

Weeds and Aliens
in
Africa

The American Immigrant

An Inaugural Lecture

GIVEN IN THE UNIVERSITY COLLEGE OF RHODESIA

Professor
Hiram Wild

UNIVERSITY COLLEGE OF RHODESIA

**WEEDS AND ALIENS
IN AFRICA:
THE AMERICAN IMMIGRANT**

*An Inaugural Lecture
given in the University College of Rhodesia
on 10th October, 1967*

by

HIRAM WILD

Professor of Botany

**UNIVERSITY COLLEGE OF RHODESIA
SALISBURY
1968**

**(C) UNIVERSITY COLLEGE OF RHODESIA
SALISBURY, 1968**

**THE ART PRINTING WORKS LIMITED
LYTTON ROAD, SALISBURY
19496**

PRINTED IN RHODESIA

WEEDS AND ALIENS IN AFRICA: THE AMERICAN IMMIGRANT

by

H. WILD

ABSTRACT

Evidence is produced that a high proportion of weeds in South Central Africa are of tropical South American or Central American origin. In the case of the Heliantheae tribe of the Compositae which has recently been revised for the Flora Zambesiaca area, 28% of the Heliantheae are American in origin, cosmopolitan or pantropical weeds comprise 10%, African weeds 10%, and none come from Europe. 50% are non-weedy species. Of the important weeds of Rhodesia of all flowering plant families, American weeds constitute 32%, Mediterranean and European weeds 9%, Eurasian or Asiatic weeds 4%, pantropical or cosmopolitan weeds 15%, and African weeds 39%. Although the Anglo-Boer war at the beginning of this century is often said to be responsible for the introduction of many weeds, including the Khaki weeds *Alternanthera pungens* and *Tagetes minuta*, to southern Africa in fodder, etc., it is shown that many American weeds have been recorded from tropical Africa from the early nineteenth century onwards. Furthermore, documentary evidence is produced that American cultivated plants were of importance in tropical Africa from about 1600 onwards and that they were introduced to tropical Africa mainly by the Portuguese and by other western European nations, because of the close maritime connection between South and Central America and Africa, brought about by the importance of the slave trade, as well as by other forms of trade. These American plants such as maize, sweet potato, cassava, pineapple etc. could not have been introduced over such a long period without bringing American weed species with them. The spread of maize through Africa as an important cultivated crop must also have played its part in spreading weeds, although some of the American weeds in Africa such as *Acanthospermum* spp., *Bidens* spp., etc., are common by footpaths and roads and must have also been distributed on clothing, etc., by human agency.

WEEDS AND ALIENS IN AFRICA

Finally, the numbers of African Composite introductions to America are discussed. In the case of Argentina, Venezuela, Jamaica, the Barbados and Cuba which have up-to-date Composite floras the proportion of African immigrants is found to be very small. On the other hand, the proportion of American aliens in the Java flora is high (25%). The greater density of species in tropical America than in Africa may, by subjecting American species to greater competition, cause their success as colonists, although this explanation is not so applicable to Malaysia where species density is also high. The fact that Europe, Asia and Africa still have land connections, whilst America has been completely isolated since the fragmentation of Gondwanaland in the late Jurassic-Cretaceous may be of more significance. An analysis of the Composite flora of Madagascar reveals a picture very similar to that of the African mainland, with a high proportion of American aliens, especially Heliantheae.

I. INTRODUCTION

In Sir Edward Salisbury's fascinating and scholarly book "Weeds and Aliens" (1961, pp. 86-88) the preponderance in many parts of the world of weeds of European origin is commented on. For instance, he quotes Canada as having 60% of its weed species comprised of introductions from Europe, New Zealand 80% (including those occurring in the remainder of the Old World also but with a high proportion from Europe alone), and New South Wales 59% (including 25% from the Mediterranean area). Without giving figures he also comments on the importance of weeds from Europe in Rhodesia and S. Africa. In some cases it is true he is not speaking strictly of weeds of European origin but of those that occur in Europe and which may have come originally from elsewhere, e.g. *Galinsoga parviflora* and *Oxalis corniculata*. Nevertheless, particularly in the case of Rhodesia, this gives a wrong impression since even fairly casual observation in this country reveals that a surprising proportion of our important annual weeds such as *Acanthospermum hispidum*, *Bidens formosa* (*Cosmos bipinnata*), *Argemone mexicana*, etc., are American weeds and are not likely to have reached us via Europe. There is also a very interesting analysis of the Transvaal alien flora (Burt Davy, 1904) which shows that early this century 17%

WEEDS AND ALIENS IN AFRICA

of the Transvaal weed flora was of American origin, although 40% came from the Mediterranean and Asiatic regions; from Europe the comparable figure was only 8%.

Particularly, perhaps, in Africa it is not always easy to give an accurate picture of the provenance of weed species because the nomenclature and taxonomy of the species often pose difficulties since the regions to which they are native, as well as Africa itself, often lack complete and reasonably recent written floras. However, the present author (Wild, 1967) recently published a comprehensive account of the Heliantheae tribe of the Compositae for the Flora Zambesiaca (Botswana, Zambia, Rhodesia, Malawi and Mozambique) and the assessment of countries of origin of the weed species is, it is hoped, more reliable than usual. Sixty species were involved altogether and an unusually high proportion were shown to be weeds of American origin. This may be a somewhat unusual case since the Heliantheae are particularly well represented on the American continent. However, with the aid of some additional evidence regarding other groups, and from the historical picture generally, it will be shown that weeds or aliens of American origin are of particular importance in South Central Africa and indeed in tropical Africa as a whole.

II. WEED SPECIES BELONGING TO THE HELIANTHEAE FOUND IN THE FLORA ZAMBESIACA AREA.

All the species discussed below are taken from "The Compositae of the Flora Zambesiaca Area, 1, Heliantheae" (Wild in *Kirkia*, 6, 1: 1-62, 1967).

1. *Ambrosia maritima* L.

This species is indigenous (usually as a coastal species) in the Mediterranean, East and West Tropical Africa, Northeast Africa, the Mascarenes and South Africa.

An annual weed of the flood plains of the Kafue and also near Umtali. It occurs elsewhere in the Flora Zambesiaca area but on the relevant herbarium sheets is not stated to be a weed.

It is not considered a weed outside our area. Our plant is glabrescent and more slender than the form from the Mediterranean and Northeast Africa and may be a distinct subspecies.

WEEDS AND ALIENS IN AFRICA

It is interesting to note that the American species *A. artemesiifolia* is widespread as a weed but not in Africa.

2. *Xanthium strumarium* L.

A pantropical weed occurring also in the subtropics. It occurs more rarely in the temperate zone and is probably more ephemeral in these regions. By 1904 it was a common weed in Natal but was rare in the Transvaal.

Our form, like that in S. Africa (Henderson and Anderson, 1966) belongs probably to the American taxon *X. strumarium* subsp. *cavanillesii* (Schouw) D. Löve and Dansereau var. *glabratum* (DC.) Cronq.

With us it is a weed of disturbed ground or moist grassland near streams throughout Rhodesia and in southern Zambia, Botswana and southern Mozambique.

3. *Xanthium spinosum* L.

A cosmopolitan weed. Henderson and Anderson (1966) state that this species is American in origin. However, as it is now cosmopolitan its source of origin is somewhat doubtful. In order not to distort unwittingly the true picture, cases which are at all doubtful will be left as such.

An annual weed in the drier parts of Rhodesia and Botswana. By 1904 it was abundant in the Cape, Natal, Orange Free State, the Transvaal and Botswana (Burt Davy, 1904).

4. *Acanthospermum hispidum* DC.

Indigenous in tropical South America (Type from Brazil). An important weed in tropical and subtropical Africa.

An annual weed common around African villages, along tracks, in overgrazed grassland, and in arable land (particularly in maize).

5. *Acanthospermum glabratum* (DC.) Wild

Indigenous in South America occurring in eastern Brazil, as far north as Rio de Janeiro, and in Paraguay and Uruguay.

An annual or perhaps rarely a perennial weed recorded from Zambia, Rhodesia and southern Mozambique. A weed also in Kenya, South Africa and Florida and Georgia (United States) Occurs in higher rainfall areas at roadsides and in overgrazed grassland.

WEEDS AND ALIENS IN AFRICA

6. *Acanthospermum australe* (Loefl.) Kuntze

Indigenous in South and Central America but more tropical in its distribution than *A. glabratum*, i.e. native to the West Indies, the Guianas, Brazil (south to about Rio de Janeiro), Venezuela, Columbia, Bolivia and northern Paraguay.

An annual or perhaps sometimes perennial weed in Zambia, Rhodesia, Malawi and Mozambique. Occurs at roadsides and in overgrazed grasslands in higher rainfall areas.

It is interesting to note that this species and *A. glabratum* have discrete geographical distributions where they are indigenous. In South Central Africa they occur together. In other words, once the ecological situation is changed and their natural competitors are no longer present, they are no longer mutually exclusive.

7. *Parthenium hysterophorus* L.

Indigenous in South and Central America from Chile and the Argentine to Mexico. Occurs also in Texas and Florida.

An annual weed of roadsides and disturbed ground, confined in our area to southern Mozambique. Occurs also in Madagascar.

8. *Galinsoga parviflora* Cav.

A native of Central and South America.

In Rhodesia a common annual weed of arable land, cultivated areas and roadsides. Recorded as a weed also in the United States, the Old World tropics, the subtropics and even from some temperate areas, i.e. southern England.

9. *Galinsoga ciliata* (Raf.) Blake

A native of Central and South America.

A rare annual weed in the eastern part of Rhodesia found at roadsides and in waste places. Recorded as a weed also in tropical West Africa, the United States, Canada and Europe. A not very conspicuous plant which would also probably be found to be present in other parts of tropical Africa between tropical West Africa and Rhodesia.

10. *Tridax procumbens* L.

A native of Central America.

WEEDS AND ALIENS IN AFRICA

An annual (or/? perennial) weed of roadsides, waste places and gardens in Zambia, Rhodesia, Malawi, and Mozambique. Also recorded as a weed in tropical Africa, Madagascar, Asia, Australia, and some Pacific islands.

11. *Bidens schimperi* Schultz Bip.

Indigenous in Africa from Ethiopia to Natal and westwards to Angola.

An annual weed of bare areas or arable land. Also common as a normal constituent of indigenous woodlands and savannas.

12. *Bidens pilosa* L.

The type is from America and it may be of American origin but it is so cosmopolitan as a weed throughout the tropics and subtropics that it is difficult to be certain.

An annual weed of arable land and waste places, common throughout Africa.

13. *Bidens biternata* (Lour.) Merr. and Sherff

Widespread in the Old World from Arabia to Japan, in Malaysia, Australia, and the Pacific Islands. Also throughout Africa from Natal, the Transvaal and South West Africa to Kenya and tropical West Africa; in the Cape Verde Islands, Madeira, Sokotra, and the Mascarenes.

Annual weed of waste places and, rather uncommonly, of arable lands. Also common as a normal constituent of indigenous vegetation. The species probably includes a number of more or less distinct subspecies and varieties and some of these are indigenous components of the flora of South Central Africa at least. It is considerably rarer as a weed than *B. pilosa*. The commonest African form which has yellow ray florets may be an African subspecies distinct from the Asiatic form which is said to have whitish florets. Some of our forms may also represent hybrids between *B. biternata* L. and *B. bipinnata* L. The latter is a weedy species which occurs in Africa but which has not been recorded in its typical form in the Flora Zambesiaca area. *B. bipinnata* may in fact have been introduced to the area in the past but lost its identity by hybridisation with *B. biternata*.

WEEDS AND ALIENS IN AFRICA

14. *Bidens formosa* (Bonato) Schultz Bip. (*Cosmos bipinnatus* Cav.)

A native of Central America from Central Mexico to Arizona; also in the West Indies.

A widespread annual weed introduced in the first place no doubt as a garden plant. A roadside weed common in Zambia and Rhodesia; also recorded as a weed in Natal, the Transvaal, Orange Free State, Eastern Cape, and Basutoland. It was known as a weed or escape in the Transvaal prior to 1904 (Burt Davy, 1904).

15. *Bidens sulphurea* (Cav.) Schultz Bip. (*Cosmos sulphureus* Cav.)

A native of Mexico.

A common annual roadside weed in Zambia and Rhodesia but usually in somewhat hotter and drier areas than *B. formosa*. Also recorded as a weed in Tanganyika and may be more widespread in Africa than herbarium records show. Also a weed in the United States of America.

16. *Chrysanthellum americanum* (L.) Vatke

Probably tropical American in origin (the type comes from the West Indies) but as it is now pantropical in distribution it is difficult to be sure.

Common annual weed in Zambia, Rhodesia, Malawi, and Mozambique. Often in damp situations or gardens, roadsides, heavily grazed grassland, etc. Widespread as a weed in tropical Africa from the Sudan and tropical West Africa southwards to Rhodesia, and also throughout the remainder of the tropics generally.

17. *Sigesbeckia orientalis* L.

Probably native in Africa as well as Asia. A weed of cultivation in higher rainfall areas in Zambia, Rhodesia, Malawi and Mozambique, especially near forest patches. At forest edges it gives an impression of being a normal constituent of the indigenous vegetation. It has also been recorded as a weed in the Transvaal (Henderson and Anderson, 1966, p. 394). Also widespread in the tropical and subtropical regions of the Old World.

18. *Blainvillea gayana* Cass.

Indigenous in Africa. If this is a good species taxonomically it is an example of a weed of African origin. However, it is only distinguished from the tropical American *B. latifolia* (L.f.) DC. and the Indian and Madagascan *B. rhomboidea* Jacq. by having elongate-campanulate rather than hemispheric capitula. It may be a distinct subspecies but if future taxonomic research should show it to be not significantly distinct from the above-mentioned American and Asiatic species then it may not be exclusively African in origin as a weed.

An annual weed of cultivation in the hotter and usually lower areas in Botswana, Zambia, Rhodesia, and Mozambique; also throughout tropical Africa to the north. In our area at least it often appears to be a normal constituent of natural vegetation. This could point to its origin in Africa as a weed whatever the taxonomic situation.

19. *Aspilia kotschy* (Schultz Bip.) Oliv.

Occurs as an indigenous component of natural vegetation throughout tropical Africa from Senegal and Ethiopia in the north to Rhodesia and Mozambique in the south. It is therefore a weed of purely African origin.

An annual weed of cultivation in Zambia, Rhodesia, Malawi and Mozambique in the hotter areas. Can also be a weed in tropical Africa farther to the north.

20. *Aspilia ciliata* (Schumach.) Wild

Native in tropical Africa from Ethiopia and Senegal southwards to the northern escarpment of the Zambezi.

An annual weed of cultivation on bare ground in Zambia and also in tropical West Africa (Adams in Hepper, 1963, p. 239)

21. *Zinnia peruviana* (L.) L.

Native in South and Central America from Brazil and Bolivia to Mexico. It also occurs in Florida and Texas but here it may be introduced.

An annual roadside weed in Matabeleland. Also a common roadside weed in S. Africa and South West Africa. As it is also recorded as a weed in the islands of the Gulf of Guinea (Exell, 1944) and Ethiopia it probably has a wider distribution

as a weed in other parts of tropical Africa than published records show.

22. *Tithonia rotundifolia* (Mill.) Blake

Native in Central America from Mexico to Panama. It also occurs in the West Indies, Venezuela and Brazil, although in these territories it may be introduced.

A tall annual weed of roadsides and waste ground in Zambia and Rhodesia. It has also been recorded as a ruderal on copper bearing soils in Katanga by Duvigneaud (1958, p. 268).

23. *Tithonia diversifolia* (Hemsl.) A. Gray

Native in Central America from Mexico to Costa Rica.

A tall annual (or perhaps sometimes perennial) herb of roadsides and waste places in Zambia, Rhodesia, Malawi and Mozambique. It probably occurs farther north in tropical Africa as a weed but there appear to be no reliable records. It is also an introduced weed in the West Indies, Ceylon, India and Malaysia.

24. *Montanoa bipinnatifida* (Kunth) C. Koch

Native in Mexico.

A rather rare weed of waste areas in the higher rainfall areas of Rhodesia.

25. *Helianthus argophyllus* Torr. & Gray

Native to the southeastern United States.

An annual herb which is a successful colonist of the sand dunes and sandy coastal areas of the Lourenço Marques district of Mozambique.

**26. *Helianthus debilis* Nutt. var. *cucumerifolius* (Torr. & Gray)
A. Gray**

Native to the southeastern United States.

A colonist of the coastal areas near Lourenço Marques in Mozambique but not as common as *H. argophyllus*.

27. *Eclipta prostrata* (L.) L.

A cosmopolitan weed of the warmer regions of the world and so it is not possible to say to which part of the world it is indigenous. In our area it appears to occur naturally around

pans and in flood plains. The possibility that it is indigenous in Africa, as well as perhaps elsewhere, cannot be excluded.

An erect or decumbent annual weed (sometimes surviving for more than one year), common throughout the Flora Zambesiaca area in the hotter parts and usually in damp or swampy situations.

28. *Verbesina encelioides* (Cav.) A. Gray

Native to the southwestern United States and Mexico.

A colonist of bare ground in low rainfall areas in Botswana, the Limpopo Valley in Rhodesia, and in southern Mozambique; often on river banks. It occurs also as an introduction in the Cape Province, the Transvaal and South West Africa, as well as in tropical West Africa, the Sudan and the West Indies.

The Heliantheae of the Flora Zambesiaca area may thus be subdivided as follows: American weeds; *Xanthium strumarium* subsp. *cavanillesii* var. *glabratum*, *Acanthospermum hispidum*, *A. australe*, *A. glabratum*, *Parthenium hysterophorus*, *Galinsoga parviflora*, *G. ciliata*, *Tridax procumbens*, *Bidens formosa*, *B. sulphurea*, *Chrysanthellum americanum*, *Zinnia peruviana*, *Tithonia rotundifolia*, *T. diversifolia*, *Montanoa bipinnatifida*, *Helianthus argophyllus*, *H. debilis* var. *cucumerifolius* and *Verbesina encelioides*; cosmopolitan or pantropical weeds, *Xanthium spinosum*, *Bidens pilosa*, *B. biternata* (Old World only), *Enydra fluctuans* (Old World and Australia) and *Eclipta prostrata*; African weeds, *Ambrosia maritima*, (also in Mediterranean area and Mascarenes but not necessarily as a weed), *Bidens schimperi*, *Sigesbeckia orientalis* (also in Old World), *Blainvillea gayana*, *Aspilia kotschyi* and *Aspilia ciliata*. The American weeds comprise 28% of the total, the cosmopolitan or pantropical (some of which may in fact be American, e.g. *Xanthium spinosum* and *Bidens pilosa*) 10%, and the African weeds 10%. There is a total of 60 species of Heliantheae recorded for the Flora Zambesiaca so that 48% of them are weeds. This high proportion is in part correlated no doubt with the high efficiency of the Compositae in seed dispersal and the high proportion of annuals. On the other hand the percentage is a good deal lower in all other tribes of Compositae occurring in the Flora Zambesiaca area. A rough estimate of the percentage of weed species in the whole flora would probably not go much higher than 4%.

WEEDS AND ALIENS IN AFRICA

However, the proportion of American species is strikingly high and this would be confirmed in other families, and other tribes of the Compositae, by reference to Wild (1955). The more important American species included in this latter work are as follows:

<i>Eichhornea crassipes</i>	<i>Erigeron bonariensis</i>
<i>Argemone mexicana</i>	<i>E. floribundus</i>
<i>Gomphrena celosioides</i>	<i>Galinsoga parviflora</i>
<i>Oxalis latifolia</i>	<i>G. ciliata</i>
<i>Oenothera rosea</i>	<i>Schkuhria pinnata</i>
<i>Opuntia megacantha</i>	<i>Tagetes minuta</i>
<i>Euphorbia chamaesyce</i>	<i>Nicandra physaloides</i>
<i>Apium leptophyllum</i>	<i>Nicotiana glauca</i>
<i>Richardia brasiliensis</i>	<i>Physalis angulata</i>
<i>Acanthospermum glabratum</i>	<i>P. peruviana</i>
<i>A. australe</i>	<i>Lantana camara</i>
<i>A. hispidum</i> .	

The weeds which can be called European or Mediterranean with a reasonable degree of certainty are:

<i>Rumex angiocarpus</i>
<i>Chenopodium murale</i> (also Asiatic)
<i>Chenopodium album</i> (also temperate Asia)
<i>Sonchus oleraceus</i>
<i>Plantago lanceolata</i> (also Asiatic)
<i>Gnaphalium luteo-album</i> (southern Europe)
<i>Portulaca oleracea</i> (southern Europe).

It is noteworthy that these are much less common and less important than those from America. *Rumex angiocarpus* is confined to the acidic soils of the pome fruit orchards, etc. of the Eastern Border areas of Rhodesia. *Sonchus oleraceus* is confined to gardens and damp places. *Plantago lanceolata* is a rare garden weed and *Portulaca oleracea* is likewise mostly a garden weed. *Gnaphalium luteo-album* on the other hand is widespread and common. Weeds of Asiatic or Eurasian origin are *Caesalpinia decapetala*, *Cassia absus*, *Cannabis sativa* and *Boerhaavia diffusa* (may also be indigenous in Africa).

Pantropical and cosmopolitan weeds are:

<i>Cyperus rotundus</i>	<i>Dichondra repens</i>
<i>Cyperus esculentus</i>	<i>Sida alba</i>
<i>Commelina benghalensis</i>	<i>Ageratum conyzoides</i>

WEEDS AND ALIENS IN AFRICA

Hibiscus trionum
Euphorbia hirta
Bidens pilosa.

Eclipta prostrata
Leucas martinicensis

African weeds are:

Rottboellia exaltata
Gynandropsis gynandra
 (& India)
Gisekia africana var.
pedunculata
Trianthema pentandra
 (Africa to India)
Chenopodium schraderianum
Kyphocarpa zeyheri
Sida cordifolia
Ricinus communis
Borreria scabra
Bidens biternata
 (African form)
Crassocephalum rubens
Lopholaena coriifolia
Heliotropium ovalifolium
Withania somnifera
Dicerocaryum zanguebarium
Corchorus tridens
 (and Asia)
Hibiscus cannabinus
 (and Asia)

Cleome monophylla
Corbichonia decumbens
 (Africa & India)
Achyranthes aspera
Celosia trigyna (and
 Madagascar).
Tribulus terrestris
Acalypha segetalis
Dichrostachys cinerea
 (and Asia)
Oldenlandia herbacea
 (and Asia)
Stoebe vulgaris
Solanum incanum
Alectra kirkii (parasite)
Alectra vogelii (parasite)
Striga asiatica (parasite, and
 Asia)
Striga forbesii (parasite)
Striga gesneroides (parasite)
Ipomoea cynanchifolia
 (and Asia)
Phyllanthus maderaspatensis
 (and Asia).

Further research may elucidate the origin of some cosmopolitan, pantropical or intercontinental weeds but the above is probably a conservative assessment in the light of present knowledge. Worked out in percentages we have (omitting a few weeds in Wild (1955) which were included for special reasons, i.e. *Dichapetalum cymosum* included because very poisonous), American weeds 32%, Mediterranean and European weeds 9%, Eurasian or Asiatic weeds 4%, pantropical or cosmopolitan weeds 15% and African weeds 39%. The comparable figures for the whole of S. Africa based on Henderson and Anderson (1966) are, out of a total of 210 weed species, American weeds 30%, Mediterranean and European weeds

WEEDS AND ALIENS IN AFRICA

25%, Asiatic or Eurasian weeds 9%, pantropical or cosmopolitan weeds 5%, Australian weeds (*Acacia* and *Hakea* spp. only) 3%, and African weeds 20%. Apart from weeds of African origin the American and pantropical or cosmopolitan weeds are most important in Rhodesia whilst in S. Africa the Mediterranean and European weeds assume a greater importance, the pantropical element is not surprisingly less important, but the American group remains very significant.

III. THE ENTRY OF AMERICAN WEEDS INTO SOUTH CENTRAL AFRICA AND AFRICA AS A WHOLE

If we accept the importance of American weeds in South Central Africa, and Africa as a whole, there are three questions to which it would be very interesting to have answers. These are firstly, when did these plants arrive in Africa, secondly, how did they get to Africa and thirdly, why did they successfully persist in Africa?

The last of these questions is the easiest to answer. Introduced weeds in any part of the world tend to have innate advantages in that their introduction often leaves behind the natural pests, insects, fungi, etc. which operate to their disadvantage in their natural homes. In addition they leave behind their most effective ecological competitors in the form of other plant species and enter an environment in which their new competitors are not specially adapted to compete against them. In the case of Central and South American weeds they have an additional advantage in that they come from an area such as the high plateau savannas of Brazil and the lower coastal tropical areas which can be more or less exactly matched in Africa. Immigrants from South and Central America are bound to find ecological niches in Africa in which they can thrive.

If we pass on to the question as to when these immigrants first arrived and established themselves in Africa the picture is more complicated. In South Africa the theory is very widely held that the Anglo-Boer war played an important part in the introduction of weed species to S. Africa. It will be found expressed by Burt Davy (1904, p. 293) as follows, "The problem is much complicated in the case of South Africa, from the fact that so much stock, forage and agricultural seed was gathered together during the late war by the Military and Repatriation

Departments, from all parts of the world and has been scattered broadcast over the country. That many aliens owe their introduction to these sources is evident from the fact that they are found only on the sites of Military and Repatriation camps." The idea has passed into folklore in South Africa through the names given to two common weeds of American origin in South Africa; *Alternanthera pungens* is known as khaki weed in South Africa (and Rhodesia) and *Tagetes minuta* is known as tall khaki weed. The assumption is that the British army, who adopted khaki uniform in the South African war, were responsible for the introduction of these species (Smith, 1966). It is very likely that they were, but were these necessarily the first introductions to South Africa, or tropical Africa, of these weeds and other American species, as well as of species from elsewhere? Salisbury (1961, p. 19) remarks that species may be present in an area in small numbers without becoming aggressive, but when conditions arise that enable the populations to be built up to a certain level aggressiveness develops, not as a gradual, but as a comparatively abrupt phenomenon. He refers to the aggressiveness of the Rosebay Willowherb (*Chamaenerion augustifolium*) which had been present in Britain from late Glacial times but was unobtrusive until the London bomb sites of the 1939-1945 war provided the habitats that stimulated an explosive development. Perhaps this was the case with some South African weeds particularly as it can be shown that many of them were present in Africa, if not in South Africa itself, long before the Anglo-Boer war. The following American weeds and introductions are examples, most of which occur in South Africa and South Central Africa, whose establishment in continental Africa antedates the beginning of this century:—

1. *Alternanthera pungens* Kunth (*A. repens* (L.) Link; *A. echinata* Sm.)

Recorded in:

- (a) Angola, Lower Congo (Zaire by C. L. Smith in 1816 (Oliver, 1868-); Luanda 1854 by Welwitsch (Hiern, 1866); Cuanza Norte, Golungo Alto, Camilungo (i.e. inland) 1855 by Welwitsch.
- (b) Nigeria, 1841 by Vogel
- (c) Niger (Nupe) by Barter 1858.

2. *Apium leptophyllum* (Pers.) F. Muell.

Recorded in:

Angola, Barra no Bengo, in Sugar plantations by Welwitsch in 1853; Icole e Bengo, near Panda in Maize and Cassava by Welwitsch in 1854.

3. *Argemone mexicana* L.

Recorded in:

Sierra Leone, Freetown, in 1853 by Welwitsch.

4. *Duranta repens* L.

Recorded in:

- (a) Angola, Huila by Welwitsch (already spontaneous in thickets far inland by 1859).
- (b) Nigeria, Lagos, by Barter in 1858.
- (c) Transvaal by Burke in 1829, i.e. far inland (Harvey and Sonder, 1894-).

5. *Euphorbia chamaesyce* L. (*E. prostrata* Ait.)

Recorded in:

- (a) Sierra Leone, by George Don in 1822.
- (b) Angola, Huila, Lopollo (i.e. well inland) by Welwitsch in 1859.

6. *Lantana camara* L.

Recorded in:

- (a) Gold Coast (Ghana), Cape Coast, by Vogel in 1841.
- (b) Angola, Cuanza Norte, Pungo Andongo (i.e. inland) by Welwitsch in 1856.

7. *Mirabilis jalapa* L.

Recorded in:

- (a) Angola, Cuanza Norte, Golungo Alto (i.e. inland) by Welwitsch in 1855.
- (b) Malawi, Shire R., by Kirk in 1859.

8. *Physalis angulata* L.

Recorded in:

Sierra Leone and Ghana by Vogel in 1841.

The above records are taken from Oliver's Flora of Tropical Africa (1868-), Harvey and Sonder's Flora Capensis (1894-1908), and Hiern's Catalogue of Welwitsch's African Plants (1896-1901), the latter consisting mainly of Angolan plants. The recordings of these American species date from 1816 (for Christen Smith). Prior to this there was very little systematic plant collecting carried out in tropical Africa although there are a few exceptions such as the collection of Palisot de Beauvois in Benin 1786-1798 and of Thonning in Ghana in 1799-1803. The recording of some of these species such as *Duranta repens* well inland shows that they were well established in tropical Africa before the middle of the nineteenth century.

Their original introduction must therefore, in some cases at least, go back well before this and the question arises as to when this was and how it was brought about.

IV. THE ORIGINAL INTRODUCTION OF AMERICAN WEEDS TO AFRICA.

The importance of the dispersal of weed seeds as impurities in crop seeds, fodder, etc. is well known and has been treated at some length by Salisbury (1961, p. 111-119, etc.). Most weeds which have reached continents and territories new to them must have done so by this means. This method was particularly effective before modern machinery for seed cleaning, winnowing, screening, etc., was in common use. As we are dealing with the period prior to 1850 we can assume that seed imported to Africa was not likely to be very free of weed seeds. Furthermore, some of the crop plants concerned such as sweet potato (*Ipomoea batatas*), cassava (*Manihot utillissima*) and perhaps the pineapple (*Ananas sativa*) would have been imported as vegetative propagules, tubers, rhizomes, etc. Often soil would remain clinging to them and weed seed dispersal would have been even more effectively brought about.

The probable answer as to how weed seeds were first brought to tropical Africa is, as will be shown, fairly clear. The chances that Portuguese ships travelling between South America and West Africa, subsequent to the first landing in Brazil by the Portuguese navigator Pedro Alvares Cabral in 1500, must have brought weed seeds with them is very strong. However, it is interesting to go into the evidence a little more thoroughly.

V. THE MARITIME CONNECTION BETWEEN SOUTH AND CENTRAL AMERICA AND AFRICA SUBSEQUENT TO 1500.

After Cabral's visit to Brazil in 1500 there was no real settlement in Brazil by the Portuguese until the reign of João III (1521-1557). Organised government was first established (*Encyclopaedia Britannica*, ed. 1962, Brazil) at São Vicente south of the present city of Santo in 1532 and soon became a flourishing settlement. This type of settlement was called a captaincy governed by a "captain" and by the mid-16th century this captaincy had a population of 5,000 and included the ports of Santos and São Paulo some distance inland. In northern Brazil the captaincy of Pernambuco at about the same time had become a flourishing sugar producing region. In 1549 Tomé de Sousa became the first Governor-General of Brazil and Bahia became the capital. The country, now unified, progressed more rapidly and by 1600 Bahia and Pernambuco (Recife) each had populations of 2,000 Europeans as well as large populations of Africans and Indians. Brazil was thus by 1600 an important trading nation and the large population of Africans in the settlements is very significant. They were of course brought as slaves from Africa and until 1850 this trade in slaves between Africa and tropical America continued on a large scale, first on the part of the Portuguese, and soon by the English, Dutch, French, and Danes. The size of this trade, the amount of shipping it involved, and the bulk of edible as well as other stores, can be guessed at if we consult Coupland's (1933) review of the subject. Slaves were apparently first taken from Guinea to Haiti in 1510 and to Cuba in 1521. By 1576 there were an estimated 40,000 slaves who had been carried to Spanish America and by 1585 there were 10,000 Africans in Pernambuco alone. From the end of the sixteenth century the English, Dutch, French, and Danes were vigorously assisting with the trade and this continued for 250 years, more or less.

The Portuguese in their famous series of navigations had reached Angola by 1482 (voyage of Diego Cão) but the main phase of occupation of the coastal regions of Angola began in 1575. From sometime subsequent to this date the Portuguese slave traders, with the energetic aid of some of the African

WEEDS AND ALIENS IN AFRICA

Kingdoms inland, took many of the Africans destined for tropical America from Angola. This is not to say that there was not plenty of other types of maritime trade between tropical Africa and tropical America and since Portugal had both control of Brazil as well as of Angola and Portuguese Guinea, much of this was in their hands. However, there is no doubt that the slave trade must have guaranteed a constant flow of ships between the two continents during the two hundred years or more prior to 1850. By 1850 we know from the records given earlier that many American weeds were well established in tropical Africa and it must have been in the period beginning shortly before 1600 and continuing to 1850 that they were constantly being introduced to Africa. We have records only for the latter part of this period in the form of authentic specimens of the weeds themselves, but we know they could scarcely have failed to accompany crop plants and other cultivated plants brought to Africa from America. This importation of crop plants was no doubt stimulated by the greater abundance of valuable tropical food plants in America than in Africa. The Portuguese, excellent gardeners and cultivators that they have always been, were particularly quick to export these useful plants not only to Africa but to their other possessions throughout the world. Ships travelling back to Africa from South America had no slaves and so had ample room for other cargoes, including plants.

Published evidence for the well established presence of American crop plants in Africa is not far to seek and it is impossible to believe that they could have been brought to Africa without a proportion of weed contaminants. Dr. F. A. Mendonça (1962) has already published an interesting account of early plant collectors in Angola and reproduces illustrations of *Ipomoea batatas* (sweet potato), *Ananas sativa* (pineapple) and *Carica papaya* (pawpaw) which were growing in Angola by 1687. Furthermore, the author who first published these illustrations, P. Giov. Antonio Cavazzi de Montecuccolo (1687), saw these plants so well established in Angola that he assumed them to be indigenous to Africa.

There is another somewhat earlier work whose illustrations give reliable evidence of the effective establishment of American crop plants in Africa. This is Pieter de Marées' *Descr. Recit. Hist. Riche Roy d'Or de Gunea*, Amsterdam, 1605. It refers to

WEEDS AND ALIENS IN AFRICA

Portuguese Guinea and his fig. 3 shows a quartette of African maidens carrying platters of sugar cane, pineapple and bananas. His figure 13 (see plate I) has an excellent drawing of a maize plant and his figure 14 has Ananas or pineapple, which he actually says was brought by the Portuguese from New Spain, and the sweet potato (*Ipomoea batatas*) (see plate II). His Figure 15 has a recognisable drawing of what he calls "Mandioc" or *Cassava utilisissima*.

François Froger in his "Relation d'un Voyage fait en 1695, 1696 and 1697 aux Côtes de'Afrique . . ." Paris (1698, p. 46) has an illustration of "Cerifes du Bresil" which looks as if it is probably the tropical American Pitanga cherry, *Eugenia uniflora*.

The above references have all applied to tropical West Africa; there are also a number for tropical East Africa particularly referring to Mozambique, which can be found conveniently brought together in facsimile with translations by G. M. Theal in his "Records of South-Eastern Africa" (1898-1903). Among these Fr. João dos Santos in his "Ethiopia Oriental" (1609, Tome I, Cap. IV) in referring to Mozambique Island in Northern Mozambique mentions the American species *Ananas sativa*, *Ipomoea batatas* and "milho". This latter word usually means maize in Portuguese but unless qualified in some way may just possibly refer to a *Sorghum* species or millet.

Also in "Ethiopia Oriental" the districts of Sena and Tete are mentioned and reported as growing there prior to 1609 are sweet potatoes (*Ipomoea batatas*), Ananas, and cucumbers (*Cucumis sativus*).

There is a document in the library of the British Museum, reproduced by Theal, which is a letter written by a Jesuit missionary on visiting Mozambique Island. He was one of twelve who went from Lisbon to Goa in the ship *Nossa Senhora da Conceição* (20934, folio 23) in 1688. He mentions among other fruits the American guava (*Psidium guajava*), pawpaw (*Carica papaya*) and sweet potato (*Ipomoea batatas*).

In the case of the introduction of the American plant maize (*Zea mais*) to Africa and its subsequent dispersal through Africa as a food crop there is no doubt that this must have been responsible for the spread of weeds to a considerable

WEEDS AND ALIENS IN AFRICA

extent. In a comprehensive review of speculation on the subject (Miracle, 1965), the first reference to maize in Africa is stated to be a mention by the Portuguese writer Valentin Fernandes in 1502 who was speaking of the Guinea Coast. He spoke of "milho zeburro" which term was applied specifically to maize. This reference may not be entirely reliable apparently, although that from an Italian historian Ramusio writing of the period 1535-1550 is more conclusive in speaking of the Cape Verde Islands and the coast of West Africa. As we have seen earlier, Pieter de Marées' illustration of maize shows that the plant was well established by 1606.

Miracle refers to considerable evidence that much of Africa's maize was actually introduced by Arab traders across the Sahara from Europe and such introductions would not have been so likely to bring American weeds with them (although this is not to say that it would have been impossible for them to have done so at second hand). Nevertheless, whether these first introductions came from Europe is beside the point; it is impossible to imagine that maize as a food, or for seed, was not subsequently carried between America and Africa by the ships of the slave trade and ships with other cargoes. This maize would certainly have had some American weed seeds as contaminants. Secondly, if we assume that American weeds must have been introduced regularly to Africa during the period 1600-1850, the subsequent spread of maize through tropical Africa and well into the interior must have taken these weeds on the second stage of their travels away from the coastal areas. With regard to the areas of cultivation devoted to maize, which in itself would have been correlated with the extension of weed populations, Miracle calculates that about 9,000 metric tons of maize per annum would have been required to maintain the slave trade alone in victualling. This amount no doubt came largely from African sources.

Miracle further concludes that by 1600 maize was well established some 600 miles inland from the mouth of the Congo. He refers to Livingstone's observation of its importance near Lake Tanganyika in 1871, and in eastern Africa quotes fairly reliable evidence that maize was cultivated in the Monomatapa Kingdom (Rhodesia—Mozambique region south of the Zambezi) in 1561. By 1798 there is good evidence that maize was a staple crop in Mozambique. In this connection

there is some interesting archaeological evidence that maize was cultivated in Rhodesia before 1800 at least. Wild, in Summers (1958), reports the finding of a carbonised maize cob in controlled excavations of the Van Niekerk Ruins. This area of stone-terraced agricultural occupation, probably by a Bantu culture, was largely abandoned about two hundred years ago (Summers, 1958, p. 313). On the other hand, although the spread of maize in Africa no doubt assisted the movement of weeds, in the case of many African weeds once they were established on the coast, they would have spread inland in any case without the aid of crops. These species are those particularly common by tracks and roadsides and some, such as *Acanthospermum* and *Bidens* species, have seeds particularly well adapted to being carried on clothing, etc. Africans still move tremendous distances on foot, walking huge distances as they come, for example, from such territories as Tanganyika, Botswana, etc., to work on the South African mines or to find work in South Africa. Officially recruited labour can go nowadays by 'plane but there is still much unofficial movement on foot. Such movements help in the spread of some weeds and, prior to the beginning of the nineteenth century, the raids of the Matabele, Swazi and Angoni, for instance, must have helped the spread of roadside weeds.

Consequently, although there were no doubt many introductions of American and other weeds during the Anglo-Boer war, in tropical Africa as a whole as well as in South Central Africa there must have been a movement inland of weed seeds which were the progeny of numerous weeds introduced often from America by the Portuguese and others from as early as 1600 A.D. Even in the Transvaal they could have moved in from the tropical north rather than from the coast of South Africa itself.

VI. WEED AND ALIEN IMMIGRATION INTO TROPICAL AMERICA AND FROM AMERICA TO TERRITORIES OUTSIDE AFRICA.

As American aliens are so successful as immigrants to Africa has there been a comparable movement from Africa to America? A practical answer to this question can be given since fortunately there have been published recently, or relatively

WEEDS AND ALIENS IN AFRICA

recently, a number of tropical American floras and, in particular, several detailed Composite floras.

In the case of Cabrera's "Flora de la Provincia de Buenos Aires," Part VI, *Compuestas* (1963), which includes 314 Composite species, there are 12.4% introduced weeds from Europe and the Mediterranean region, 2.2% Eurasian species, 1.3% Asian species, 1% approx. (3 species) African and 0.3% Australasian species. In the area surrounding a large port such as Buenos Aires particularly good conditions for the establishment of aliens are bound to exist and so the small percentage of African introductions is remarkable. The three species involved are *Senecio burchellii*, *S. mikanioides* and *Cryptostemma calendulaceum*, all from South Africa.

In Aristeguieta's *Compositae* of the *Flora de Venezuela* (1964) out of 285 species there are seven (2.5%) aliens from Europe and the Mediterranean and one (0.35%), *Guizotia abyssinica*, from Africa.

In Spencer Moore's treatment of the *Compositae* in Fawcett and Rendle's *Flora of Jamaica*, Vol. 7 (1936), out of 138 species there are 2.9% aliens or weeds from Europe and the Mediterranean, 2.1% from Asia and no species from Africa.

In Alain's *Flora de Cuba* (1963), the *Compositae* include, out of 365 species, 1.6% from Europe and the Mediterranean, 0.8% from Asia and no species certainly of African origin.

In Gooding, Loveless and Proctor's *Flora of Barbados*, out of 30 Composite species, there are 3% aliens from Europe and the Mediterranean, 3% from Asia and none from Africa.

With the exception of that relating to Argentina, all the above floras would have had an extensive and long continued maritime connection with Africa through the slave trade. The disparity between the situation in Africa and tropical America is therefore very striking and it is interesting to speculate on possible explanations. The success of weed species is due very largely to their ability to compete ecologically with other species and it may be that an explanation could lie in the fact that the species density of tropical America is greater than that of Africa. Good (1964, pp. 154-161) has some relevant figures. For instance, Brazil alone has some 40,000 flowering plant species and he gives the density figure in relation to area (species per square mile) as 0.12. He considers that the figure for the remainder of tropical America would be somewhat

similar. In tropical Africa as a whole he estimates the number of species to be about 25,000 species and certainly not more than 30,000. His density figure is .005. The lowness of this latter figure may be due to the proportion of desert and semi-desert country in Africa and perhaps to a greater variation in climates in the recent geological past.

This is at first sight an attractive theory but is weakened if we examine the situation in Malaysia. Good considers the number of species involved there may reach 40,000 but gives 27,000 as van Steenis' estimate. The relative density figure Good estimates as 0.33 and this is much higher than that for Africa. If we now consult Dr. Koster's treatment of the Compositae in Backer's Flora of Java (1953) we find that American aliens constitute 25% of the Composite flora, Eurasian species 4% and Asian species 1%. There is one African species (*Gynura crepidioides*). The proportion of American species is therefore of the same order as that in Africa although the flora of Malaysia is very rich and there are no deserts. Furthermore, the relative richness of the floras of tropical America, and of Malaysia, is probably due to the very much richer flora of their rain forest areas. *Sigesbeckia orientalis* in Africa and Asia is perhaps an exception but weed species are not usually the product of forest conditions. The ground flora of forests is, in any case, notoriously poor. The weed species that originate in America are doubtless mostly derived from the tree savannas of tropical America and it is these areas in Africa that they mostly invade, especially after disturbance or cultivation. We have no evidence that the savanna floras of tropical America are markedly richer than those of tropical and subtropical Africa. It may be, therefore, that the densities of the relevant floras are not so important but that the greater degree of isolation of the American flora is responsible. Although S. America, Africa and Malaysia were all integral parts of the supercontinent of Gondwanaland, Africa, Europe and Asia still remain to some degree united, whilst there has been no land connection with S. America since the fragmentation of Gondwanaland in the late Jurassic-Cretaceous period (Lester King, 1962).

Another possibility is that as most American introductions to Africa have arrived in the company of importations of American food plants, the entry of African weeds into America has not

WEEDS AND ALIENS IN AFRICA

been so great since important African food plants are few and have not been taken to America on any scale. Only *Sorghum kaffrorum* and *Citrullus lanatus* (*C. vulgaris*) can be quoted as African food plants introduced on any scale into tropical America.

The completion of the Compositae of the Flora de Madagascar et des Comores by Humbert (1960-1963) allows a comparison to be made with tropical Africa. Out of a total of 550 Composite species recorded for Madagascar, 2.4% are American aliens and half of these (8) belong to the Heliantheae, 1.1% are introductions from Europe, 1% from Asia and perhaps 2% from the African mainland. This latter figure is difficult to assess since a fair number of African species also occur naturally in Madagascar. The situation is obviously a fairly close parallel with that on the African mainland.

Finally, an interesting aspect of the naturalised alien Composite flora of Java is that its species content is noticeably different from that of tropical Africa and South Central Africa in particular. The species concerned in Java are:—

<i>Struchium sparganophorum</i>	<i>Tithonia rotundifolia</i>
<i>Pseudelephantopus spicatus</i>	<i>Eleutheranthera ruderalis</i>
<i>Rolandra fruticosa</i>	<i>Spilanthes oleracea</i>
<i>Ageratum conyzoides</i>	<i>Podochaenium eminens</i>
<i>Ageratum houstonianum</i>	<i>Verbesina elata</i>
<i>Eupatorium riparium</i>	<i>Calyptrocarpus vialis</i>
<i>Eupatorium adenophorum</i>	<i>Synedrella nodiflora</i>
<i>Eupatorium sordidum</i>	<i>Bidens calva</i>
<i>Eupatorium inulifolium</i>	<i>Bidens caudata</i>
<i>Eupatorium odoratum</i>	<i>Bidens formosa</i>
<i>Erigeron karvinskianus</i>	<i>Bidens sulphurea</i>
<i>Gnaphalium purpureum</i>	<i>Bidens tinctoria</i>
<i>Gnaphalium peregrinum</i>	<i>Tridax procumbens</i>
<i>Baltimora recta</i>	<i>Galinsoga parviflora</i>
<i>Melampodium perfoliatum</i>	<i>Porophyllum ruderale</i>
<i>Jaegeria hirta</i>	<i>Erechtites valerianifolia</i>
<i>Tithonia diversifolia</i>	<i>Erechtites hieracifolia</i>

Of these, 10 species, *Ageratum conyzoides*, *Gnaphalium purpureum*, *G. peregrinum*, *Tithonia diversifolia*, *T. rotundifolia*, *Synedrella nodiflora*, *Bidens formosa*, *B. sulphurea*, *Tridax procumbens* and *Galinsoga parviflora* have been recorded in South

Central Africa, 4 species, *Struchium sparganophorum*, *Eupatorium odoratum*, *Eleutheranthera ruderalis* and *Spilanthes oleracea* have been recorded from other parts of Africa, but 20 species or 57% have not been recorded from Africa at all. Does this indicate that the potential for new weed immigrants from America to Africa is still high, as many of these species could no doubt establish themselves as readily in Africa as in Java? Certainly, the relatively recent arrival of the American species *Salvinia auriculata* and its explosive development in Lake Kariba would also point in this direction. The immigration of American species into Africa would seem to be a continuing process.

VII. BIBLIOGRAPHY

- ALAIN, H. (1962). *Flora de Cuba*, 5. Rio Piedras.
- ANON. (1962). *Encyclopedia Britannica* 1962 ed., Brazil.
- ARISTEGUIETA, L. (1964). *Flora de Venezuela*, 10, 2, *Compositae*. Ed. Esp. Inst. Bot. Caracas.
- CABRERA, A. L. (1963). *Flora de la Provincia de Buenos Aires*, part 6. I.N.T.A., Buenos Aires.
- COUPLAND, R. (1933). *The British Anti-Slavery Movement*. Butterworth, London.
- DAVY, J. BURTT, (1904). Alien plants spontaneous in the Transvaal. *Rep. S. Afr. Ass. Adv. Sc., Johannesburg meeting*, 1904: 252-299.
- EXELL, A. W. (1944). *The Vascular Plants of S. Tomé*. Trustees Brit. Mus., London.
- FROGER, F. (1698). Relation d'un Voyage fait en 1695, 1696 et 1697 aux Côtes d'Afrique . . . Paris.
- GOOD, R. (1964). *The Geography of the Flowering Plants*. ed. 3. Longmans, London.
- GOODING, E. G. B., LOVELESS, A. R. and PROCTOR, G. R. (1965). *Flora of Barbados*. H.M.S.O., London.
- HARVEY, W. H. and SONDER, O. W. (1894-1908). *Flora Capensis*. Vols. 1-7. Reeve, London.
- HENDERSON, M. and ANDERSON J. G. (1966). Common Weeds in S. Africa. *Mem.* 37, *Bot. Surv. S. Afr.*
- HEPPER, F. N. (1963). *Flora of West Tropical Africa*, ed. 2, 2: 239, *Compositae* by C. D. Adams.
- HIERN, W. P. (1896-1901). *Catalogue of the African Plants collected by Dr. Friedrich Welwitsch in 1853-61*. Trustees

WEEDS AND ALIENS IN AFRICA

- Brit. Mus., London.
- HUMBERT, H. (1960-1963). *Flore de Madagascar et des Comores, Composées* 1-3. Paris.
- KING, L. C. (1962). *The Morphology of the Earth*. Oliver and Boyd, Edinburgh and London.
- KOSTER, J. Th. (1953) in Backer, C.A., *Beknopte Flora van Java*, Afl. 13A, Compositae (Cyclostyle).
- MARÉES, P. de (1605). *Descr. Recit. Hist. Riche Roy d'Or de Gunea*. Amsterdam.
- MENDONÇA, F. A. (1962). Botanical collectors in Angola. *Comptes Rendus IVe Réunion Plén. Ass. l'Etude Tax. Fl. d'Afr. Trop. Lisbonne & Coimbra*, 1960. Lisboa.
- MOORE, S. M. (1936) in Fawcett, W. & Rendle, A.B., *Flora of Jamaica*, 7. Trust. Brit. Mus., London.
- MIRACLE, M. P. (1965). The introduction and spread of maize in Africa. *Jour. Afr. Hist.* 6, 1: 39-55.
- MONTECUCCOLO, P. G. A. C. de (1687). *Istoria Descrizioni de tre Regni Congo, Matamba et Angola*. Bologna.
- OLIVER, D. (1868-). *Flora of Tropical Africa*. 1-10. Reeve, London.
- SALISBURY, E. (1961). *Weeds and Aliens*. Collins, London.
- SANTOS, Fr. J. dos (1609). *Ethiopia Oriental*. Evora.
- SMITH, C. A. (1966). *Common Names of S. African Plants*: 288-289. Govt. Printer, Pretoria.
- SUMMERS, R. (1958). Inyanga, Prehistoric Settlements in Southern Rhodesia. Cambridge Univ. Press., Chap. 9. Botanical notes relating to the van Niekerk Ruins by H. Wild.
- THEAL, G. M. (1898-1903). *Records of South-Eastern Africa*. 1-7, London.
- WILD, H. (1955). *Common Rhodesian Weeds*. Govt. Printer, Salisbury.
- (1967). *The Compositae of the Flora Zambesiaca Area*, 1. *Kirkia*, 6, 1: 1-62.

ACKNOWLEDGEMENTS

I am very grateful to Mr. E. E. Burke, Principal Archivist, Rhodesian National Archives, Salisbury, for his valuable assistance in tracing historical works relevant to this paper.



ES

La description de la figure No. 13.

Cette pourtraicture represente les herbes & bleds qu'on trouve icy, A est la Canne de Sucre, B est le Mayss ou Bled de Turquie, C est le Riz, D est le Millet dont il s'en fait pour le pain, E a ceste herbe croissent des petites poix rouge & noire, sorti Geyemen, tachettes de couleurs, F est le persil de mer, G est le Gingembre, H est une arbre grande a la- quelle les feubes, croissent, qu'on bien enre paulte en rondes, I est le Crasin ou Mangostie.

Plate 1. Illustration of maize plant in fig. 13 from Marées' Descrip-
Recit. Hist. Riche Roy d'Or de Guenea, Amsterdam, 1605.



La description de la figure No. 14.

69

Cette pourtraicture represente les fruits (avec leurs herbes & arbres) qu'on trouve en ces pais, ainsi qu'ils y furent au passe & par les Portugais y sont estz apportez de puis. A est vne arbre a laquelle les Bannanas de Congo croissent: qui est du tout semblable audit arbre de Bannana: & y a este tout premierement conduit au pais par les Portugais, B est l'arbre du vin de Palma, C est l'arbre de Palmites, D est l'arbre des Bannanas ou figuier d'Inde qu'ils ont: tousieurs en, E demonstre comme ils abbattent l'arbre du vin de Palma, apres qu'il ne rend plus nul vin par enhais, & comme il: le tirent puis par embas avecq du feu dont la racine ti: ent a recroistre de rechief, F est le fruit qu'on nomme Ananas estant l' plus delicat qu'on scait trouver en toute l'Inde, de grandeur comme vng Melon, n'estant dissimblable a l'herbe appallee *Semperuiuum* & est venu en ces pais par les Portugais qui l'ont apportee de la neufue Espagne, G est la racine du Batatas vng fruit bien delicat aussi, estant rosti car lors a il le goust semblable aux Chastagnes, H est l'*Amamos* vng peu moins delicat que le Batatas, qui est la plus ordinaire viande des Indiens en lieu de pain ou qu'ils n'en ont point.

Plate II. Illustration of *Ananas sativa* or pineapple (F) and *Ipomoea batatas* or sweet potato (G, partially obscured at right of plate) in fig. 14 from Marées' Descr. Recit. Hist. Riche Roy d'Or de Gunea, Amsterdam, 1605.



This work is licensed under a
Creative Commons
Attribution – NonCommercial - NoDerivs 3.0 License.

To view a copy of the license please see:
<http://creativecommons.org/licenses/by-nc-nd/3.0/>

This is a download from the BLDS Digital Library on OpenDocs
<http://opendocs.ids.ac.uk/opendocs/>