually open but sometimes almost spike-like, 6-30 cm long, with hairs in the axils of the lowest branches. Spikelets 4-13-flowered, parallel-sided, 4-10 x 1-1.5 mm, grey-green; lower glume 1-1.8 mm long, upper glume slightly broader, 1.5-2.2 mm long. The spikelets break up from the base upwards; each floret falls leaving the palea attached to the spikelet axis (rhacilla) which is brittle and tends to break up soon after the spikelets fall.

3 ECOLOGY

A species of the drier grassland areas of southern Africa, usually in sites which have been more-or-less disturbed by overgrazing, trampling or cultivation. It occurs over a rainfall range of 360-800 mm. It becomes dominant (with other Eragrostis spp.) on abandoned fields after c. 3 years, and then persists for about 5 years before being replaced by Hyparrhenia hirta. It cannot withstand waterlogging.

4 DISTRIBUTION

Mozambique; Zambia; Zimbabwe; Angola; Botswana; Namibia; South Africa.

Introduced to Kenya and Tanzania, and also to the USA and Australia.

5 USES

A useful grazing grass, although it tends to have a high fibre content. The protein content is fairly high, but because of the rapidly increasing fibre content it is usually grazed only early in the growing season. The species has been extensively used in the USA and seed is commercially available both there and in South Africa.

Analyses

Source	CP	EE	CF	NFE	Ash
Spring/early summer	11.62- 15.49	2.08- 3.13	28.70- 30.43	39.64- 44.94	3.38- 4.55
Late summer, recovery growth after grazing or cutting	9.18- 14.65	2.72- 4.41	28-24- 36.70	40.07- 50.03	4.55- 7.81
Mature green leaves - autumn/ winter	7.36	3.75	31.52	52.16	5.17
Mature dry leaves - dry winter pasture	7.50- 8.88	1.79- 2.28	33.11- 36.30	48.61- 49.98	4.17- 7.12
	Ca total range - 0.20-0.42				
	P total range - 0.04-0.10				

6 SEED COLLECTIONS

16 samples in South Africa (Division of Plant and Seed Control). A wide range of strains has been tested in the USA and South Africa.

7 POTENTIAL FOR IMPROVEMENT

A recent paper (Kruger & Smit 1978) reports trials using 40 strains although most of these were in use only on an experimental scale. One cultivar (Ermelo) appears to be the most widespread and most used, and was not significantly outyielded by any others in the trial mentioned above. There seems still to be scope for the production of strains with a lower fibre content. Unfortunately Ermelo has been shown to be the least palatable strain tested in the Curvula group; the Curvula group was the least palatable of the groups in the species. There is still therefore a need for a strain that combines the high yield of 'Ermelo' with high palatability. The strain 'Catalina' is valued for its drought resistance. The species is extremely variable and has at times been divided into a large number of forms and even species. All seem to intergrade completely. The cytology of the group is complex, with chromosome numbers of $2n = 20, 40, 42, 50, 60,$ and 63 being recorded. Most seed is set apomictically.

8 AGRONOMY

The species is easily established from seed. There are 3-5 000 000 seeds per kilogram. Trials in South Africa led to a minimum seeding rate of 1 kg seed/ha being recommended, with 2 kg/ha giving better results. In normal seasons, there was no difference in the yields from plots sown at different row spacings and broadcast, but in dry seasons the widest row spacing (91 cm) gave the higher yields, followed by broadcast seed. A well-prepared fine seed-bed gives best establishment, as does a long-acting phosphatic fertilizer.

Seed is said to be easily collected and cleaned by combine. Temporary pastures established using this species can easily be ploughed out because of the tussock growth form.

The species may be cut young and dried as hay or ensiled; both products are readily eaten by stock. Material ensiled with a dilute molasses solution gave a palatable silage with 5.9% crude protein.

Heavy nitrogen fertilisation, with or without additional phosphorus, leads to E.curvula becoming dominant in natural Hyparrhenia veld. Yields of all strains of Eragrostis curvula are greatly increased by fertilisation with N & P; this has little effect on the N & P content of the vegetation, but since the yield of herbage is higher, the yield of N & P to the grazing animal is increased.

9 RELATED SPECIES

Eragrostis cilianensis (All.)Lut. ex Hubb. is an annual, widespread in the Old World Tropics and introduced to the New. It is a weed of cultivation but also has some grazing value, partly because of its rapid growth.

REFERENCES

Bogdan 1977; Chippindall 1955; Crider 1945; Clayton, Phillips & Renvoize 1974; Kruger & Smit 1978; Leigh 1967; Rethman 1973; Voight et al 1970

1 BOTANICAL

1.1 Accepted name Eragrostis lehmanniana Nees

1.2 Synonyms -

1.3 Family Gramineae

1.4 Vernacular Names -

2 DESCRIPTION

A perennial, forming tufts. Culms 30-60 cm high, branched, erect or semi-prostrate and rooting at the lower nodes. Leaf sheaths without hairs between the nerves. Leaf blades very narrow, up to 20 x 0.3 cm, finely and stiffly pointed. Inflorescence an open panicle 6-20 cm long, branches rather stiff. Spikelets 4-13-flowered, 4-8 x 1-1.5 mm; glumes nearly equal, shorter than the lowest florets. Seeds elongate, about 0.6 mm long. The spikelets break up in the same way as those of E.tremula.

3 ECOLOGY

A plant of dry grasslands, wooded grasslands and bushlands in the Zambebian and Karoo-Namib regions, often on disturbed ground, in southern Africa. It occurs in drier regions than Eragrostis curvula, under rainfalls of 200-500 mm.

4 DISTRIBUTION

Mozambique; Zambia; Zimbabwe; Botswana; Namibia; South Africa
Introduced to Kenya and Tanzania and also to the USA.

5 USES

In South Africa, regarded as being not particularly palatable, but important where it occurs because of its abundance. In Botswana it is regarded as moderately palatable. Although it dies back during the most unfavourable seasons, it remains alive at the base.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

It has been introduced into the USA as a species suitable for the reclamation of degraded land in semi-arid areas, and some selection has been carried out.

8 AGRONOMY

No information

9 RELATED SPECIES

See under other species of Eragrostis.

REFERENCES

Blair Rains & Yalala 1972; Chippindall 1955; Clayton, Phillips & Renvoize 1974.

1 BOTANICAL

- 1.1 Accepted name Eragrostis superba Peyr.
- 1.2 Synonyms Uniola jardinii Steudel; Eragrostis elata Ficalho & Hiern; E.platystachys Franchet
- 1.3 Family Gramineae
- 1.4 Vernacular Names -

2 DESCRIPTION

A perennial, forming tufts. Culms erect, 20-120 cm high. Leaf-blades up to 40 x 1 cm, with a whitish bloom. Inflorescence a broad panicle, much-branched, up to 30cm long. Spikelets broad and much flattened, 6-30-flowered, usually 6-16 x 3-10 mm, falling whole with the glumes when mature. Glumes nearly equal, 2-4 mm long; lemmas 3-4.5 mm long, strongly keeled. Seed ellipsoid 1-1.5 mm long.

3 ECOLOGY

A species which generally occurs in wetter areas than those covered by this work, but which extends well into the semi-arid zone in East Africa. It prefers well-drained sites and is not found in seasonally flooded or waterlogged sites. Soils include loams and sands, and may be rocky. It is often found in disturbed sites. For reseeding, a minimum rainfall of 550 mm is suggested.

4 DISTRIBUTION

Sudan; Ethiopia; Uganda; Kenya; Tanzania; Zaire; Gabon; Mozambique; Zambia; Malawi; Zimbabwe; Angola; Namibia; Botswana; South Africa.

Introduced to India and Australia

5 USES

Regraded as a moderately useful grazing grass in Kenya, although it has hard stems. It seeds abundantly and regenerates well, and may thus be of value.

Analysis: Leaves and stems, pre-flowering, Tanzania. CP 11.3 EE 1.9 CF 32.3 NFE 47.9 Ash 6.6 SFA n.d. Ca 0.51 P n.d.

6 SEED COLLECTIONS

102 samples in Kenya (National Agricultural Research Centre)

7 POTENTIAL FOR IMPROVEMENT

There may be some scope for the selection of the most drought-resistant forms; also or more leafy forms. Hybridisation with some of the many other species of Eragrostis could also be considered, although little appears to be known of genetic relationships within the genus.

8 AGRONOMY

A species which can easily be established from seed, and which seeds freely, producing relatively large seeds. There are about 100 000 seeds per kilogram, so that a seeding rate of 10 kg/ha is needed to give 100 seeds per m². However, since the seeds are large and establish well, it is possible that lower seeding rates would be effective.

9 RELATED SPECIES

As mentioned above, there are a large number of Eragrostis species and little is known of their genetic relationships. The only other species in which the spikelets fall entire, with the glumes, is E.abrumpens Kabuye, which occurs in Ethiopia, Kenya and Somalia. However, it is not clear whether similarity in the mode of spikelet shedding reflects genetic similarity. E.abrumpens is an annual species.

REFERENCES

Clayton, Phillips & Renvoize 1974; Edwards & Bogdan 1951; Pratt & Gwynne 1977; Greeramulu & Chande 1983.

1 BOTANICAL

- 1.1 Accepted name Eragrostis tremula Steudel
- 1.2 Synonyms Poa tremula Lam.; Eragrostis lamarkii Steudel;
Eragrostis serpula Chiov.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Sarahol (Peul); Bibirua (Hausa); Binnum, Bano (Arabic-Sudan).

2 DESCRIPTION

An annual, forming loose tufts. Culms 30-100 cm high, usually more-or-less erect. Leaf-blades flat, up to 20 x 0.5 cm. Inflorescence an open panicle up to 30 cm long, with the spikelets carried on very fine stalks so that they shake and tremble easily. Spikelets 10-60-flowered, parallel-sided, 5-25 mm long, usually tinged pink or purple; glumes unequal, the upper 0.8-1.2 mm long; the lower broader, 1.2-1.5 mm long. The spikelets break up from the base upwards; each floret falls leaving the palea attached to the spikelet axis (the rhachilla) which itself remains unbroken. Seeds almost spherical, 0.4-0.6 mm long.

3 ECOLOGY

A species of disturbed ground and waste places, often on a sandy ground. In the southern Sudan it is often in flower on sandy ground during the dry season when other species are dormant. It occurs in areas with annual rainfall of 200-950 mm, most with a long dry season.

It is often associated with Aristida mutabilis.

4 DISTRIBUTION

Mauritania; Senegal; Gambia; Mali; Guinea-Bissau; Guinea; Sierra Leone; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Central African Republic; Sudan; Ethiopia; Uganda; Kenya; Tanzania; Zaire; Rwanda; Burundi; Congo; Mozambique; Zambia; Malawi; Zimbabwe; Angola.

Also in India and Pakistan.

5 USES

Opinions of its forage value vary; in Sudan it is described as 'moderate forage for camels and also as 'excellent forage, very fine, both green and dry'. In Niger it is said to be liked by stock. It can be made into hay and silage.

Analyses

Source	CP	CF	EE	NFE	Ash	Ca	P
Flowering stage	6.9	1.7	34.5	52.3	4.7	0.26	0.19
Fruiting stage	3.77- 6.89	1.7	34.5- 36.9	52.3	4.7- 10.0	0.26- 0.58	0.16- 0.19
Straw (dry season)	0.96- 3.9	1.4	38.6- 43.3	50.8	5.8- 6.9	0.25- 0.34	0.05- 0.17

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Could be considerable. The plant has a very wide range which must include substantial genetic variability. Clearly progeny trials under standard conditions are needed. Selection for leafy strains and for types which are drought-tolerant should be the first priority.

8 AGRONOMY

The seeds are hard and germination is improved by scarification. Germination begins some days after the first rains and is complete after several weeks. The vegetative phase lasts 19-35 days and there is little vegetative growth after flowering starts.

9 RELATED SPECIES

The comments under E.superba apply here. It is not clear which of a very large number of species are most closely related genetically.

REFERENCES

Andrews 1957; Baumer 1975; Clayton 1972; Clayton, Phillips & Renvoize 1974; Naegele 1977; Penning de Vries & Djiteye 1983; Peyre de Fabregues 1965; Tothill 1948

1 BOTANICAL

- 1.1 Accepted name Lasiurus scindicus Henr.
- 1.2 Synonyms Lasiurus hirsutus (Pursh) Boiss.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Guerfis (Tamachek); El Ghurus (Arabic, Sudan);
Dunghara, Darif (Somali)

2 DESCRIPTION

A perennial, forming tufts. Culms sometimes branched at the base, arising from a tough rhizome, to 100 cm. Young basal buds are covered with neatly alternating overlapping hairy sheaths. Leaf-blades up to 25 x 0.5 cm. Ligule a fringe of hairs. Inflorescences spike-like, to 12 x 0.6 cm, densely covered with silky hairs. Spikelets paired, one stalked and one stalkless. The stalkless spikelets are c 8 mm long.

3 ECOLOGY

A species occurring in the dry regions of northern Africa, mainly in Units 70 (Desert dunes with perennial vegetation), and 71 (Regs, hamadas and wadis). It is usually found on sandy or gravelly substrates, often with Panicum turgidum. It is very drought-resistant, growing in sites with 50-250 mm of rain per annum.

4 DISTRIBUTION

Egypt; Libya; Algeria; Morocco; Western Sahara; Mauritania; Mali; Niger; Chad; Sudan; Ethiopia; Djibouti; Somalia [Map 18 Lebrun II].

Also in Arabia, Pakistan & India.

5 USES

This is one of the most valuable grazing grasses of the arid regions of North Africa, extending into drier regions than almost any other perennial grass. It is eaten by all species and also has some sand-binding properties.

Analysis: CP 5.9-15.0 EE 0.3-3.08 CF 24.17-42.2 NFE 40.24-52.85
Ash 2.65-15.33 Ca 0.52-1.11 P 0.06-1.20

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Leafy yet still drought-resistant strains would be desirable, but there is really too little information to allow useful suggestions. A number of varieties have been tested together in India.

8 AGRONOMY

Recommended sowing rates are 2.2-6.75 kg/ha; broadcasting onto well-prepared seedbeds gave the best establishment. Rooted cuttings can also be used.

9 RELATED SPECIES

L.scindicus is the only species in the genus. The name Lasiurus hirsutus can no longer be used for nomenclatural reasons.

REFERENCES

Andrews 1956; Chakravarty & Kachar 1970; Chakravarty & Verma 1966; Kernick 1978; Lebrun 1979; Naegele 1977.

1 BOTANICAL

- 1.1 Accepted name Panicum laetum Kunth
- 1.2 Synonyms P.albidulum Steudel; P.sociale Stapf
- 1.3 Family Gramineae
- 1.4 Vernacular Names Pagiri, Paggiri (Peul); Hallun, isiben (Tamachek); Baya, Guirji (Hausa)

2 DESCRIPTION

A small annual, with erect or ascending culms 17-70 cm high. Leaf-blades 4-24 x 0.5-1.0 cm, without hairs, gradually tapering to a point. Inflorescence an open panicle, 7-20 cm long, much-branched, the branches spreading away from the main axis at nearly 90° at maturity. Spikelets ovate, 2.5-3 mm long, hairless; lower glume half as long as the spikelet.

3 ECOLOGY

An annual grass forming extensive almost pure stands in areas which are seasonally flooded on black clay soil. This habitat is reported from Tanzania, Chad and Sudan.

4 DISTRIBUTION

Mauritania; Senegal; Gambia; Mali; Ivory Coast; Upper Volta; Ghana; Nigeria; Cameroon; Chad; Sudan; Tanzania.

5 USES

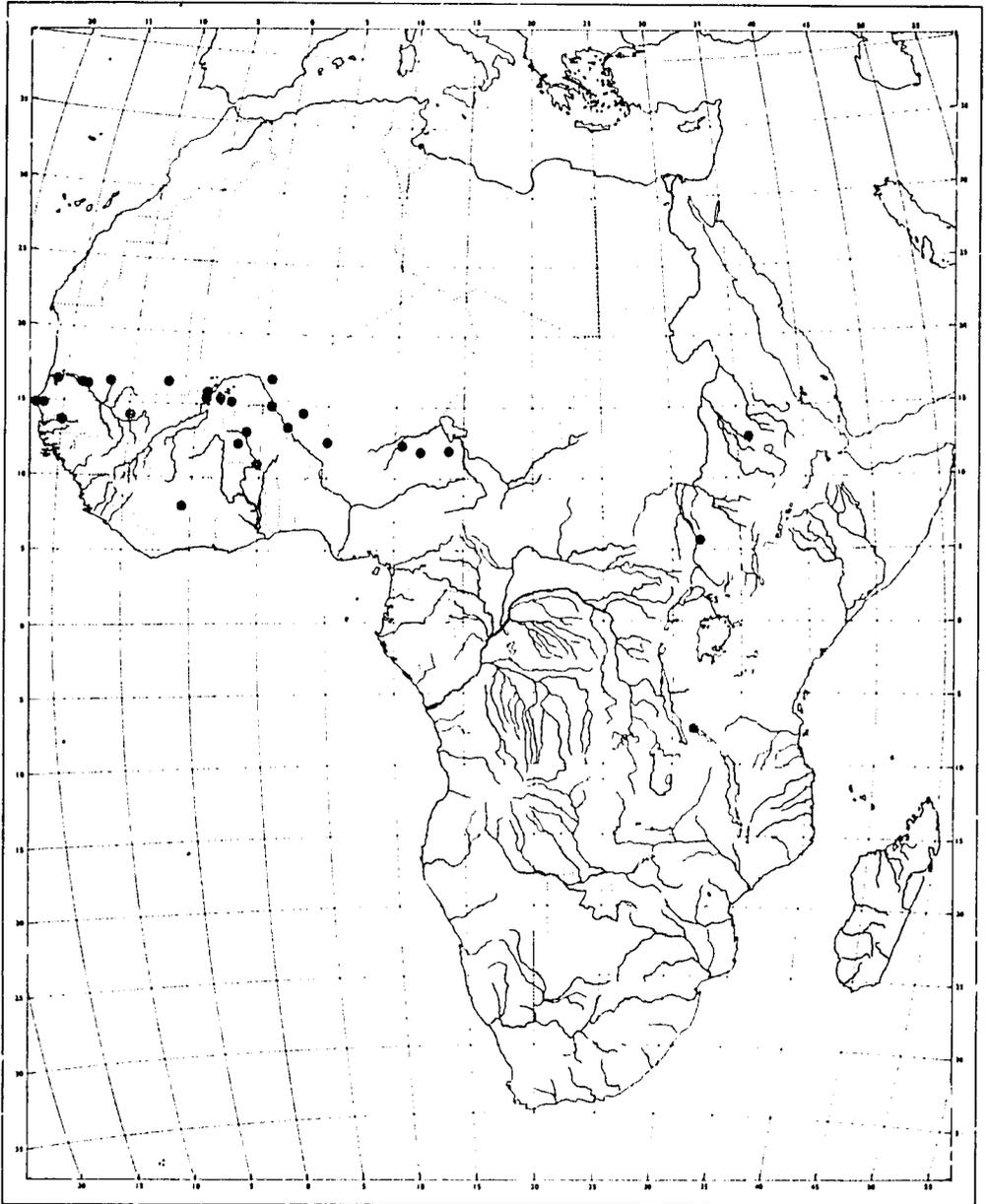
This is a useful grazing grass where it occurs, as it often forms extensive stands and occurs on black clay soils where it may be more-or-less inaccessible during the wet season so that it provides a late wet and early dry season forage.

The seeds are collected as human food in many parts of West Africa, to the extent that it is sometimes sold in markets. Its occurrence in extensive stands makes collection easy; it suffices to sweep a small bowl or calabash through the grass to collect the ripe grains.

For analyses, see Naegele (1977)

6 SEED COLLECTIONS

None known



SCALE
1:30,000,000
Statute Miles Kilometers

7 POTENTIAL FOR IMPROVEMENT

This probably lies in two directions - forage and human food. For forage, leafy strains producing rather more vegetative growth and rather less inflorescence would be desirable. For human consumption, a larger grain size would be desirable. Little appears to be known of variation in these characters.

8 AGRONOMY

There are 600 000-700 000 seeds per kilogram. The seeds germinate better after scarification. The vegetative phase lasts 21-29 days, and there is little production after flowering.

9 RELATED SPECIES

The genus Panicum is a very large one and includes many annual species. P.atrosanguineum A.Rich., from East Africa, is very similar but has smaller spikelets. P.arcurameum Stapf and P.novemnerve Stapf, from southern tropical Africa, are also very similar but have very short lower paleas. It is not known to what extent morphological similarity reflects genetic similarity in this genus.

Setaria is a related genus most of whose members occur in moister areas. However, S.verticillata (L.)P.Beauv. is a weedy species which extends into arid areas where it may have considerable forage value at times. The bristles below the spikelets are covered with barbs which attach the inflorescence to hair and clothing but the plant is grazed avidly in spite of these. It is eaten both green and dry, and the seeds are collected as a famine food.

REFERENCES

Baumer 1975; Clayton & Renvoize 1982; Dalziel 1937; Gillet 1961; Leistner 1967; Mefit Babbie 1984; Naegele 1977; Penning de Vries & Djiteye 1983.

1 BOTANICAL

- 1.1 Accepted name Panicum turgidum Forsskal
- 1.2 Synonyms -
- 1.3 Family Gramineae
- 1.4 Vernacular Names Afozo (Tamachek); Markouba (Hausa); Tumäm, Tomam, Abu Rukba, (Arabic, Sudan); Dungara (Somali).

2 DESCRIPTION

A clump-forming perennial. Culms stiff and woody, up to 150 cm, often with clusters of branches at the nodes and with very unequal internodes. Leaf-blades up to 20 x 0.7 mm, very variable in size, hairless, bluish-green, very firm; ligule a membranous rim fringed with hairs. Inflorescence a panicle, very variable in size. Spikelets ovoid, about 4 mm long.

3 ECOLOGY

A species of sandy areas in semi-arid or arid climates with rainfalls of 30-250 mm, mainly in Units 54a & b (northern Sahel and Somalia-Masai semi-desert grassland and shrubland), 68b (Red Sea coastal desert) and 71 (Desert vegetation of wadis). In the last type it forms a community with Acacia tortilis. It colonises wind-blown sand-dunes, often while they are still unstable, and can grow on steep slopes. It forms loose tussocks to 1 m in diameter. The root system is extensive, reaching a depth of at least 1.2 m and extending 3.4 m horizontally in plants excavated in Somalia.

4 DISTRIBUTION

Egypt; Libya; Tunisia; Algeria; Morocco; Western Sahara; Mauritania; Senegal; Mali; Niger; Chad; Sudan; Ethiopia; Djibouti; Somalia.

5 USES

Its main use is as a sand-binder. The stems fall over and root at the nodes. It provides some grazing for camels and goats, and for most species when young, but in Niger its value as food for cattle was reckoned to be almost nil. Its ability to grow in virtual desert conditions as a perennial makes it a valuable plant in spite of its generally low palatability.

For analyses, see Naegele 1977.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

No useful information.

8 AGRONOMY

It can be propagated by seed, sown at or near the soil surface, and by rooted offsets. Both should be planted during the wettest time of the year.

9 RELATED SPECIES

Other perennial species of Panicum generally require a higher rainfall. However, some forms of Panicum coloratum L., particularly cultivars of var. makarikariense Goossens, are drought-resistant and can grow in regions with rainfall of 500 mm or less. In general they prefer black clay soils. P.coloratum has about 900 000-1 100 000 seeds per kilogram so that about 1 kg per hectare gives a seeding rate of 100 seeds per m². Much work has been done on selection and improvement of forms of P.coloratum.

REFERENCES

Andrews 1956, 1957; Bogdan 1977; Clayton & Renvoize 1982; Gillet 1941; Naegele 1977; Peyre de Fabregues 1965; Pratt & Gwynne 1977; Skerman 1970; Tothill 1948; Whiteman 1980; Williams & Farias 1972.

1 BOTANICAL

- 1.1 Accepted name Paspalidium desertorum (A.Rich.) Stapf
- 1.2 Synonyms Panicum arabicum Steudel
- 1.3 Family Gramineae
- 1.4 Vernacular Names mordeb, mordeib (Arabic-Sudan); Gurgurro, Gargaro (Somali)

2 DESCRIPTION

A perennial, forming loose tufts but also with trailing stems or stolons. Culms 10-60 cm high. Leaf-blades 3-25 x 0.1-0.8 cm, flat, or folded when dry, tapering to a long bristle-like point; ligule a low hair-fringed rim. Inflorescence racemose, up to 4-20 cm long, made up of several to many upright spikelike racemes each 0.5-3 cm long, appressed to the main axis. Spikelets ovate, 1.7-2.6 mm long; lower glume $\frac{1}{3}$ - $\frac{1}{2}$ the length of the spikelet, the upper glume longer.

3 ECOLOGY

A species of seasonally wet sites, often on black clays or in river beds, mainly in the Somalia-Masai region, usually in areas with an annual rainfall above 200 mm. Its trailing stems, rooting at the nodes, allow it to spread vegetatively. It is recorded from sites with some soil salinity and also from gypsum-containing soils.

4 DISTRIBUTION

Sudan; Ethiopia; Somalia; Kenya.
Also in Arabia.

5 USES

In northern Kenya it is said to be valuable and well-grazed in dry areas. In Sudan it is regarded as a good forage grass, most useful in its young stages. Its need for seasonally good moisture supply may somewhat limit its usefulness.

Analyses

Source	CP	CF	EE	NFE	Ash	SFA	Ca	P
Kenya; cultivated at Kitale. Whole pl at early fl. stage.	12.78	29.42	1.20	42.59	13.01	8.24	0.97	0.18

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

There is too little information for useful suggestions to be made.

8 AGRONOMY

There are about 1 200 000 seeds/kg so that a seedling rate of 1 kg/ha will give 100 seeds per m². It is best suited to loamy soils and alluvial sites, with a minimum rainfall of 400 mm, when reseeding, although in the wild it occurs in sites with less rain than this.

9 RELATED SPECIES

The genus is most abundant in Australia where there are 19 species. In East Africa, all but the present species are confined to wet sites, often in water. P.geminatum (Forsskal) Stapf is the most widespread.

REFERENCES

Baumer 1975; Clayton & Renvoize 1982; Dougal & Bogdan 1965; Gilliland 1951; Pratt & Gwynne 1977; Tothill 1948.

1 BOTANICAL

1.1 Accepted name Pennisetum violaceum (Lam.)Rich.

1.2 Synonyms

P.fallax (Figari & De Notaris)Stapf & Hubb.;
P.americanum (L.)Leeke subsp. monodii
(Maire)Brunken; P.mollissimum Hochst.;
P.ramosissimum Steudel; P.cognatum Steudel;
P.subeglume Trabut; P.molle Hitchc.; P.chudeaui
Maire; P.rogeri Stapf & C.E.Hubb.; P.barteri
Stapf & C.E.Hubb.; P.darfuricum Stapf & C.E.Hubb.

1.3 Family Gramineae

1.4 Vernacular Names Um Hareiba, Wiwi, Windi, El Balang (Arabic, Sudan)

2 DESCRIPTION

An annual, forming loose clumps. Culms 80-150 cm high, branched above, densely hairy on the upper parts. Leaf-blades up to 30 x 1.3 cm, tapering to a finely pointed tip, usually very hairy, as are the leaf-sheaths; ligule a short rim densely covered with hairs up to 3 mm long. Inflorescence spike-like 7-15 cm long, made up of a series of clusters of spikelets each surrounded by about 90 bristles; each spikelet about 8 mm long.

3 ECOLOGY

A widespread and variable weed, occurring in disturbed places such as roadsides and abandoned cultivation. In northern Sudan it is recorded as growing under trees on sandy soil, and not in the open.

4 DISTRIBUTION

Mauritania; Senegal; Mali; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia

5 USES

In the Sudan this is stated to be an excellent forage grass of arid regions, even when dry. It is a close relative of the cultivated bulrush millet (Pennisetum glaucum (L.)R.Br. [syn. P.americanum (L.)Leeke; P.typhoides (Burm.)Stapf & Hubb.]), and is sometimes considered to be only a subspecies of it.

6 SEED COLLECTIONS

None known, but may well exist among collections of P.glaucum.

7 POTENTIAL FOR IMPROVEMENT

Since it is likely that the species is interfertile with P.glaucum, an opportunity may well exist for the production of a 'forage' form of bulrush millet, which could either be fed standing, thus resting natural pastures at the end of the rains and allowing them to retain a better reserve of material for the dry season, or dried and fed as hay, if drying and storage problems can be overcome, or ensiled. Work in the southern Sudan has shown that good silage, palatable to cattle, can be prepared from native grasses in simple earth pits.

8 AGRONOMY

It may be expected to have similar demands to the cultivated millets. There is great variation in time to maturity, which could be exploited.

9 RELATED SPECIES

As mentioned above, the plant is closely related to the cultivated bulrush millet and to another weedy species, P.sieberianum (Schlect.) Stapf & Hubb., which is very similar to the cultivated species. The taxonomy of the group is complex and there is a great deal of variation.

REFERENCES

Andrews 1956; Baumer 1975; Clayton 1972; Clayton & Renvoize 1982; Purseglove 1972

1 BOTANICAL

- 1.1 Accepted name Schmidtia pappophoroides J.A.Schmidt
- 1.2 Synonyms S.bulbosa Stapf; Antoschmidtia bulbosa (Stapf)Peter; S.quingseta Benth. ex Ficalho; S.glabra Pilger
- 1.3 Family Gramineae
- 1.4 Vernacular Names El mileha, El mileiha, Mamleiha (Arabic, Sudan); Krulblaargras, Sandkweek (Afrikaans)

2 DESCRIPTION

Perennial, with a short creeping rhizome and often with long surface stolons. Culms 30-90 cm high, often sprouting from the nodes and becoming bushy and tough. Leaf-blades 5-16 x 0.2-0.7 cm, flat or inrolled, finely hairy on both surfaces. Inflorescence an open panicle, 6-12 x 2-4.5 cm. Spikelets 4-6-flowered, lower glume 4.6-7.5 mm long, upper glume 6-9 cm long; lowest lemma 8.5-14 mm long, 6-lobed to about one third of its length, with 5 awns each 4.5-8 mm long arising between the lobes.

3 ECOLOGY

A perennial occurring in stony or sandy places in dry country, mainly in the Zambezi and Karoo-Namib regions and the Kalahari-Highveld regional transition zone, but extending sparsely into the Somalia-Masai and Sahel regions. Annual rainfall is generally within the range 100-500 mm.

4 DISTRIBUTION

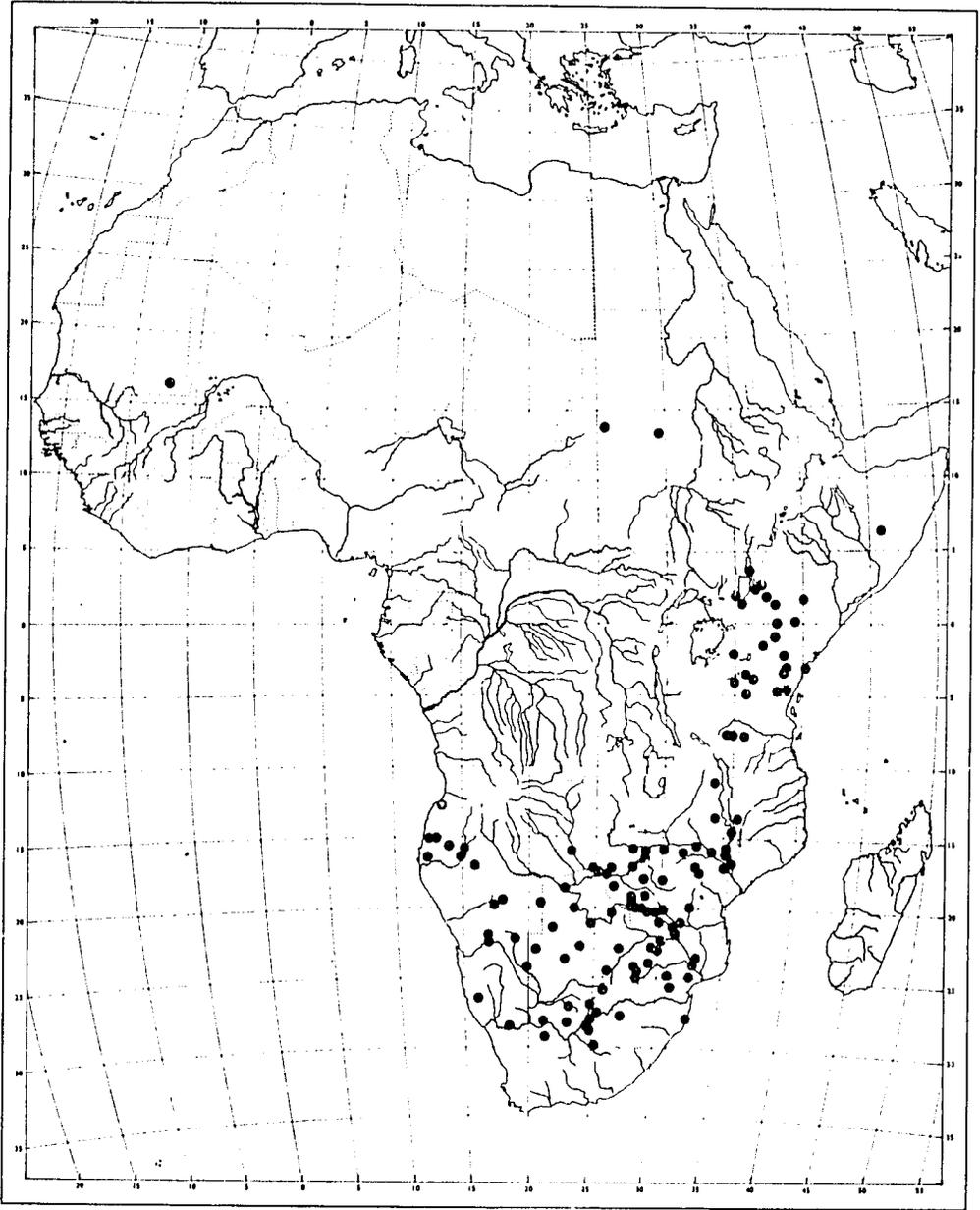
Senegal; Mauritania; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Mozambique; Zambia; Malawi; Zimbabwe; Botswana; Namibia; Angola; South Africa.

5 USES

In the Sudan it is stated to provide good fodder. In South Africa it is said to have a fairly high nutritional value, to sprout quickly after rain, and to be comparatively resistant to fire and grazing because of its slightly swollen underground basal internodes.

6 SEED COLLECTIONS

None known.



SCALE
1:30,000,000

7 POTENTIAL FOR IMPROVEMENT

An extremely variable species - it should be possible to select strains which are more aggressive spreaders, as well as those which form a miniature bush and spread slowly if at all.

8 AGRONOMY

No information

9 RELATED SPECIES

S.kalahariensis Stent (Umm Hemmedede - Arabic, Sudan; suurgras - Afrikaans) is a species of the arid regions of South Africa, Angola, Namibia, Botswana, Chad and Sudan. It is described as a pioneer species which sometimes forms dense pure stands resembling cornfields. The inflorescences are covered with glandular hairs which exude a watery, slightly sticky acid substance 'with a strong acid salt taste' which is said to blister the mouths of animals and damage leather. The plant is described in Sudan as having a strong offensive sweet smell of decay. The species is thus left ungrazed until it is completely dry (although it can also be grazed when very young, before flowering). It has a high nutritional value and can grow to 1 m tall; it has been suggested for hay-making.

REFERENCES

Broun & Massey 1928; Clayton 1970; Clayton 1972; Launert 1971; Leistner 1967.

1 BOTANICAL

- 1.1 Accepted name Schoenefeldia gracilis Kunth
- 1.2 Synonyms Schoenefeldia pallida Edgew.; Chloris myosuroides Hook.f.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Wutsiyan biri, Wutsiyan bera, Shinaka (Hausa); Umm Ferrodo, Umm Koreidu, Emferid, Danab el naga (Arabic, Sudan)

2 DESCRIPTION

Annual, forming small tufts. Culms more or less erect, to 90 cm high. Leaf-blade long and very narrow with a constriction about halfway up; ligule minute, membranous. Inflorescence of 1-5 more or less upright racemes up to 15 cm long arising from the tip of the culm; spikelets in a double row on one side of the axis; lower glume about 4 mm long, with a bristle at the tip, upper glume about 5 mm long, pointed; lemma with an awn 3-4 cm long, the awns of the spikelets becoming braided at maturity.

3 ECOLOGY

An annual grass of the Sahelian regional transition zone. In the wetter parts of its range it is a plant of disturbed ground and shallow soils. In the drier parts it can be a very important constituent of the vegetation of semi-arid regions with rainfall of 300-600 mm. In Niger it is reported to occur mainly on sandy clay soils at the foot of dunes. In the Sudan it is often the dominant grass on clay soils with Acacia mellifera. It can form extensive stands and may yield up to 2000 kg/ha or more.

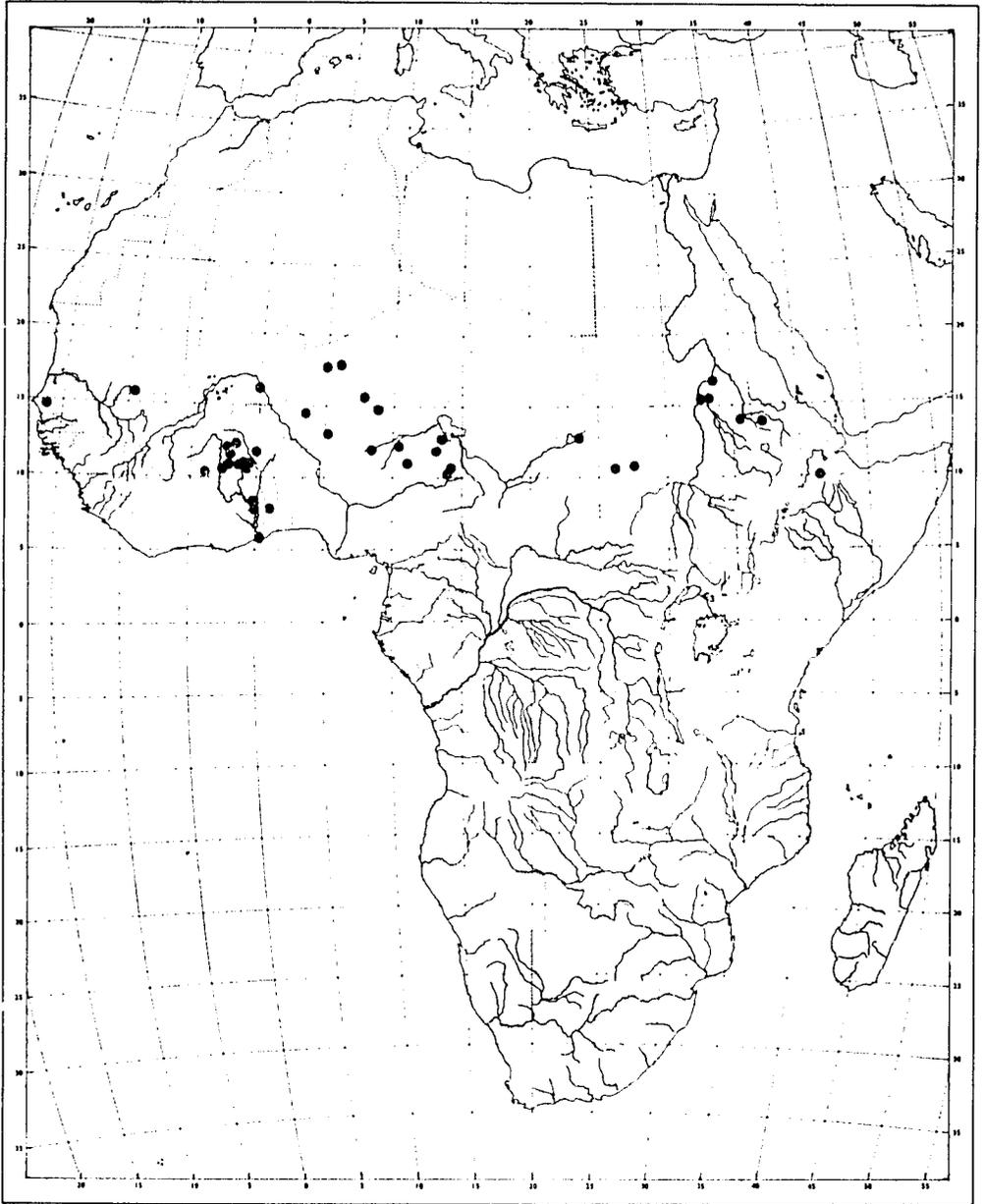
4 DISTRIBUTION

Egypt; Mauritania; Senegal; Mali; Upper Volta; Ghana; Togo; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia.

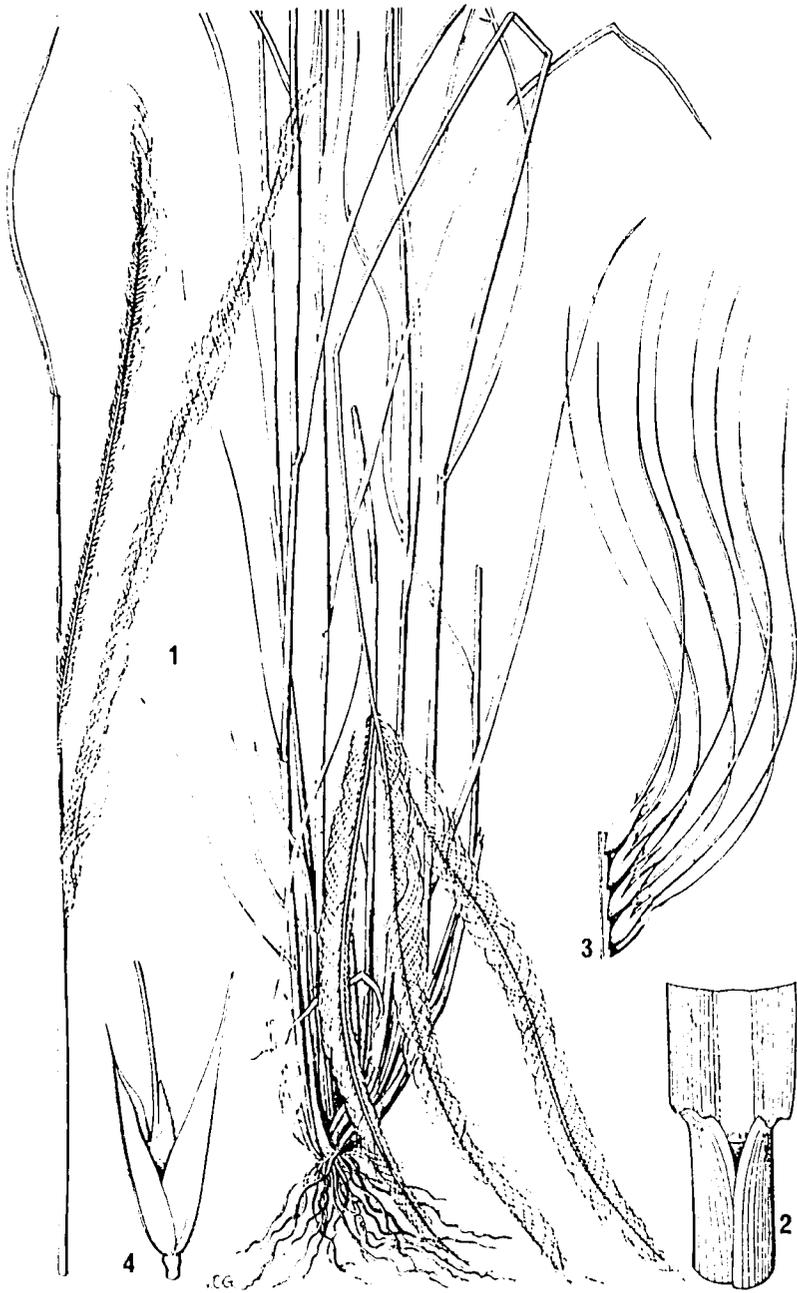
Also in Arabia and India.

5 USES

It is reported to be a useful grazing grass which retains some of its value when dry, forming a good standing hay, although there are conflicting reports of its value. In the Sudan it is not grazed during the rainy season because it grows on waterlogged clay soils.



SCALE
1:30 000 000



Schoenefeldia gracilis - 1, habit; 2, ligule; 3, florets.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Niger; 6/64 dry	1.91	0.51	43.50	44.89	9.19	n.d.	0.37	0.04
Niger; 8/64 fl.	4.19	1.27	40.85	44.99	8.70	n.d.	0.28	0.11
Niger; 9/64 fl.	4.33	1.53	37.90	48.88	7.36	n.d.	0.36	0.11
Niger; 11/64 dry	3.05	0.72	39.20	48.21	8.82	n.d.	0.34	0.08
Niger; 11/64 dry	1.55	0.95	42.45	47.07	7.98	n.d.	0.29	0.05

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Too little known for useful suggestions to be made, but protein content is generally low and any increase in this would be of value.

6 AGRONOMY

There about 10 000 000 seeds per kilogram. Germination occurs a few days after sufficient rain has fallen. The vegetative phase lasts 30-70 days, and there is little production after flowering.

9 RELATED SPECIES

The only other species in the genus is S.transiens (Pilger)Chiov. This is a perennial found in Sudan, Uganda, Kenya, Tanzania, Mozambique and Zimbabwe. It occurs in dry places but usually on heavy soils and in seasonally flooded sites. It is apparently cleisogamous - the spikelets do not open so that the anthers remain within the floret and self-pollination is the rule.

REFERENCES

Clayton 1972; Clayton, Phillips & Renvoize 1974; Naegele 1977; Penning de Vries & Djiteye 1983; Peyre de Fabregues 1965; Rose Innes 1977.

1 BOTANICAL

- 1.1 Accepted name Sporobolus helvolus (Trin.) T. Durand & Schinz
- 1.2 Synonyms S. glaucifolius (Steudel) T. Durand & Schinz;
S. podotrichus Chiov.; S. trichophorus Gand.;
S. flagelliferus Peter; S. senegalensis Chiov. var.
glaucifolius (Steudel) Chiov.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Manda-manda (Hausa); Lokh, Lukh, Lokhl Akrashl
Ankog (Arabic, Sudan); Domar, Aggagar, Dabro
(Somali); Amanakuri, Anyudae, Amuriat (Turkana)

2 DESCRIPTION

A perennial, forming tufts but also with long slender stolons. Culms 15-60 cm high. Leaf-blades flat, 2-15 x 0.2-0.4 cm; bluish. Inflorescence a panicle, long and narrow, 4-12 x 0.5-2 cm, with the primary branches 0.5-2 cm long, but sometimes almost spike-like. Spikelets 1.4-2 mm long, glumes both about as long as the spikelet but the lower sometimes a little shorter; lemma as long as the glumes. Seed 0.5 mm long.

3 ECOLOGY

A species of clay or other alluvial soils which are often flooded or waterlogged in the wet season. Its distribution is, however, largely within the semi-arid or arid zones of the Sahelian and Sudanian regions.

4 DISTRIBUTION

Mauritania; Senegal; Mali; Niger; Nigeria; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania.

Also in Arabia and India.

5 USES

Regarded as good fodder in the Sudan, but one report says that it is not eaten when dry. Another report, from south-eastern Sudan, states that it is highly regarded as dry season grazing. Also said to be willingly eaten in Chad by cattle.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Not enough is known of this species for useful suggestions to be made.

8 AGRONOMY

No information

9 RELATED SPECIES

There are a number of similar species most of which occur in saline or alkaline sites either inland or near the sea. S. virginicus (L.)Kunth and S.arenarius (Gouan)Duval-Jouve are both species of sandy sea-shores, the former in the tropics and sub-tropics and the latter around the Mediterranean. S.corsimilis Fresen. is a much larger (up to 3 m high) tussock forming species found round salt or alkaline lakes; it has been confused with S.robusta Kunth, which is smaller and occurs near the sea in West Africa.

REFERENCES

Andrews 1957; Baumer 1975; Broun & Massey 1929; Clayton 1972; Clayton, Phillips & Renvoize 1974.

1 BOTANICAL

- 1.1 Accepted name Sporobolus ioclados (Trin.) Nees
- 1.2 Synonyms Sporobolus marginatus A. Rich.; S. laetevirens Cosson; S. seineri Mez; S. smutsii Stent; S. gillii Stent; S. usitatus Stent; S. genalensis Chiov.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Dihi, Harfo, Timo hwelli, Timo nagodleh (Somali); Alet, Asurut (Turkana)

2 DESCRIPTION

A perennial, forming short dense tussocks or mats, and also spreading by stolons. Culms 15-60 cm high. Leaf-blades flat, 2-30 x 0.2-0.5 cm, rather hard and often somewhat bluish, usually hairy at the margins. Inflorescence an open panicle, more or less pyramidal, 3-20 cm long, with 4-8 whorls of main branches. Spikelets one-flowered, 1.5-2.2 mm long, 2-3 times longer than broad, lower glume 0.2-0.8 mm long, upper glume the same length as the spikelet. Seed 0.6-1 mm long, free from the pericarp as in the other species of the genus.

3 ECOLOGY

This species is usually found on compacted alluvial soils, usually fine-grained and often seasonally flooded, in semi-arid and arid regions. Minimum rainfall is said to be 300 mm. It is usually found on soils which are somewhat alkaline or saline but is not confined to such sites.

4 DISTRIBUTION

Tunisia; Mauritania; Mali; Niger; Cameroon; Chad; Sudan; Ethiopia, Somalia; Uganda; Kenya; Tanzania; Zaire; Burundi; Mozambique; Zambia; Malawi; Zimbabwe; Botswana; Namibia; South Africa

5 USES

In Somalia and Kenya this is said to be a good grazing grass, and because of its ability to form mats, it withstands trampling well. Its resistance to alkaline and saline conditions is also of potential value, and it can also, to a limited extent, trap blowing sand.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Strains which are particularly resistant to salinity and/or alkalinity, without losing their valuable mat-forming ability, would be of line of development, as would leafier and more productive strains, without loss of salinity/alkalinity resistance. However, rather little seems to be known of variation patterns within this species.

8 AGRONOMY

There are 7 700 000 seeds per kilogram, so that very low seeding rates of the order of 0.2 kg/ha are needed to give 100 seeds per m². In some species of Sporobolus the pericarp, which is not firmly attached to the seed coat as in other grasses, absorbs water, swells and becomes sticky, assisting seed dispersal and also, perhaps more importantly, sticking the seed to the rather hard surfaces where the species normally occurs and perhaps helping to improve seed hydration.

9 RELATED SPECIES

S.cordofanus (Steudel)Cosson is an annual species, very similar; S.rangei Pilger is a perennial, forming dense mats and clumps, which occurs in very saline/alkaline sites such as the margins of salt lakes. In western Uganda it is grazed in such places by game. It occurs in Uganda, Tanzania, Kenya, Zaire, Botswana and South Africa. S.kentrophyllus (Schumann)W.Clayton is another very similar species from eastern Africa which occurs mainly in saline soils near the sea but also inland.

REFERENCES

Clayton 1972; Clayton, Phillips & Renvoize 1974; Edwards & Bogdan 1951; Glover 1951; Lock 1970; Pratt & Gwynne 1977

1 BOTANICAL

- 1.1 Accepted name Stipagrostis uniplumis (Lichtenst.) De Winter
- 1.2 Synonyms Aristida uniplumis Lichtenst.; Aristida papposa Trin. & Rupr.; Stipa prolifera Steudel; Stipagrostis papposa (Trin. & Rupr.) De Winter
- 1.3 Family Gramineae
- 1.4 Vernacular Names Bayad (Arabic, Sudan); Bal, Balhorle (Somali); Ekopir (Turkana); Blinkhaargras (Afrikaans)

2 DESCRIPTION

Perennial, usually densely tufted. Culms to 75 cm high. Leaf-blades bristle-like, up to 15 cm long. Inflorescence a rather dense panicle. Spikelets 1-flowered; glumes very narrow, the lower 8 mm, the upper 9-10 mm long; lemma 2-3.5 mm long, with an awn column about 5 mm long, branching into three with a dense ring of hairs at the fork, the central branch 2-3.5 cm long, fluffy, the lateral up to 1.23 cm long, hairless.

3 ECOLOGY

A species of dry regions, often with an annual rainfall of less than 100 mm, often among bushes of Acacia and Commiphora in semi-desert grassland in the Sahelian regional transition zone and also in the Karoo-Namib region.

It is likely that the twisted column of the awn assists in burying the seed in the soil.

4 DISTRIBUTION

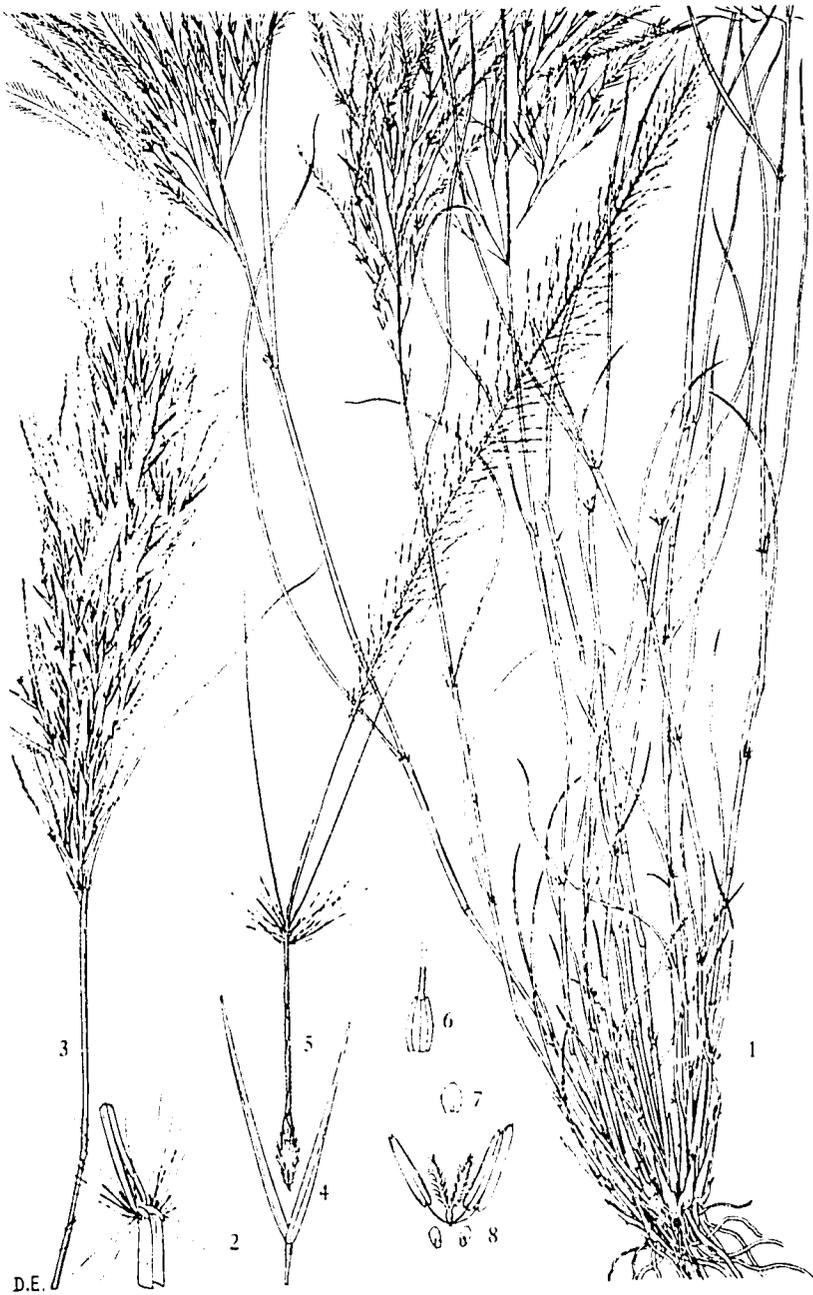
Mauritania; Senegal; Mali; Niger; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Mozambique; Zimbabwe; Angola; Botswana; Namibia; South Africa.

5 USES

It is reported to be of some importance as pasture in the regions of sparse herbage where it grows.

6 SEED COLLECTIONS

None known.



Stipagrostis uniplumis - 1, habit; 2, ligule; 3, inflorescence; 4, glumes; 5, floret; 6, lemma; 7, palea; 8, flower.

7 POTENTIAL FOR IMPROVEMENT

Insufficient information for useful suggestions to be made.

8 AGRONOMY

No information

9 RELATED SPECIES

S.ciliata (Desf.) de Winter (langbeenboesmangras - Afrikaans) and S.obtusa (Del.) Nees (kortbeenboesmangras - Afrikaans) are regarded as important fodder grasses in the arid regions of western South Africa. However, they have a low feeding value (digestible protein less than 2.5% and phosphorus less than 0.15%), and the young leaves are preferred as grazing. Both also occur in North Africa. S.amabilis (Schweick.) de Winter (duinriet, steekriet - Afrikaans) acts as a sand binder in the same region. The genus includes about 50 species of the arid or semi-arid regions of Africa, the Middle East and north-west India. S.hirtigluma (Steudel) de Winter is closely related to S.uniplumis and hybridises with it. S.pungens (Desf.) de Winter is widespread in the Saharan region and is of some importance to animals because of its abundance and because it is always more-or-less palatable.

REFERENCES

Clayton 1970; Clayton 1972; Edwards & Bogdan 1951; Launert 1971; Leistner 1967; Naegele 1977

1 BOTANICAL

- 1.1 Accepted name Tetrapogon villosus Desf.
- 1.2 Synonyms Chloris villosus (Desf.) Pers.
- 1.3 Family Gramineae
- 1.4 Vernacular Names Aya Mukarre (Somali - various spellings) - also applied to T.cenchriformis (see below)

2 DESCRIPTION

A perennial, forming dense tussocks. Culms erect to 40 cm, with conspicuous black nodes. Leaf-blades 2-6 cm long and very narrow (1-2 mm); sheaths flattened and markedly in two rows at the base, forming a fan-shaped mass; ligule membranous, fringed with hairs. Inflorescence of two spikes which often remain appressed to one another at maturity, 2-8 cm long. Spikelets 4-6-flowered, with 1-3 fertile lower florets; lower glume 2-3 mm long, pointed; the upper glume 3-4 mm long, blunter, with the nerve projecting beyond the tip. Grain of lowest floret 1.5 mm long.

3 ECOLOGY

A grass of semi-arid and arid areas with poor stony soils, mainly in the Sahelian regional transition zone but extending into the Somalia-Masai region. It is said to need a minimum of 350 mm of rain for easy establishment, but occurs in areas with less than this figure. It also occurs on loose sands.

4 DISTRIBUTION

Egypt; Tunisia; Algeria; Sudan; Ethiopia; Somalia; Uganda.

Also in Arabia and India.

5 USES

It is said to provide a good fodder in desert regions of the Sudan. Opinions vary, however, of its real value. 'Grazed by all stock'; 'highly valued as forage'; and 'indifferent forage' are all comments found on specimens from Somalia at Kew.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Not enough is known of this species for sensible suggestions to be made.

8 AGRONOMY

There are about 380 000 seeds per kg, so that about 2.7 kg/ha gives a seeding rate of 100 seeds/m².

9 RELATED SPECIES

T.cenchriformis (A.Rich.)W.Clayton (T.spathaceus (Steudel)T.Durand & Schinz) is an annual species, more widespread than T.villosus (Mauritania; Senegal; Mali; Niger; Sudan; Ethiopia; Somalia; Kenya; Uganda; Tanzania). Opinions of its grazing value differ. In the Sudan it has been described as a mediocre forage, growing in sand dune areas of the desert fringe; in Kenya it has been described as an important grazing grass in such areas. Its importance probably arises from its abundance and quick growth after rain in places which otherwise provide virtually no forage. Material analyses at the flowering stage in Kenya contained 12.6% CP, 1.67% EE, 34.6% CF, 42.47% NFE, 0.5% Ca and 0.21% P - by no means a poor fodder. T.tenellus (Roxb.)Chiov., another annual of similar or perhaps rather moister habitats gave a very similar analysis from the same site in Kenya.

REFERENCES

Broun & Massey 1928; Clayton 1972; Clayton, Phillips & Renvoize 1974; Dougall & Bogdan 1965; Edwards & Bogdan 1951; Pratt & Gwynne 1977; Tothill 1948.

1 BOTANICAL

1.1 Accepted name Trichoneura mollis (Kunth) Ekman

1.2 Synonyms Uralepis arenaria Steudel; U.ciliata Steudel; Triodia mollis (Kunth) T. Durand; Crossopteris arenaris (Steudel) Rendle; C.mollis (Kunth) Stapf; Trichoneura arenaria (Steudel) Ekman; Leptochloa longiglumis Hitchc.

1.3 Family Gramineae

1.4 Vernacular Names Garajun fadama, Tchirki n'zomo (Hausa)

2 DESCRIPTION

Annual, forming small tufts. Culms 12-50 cm high, erect. Leaf-blades flat, 3-11 cm x 3-5.5 mm, hairy to almost hairless; ligule membranous, truncate, 1-2 mm long. Inflorescence 5-25 cm long, made up of 10-40 ascending racemes each 1.5-5 cm long. Spikelets 5-9 flowered, 6.2-8 mm long; glumes narrow, the lower 4.6-7 mm long, the upper 5.5-7.2 mm long, both with a short bristle at the tip; lemmas 2.5-3.5 mm long, ending in two blunt teeth with a 0.6-2 mm long awn arising from between the teeth.

3 ECOLOGY

A small annual grass of semi-desert country.

4 DISTRIBUTION

Egypt; Mauritania; Senegal; Mali; Niger; Nigeria; Sudan; Somalia; Ethiopia; Kenya.

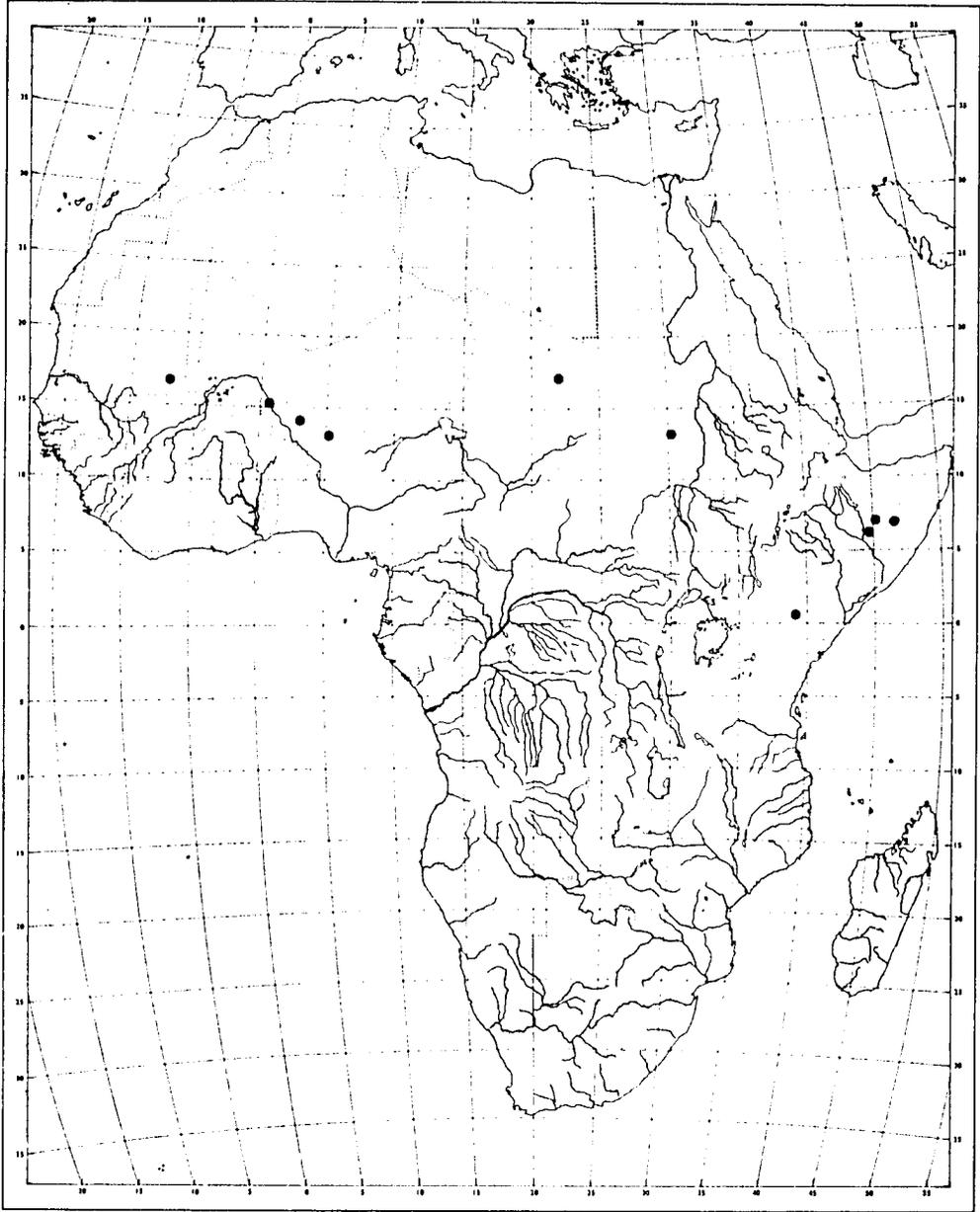
Also in Arabia.

5 USES

In Sudan, said to be sought after and eaten at all stages by all species, and to be preferred by cattle when green. However, it was rare in the area studied. In Niger it was found to be liked by cattle but not sought-after.

6 SEED COLLECTIONS

None known.



Scale Meter SCALE Kilometers
1:30,000,000

7 POTENTIAL FOR IMPROVEMENT

Insufficient information

8 AGRONOMY

No information

9 RELATED SPECIES

The other African species of the genus occur in moister environments.

REFERENCES

Baumer 1975; Clayton 1972; Clayton, Phillips & Renvoize 1974; Peyre de Fabregues 1965.

1 BOTANICAL

- 1.1 Accepted name Urochloa mosambicensis (Hackel) Dandy
- 1.2 Synonyms Panicum mosambicensis Hackel; Urochloa rhodesiensis Stent; Urochloa pullulans Stapf
- 1.3 Family Gramineae
- 1.4 Vernacular Names Sabi Grass (English)

2 DESCRIPTION

A perennial, forming tufts and also often with stolons. Culms 20-150 cm high, almost upright except at the base. Leaf-blades 2-30 x 0.3-2 cm; ligule a line of hairs. Inflorescence made up of 3-15 more or less horizontal spike-like racemes on a common axis 3-12 cm long; axis of the racemes slightly flattened. Spikelets 3-5 mm long, pointed; lower glume $\frac{2}{3}$ the length of the spikelet, with a tuft of hairs in the middle at the back, blunt, upper lemma rough.

3 ECOLOGY

A species of wooded grassland and bushland, sometimes on seasonally flooded sites, and also in disturbed places. Minimum rainfall requirement is said to be 400 mm.

4 DISTRIBUTION

Uganda; Kenya; Tanzania; Mozambique; Malawi; Zambia; Zimbabwe; Botswana; South Africa.

Also in Burma. Introduced to other tropical countries, including Ghana, as forage.

5 USES

A useful grazing grass for semi-arid areas. It has been introduced to Australia and improved varieties selected (e.g. cv. Nixon) which are suitable for semi-arid regions.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Not clear; some selection has already been carried out in Australia.

8 AGRONOMY

Not known.

9 RELATED SPECIES

The genus contains a number of both annual and perennial species some of which are very similar morphologically. U.oligotricha (Figari & De Notaris)Henrard, an annual of eastern Africa, is extremely similar to U.mosambicensis. U.trichopus Stapf (U.pullulans Stapf) (Difra - Arabic, Sudan) is an annual, of dry areas, reported to be eaten by all animals in Sudan.

REFERENCES

Clayton & Renvoize 1982; Whiteman 1980.

Herbaceous Legumes

Alysicarpus ovalifolius

Cassia mimosoides

Crotalaria arenaria

Cullen plicata

Indigofera disjuncta

Rhynchosia minima

Stylosanthes fruticosa

Tephrosia subtriflora

Tylosema esculentum

Vigna unguiculata

Zornia glochidiata

1 BOTANICAL

- 1.1 Accepted name Alysicarpus ovalifolius (Schum.) J. Léonard.
- 1.2 Synonyms: Hedysarum ovalifolium Schum. & Thonn.;
A. vaginalis (L.) DC. var. paniculatus Baker f.
- 1.3 Family Leguminosae-Papilionoideae
- 1.4 Vernacular Names Gádégui (Hausa)

2 DESCRIPTION

An annual herb with erect or spreading stems, 20-60 cm high. Stems often woody at the base, hairy or not. Leaves simple, elliptic to narrowly lanceolate, 1-10 x 0.6-3 cm, slightly cordate at the base; leaf-stalk 2-8 mm long; stipules persistent, 0.5-2 cm long; there is a pair of persistent stipels near the top of the leaf stalk. Inflorescences racemose, spike-like, 6-15 cm long, made up of flowers with long internodes between them. Flowers 4-6 mm long; standard usually orange or pinkish-purple; wings purplish; keel greenish. Pods 1.8-2.5 cm long, almost cylindrical, made up of 2-8 finely hairy lightly ridged segments which fall apart when ripe, each containing one seed.

3 ECOLOGY

An annual legume of the Sahelian grasslands and shrublands, often in rocky or sandy places, where it is frequently associated with Aristida mutabilis and Zornia glochidiata. It is widespread in woodlands and bushlands of the Sudanian, Zambezi and Somalia-Masai regions of Africa.

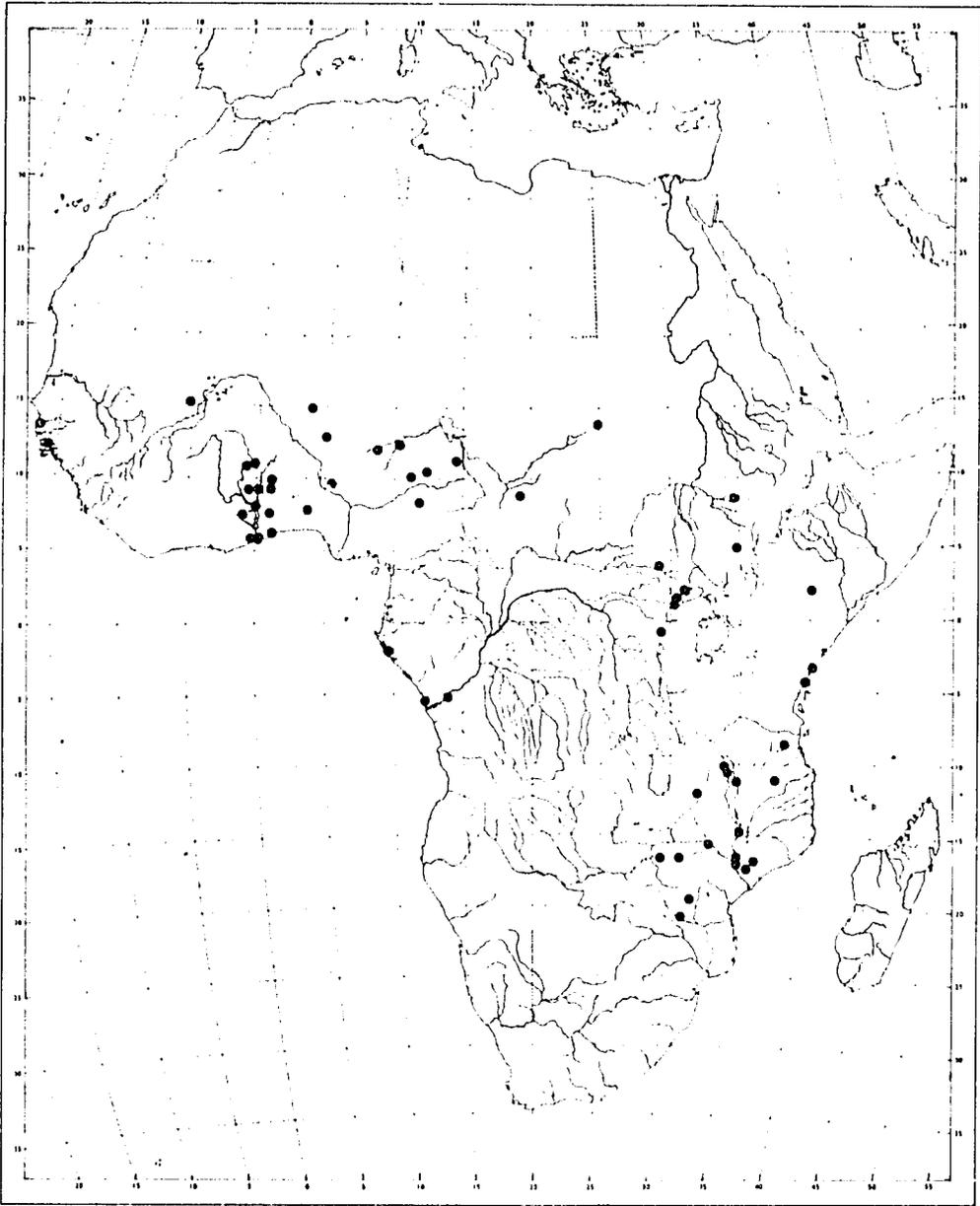
4 DISTRIBUTION

Senegal; Gambia; Mali; Guinea-Bissau; Sierra Leone; Ghana; Togo; Niger; Nigeria; Cameroon; Chad; Central African Republic; Sudan; Zaire; Gabon; Ethiopia; Kenya; Tanzania; Mozambique; Malawi; Zambia; Zimbabwe; Angola.

Also in Asia.

5 USES

A useful component of the grasslands during the late wet season when protein content tends to fall in the grasses and when many grasses are unpalatable because of their seed heads. It can be made into hay at the fruiting stage; silage has also been made successfully. There are reports that it can cause diarrhoea in horses if fed to excess when young and green, but in Ghana, Nigeria and Sudan it is regarded as particularly good fodder for horses.



Scale 1:50,000,000

SCALE

1:50,000,000

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Not known. Some of the West African localities, in Ghana and Togo, are coastal and plants from here could show salt-tolerance.

8 AGRONOMY

Propagation by seed is relatively simple. A collection from Zimbabwe is said to have been nodulated.

9 RELATED SPECIES

Alysicarpus monilifer (L.)DC. (Fraish; Fraisha; Um Migaigira (Arabic-Sudan)) occurs in the semi-arid regions of Sudan, on deep sands under 300-400 mm or rain. It is another annual, also much liked by animals, particularly horses, at all stages, to such an extent that it can be difficult to find. It seeds heavily. A.vaginalis (L.)DC. tends to replace A.ovalifolius in East Africa, although the ranges of the two species overlap. It tends to occur in rather moister places. Intermediates occur and hybridisation is suspected.

REFERENCES

Andrews 1953; Baumer 1975; Gillett, Polhill & Verdcourt 1971; Keay 1958; Penning de Vries & Djiteye 1983; Peyre de Fabregues 1965; Skerman 1970.

1 BOTANICAL

- 1.1 Accepted name Cassia mimosoides L.
- 1.2 Synonyms None in common use
- 1.3 Family Leguminosae-Caesalpinioideae
- 1.4 Vernacular Names Taku d'abdel, Gawarlil leydi (Peul); Bagaroua kassa, Bagarwa kasa (Hausa).

2 DESCRIPTION

An extremely variable annual or sometimes perennial erect or prostrate herb to about 1.5 m high, but generally very much less in semi-arid regions. Stems usually hairy. Leaves pinnate, without a terminal leaflet, 0.6-10 cm long. Leaf stalk with a conspicuous gland near the top. Leaflets without stalks, in 16-75 pairs, 2.5-8 x 0.5-1.3 mm, pointed at the tips, hairless on both surfaces but sometimes fringed with fine hairs. Stipules 0.5-1 cm long, tapering to a fine point from a broad base. Flowers single or up to three together in the leaf axils or just above them; flower-stalks 0.5-2.5 cm long; petals yellow, 4-13 x 2-9 mm. Pods parallel-sided, 3.5-8 x 0.3-0.5 cm.

The species is extremely variable and it has proved difficult to treat the variation in an orthodox taxonomic fashion. Seven groups have been distinguished in the area of Flora of Tropical East Africa, using flower-stalk length, plant habit, flower size and the form of the hairs on the flower-stalks and pods.

3 ECOLOGY

The species occupies a wide range of habitats from tall moist grasslands to sandy soils near the sea and semi-arid grasslands and bushlands. In the more arid areas annual forms are the rule; some of these are erect; other prostrate. The species can withstand some waterlogging (or, at least, some forms can). It is well nodulated.

4 DISTRIBUTION

Mauritania; Senegal; Gambia; Mali; Guinea-Bissau; Guinea; Sierra Leone; Liberia; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Central African Republic; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Rwanda; Burundi; Zaire; Mozambique; Malawi; Zambia; Zimbabwe, Botswana; Namibia; South Africa.

It is probably reasonable to assume that it occurs in all sub-Saharan Africa. Also in India.

5 USES

In the Sudan it is reported to be much sought-after by sheep and cattle when green, but to be left by other animals. In Chad it is said to be largely ignored.

Analysis - green shoots - Niger

CP 15.34 CF 23.15 EE 3.01 NFE 54.58 Ash 3.92 Ca 0.56 P 0.14

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

The range of variation in the species is so vast that there must be considerable possibilities for the selection of fast-growing, protein-rich, leafy, non-toxic forms.

8 AGRONOMY

No information

9 RELATED SPECIES

There are a number of small Cassia species in eastern and southern tropical Africa but all occur in rather wetter grasslands than those being considered here, and are unlikely to be of use in the semi-arid zone.

REFERENCES

Baumer 1975; Brennan 1967; Boudet et al 1969; Gillet 1961; Keay 1958; Peyre de Fabrègues 1965.

1 BOTANICAL

1.1 Accepted name Crotalaria arenaria Benth.

1.2 Synonyms None, but see 9

1.3 Family Leguminosae-?papilionoideae

1.4 Vernacular Names -

2 DESCRIPTION

A prostrate perennial, usually a herb but sometimes a shrublet attaining 0.5 m. Branches ribbed, densely hairy with short hairs. Leaves simple; leaf-blade 0.7-2 x 0.5-1.1 cm, rounded at both ends, finely hairy above and below. Stipules absent. Flowers in spike-like racemes 5-12 cm long, 6-16-flowered. Petals arranged as is usual in the family, yellow, with brown markings. Pods swollen, 1-1.4 x 0.6-0.8 cm, hairy with short and long hairs, 8-12-seeded.

3 ECOLOGY

A plant of sandy plains in the Sahelian zone and into the Sahara, mainly along wadis.

4 DISTRIBUTION

Mauritania; Senegal; Mali; Niger; Nigeria; Chad.

5 USES

A species that provides some grazing in desert regions, although reported to be ignored by horses and donkeys. It should be remembered, however, that some members of the genus are toxic, containing pyrrolizidine alkaloids and non-protein amino-acids. Toxicity is not, however, usually important if the plants are eaten as a small proportion of the diet.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Screening for toxicity is a prerequisite for assessment of grazing potential.

8 AGRONOMY

No information

9 RELATED SPECIES

C.arenaria is replaced by C.thebaica (Del.)DC. (Nuttash (Arabic, Sudan)) from Chad eastwards, and there has been confusion between the species in the literature. C.thebaica has smaller pods and is a more upright plant. It is browsed by camels in Sudan and many specimens have obviously been browsed.

REFERENCES

Naegele 1977; Polhill 1982

1 BOTANICAL

- 1.1 Accepted name Cullen plicata (Del.)C.H.Stirton
- 1.2 Synonyms Psoralea plicata Del.
- 1.3 Family Leguminosae-Papilionoideae
- 1.4 Vernacular Names Tareda (Tamachek); Ruml, Rubl (Arabic-Sudan)

2 DESCRIPTION

A low shrub or woody herb to 1.5 m but usually less. Branchlets weakly spiny, ribbed. Leaves 3-foliolate; leaflets oblanceolate to oblong, 1-1.5 cm long, covered with very small hairs and glands. Leaf stalk short. Stipules 2-3 mm long, persistent. Flowers in 6-12-flowered axillary racemes, whitish. Pod as long as the calyx, ellipsoid, hairy, black when ripe, one-seeded, indehiscent.

3 ECOLOGY

A plant of the dry regions of the Sahara, where it occurs in Unit 71 - Desert vegetation of wadis. It occurs particularly in sites where wadis slope gently, where water stands for some time and where the soil is thus finer-textured. In such sites it is often accompanied by Hyocyamus muticus L. which is very toxic. Such sites are thus avoided by graziers and this may have given rise to some of the reports that Cullen is not or little grazed.

4 DISTRIBUTION

Egypt; Libya; Algeria; Mauritania; Senegal; Mali; Niger; Nigeria; Chad; Sudan; Ethiopia; Somalia.

5 USES

Sometimes said to provide useful grazing, as in Niger and Mauritania, where it is reported to be eaten by camels and cattle, but other reports, from Chad and Sudan, state that it is grazed little or not at all. There may be local variations in palatability, or it may be a species which is normally only grazed when little else is available.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficient information

8 AGRONOMY

No information

9 RELATED SPECIES

There are several closely related species in southern Africa. Among these is Cullen obtusifolia (DC.)C.H.Stirton (Psoralea obtusifolia DC.) (Rivierklawer - Afrikaans) which is said to look like lucerne (Medicago sativa L.) and to have comparable feeding value; it is greatly favoured by sheep and springbok. It occurs in South Africa, Namibia and Angola.

REFERENCES

Andrews 1952, 1953; Baumer 1975; Dalziel 1937; Keay 1958; Leistner 1967; Stirton 1981.

1 BOTANICAL

- 1.1 Accepted name Indigofera disjuncta Gillett
- 1.2 Synonyms 'I.arenaria A.Rich.' as used in Flora of Tropical Africa and elsewhere; the name 'I.arenaria A.Rich.' is really a synonym of 'I.hochstetteri Baker, which also occurs in semi-arid regions (see below).
- 1.3 Family Leguminosae-Papilionoideae
- 1.4 Vernacular Names Khasheir (Arabic-Sudan). It is not clear, due to the varying use of 'I.arenaria', to which species this name really applies.

2 DESCRIPTION

A small herb, probably usually ephemeral, to 10-20 cm, densely branched from the base. Branches with silky hairs and, as in other members of the genus, with medifixed hairs which are also found on other parts of the plant. Leaves simple or 3-5-foliolate. The leaf shape extremely variable especially in the southern part of the range where the terminal leaflet may be 1-20 times as long as broad. Flowers purple, in short racemes in the leaf-axils. Pod straight, c 10-15 x 1-1.5 mm, covered with appressed hairs, 6-8-seeded.

3 ECOLOGY

An annual of the semi-arid and arid zones of north and south-west Africa.

4 DISTRIBUTION

Mauritania; Niger; Chad; Sudan; Namibia; South Africa.
Also in Arabia.

5 USES

Grazed where it occurs as part of the ephemeral desert pasture.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

The genus Indigofera contains various species which are grazed but also a number of toxic species. The toxic principles are unusual amino-acids which interfere with protein synthesis. Much work has been carried out in Australia to find species and forms which lack these toxic principles but there is still room for more research into a wider range of species and populations.

8 AGRONOMY

No information

9 RELATED SPECIES

Indigofera ruspolii Baker f. (Jelud, Jelab - Somali) is a perennial shrublet occurring in Somalia and Ethiopia. It is said to be extensively grazed by stock. The young fresh shoots are particularly attractive; in the dry season it becomes tough and hard and is then much less attractive.

I.spinosa Forsskal (Machin - Somali) is a perennial spiny shrub. The young green shoots are eaten but in the dry season the plant becomes tough and unpalatable. It is nodulated, and resists grazing, trampling and burial by sand.

I.suaveolens Jaub. & Spach (Singit - Arabia-Sudan) is described as being the best undershrub for camels on the Red Sea coast of the Sudan.

I.pilosa Poiret is reported to be much liked by all species when green, in northern Sudan.

I.oblongifolia Forsskal (Dahassir - Arabic-Sudan) has leaves and young branches which are eaten by goats and sheep throughout the year; the green leaves and green pods are eaten by cattle.

I.hochstetteri Baker.f. is an annual of semi-arid places which is grazed when available.

The list could be considerably extended but the above are the species mentioned with the greatest enthusiasm by observers, mainly in the Sudan.

REFERENCES

Andrews 1953; Baumer 1975; Gillet 1964; Gillet 1941, 1958; Gillett, Polhill & Verdcourt 1971; Glover 1951a; Keay 1958; Maxwell-Darling 1938.

1 BOTANICAL

- 1.1 Accepted name Rhynchosia minima (L.)DC.
- 1.2 Synonyms R.nuda DC.; R.flavissima Baker var. macrocalyx Chiov.; R.maitlandii Baker.f.; R.senaarensis Schweinf. var. macrocalyx (Chiov.)Cuf.; R.memnonia (Del.)DC. var. prostrata Harvey; R.ischnoclada Harms
- 1.3 Family Leguminosae-Papilionoideae
- 1.4 Vernacular Names El Turba (Arabic-Sudan); Jajale (Somali); Ol'gedungaigere, Olopito (Masai).

2 DESCRIPTION

A perennial herb, climbing or prostrate. Stems to several metres long from a woody rootstock. Leaves trifoliolate; leaflets rhomboid to almost circular in outline, 0.9-6 x 0.8-5 cm, usually hairy to some extent; leaf-stalk 0.7-4 cm long. Stipules small, persistent, 3.5 x 0.5 mm. Flowers spike-like racemes 2-15 cm long in the leaf axils; flower stalks 1-1.5 mm long. Flowers 5-10 mm long; standard yellow, with or without dark red markings; wings and keels yellowish. Pods 0.6-2 x 0.3-0.5 cm, somewhat curved, blackish when ripe, usually hairy, 1-or 2-seeded.

An extremely variable species, divided into a number of varieties; there is no general agreement on the status of distinctness of many of these and further work is needed, preferably involving cultivation of many forms in identical conditions together with experimental hybridisation.

3 ECOLOGY

The species occurs in a wide range of habitats, as might be expected from its extreme variability. These are generally open and grassy, but the plant can also climb on bush clumps.

4 DISTRIBUTION

Senegal; Mali; Sierra Leone; Ivory Coast; Ghana; Togo; Niger; Nigeria; Cameroon; Chad; Central African Republic; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Rwanda; Burundi; Zaire; Mozambique; Malawi; Zambia; Zimbabwe; Angola; Botswana; Namibia; South Africa

Pantropical, but probably an introduction to the New World.

5 USES

A species generally regarded as good forage in spite of its small size. It is much liked by horses and cattle. Its climbing habit is an advantage in tall grasslands. In Barbados (West Indies) it has been reported to be injurious to grazing cattle (hence the local name of 'Burn Mouth Vine') but this needs confirmation.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

There is obviously very considerable variation which could be exploited. This includes very drought-resistant forms which are sometimes regarded as a separate species, R.memnonia (see below).

8 AGRONOMY

Germination is improved by high temperature pretreatment. It is susceptible to various virus diseases including bean common mosaic virus (BCMV).

9 RELATED SPECIES

R.malacophylla (Sprengel)Bojer (including R.sennaarensis Schweinf.) is a rather larger but otherwise similar (flowers 1-1.4 cm long). It occurs in Sudan, Ethiopia, Somalia, Uganda, Kenya and Tanzania, and has been tested as a forage legume in grass mixtures in northern Tanzania, with some success.

R.memnonia (Del.)DC. (Ra'afa, Luweis, Farah el Gumri, Bal (Arabic, Sudan)) is usually considered to be a variety of R.minima. The leaves and fruits are covered with silvery hairs. It occurs in the drier regions of West Africa, extending to Egypt, Sudan, Somalia and Arabia. It seems to represent the most drought-tolerant end of the variation within R.minima.

REFERENCES

Andrews 1953; Baumer 1975; Gillett, Polhill & Verdcourt 1971; Grear 1978; Meiners et al 1978; Mullick & Chatterji 1972.

1 BOTANICAL

- 1.1 Accepted name Stylosanthes fruticosa (Retz.) Alston
- 1.2 Synonyms S. flavicans Baker; S. mucronata Willd.; S. bojeri
Vogel
- 1.3 Family Leguminosae-Papilionoideae
- 1.4 Vernacular Names Kifyagia, Kikumbio (Swahili)

2 DESCRIPTION

A woody herb or shrublet, usually perennial but sometimes short-lived, usually erect but sometimes prostrate, 10-100 cm long or high. Stems hairy to varying degrees. Leaves usually trifoliolate, leaflets elliptic or lanceolate, 0.5-3.3 x 0.1-0.9 cm, tapering to each end, usually hairy all over. Stipules fused with the leaf-stalk for most of their length so that the leaf stalk appears to have a broad bilobed sheathing base 0.8-1.6 cm long. Inflorescences dense, in short spikes, terminal or in the leaf axils. Each flower is in the axil of a bract which, like the leaves, has a bilobed sheathing base formed from the attached stipules and a single apical green segment. Flowers pale yellow to orange with darker markings, about 5-7 mm long. Pods made up of two segments, each 3.5-4 x 2-2.5 mm, hairy; the apical segment bearing a curved beak c 2 mm long.

3 ECOLOGY

Grassland and bushland of the semi-arid zone. The strong thick rootstock give the plant considerable reserves if heavily grazed and trampled. Will grow in regions with rainfall as low as 300 mm, with an 8 month dry season.

4 DISTRIBUTION

Senegal; Gambia; Mali; Guinea-Bissau; Ivory Coast; Upper Volta; Ghana; Togo; Nigeria; Cameroon; Sudan; Somalia; Uganda; Kenya; Tanzania; Burundi; Rwanda; Zaire; Mozambique; Zambia; Zimbabwe; Botswana; Namibia; South Africa.

5 USES

In Sudan and Tanzania it has been regarded as an excellent forage legume, although not common, perhaps because of excessive grazing. However, the deep and strong root system makes it resistant to grazing. The prostrate forms have some value in protecting the soil against erosion.

6 SEED COLLECTIONS

56 samples in Kenya (National Agricultural Research Centre). It has been collected for introduction into Australia.

7 POTENTIAL FOR IMPROVEMENT

This is a species which has received less attention than its South American allies S.guianensis (Aubl.)Sw. and S.humilis Kunth, particularly in Australia. It must be presumed to have considerable potential as a forage legume in regions with a single long dry season.

8 AGRONOMY

Seeds are mostly hard and germinate much more quickly and evenly if scarified. Production is high if the plants are protected when young, and if regularly mown it can produce a dense sward. It combines well with tall grass species such as Andropogon gayanus and Hyparrhenia spp. It has root nodules but does not seem to require a particular Rhizobium.

9 RELATED SPECIES

The only other member of the genus native to Africa is S.erecta P.Beauv. which is mainly a coastal plant of both West and East Africa. It occurs near the sea so might have some salt resistance but is likely to be less drought-tolerant than S.fruticosa.

REFERENCES

Baumer 1975; Gillett, Polhill & Verdcourt 1971; Keay 1958; Skerman 1970, 1977.

1 BOTANICAL

- 1.1 Accepted name Tephrosia subtriflora Baker
- 1.2 Synonyms T.encoptosperma Schweinf.; T.graminifolia Chiov.;
T.sulphurea Chiov.
- 1.3 Family Leguminosae-Papilionoideae
- 1.4 Vernacular Names Eyiemiim-oondare (Masai)

2 DESCRIPTION

A prostrate or partially upright annual, or short-lived perennial. Stems and leaves hairy, the hairs appressed or spreading, and variable in density. Leaf rachis, with petiole, up to 7 cm. Leaves pinnate, with a terminal leaflet; leaflets 5-13, up to 4 x 0.7 cm. Stipules narrow, up to 0.8 cm long. Flowers in groups of 2-6 in the leaf axils. Petals pink-purple; longest 5-8 mm long. Pod curved, about 4.5 x 0.4 cm, finely and densely hairy.

3 ECOLOGY

A species of dry grassland and bushland, mainly in the Somalia-Masai region.

4 DISTRIBUTION

Niger; Sudan; Ethiopia; Somalia; Kenya; Tanzania; Angola.

Also in Arabia and India.

5 USES

Suggested as a potentially useful forage for dry areas in Kenya. Some specimens are heavily browsed.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

The species shows considerable variation, particularly in leaf-shape.

8 AGRONOMY

No information

9 RELATED SPECIES

The genus is a large one and many of the species extend at least into semi-arid regions.

Tephrosia obtcordata (Lam. ex Poiret) Baker (Podalyria obtcordata Lam. ex Poiret; Requienia obtcordata (Lam. ex Poiret) DC. (Tām̄r el Fār; Arabic, Sudan) occurs in the desert regions of northern Africa (Senegal to Sudan). It is not grazed much during the wet season, but remains green well into the dry season and is then used. Reports vary, however, and further information is needed as the plant grows well in very dry places. T. uniflora Pers. occurs in the Sahelian and Somali-Masai regions and extends south to Transvaal. Other species of the dry regions of northern Africa include T. vicioides A. Rich. and T. purpurea (L.) Pers.

REFERENCES

Dalziel 1937; Edwards & Bogdan 1951; Gillet 1961; Gillett, Polhill & Verdcourt 1971; Keay 1958.

1 BOTANICAL

- 1.1 Accepted name Tylosema esculentum (Burchell) A. Schreiber
- 1.2 Synonyms Bauhinia esculenta Burchell; Bauhinia burkeana (Benth.) Harvey; Bauhinia bainesii Schinz
- 1.3 Family Leguminosae-Caesalpinioideae
- 1.4 Vernacular Names Marama Bean, Gemsbok Bean (English); braai-boontjie, gemsbokboontjie (Afrikaans); marama, marami, morama (Tswana); ombanui (Herero).

2 DESCRIPTION

Stems prostrate and trailing, to 3 m long; young parts finely hairy. Tendrils forked, axillary, 2-4 cm long, the branches 8-12 mm long. Leaves alternate; petiole 1.5-3.5 cm long; blade deeply bilobed 3-7.5 x 4-10 cm. Stipules 3-5 x 2-3 mm, persistent. Flowers in racemes, peduncle 2-4 cm, axis 4-12 cm, pedicels 2-4.5 cm long. Sepals 5, 8-12 x 2-3 mm, the upper pair fused. Petals yellow, the upper one small, the rest 1.5-2.5 x 1-1.4 cm, tapering into a basal claw. Stamens: 2 fertile, 10-12 mm long; the rest 3-6 mm long. Ovary long stalked, 5-6 mm long. Pod woody, oval to almost circular, 3.5-6 x 2.8-4 cm. Seeds 1-2, 1.3-1.8 x 1.2-1.5 cm.

3 ECOLOGY

The species occurs in grassland or in bushed or wooded grassland. Its distribution is patchy, perhaps due to soil preferences. It occurs on sand and limestone, including dolomite, but does not occur on soils developed over granites or basalts.

The climate is a summer rainfall one, with total rainfall of 100-900 mm, falling in 3-4 months. Temperatures may be very high, up to 50°C, during the hot season, and the plant can also withstand slight frosts. It can survive a year without rain by using deep-lying water sources and by drawing on water stored in the root tuber.

The plant is monoecious with bisexual flowers, and does not flower before its third year. Nothing is known of its pollination biology but it is heterostylous. Not all mature plants produce pods in any given year. Seed germinates slowly, and germination is improved and hastened by scarification. Establishment of young plants is quicker and better with irrigation, and it is likely therefore that successful regeneration in the wild only occurs in abnormally wet years. The tuber increases in size with age and may reach 50 kg or more in weight.

4 DISTRIBUTION

Namibia, South Africa, Botswana. Local
800 - 1500 m.

5 USES

The main use of the plant (not dealt with in detail here) is as a source of protein and oil-rich highly palatable seeds for human consumption. The tubers are also edible when young but become fibrous when old.

Some reports say that the foliage is not grazed but others state that it is palatable to cattle to an extent that the expansion of ranching is a threat to the plant's survival. The tubers are eaten by wild animals, and the beans are said to be excellent fodder.

No analyses of the leaves are available. The seeds contain 30-39% protein and 36-43% of oil. The protein is rich in lysine (5%) and poor in methionine (0.7%). The tuber contains 9% crude protein, on a dry matter basis; it contains, when fresh, 83% water.

6 SEED COLLECTIONS

None known. Since the plant is grown in the USA there has clearly been some seed collection but it is not known how much of the gene pool has been sampled.

7 POTENTIAL FOR IMPROVEMENT

Too little is known of the feeding value of the leaves and tubers for comment here. For beans for human consumption, the obvious lines for improvement are number of seeds per pod, size of seed, speed of growth and tuber size. Nothing is known of nodulation in this species - this needs to be investigated.

8 AGRONOMY

The seeds are hard and germination is improved by mechanical or acid scarification. They should be sown in situ. Germination occurs in 28 days. Growth is slow but is much faster under irrigation. Tuber may reach marketable size in 2-4 years, and seeds are first produced after 4-5 years. Transplanting inhibits resprouting and drying the roots further inhibits regrowth. Some experimental cultivation has been carried out in the USA.

9 RELATED SPECIES

Tylosema fassoglense (Schweinf.) Torre & Hillc. (Karauerau (Arabic, Sudan); Sakura (Turkana); Olobito (Masai) is a very similar species found from Sudan to Zimbabwe. It also has a tuber, and grows at lower altitudes. The seeds are recorded as human food in northern Tanzania and southern Ethiopia. Two related but poorly-known species T. humifusa (Pichi-Sermolli & Roti-Michelozzi) Brenan and T. argentea (Chiov.) Brenan, occur in Somalia and northern Kenya, in dry country. T. humifusa arises from a large tuber.

REFERENCES

Bousquet 1982; Coetzer & Ross 1977; Gillett, Polhill & Verdcourt 1971; National Academy of Sciences 1979; Story 1958.

1 BOTANICAL

- 1.1 Accepted name Vigna unguiculata (L.)Walp.
- 1.2 Synonyms Vigna sinensis (L.)Hassk.; Vigna sinensis Endl.;
Vigna catjang (Burm.)Walp.
- 1.3 Family Leguminosae-Papilionoideae
- 1.4 Vernacular Names Waken gizo, Gayan gayan (Hausa); Mkundemwitu
(Swahili); Cowpea (English)

2 DESCRIPTION

A perennial, or more usually annual herb, usually climbing or trailing, up to 3 m long. Stems slightly hairy. Leaves trifoliate; leaflets 1.5-16.5 x 1-12.5 cm, usually broadest below the middle, and the lower two often asymmetric, sometimes with small hairs on both surfaces. Stipules attached close to the middle, pointed above and below the place of attachment, 0.8 to 2.5 cm long in total. Flowers several together at the ends of relatively long stalks arising in the leaf axils; largest petal 1.2-3.3 x 1-3.2 cm, whitish, yellowish or purplish. Pods 5.5-10 x 0.3-1.1 cm. Seeds variously coloured, often spotted, 3.5-5 x 2-3.5 mm.

3 ECOLOGY

Its main area of distribution lies in regions somewhat wetter than those treated here, but it extends into areas with 400 mm or less of rain each year. It is widely cultivated as a legume crop and it is often very difficult to know if it is truly wild in any particular area. It occurs in grasslands and bushlands, often climbing over bushes and small trees. It is not tolerant of flooding.

4 DISTRIBUTION

Gambia; Mali; Guinea-Bissau; Sierra Leone; Liberia; Ivory Coast; Ghana; Togo; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Uganda; Kenya; Tanzania; Zaire; Mozambique; Malawi; Zambia; Zimbabwe; Angola; Botswana; Namibia; South Africa.

Introduced throughout the tropics.

5 USES

Its main use is as a crop, yielding edible beans. However, it has considerable potential as a fodder crop although perhaps most suitable for moister regions.

6 SEED COLLECTIONS

It is represented in collections of pulse crops from many areas including Africa.

7 POTENTIAL FOR IMPROVEMENT

The main line to be followed is surely that of drought-resistance. There is a need for drought-resistant and productive forms to be sought in the drier parts of the range of the species.

8 AGRONOMY

There are 4000 to 9000 seeds per kilogram. Scarification is not usually needed. The species is nodulated but is not associated with special strains of Rhizobium. It can be grown alone or mixed with annual grasses and can be fed directly or made into hay or silage.

9 RELATED SPECIES

There are many species of Vigna and the taxonomy of the genus is not simple. A number of species occur in dry areas.

REFERENCES

Andrews 1952; Gillett, Polhill & Verdcourt 1972; Skerman 1977.

1 BOTANICAL

- 1.1 Accepted name Zornia glochidiata DC.
- 1.2 Synonyms Z.biarticulata G.Don; Z.diphylla as used in Flora of West Tropical Africa Ed. 1, partly
- 1.3 Family Leguminosae-Papilionoideae
- 1.4 Vernacular Names Dengere; Dingerohi (Peul); M̄arack-Emori (Hausa).

2 DESCRIPTION

An annual herb with erect or decumbent stems, to 40 cm high, somewhat wiry at the base. Leaves with two leaflets, each lanceolate, up to 30 x 8 mm, pointed at the apex; the leaflets of the lower leaves tend to be shorter and broader. Stipules narrow, persistent, up to 12 mm long. Inflorescence a terminal or axillary spike, each flower subtended by an ovate bract, the bracts overlapping. Flowers with yellow petals, shorter than the bracts, about 5 mm long. Fruit made up of 4-6 one-seeded flattened segments each 3.5 x 3 mm, bearing stiff bristles with tiny barbs on them.

3 ECOLOGY

A plant of grasslands in semi-arid areas, particularly where these have been somewhat disturbed and trampled, and on sandy or rocky soils, often forming pure stands. In Mali its abundance has been attributed to the heterogeneity of its seed population and its short life cycle. Early sporadic rains stimulate germination of all species, most of which die in subsequent dry periods. Zornia, however, retains a seed population in the soil which germinates when the real rains start.

4 DISTRIBUTION

Senegal; Gambia; Mali; Guinea-Bissau; Guinea; Sierra Leone; Ivory Coast; Upper Volta; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Zaire; Rwanda; Burundi; Mozambique; Zambia; Zimbabwe; Angola; Botswana; Namibia; South Africa.

5 USES

A very valuable grazing species in the semi-arid grasslands of the Sahel. It is extremely sought after by horses in all stages, and is eaten by all species when green. It can also be used for silage. It is brittle when dry and so is difficult to handle as hay, although there is a potential yield of 500-800 kg/ha.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Not known

8 AGRONOMY

It is nodulated and has considerable nitrogen-fixing ability. Germination is greatly improved by scarification. 1000 seeds weigh 1.6 g. In Mali, yields were increased by application of phosphate.

9 RELATED SPECIES

Zornia apiculata Milne-Redh. is a perennial species found in Ethiopia, Somalia, Kenya and Tanzania. It is similar to the last species but is perennial and has rather larger flowers. Z.latifolia Sm. has been introduced to West Africa from South America; it is also a perennial and is rather similar to Z.apiculata.

REFERENCES

Baumer 1975; Boudet et al. 1969; Gillett, Polhill & Verdcourt 1971; Keay 1958; Penning de Vries & Djiteye 1983; Peyre de Fabregues 1965; Sanogho 1977.

Forbs (excluding legumes)

Blepharis linariifolia

Commelina spp.

Cyperus conglomeratus

Ipomoea cordofana

Monoechma australe

Neurada procumbens

Schouwia purpurea

Tribulus terrestris

1 BOTANICAL

- 1.1 Accepted name Blepharis linariifolia Pers.
- 1.2 Synonyms B.passargei Lindau; B.dichotoma Engl.
- 1.3 Family Acanthaceae
- 1.4 Vernacular Names Girlai (Peul); Maikaba (Hausa); Bagheil; Bigheil; El Bigheil (Arabic-Sudan)

2 DESCRIPTION

Annual or sometimes perennial somewhat woody herb or undershrub, reaching 35 cm high. Leaves in opposite pairs, long and narrow, to 12 x 2 cm, sometimes with a few marginal spines, or toothed; sometimes with neither. Stipules absent. Inflorescences dense and cone-like, 3-8 cm long often in the forks of branches (in fact terminal, with growth being continued by two lateral branches); flowers 2-2.5 cm long, blue, surrounded by prickly bracts 2-2.5 cm long. Seed-capsule splitting into two halves when ripe; seeds held on small hooks on the capsule. Seeds with tufts of rope-like hairs which untwist when wet.

3 ECOLOGY

Often a common plant in the grasslands and shrublands of the semi-arid regions of northern and north-eastern Africa. Loamy or sandy soils are preferred; rainfalls of 50-600 mm are tolerated, 300-600 preferred.

The hard two-seeded fruits open explosively if wetted when dry. Seeds germinate quickly and easily and germination is complete within a few days of rain. Many seeds are dispersed by cattle.

4 DISTRIBUTION

Mauritania; Senegal; Mali; Ivory Coast; Ghana; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania.

Also in Arabia.

5 USES

Its grazing value is disputed, or may vary across its range, or may vary according to what else is available. In Sudan it is reported to be relished by all animals; it is also said to be sought after by camels when green but to be left when fruiting starts. In Niger it is said to be not liked. Individual plants tend to be well spaced and are therefore not easy for an animal to graze. The seeds are eaten by nomads in northern Sudan.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficient information for useful suggestions to be made.

8 AGRONOMY

1000 seeds weigh 49.5 g. Carbon fixation is by the C₄ pathway.

9 RELATED SPECIES

B.ciliaris (L.)B.L.Burtt (B.edulis (Forsskal)Pers.; B.persica (Burm.f.)Kuntze) (Siha, Silih - Arabic, Sudan) has a similar range but extends less far to the west. In Sudan it is described as being the best camel fodder when green or dry, and to have been eliminated in places by poor grazing management.

Analysis, lvs, fls, fr ex Kenya

CP 14.48 EE 1.44 CF 32.66 NFE 40.57 Ash 10.85 SFA 9.95 Ca 1.84 P 0.24
This analysis supports the comment made under the analysis of B.integrifolia.

Blepharis integrifolia (L.f.)E.Meyer occurs in short grassland in East Africa. In north-eastern Uganda it is reported to be readily eaten by cattle when grass is scarce.

Analysis - whole plant, north-east Uganda.

CP 13.00 EE 2.75 CF 20.89 NFE 42.63 Ash 20.73 SFA 11.91
The high ash content, and particularly the high silica content, is somewhat unexpected and the sample may have been contaminated with soil.

Blepharis phillipsiae Rendle (Getawe (Somali)) is frequent in dry parts of Somalia, and is browsed.

REFERENCES

Andrews 1952, 1953; Baumer 1975; Boudet et al. 1969; Hepper 1963; Maxwell-Darling 1938; Penning de Vries & Djiteye 1982; Peyre de Fabrègues 1965; Tothill 1948; Wilson & Bredon 1963.

1 BOTANICAL

- 1.1 Accepted name Commelina spp.
- 1.2 Synonyms Not applicable
- 1.3 Family Commelinaceae
- 1.4 Vernacular Names Balassa (Hausa); Bayad; Dueid; Jabab; ʔl Beyyeid; Ibrig el Fagir; Um Damas (Arabic-Sudan). There may be some differentiation between species incorporated here.

2 DESCRIPTION

Annual or perennial herbs, usually prostrate but sometimes upright, usually less than 50 cm high but occasionally scrambling in bush clumps to greater heights. Stems usually containing a mucilaginous juice. Leaves alternate, usually elliptic, with sheathing bases, hairy or not. No stipules. Inflorescences terminal or in the leaf axils, usually surrounded by a folded bract. Flowers blue in most species but also yellow, dull orange or purple, generally with two large lateral petals and one smaller one, but sometimes with three the same size, and with six stamens which are usually of at least two different sizes in the same flower. Fruit capsular, containing several hard rough seeds.

3 ECOLOGY

Most species of Commelina occur in grassland, often at the edges of bush clumps, or in places which are disturbed or which have some special soil feature such as seasonal waterlogging or shallow soil. Some are weeds of cultivation.

4 DISTRIBUTION

Species of Commelina occur in every country in Africa. They are perhaps most abundant in East Africa.

5 USES

Most species of Commelina are readily eaten by cattle and other animals when available. Many are perennial and begin to grow soon after the first rains of the wet season; others are annuals which germinate at this time. They thus tend to be available soon after the beginning of the wet season. In general they provide little or no forage during the dry season although the stems of some remain after the leaves have dried. In Sudan they are reported as being excellent for horses. In north-eastern Uganda cattle eat them readily when they are available.

Analyses

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Uganda; 5/58	20.73	1.42	18.41	33.40	26.04	11.89	n.d.	n.d.
Uganda; 8/58	7.09	1.20	21.27	44.79	25.65	10.39	n.d.	n.d.
Uganda; 8/58	8.85	1.83	19.76	50.41	19.15	8.00	n.d.	n.d.
Uganda; 8/58	9.66	1.72	27.33	44.14	17.15	9.84	n.d.	n.d.
Uganda; 8/58	10.93	1.62	28.27	39.18	20.00	10.77	n.d.	n.d.
Uganda; 8/58	14.41	2.19	23.47	42.85	17.08	11.78	n.d.	n.d.
Kenya; young shoots	8.42	0.92	22.84	34.57	33.25	16.12	0.89	0.5
Kenya; stems & leaves	14.21	1.89	25.13	32.12	26.65	26.50	7.11	0.1
Kenya; mature leaves & stems	19.41	1.53	21.05	31.48	26.55	19.75	2.54	0.5
Kenya; stem & brown leaves	9.29	1.63	26.60	46.55	15.93	11.56	1.37	0.2

The great variation of the elements in the ash of Kenya samples is peculiar; some samples also have high potassium levels.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficient information

8 AGRONOMY

Some species are weeds of cultivation; otherwise no information.

9 RELATED SPECIES

Some of the species commonly mentioned are listed here:

C.forskalaei Vahl is common in eastern Africa. It is a prostrate perennial, rooting at the nodes. It usually grows in partial shade often at the edges of bush clumps.

C.benghalensis L. is a common and very widespread weed of cultivation all over Africa.

C.albescens Hassk. and C.elgonensis Bullock are reported to be eaten readily by cattle in north-east Uganda.

Other genera in the family, such as Aneilema and Cyanotis are also eaten at times.

REFERENCES

Andrews 1956, 1957; Baumer 1975; Dougal, Drysdale & Glover 1964; Peyre de Fabrègues 1965; Wilson & Bredon 1963.

1 BOTANICAL

- 1.1 Accepted name Cyperus conglomeratus Rottb.
1.2 Synonyms see note under 9
1.3 Family Cyperaceae
1.4 Vernacular Names Gnémé n'dari (Hausa); Bishup (Arabic-Sudan)

2 DESCRIPTION

A perennial herb forming dense clumps, sometimes with short spreading rhizomes. Leaves in three rows, 10-50 x 0.3-0.5 cm, tough and firm. Inflorescences at the ends of upright stems 10-70 cm high, subtended by 3-5 leaf-like bracts up to 15 cm long, made up of a single dense mass of spikelets, or 2-4 similar masses arising from the top of the stem. Spikelets 3-25 in each mass, 8-12 x 3-6 mm, each with 8-16 flowers. Glumes tightly folded together, without a keel at the back, ovate, with a small apical point. Seeds three-angled.

A variable species, with several recognised varieties, some of which may be separate species.

3 ECOLOGY

A species of dry sandy regions which may be temporarily wet after heavy showers.

4 DISTRIBUTION

Egypt; Tunisia; Algeria; Mauritania; Senegal; Mali; Niger; Chad; Sudan; Ethiopia; Somalia; Kenya.

Also in Arabia, and eastwards to India.

5 USES

In Niger it is reported to be liked as pasture, but in Chad it is said not to be particularly sought-after although eaten if encountered. Camels eat it in Sudan, particularly in the early dry season when it is still green. One report states that it retains its nutritive value well when drying naturally.

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficient information for useful suggestions to be made.

8 AGRONOMY

No information

9 RELATED SPECIES

Recent work suggests that plants named as C.conglomeratus may belong to at least two species, including C.effusus and C.jiminicus. Until the group is fully revised, the old name is used here as most information has been published under it.

REFERENCES

Andrews 1956; Gillet 1961; Kowal & Kassam 1978; Peyre de Fabrègues 1965.

1 BOTANICAL

- 1.1 Accepted name Ipomoea cordofana Choisy
1.2 Synonyms Ipomoea auriculata Hall.f.
1.3 Family Convolvulaceae
1.4 Vernacular Names Tabr; Tebr (Arabic-Sudan)

2 DESCRIPTION

A perennial herb with training stems up to 1.8 m long. Leaves alternate; leaf-blades almost round in outline but with a broad cordate base; leaf stalk 5-7.5 cm long. Inflorescence 1-6-flowered (usually 3-flowered); stalk 1-7 cm long, hairy; flower stalks up to 2.6 cm long; bracts 0.9-1.8 x 0.7-1.8 cm. Corolla pale lilac with a dark centre, or sometimes white, funnel-shaped, 3.3-4.5 cm long. Seed capsule more-or-less spherical, 8-12 mm in diameter, hairless. Seed 4 mm long, with or without a velvety coat.

3 ECOLOGY

A plant usually occurring in disturbed sites and in grassland, often on black clay soils, in semi-arid areas. Mainly in Unit 42-Somalia-Masai Acacia-Commiphora deciduous bushland and thicket, and Unit 43 - Sahel Acacia wooded grassland and deciduous bushland.

4 DISTRIBUTION

Sudan; Uganda; Kenya.

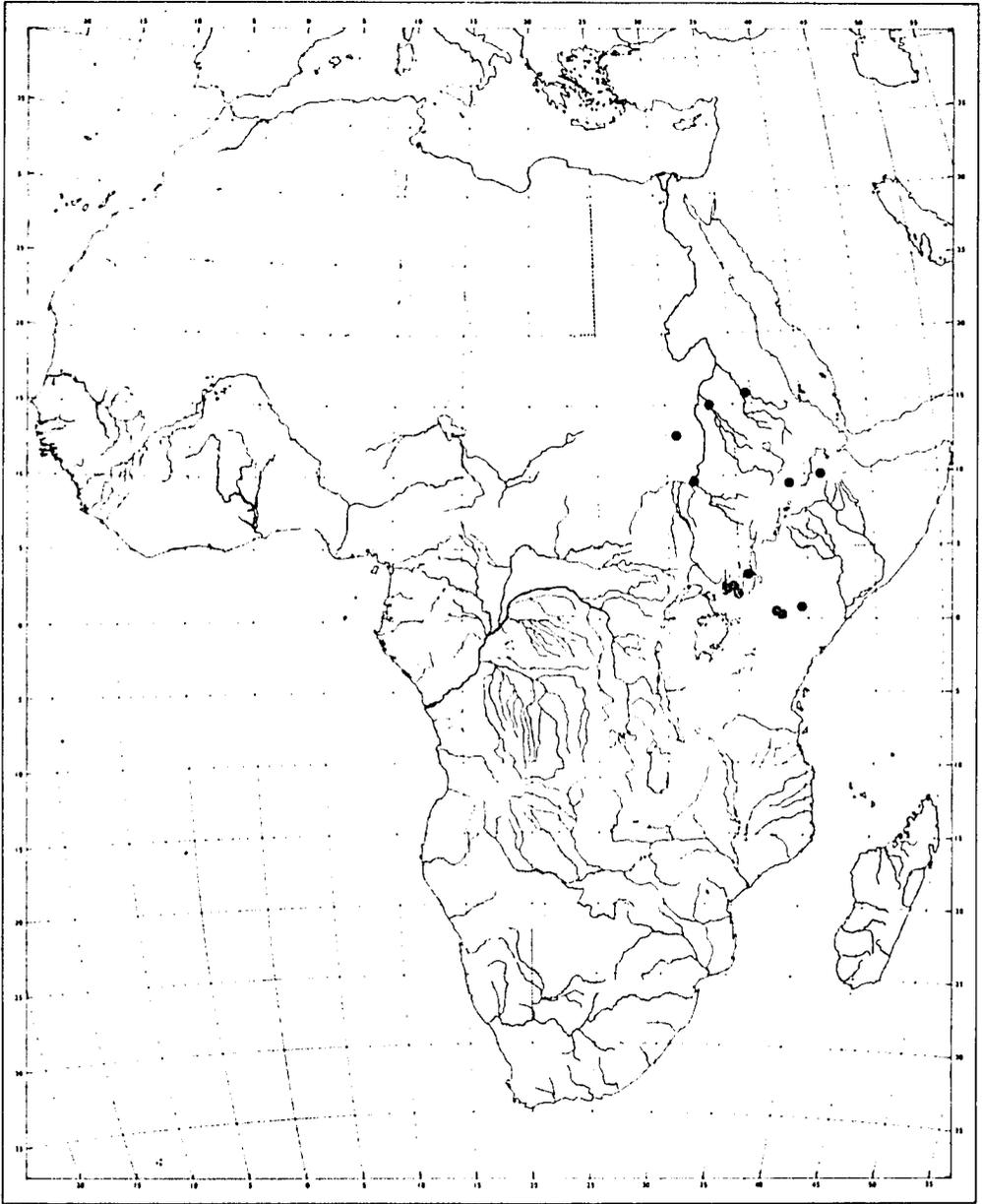
5 USES

It is grazed by most species but is said to be particularly liked by camels. Another account calls it a valuable fodder, but yet another states that it is readily eaten when grass is scarce, implying that it is not really a preferred food. Further observations are needed.

Its deep root system and its ability to sprout from this makes it a difficult plant to control in cultivated areas. In east-central Sudan it was reckoned to be the worst weed on an experimental station.

Analysis

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Uganda; shoots	18.97	1.74	20.74	41.78	16.77	11.64	n.d.	n.d.



Scale Miles SCALE Kilometers
1 20 000 000

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

Insufficient information for useful suggestions to be made.

8 AGRONOMY

At Tozi (east-central Sudan) it was controlled satisfactorily by applications of 2-4-D Sodium salt at 1 rotl (approx 450 g) per feddan (0.42 ha).

9 RELATED SPECIES

Ipomoea cardiosepala Hochst. (Hantud - Arabic-Sudan) has been reported to be a valuable fodder for all livestock but to cause purging when first eaten. I.aitonii Lindley, I.digitata L. and I.kotschyana Hochst. ex Choisy are all reported to be eaten in the northern Sudan; I.cairica (L.)Sweet, on the other hand, was not eaten much, and I.repens Lam. was reported to be poisonous to horses and camels.

REFERENCES

Andrews 1956, 1957; Baumer 1975; Bunting & Lee 1957; Tothill 1948; Verdcourt 1963; Wilson & Bredon 1963.

1 BOTANICAL

1.1 Accepted name Monechma australe P.Meyer

1.2 Synonyms -

1.3 Family Acanthaceae

1.4 Vernacular Name Perdebos (Afrikaans)

2 DESCRIPTION

Shrublet 30-50 cm high. Branchlets covered with short white recurved hairs; secondary branchlets forming an angle of 30-50° with the parent stem. Leaf-blades narrowly lanceolate, about 2 x 0.25 cm, without a leaf stalk. Flowers in the leaf axils. Bracteoles and calyx segments subulate, glandular, about 6 mm long. Corolla about 1.5 cm long, pale violet. Fruit a capsule, about 6.5 mm long.

3 ECOLOGY

A common plant in the dry shrublands of the Karroo and Namibia.

4 DISTRIBUTION

Namibia; South Africa

5 USES

This is described as being an important fodder bush, favoured especially by sheep and springbok.

6 SEED COLLECTIONS

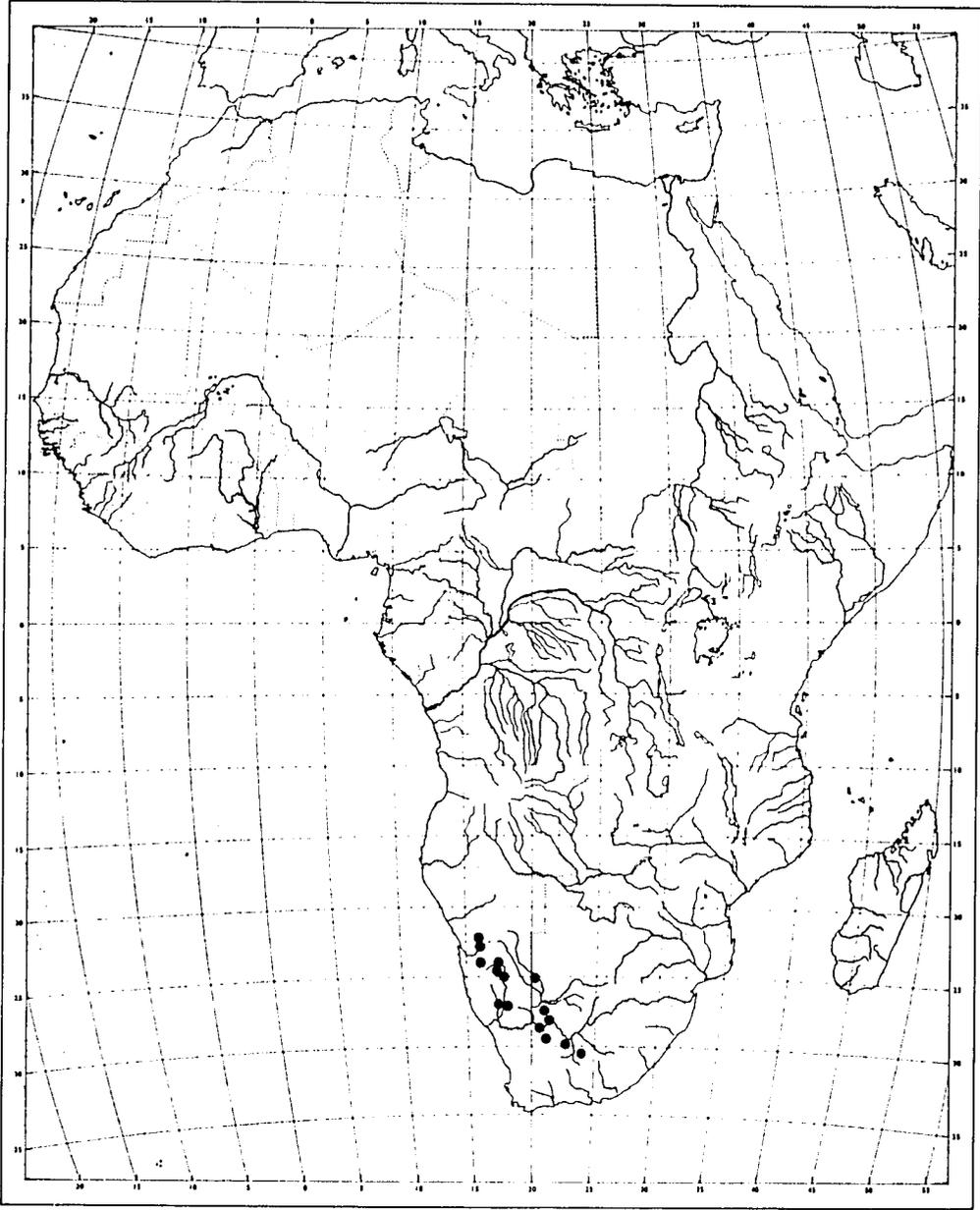
None

7 POTENTIAL FOR IMPROVEMENT

Not known

8 AGRONOMY

No information



Statute Miles SCALE Kilometers
1:30 000 000

9 RELATED SPECIES

M.hereeroense (Engl.)C.B.Clarke is very similar and occurs in the same area as M.australe.

Monechma debile (Forsskal)Nees is said not to be eaten in northern Sudan, but is described as 'readily eaten' in north-east Uganda.

Analysis - M.debile

CP 18.20 EE 4.30 CF 26.49 NFE 36.91 Ash 14.10 SFA 12.46
Ca & P n.d.

M.ciliatum (Jacq.)Milne-Pedh. is said not to be eaten in northern Sudan.

M.tonsum P.Meyer & M.genistifolium C.B.Clarke are components of the dwarf shrub belt surrounding Etosha Pan (Namibia) and presumably have some salt-tolerance.

In the family, various species of Justicia are also eaten in north-east Uganda.

Duosperma eremophilum (Milne-Redh.)Brummitt (Disperma eremophilum Milne-Redh.) is common in the dry regions of the Horn of Africa. It is mildly toxic and is therefore avoided much of the time, so forming a valuable reserve of forage for times of scarcity when it is eaten by all species, albeit with a few fatalities.

REFERENCES

Baumer 1975; J.B.Gillett pers. comm. 1984; Leistner 1967; Meyer 1960; Wilson & Bredon 1963.

1 BOTANICAL

- 1.1 Accepted name Neurada procumbens L.
- 1.2 Synonyms None
- 1.3 Family Neuradaceae (formerly included in Rosaceae)
- 1.4 Vernacular Names Anfel (Tamachek); Sa'adan (Arabic-Sudan).

2 DESCRIPTION

A prostrate ephemeral plant, somewhat woody at the base. Leaves about 1.5 cm long, long-stalked, deeply pinnately lobed, covered with dense white woolly hair. Stipules minute. Flowers solitary in the leaf axils, with 5 small yellow petals, surrounded by 5 bristle-like bracteoles which alternate with the 5 sepals. Fruits about 1.5 cm in diameter, flattened, circular in outline, spiny, made up of 10 carpels. The fruit with its spines can often be found at the base of the plant to which it gave rise.

3 ECOLOGY

A plant of deserts, appearing after episodic rain, which may amount to 10-20 mm per annum and which is insufficient to support growth every year. It occurs mainly in areas of sand with a stabilising cover of gravel (sandy regions) in Unit 71 - Psammophilous vegetation of sandy regions. The fruits are reported to be dispersed in the fleeces of sheep.

4 DISTRIBUTION

Libya; Tunisia; Algeria; Western Sahara; Mauritania; Mali; Sudan; Ethiopia.
Also in India.

5 USES

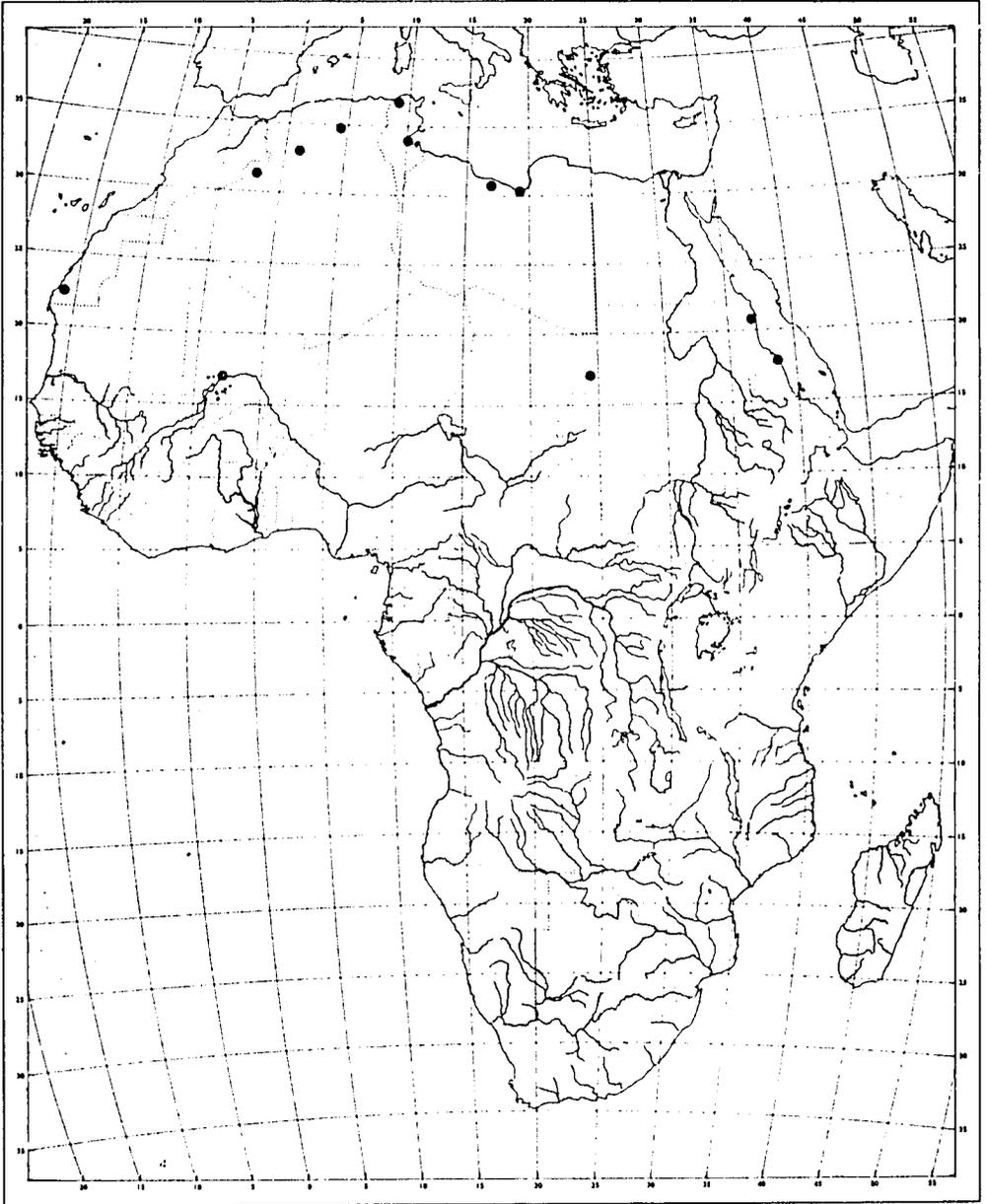
A valuable constituent of the ephemeral grazings which appear in the deserts after rain showers used by sheep and camels. The large size and spinness of the fruits may discourage animals from eating them, thus improving the plant's chances of successful reproduction.

6 SEED COLLECTIONS

None known.

7 POTENTIAL FOR IMPROVEMENT

Not known.



Scale
Statute Miles 1:30,000,000
Kilometers 1:30,000,000

8 AGRONOMY

No information. It is likely that the seeds have rather specific germination requirements; can more than one seed germinate from each fruit? If not, what prevents the several seeds in each fruit from germinating simultaneously?

9 RELATED SPECIES

Neurada procumbens is the only species in the genus. The other genera in the family, Grielum and Neuradopsis, occur in dry places in South Africa and Namibia.

REFERENCES

Andrews 1952; Keay 1958; Maxwell-Darling 1938; Tothill 1948.

1 BOTANICAL

- 1.1 Accepted name Schouwia purpurea (Forsskal) Schweinf.
- 1.2 Synonyms S.schimperi Jaub. & Spach. S.thebaica Webb;
S.arabica DC.; S.purpurea var. schimperi (Jaub. & Spach) Muschl.
- 1.3 Family Cruciferae
- 1.4 Vernacular Names Mahad; Namnam (Arabic-Sudan)

2 DESCRIPTION

An upright herb to 1.5 m but usually less. Stem somewhat woody below, hairless. Stem leaves hairless, without leaf-stalks, cordate at the base and clasping the stem, up to 8 x 3 cm, papery. Inflorescence terminal, spike-like, to 35 cm long. Flowers with four purplish petals about 1 cm long, including a long narrow claw. Fruit flattened, with a marginal wing, almost circular in outline, up to 2.5 cm long and almost as wide, with a projection about 6 mm long at the tip.

3 ECOLOGY

An annual herb of deserts, occurring mostly on alluvial sites with a clay-rich soil although in favourable seasons it can be found on a much wider range of soil types. It is a component of ephemeral desert vegetation (mainly Unit 72 - Desert vegetation of regions, hamadas and wadis). Forms occurring on coastal dunes (e.g. in Somalia) may be salt-tolerant.

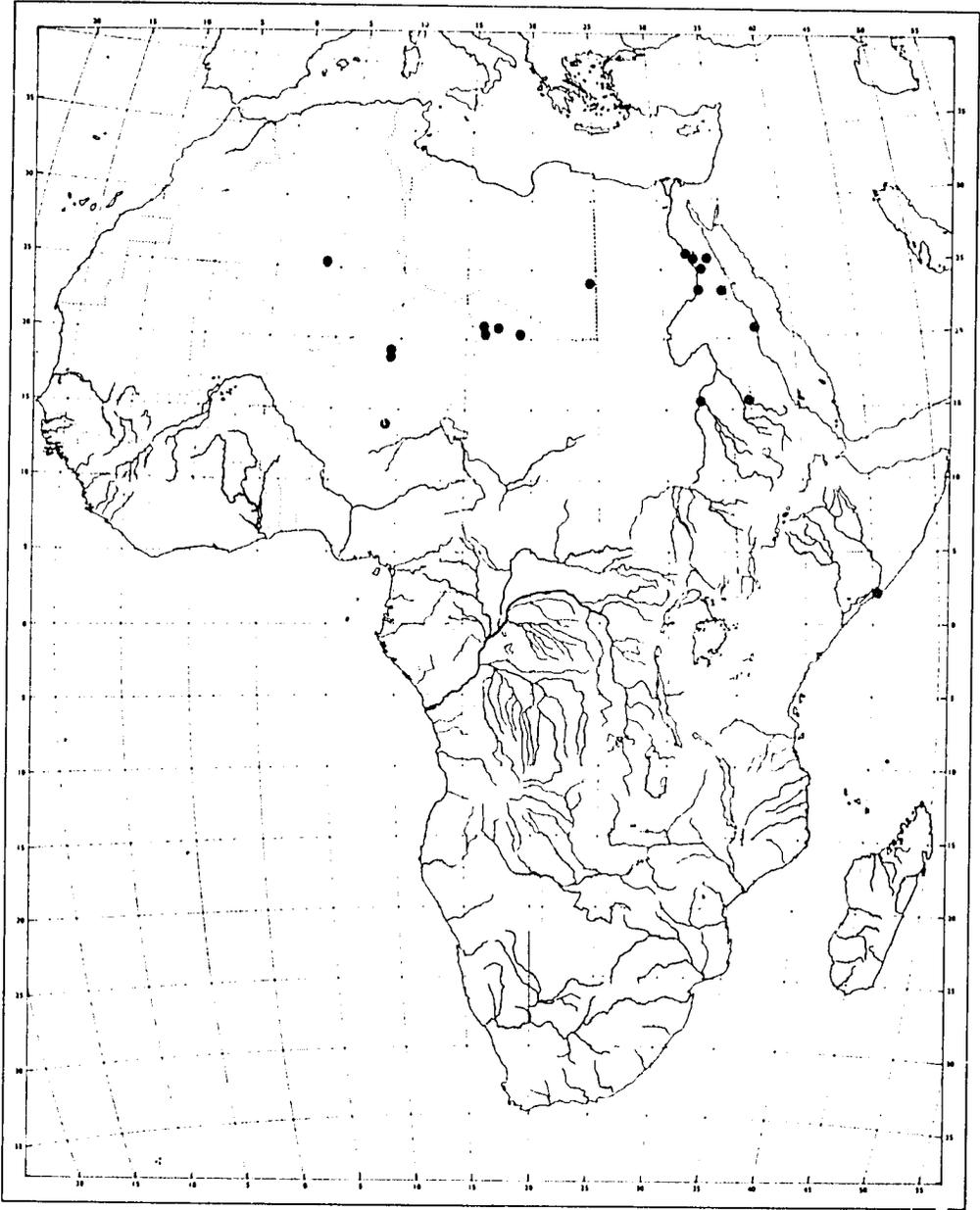
Germination occurs immediately after rain, seedlings appearing within three to four days, with further germination occurring after a longer period. Measured growth rates vary considerably but rate of height growth of up to 10 mm per day have been reported. Growth and final plant size vary according to moisture availability. At least 67 days of growth are needed to bring the plant to flowering size. The generally slow rates of growth of Schouwia compared to other desert ephemerals have been attributed to the woodiness of the stem.

The seeds are small (c 15 mm in diameter) and spherical; it has been suggested that they are distributed with blowing sand.

4 DISTRIBUTION

Egypt; Libya; Algeria; Mauritania; Mali; Niger; Chad; Sudan; Ethiopia; Somalia.

Also in Arabia.



Statute Miles SCALE Kilometers
1:10 000 000

5 USES

It is not generally reported as being a useful fodder, perhaps because it normally grows in sites too dry and remote for many observations to have been made. However, in Niger it has been reported to be the most important annual plant for livestock in the area (Central Air). Earlier observations confirm its importance to camels in the same region.

It can provide shelter and food for desert locusts.

6 SEED COLLECTIONS

Seed collected from near Mogadisho, Somalia, in October 1983, is stored at the Royal Botanic Gardens, Wakehurst Place.

7 POTENTIAL FOR IMPROVEMENT

Insufficient information, but selection of salt-tolerant forms might be possible.

8 AGRONOMY

No information

9 RELATED SPECIES

A number of other members of the family, particularly members of the genera Farsetia, Malcolmia and Zilla, occur in the deserts of northern Africa. Some have local importance for grazing. The family in general is not a tropical one and is more characteristic of cooler deserts and temperate regions.

REFERENCES

Andrews 1948, 1952; Keay 1963; Hemming & Symmons 1969; Newby & Jones 1981; Wickens pers. comm.

1 BOTANICAL

- 1.1 Accepted name Tribulus terrestris L.
- 1.2 Synonyms T.saharae A.Chev.
- 1.3 Family Zygophyllaceae
- 1.4 Vernacular Names Tsaida (Hausa); Dreys, Deræisa, Gatha (Arabic, Sudan); Go'oudo, Goaudo, Garhat, Mogore (Somali); Mbigiri, Mbiliwili (Swahili); Ollaimererwani (Masai); Croix de Malte (French).

2 DESCRIPTION

A small annual herb, sometimes slightly woody at the base, with several prostrate stems arising from a single swollen point and reaching a length of up to 50 cm, but usually less. Leaves paripinnate, in opposite pairs, the members of the pair unequal, 2-5 cm long, each leaf with 5-8 pairs of hairy leaflets each 3-13 mm long. Stipules narrow, falling early. Flowers solitary in the leaf axils; petals about 4 mm long, pale yellow. Fruit circular in outline, slightly flattened, made up of five one-seeded segments each armed with two hard sharp spines.

3 ECOLOGY

A wide-ranging plant of open habitats on relatively well-drained sites, occurring in desert and semi-desert but also ranging into grasslands and woodlands, particularly in overgrazed or trampled places. It germinates quickly after rain and grows very rapidly.

4 DISTRIBUTION

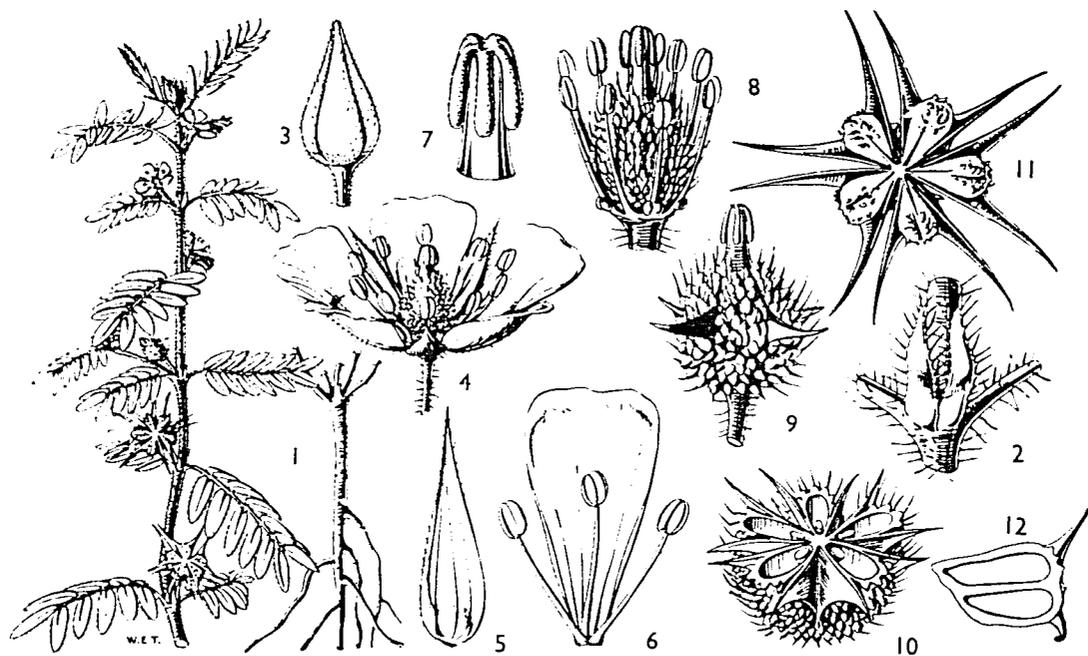
Egypt; Libya; Tunisia; Algeria; Morocco; Senegal; The Gambia; Mali; Ivory Coast; Ghana; Togo; Benin; Niger; Nigeria; Cameroon; Chad; Sudan; Ethiopia; Somalia; Uganda; Kenya; Tanzania; Zaire; Burundi; Rwanda; Mozambique; Zambia; Malawi; Zimbabwe; Botswana; Angola; Namibia; South Africa.

Widespread in the drier tropics and temperate zones of the world.

5 USES

This is a species which can be regarded either as a noxious weed, a dangerous poison to stock, or valuable fodder, depending on the region and on the species consuming it.

In the southern parts of the Sahara it provides a valuable fodder for camels during the wet season. In north-western Kenya it is eaten at the beginning of the rains by all stock. Cows, while liable to suffer from



Tribulus terrestris - 1, habit; 2, leaf-bases with stipules; 3, flower-bud; 4, open flower; 5, sepal; 6, petal with 3 stamens; 7, style with adnate stigmas; 8, flower with sepals and petals removed; 9, ovary with tubercles and spines; 10, ovary in cross-section; 11, fruit from above; 12, vertical section of fruiting carpel.

bloat when feeding on this species are not permanently injured, and goats suffer no ill-effects at all. Sheep, however, can be killed by eating the plant and losses of up to 5% of herds can occur, although the plant is regarded as providing such valuable grazing very early in the rains that this is tolerated and sheep are not prevented from eating the plant. In South Africa, too, toxicity to sheep has been well-documented. (see Verdcourt & Trump 1969 & Watt & Breyer-Brandwijk 1962 for a full discussion of the toxicity and its symptoms).

In West Africa both the leaves and seeds are eaten by humans, the latter after pounding. There are also medicinal uses. The sharp-pointed spines on the seeds are a menace, piercing the feet of men and animals.

Analyses - all from Kenya, Njemps flats. October 1957

Source	CP	EE	CF	NFE	Ash	SFA	Ca	P
Flowers	29.74	8.05	18.26	30.51	13.44	n.d.	1.47	0.64
Leaves	23.87	2.85	14.58	39.52	19.18	n.d.	4.34	0.37
Stems	17.54	1.69	32.83	35.62	12.33	n.d.	2.06	0.27

6 SEED COLLECTIONS

None known

7 POTENTIAL FOR IMPROVEMENT

There could be scope for the development of a quick screening method to detect the presence or absence of the toxic principle - then toxin-free strains could be sought.

8 AGRONOMY

No information

9 RELATED SPECIES

Several closely related species are recorded from the northern Sudan and elsewhere - they appear to be used similarly. T.cistoides L. is grazed by domestic animals in northern Kenya.

REFERENCES

Andrews 1948, 1950; Dalziel 1937; Dougal, Drysdale & Glover 1963; Hemming & Symmons 1969; Keay 1963; Verdcourt & Trump 1969; Watt & Breyer-Brandwijk 1962; White 1983.

Occurrence of each species by country

Trees and Shrubs

	Egypt	Libya	Tunisia	Algeria	Morocco	N. Sahara	Mauritania	Senegal	Mali	Ivory Coast	Niger	Chad	Sudan	Ethiopia	Somalia	Uganda	Kenya	Tanzania	Zimbabwe	Botswana	Angola	Namibia	S. Africa	
Acacia albida																								
Acacia bussei																								
Acacia edgeworthii																								
Acacia ehrenbergiana																								
Acacia etiaica																								
Acacia karroo																								
Acacia senegal																								
Acacia tortilis																								
Balanites aegyptiaca																								
Bauhinia rufescens																								
Boscia albitrunca																								
Boscia angustifolia																								
Cadaba farinosa																								
Capparis decidua																								
Colophospermum mopane																								
Combretum aculeatum																								
Commiphora africana																								
Conocarpus lancifolius																								
Cordeauxia edulis																								
Dichrostachys cinerea																								
Entada leptostachya																								
Erythrina melanacantha																								
Feretia apodanthera																								
Grewia tenax																								
Grewia villosa																								
Guiera senegalensis																								
Inhiosa rotundifolia																								
Leptadenia pyrotechnica																								
Vaerua angolensis																								
Vaerua crassifolia																								
Piliostigma reticulatum																								
Platycalyphium voense																								
Portulacaria afra																								
Pterocarpus lucasii																								
Rhizopus obovatus																								
Salvadora persica																								
Scleroxantha birrea																								
Tamarix indica																								
Vimonia americana																								
Zizyphus mauritanicus																								

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Grasses

	Egypt	Libya	Tunisia	Algeria	Morocco	W. Sahara	Mauritania	Senegal	Wali	Upper Volta	Niger	Chad	Sudan	Ethiopia	Somalia	Kenya	Tanzania	Zimbabwe	Botswana	Angola	Namibia	S. Africa	
<i>Andropogon gayanus</i>							+	+	+	+	+	+	+	+	+	+							
<i>Antheophora pubescens</i>	+																						
<i>Aristida adscensionis</i>	+	+	+	+																			
<i>Aristida mutabilis</i>		+	+				+																
<i>Aristida sieberana</i>			+																				
<i>Cenchrus biflorus</i>				+																			
<i>Cenchrus ciliaris</i>	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Cenchrus setigerus</i>													+	+	+	+							+
<i>Centropodia glauca</i>	+	+																					
<i>Chloris gayana</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Chloris roxburghiana</i>	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Chrysopogon plumulosus</i>																							
<i>Coelachyrum vemenicum</i>	+																						
<i>Cynodon dactylon</i> *	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Dactyloctenium aegyptium</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Dactyloctenium scindicum</i>																							+
<i>Dichanthium annulatum</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Digitaria macroblephara</i>																							
<i>Diplachne fusca</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Echinochloa colona</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Enneapogon desvauxii</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Enteropogon macrostachyus</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Eragrostis curvula</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Eragrostis lehmanniana</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Eragrostis superba</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Eragrostis tremula</i>																							
<i>Lasiurus scindicus</i>																							+
<i>Panicum laetum</i>																							
<i>Panicum turgidum</i>																							+
<i>Paspalidium desertorum</i>																							
<i>Pennisetum violaceum</i>																							
<i>Schmidtia pappophoroides</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Schoenefeldia gracilis</i>																							+
<i>Sporobolus helvolus</i>																							
<i>Sporobolus ioclados</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Stipagrostis uniplumis</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Tetrapogon villosus</i>																							+
<i>Trichoneura mollis</i>																							+
<i>Urochloa mosambicensis</i>	+																						

* see text

Herbaceous Legumes

	S. Africa	Mambia	Angola	Botswana	Zimbabwe	Tanzania	Kenya	Uganda	Somalia	Ethiopia	Sudan	Chad	Niger	Upper Volta	Mali	Senegal	Mauritania	W. Sahara	Morocco	Algeria	Tunisia	Libya	Egypt	
<i>Alysicarpus ovalifolius</i>			+																					
<i>Cassia mimosoides</i>	+																							
<i>Crotalaria arenaria</i>																								
<i>Cullen plicata</i>																								
<i>Indigofera disjuncta</i>		+																				+		
<i>Rhynchosia minima</i>		+																						
<i>Stylosanthes fruticosa</i>		+																						
<i>Tephrosia subtriflora</i>																								
<i>Tylosema esculentum</i>																								
<i>Vigna unguiculata</i>																								
<i>Zornia glochidiata</i>																								

Non-Leguminous Herbs

<i>Blepharis linariifolia</i>																								
<i>Commelina spp.</i> *																								
<i>Cyperus conglomeratus</i>																								
<i>Ipomoea cordofana</i>																								
<i>Monoechma australe</i>																								
<i>Neurada procumbens</i>																								
<i>Schouwia purpurea</i>																								
<i>Tribulus terrestris</i>																								

* see text

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GLOSSARY

Glossary

- alternate - an arrangement of leaves on a stem in which the leaves arise singly, rather than in pairs (see opposite).
- awn - a bristle, often spirally twisted, on the floral parts of a grass.
- axil - the angle between a leaf and the branch which bears it.
- bipinnate - a leaf in which the pinnate divisions are themselves divided into leaflets in a pinnate (q.v.) arrangement.
- bract - a small leaf, often very different in form to the foliage leaves, from whose axil a flower arises.
- calyx - the outer covering of the flower, made up of segments (sepals) which may be separate from one another (free) or joined into a tube (fused).
- capsule - a dry fruit which opens when ripe along at least two lines or pores.
- caryopsis - the seed of a grass, in which the outer layer (testa) of the seed proper is fused to the ovary wall.
- cordate - used of a leaf base when the stalk appears to indent the leaf outline.
- corolla - the inner covering of the flower, made up of segments (petals) which may be separate from one another (free) or joined into a tube (fused).
- corymbose - an inflorescence which is more-or-less flat-topped.
- culm - the stem of a grass or sedge.
- cuneate - used of a leaf base in which the sides of the blade join the leaf-stalk at an acute angle, giving a wedge-shaped outline to the base.
- decumbent - a stem which first lies more-or-less flat, but whose younger parts are usually more upright.
- dehiscent - splitting open.
- ellipsoid - a solid shape which is widest at the middle of its long axis.
- elliptic - a flat shape which is widest at the middle of its longest axis.
- ephemeral - having a very short life-span.

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- floret - a small flower which forms part of an aggregate of flowers.
- glabrous - without hairs of any kind.
- glume - the scale-like bracts which make up the spikelets (q.v.) of grasses and sedges.
- herb - a plant which is not woody, or somewhat woody near the base, and whose stems do not persist from year to year.
- imparipinnate - a pinnate leaf with a single terminal leaflet (see paripinnate).
- indehiscent - not splitting open.
- inflorescence - the groups of flowers borne by a plant. They may be arranged in various ways (see raceme, spike, panicle, corymb, spikelet).
- internode - the stem between the points where leaves arise (see node).
- keel - the lowest pair of petals in the flower of a member of the subfamily Papilionoideae in the family Leguminosae. They are often partially fused.
- lanceolate - of a leaf, narrow, with the broadest point close to the base.
- latex - a juice, usually white and sometimes sticky, which exudes from broken surfaces of a plant.
- leaflet - one of the units making up a compound leaf.
- lemma - the lower of the two glumes (q.v.) which surround each floret (q.v.) in the spikelet (q.v.) of a grass.
- lenticel - a pore in the bark of a branch, usually marked by a corky spot which may be drawn into a line by the growth of the branch.
- ligule - a membranous outgrowth on the upper surface of a grass leaf at the junction of the sheath and the blade. It may be represented by a ridge or by a line of hairs.
- linear - narrow and parallel-sided.
- loculus - a cavity, usually of an ovary.
- medifixed - of hairs, forked and attached at the fork, like a Y with no stem.
- mucronate - of a leaf, having a short abrupt point at the tip.

- node - the point on the stem where a leaf arises.
- opposite - of leaves, arranged on the stem in pairs, with one member of the pair opposite the other.
- ovate - a flat shape which is widest below the middle of its long axis.
- palea - the upper of the two glumes (q.v.) which surround each floret (q.v.) in the spikelet of a grass.
- panicle - a form of raceme (q.v.) in which the primary branches of the inflorescence are themselves branched.
- paripinnate - a pinnate leaf which does not have a single terminal leaflet.
- petiole - the leaf stalk.
- pinna - one of the leaflets making up a pinnately compound leaf.
- pinnate - a leaf divided into leaflets which are arranged along each side of a long axis.
- raceme - an inflorescence in which a single growing point gives rise to a succession of flowers, so that the oldest flowers are at the base of the inflorescence.
- rhachilla - the axis of the spikelet of a grass.
- rhachis - the axis of a pinnate leaf.
- rhizome - an underground stem, usually horizontal and often thicker than the aerial stems, bearing scale-leaves which are usually brown or colourless.
- rhomboïd - four-sided, with the sides equal, but not square.
- sepal - see calyx.
- shrub - a woody plant with many stems from a single base.
- slash - the colour, etc., of the bark seen on the surface of a cut into it.
- spathulate - spoon-shaped, with broad rounded tip attached to a narrow parallel-sided lower part.
- spike - a raceme (q.v.) in which the individual flowers lack stalks and are attached directly to the axis.

- spikelet - the unit making up a grass inflorescence. The spikelet is strictly a small inflorescence in its own right, with two basal sterile glumes (q.v.) with pairs of glumes (palea and lemma, q.v.) above them with a flower between each pair. Although strictly incorrect, it is usual to describe a grass inflorescence as if the units (spikelets) making it up were flowers, not small inflorescences.
- standard - the uppermost, usually largest petal in the flower of members of the subfamily Papilionoideae of Leguminosae.
- stipel - a small bract-like organ at the base of the leaflet of a compound leaf.
- stipule - a small appendage of a leaf, borne usually at the base of the petiole. Usually paired.
- stolon - a prostrate stem which creeps over the ground surface, bearing reduced leaves. It often roots from the nodes.
- succulent - thick and fleshy.
- tendrill - a thin, often twisted or branched organ which assists climbing.
- whorl - a group of similar parts carried in a circular arrangement at a single level.
- wing - one of the two lateral petals of a flower of the subfamily Papilionoideae of the the family Leguminosae. Also used of any flattened membranous part of (e.g.) a seed or fruit.

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