THE FUNGI AND PLANT DISEASES OF THE SUDAN

BY

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PREFACE

In this book I have attempted to list and annotate the fungi and plant diseases at present known to occur in the Sudan. I have drawn freely on the records of the Sudan Ministry of Agriculture and on the published and unpublished work of Mr. R. E. Massey, Mr. T. W. Clouston, Dr. F. W. Andrews, and Professor A. S. Boughey. I must acknowledge with gratitude the invaluable assistance and advice given by the Director and staff of the Commonwealth Mycological Institute without which this book could not have been written. My thanks are also due to Miss E. M. Wakefield, O.B.E., and Mr. D. A. Reid of the Royal Botanic Gardens, Kew, for identification of many of the larger Basidiomycetes, to the Sudan Ministry of Agriculture for financial assistance in publication, and to Dr. S. P. Wiltshire, Director of the Commonwealth Mycological Institute, for much assistance in preparing this work for the press.

I also wish to thank the numerous persons in the Sudan who have collected specimens for me, who have helped with the identification of host plants or who have criticized parts of the text—in particular Dr. T. N. Jewitt, Mr. A. W. Ireland, and Mr. J. K. Jackson.

S. A. J. TARR

THE GEZIRA RESEARCH FARM
WAD MEDANI, SUDAN

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CONTENTS

PREFACE iii

MAP OF THE SUDAN facing vi

ILLUSTRATIONS ix

PART I. GENERAL

INTRODUCTION 1

THE VEGETATION OF THE SUDAN 3

THE CLIMATE OF THE SUDAN 5

THE NUMBERS AND DISTRIBUTION OF SUDAN FUNGI 7

PART II. ANNOTATED LIST OF FUNGI AND PLANT DISEASES

PHYCOMYCETES 17

Chytridiales, Peronosporales, Mucorales

ASCOMYCETES 22

Endomycetales, Eurotiales, Erysiphales

Dothideales, Microthyriales, Sphaeriales

Hypocreales, Hysteriales, Helotiales

BASIDIOMYCETES 34

Ustilaginales, Uredinales, Tremellales

Exobasidiales, Agaricales, Hymenogastrales

Phallales, Lycoperdales, Sclerodermatales

FUNGI IMPERFECTI 53

Sphaeropsidales, Melanconiales, Moniliales

UNIDENTIFIED FUNGI 100

ALGAE 101

BACTERIA 101

VIRUS DISEASES 103

NON-PARASITIC DISEASES 109

BIBLIOGRAPHY 111

INDEX OF GENERA 113

HOST AND SUBSTRATE INDEX 115
The approximate positions of most of the places mentioned in the text are indicated by figures as listed below. Numbers run from north to south, e.g. roughly speaking 1-21 are in the north, 22-69 in the centre, and 70-89 in the south of the country. The distribution of these numbers gives a very rough picture of the areas in which some collection of fungi and plant diseases has been carried out to date.

The mean annual rainfall isohyets of 4, 12, 24, 36, and 48 inches as at present known are indicated. Provincial boundaries are shown as broken lines.
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<td>Talodi</td>
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<td>Lui</td>
<td>between 77-79</td>
<td>Tayiba (Gezira)</td>
<td>near 10</td>
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<td>82-83</td>
<td>Tebub (Gezira)</td>
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<td>Malakal</td>
<td>68</td>
<td>Tendelai</td>
<td>18</td>
</tr>
<tr>
<td>Mekali</td>
<td>near 19</td>
<td>Terrakoka</td>
<td>78</td>
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<tr>
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<td>63</td>
<td>Tokar</td>
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<td>54</td>
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<td>Um Bileil</td>
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<td>Um Girra Forest</td>
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<td>Omdurman</td>
<td>21</td>
<td>Um Girba—Nuba Mountains (untraced)</td>
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<td>5</td>
<td>Um Ruaba</td>
<td>47</td>
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<td>Um Sugura</td>
<td>34</td>
</tr>
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<td>41</td>
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<td>Red Sea Province—area bordering Red Sea.</td>
<td></td>
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<td>73</td>
<td>Yousif Natscha</td>
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<td>Zumingei</td>
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ILLUSTRATIONS

ILLUSTRATIONS

55. *Cercospora arachidicola* (JT 927). Conidia and conidiophores. ×250.
64. *Cercospora sorghi* (JT 1556). Conidia and conidiophores. ×250.
75. *Scoletotrichum (Gordana) musae* (JT 1316). Conidia and conidiophores. ×250.
PART I
INTRODUCTION

The Sudan covers an area of about a million square miles and contains within its borders a great diversity of climatic conditions, soils, and vegetation. Associated with these is a wide variety of fungi and plant diseases. This is particularly so in the wetter regions of the country, many of which are as yet very imperfectly known in respect of fungi and plant diseases present.

The earliest recorded Sudan fungi are those noted by G. Schweinfurth whose papers on Sudan vegetation were published in 1862–82. These papers are listed by Knight & Boyns (1950, pp. 208–9).

Further reference to fungus diseases of plants in the Sudan is contained in the report on Economic Entomology by H. H. King (3rd Annual Report of the Wellcome Research Laboratories, Khartoum, 1908, pp. 245–7). A few of the commoner diseases of crop plants in the northern Sudan are mentioned, e.g. *Puccinia graminis* on wheat. Others were noted by R. E. Massey, who worked in the Sudan from 1912–36: these will be found in the Annual Reports of the Research Division of the Department of Agriculture and Forests for those years and also in Sudan Notes and Records, vol. iv, No. 4, 1921, pp. 219–24. As would be expected, the emphasis is on diseases of major crop plants (e.g. cotton, sorghum millet) in the northern Sudan. A study of cotton wilt in which root invading and soil fungi were cultured and identified was made by T. W. Clouston during the years 1935–40 and is summarized in the Annual Reports for those years.

The first systematic collection and identification of plant diseases in the Sudan was carried out by A. S. Boughey, 1938–45. In 1946 he published 'A preliminary list of plant diseases in the Anglo-Egyptian Sudan' (Mycological Paper No. 14, Imperial Mycological Institute, Kew), a comprehensive list of the crop diseases at that time known to occur in the Sudan. A. S. Boughey collected many diseases of wild as well as cultivated plants, although the latter naturally predominated, and visited some of the wetter parts of the country. During the past six years (1947–52) the present author has collected a large number of fungi and plant diseases, particularly in the central Sudan (including the Nuba Mountains and Fung), Bahr el Ghazal Province, and Equatoria Province (both east and west of the Nile). The areas concerned are so vast that no more than intensive collecting at a number of widely separated localities has so far been possible. The large number of fungi recorded in the comparatively small amount of time which the author has been able to spend on this work gives some indication of the richness of the fungus micro-flora in the wetter parts of the Sudan and indicates that many more await collection and study.

Boughey also investigated the distribution of plant disease fungi in relation to climatic factors, particularly rainfall, as discussed later in this book. The Sudan borders Egypt, the Libyan Desert, Eritrea, Abyssinia, Kenya, Uganda, the Belgian Congo, and French Equatorial Africa. As would be expected, the fungus floras of the various border areas of the Sudan show considerable similarities with those of adjacent countries. Consequently the fungus floras and disease lists for these countries, e.g. those by Melchers (1931) for Egypt and
by Hendrickx (1948) for the Belgian Congo, afford useful information in the study of the plant diseases present in the Sudan. Many Sudan fungi and crop diseases occur in India, and the late Sir E. J. Butler's book 'Fungi and Disease in Plants' (Thacker, Spink & Co., Calcutta and Simla, 1918), which describes diseases of crops in India, is still perhaps the most useful reference book for many of the more important crop diseases in the Sudan.

During recent years a comprehensive Mycological Herbarium has been built up at the Gezira Research Farm, Wad Medani. This herbarium was started by A. S. Boughey, whose collections of the plant diseases in the northern Sudan are well represented. Unfortunately some of his specimens were lost or rendered useless during transit. The present author has made many additions and has reorganized the herbarium. Although much remains to be done, the herbarium now contains a representative collection of Sudan fungi and plant diseases. Duplicates of some of Boughey's specimens and of most of the present author's have been deposited in the herbarium of the Commonwealth Mycological Institute at Kew (England).

It is hoped that this book will be of interest to mycologists and plant pathologists, particularly to those working in Africa and the Tropics in general. It should assist those working in the Sudan. Identification of fungi and plant diseases is often difficult and tedious; the genus of the fungus being examined can often be determined or approximated to but specific determination has frequently to be made by the expert specializing in the particular genus or group concerned. However, identification is greatly facilitated if a comprehensive herbarium collection of authoritatively named fungi and plant diseases is available; the specimen under examination can then be 'matched' both macroscopically and microscopically against named specimens. This has been borne in mind in building up the herbarium and in the compiling of this flora. Thus the actual collection numbers of all specimens listed in this book are given wherever possible; if the number is given it means that the specimen referred to is in the herbarium, if not given it is not in the herbarium.

The specimens of A. S. Boughey are prefixed by ASB, those of the present author by JT. I have also included the accession numbers given to specimens deposited at the Commonwealth (formerly Imperial) Mycological Institute; these are prefixed by the letters IMI. Thus, JT 1370 (IMI 48171), 1951, means that the specimen was collected by the author (JT) in 1951 with accession number 1370 in the Sudan Mycological Herbarium and accession number 48171 in Herb. IMI. Some of Boughey's specimens were deposited at the Commonwealth Mycological Institute and I have given their accession numbers wherever possible. Other authors are R. E. M(assey), F. W. A(ndrews), and T. W. C(louston).

As a further aid an attempt has been made to give, for each fungus or disease, a reference to a reasonably accessible description. Wherever possible this reference is to books likely to be present in agricultural research libraries, in particular to those present in the Research Division Library, Wad Medani, Sudan. In many cases this has not been possible; descriptions of less well-known fungi and the diseases they cause are not to be found in easily accessible literature and in such cases the original published description must be consulted. This book lists the fungi collected and identified up to and including the year 1952, most of the present author's collections up to number JT 1950 being
included. Notes on distribution and economic significance are given for some plant diseases. The first part of the book briefly outlines the vegetation and climate of the Sudan and their effects on the numbers and distribution of fungi and plant diseases within the country. For further details, and indeed for information concerning all aspects of agriculture in the Sudan, reference should be made to 'Agriculture in the Sudan' by numerous authors, edited by J. D. Tothill and published by the Oxford University Press (London, 1948).

*The Vegetation of the Sudan*

Limitations of space will not permit more than a brief outline of the vegetation of the Sudan; a more detailed description has been written by F. W. Andrews (Chapter 4 in 'Agriculture in the Sudan', ed. J. D. Tothill, London, 1948) whose system of classification is adopted in this book. For information concerning soils of the Sudan, reference should be made to the article by H. Greene in the same book (Chapter 8).

The Sudan lies entirely within the tropics between latitudes 3°-22° N. and longitudes 22°-38° E. in the north-eastern sector of Africa. Its vast area of about a million square miles is mostly flat with a few relatively small and widely separated groups of hills and mountains. The Nile and its tributaries divide the country from south to north and rainfall ranges from nil in the extreme north to some 60 inches annually in the south. A wide variety of plants and plant associations is found and such regions as the Immatong and Dongotona Mountains, the mountainous Jebel Marra area and the smaller hills of the Nuba Mountains, Red Sea Hills, and Ingessana Hills differ considerably in vegetational characteristics from the surrounding plains, e.g. plants of rocky habitat occur in the Nuba Mountains and Ingessana Hills but only rarely in the nearby plains. Excluding these special areas, the vegetation of the Sudan can be divided into five principal types forming five belts running very approximately across the country from west to east and intimately related to rainfall and—to a lesser extent—soil characteristics. They are (A) desert, (B) Acacia desert scrub, (C) Acacia short grass scrub, (D) Acacia tall grass forest, and (E) broad-leaved woodland and forest.

(A) The *desert belt* comprises roughly the northern third of the Sudan and includes almost all of Northern Province and much of the northern half of Kassala Province. It lies roughly between latitudes 16° N. (i.e. about 100 miles north of the latitude of Khartoum) and 22° N. and is a region with sporadic and uncertain rainfall ranging from nil to a maximum of about 3-4 inches annually, falling mainly in July—August. Natural vegetation is very scanty and consists largely of thorny xerophytes growing mostly in depressions or watercourses which are occasionally damped by the slight run off from such infrequent showers of rain as occur. Along the banks of the Nile vegetation is more plentiful and irrigated crops are grown. Except for the silty soils near the river, the belt is a sandy, barren, almost waterless area forming part of the Nubian and Libyan deserts.

(B) *Acacia desert scrub* forms a much narrower belt lying south of the desert proper to about 15° N. but veering northwards in the eastern Sudan. It includes Khartoum Province, Port Sudan, and part of the northern Gezira. In the west Fasher lies just within its southern limit. Annual rainfall within this belt ranges
from about 3 to 12 inches, falling mostly in July–August except in the Red Sea coastal area, which receives winter rains (November–December). Shrubs and trees occur in this belt but vegetation is scattered and some areas support only a few thorny shrubs. *Acacia* spp. including *A. raddiana* are the dominant trees. In the east is found the characteristic specialized flora of the Red Sea Hills, whilst the western half contains large stretches of sandy ‘goz’ soils. Rain cultivation of quickly maturing crops is carried out in the wetter parts of this belt, particularly on clay soils.

(C) The *Acacia short grass scrub* belt runs roughly parallel with and south of the previous belt, its southern latitude being about 13° N. and veering northwards in the east. It is bounded by Dueim and Fasher in the north and by Gedaref, Singa, and Um Ruaba in the south with mean annual rainfall ranging between 12 and rather more than 20 inches. Rain falls mainly during June–September and allows widespread cultivation of rain-grown crops. It is sufficient for the growth of many grasses, herbs, and a greater variety of trees although *Acacia* spp. including *A. mellifera* (on clays) and *A. Senegal* (on sands), are still dominant—in all producing in places a rather open woodland type of country, particularly in the wetter parts of the belt. Many of the soils are heavy alkaline clays with good water-retaining properties. The Acacia desert and Acacia short grass scrub belts together include roughly the northern halves of Darfur and Kordofan Provinces in the west, Blue Nile Province (excluding its southern half, the Fung), and much of the southern half of Kassala Province in the east.

A second area of Acacia short grass scrub occurs in the far south-eastern corner of the Sudan where it borders the arid northern extremity of Kenya.

(D) The *Acacia tall grass forest belt* runs south of about latitude 13° N. to 10° N. in the west extending sharply southwards in the centre to include the Bahr el Jebel river as far south as 5½° N. (some 40 miles north of Juba) and the country eastwards. It is a large area and includes the southern halves of Blue Nile, Darfur and Kordofan Provinces, the southernmost tip of Kassala Province, and nearly all Upper Nile Province. Within it are such botanically specialized areas as the mountains of Jebel Marra in the west, the Nuba Mountains in the centre, the Ingessana Hills in the east, the swampy ‘sudd’ region south of Malakal and large areas of annually inundated grassland (‘toich’) along the White Nile in the south. Rain falls mostly in April or May–October and ranges from some 20 to 40 inches annually. The soils are diverse and vary from dark heavy clays to light sandy loams. Vegetation is often thick and forms a heavy ground cover not found in the belts previously described. *Acacia* spp. are still prominent but broad-leaved trees also occur, particularly on sandy loam soils. This diversity of soils, rainfalls, and physical features is reflected in the wide variety of plants found.

(E) *Broad-leaved woodland and forest* comprise most of the extreme south and south-west of the Sudan, i.e. most of Bahr el Ghazal Province and all but the eastern quarter of Equatoria Province. The Bahr el Arab river forms the northernmost limit of this belt which includes all the Sudan–Uganda and Sudan–Belgian Congo border country and the Sudan–French Equatorial Africa border as far north as about 9½° N. Annual rainfall is the heaviest of the Sudan and ranges from about 40 to 60 inches, falling mainly in March–November, although some rain usually falls in most months of the year. Many of the soils
are lateritic. A luxurious permanent vegetation is general and much broad-leaved woodland and grassland occur. In the north-eastern part of this belt are large areas of seasonally inundated land. As would be expected the variety of plants found is very great and cannot be described here—within it occur such diverse ecological habitats as gallery forest, depression forest, cloud forest, permanent swamp, annually flooded areas, grassland, and mountain meadow.

It will be realized that the five belts listed above are not sharply delimited and each tends to pass imperceptibly into the next. For a detailed description of the vegetation of the Sudan the reader is referred to the article by F. W. Andrews, to which attention was drawn at the beginning of this section.

The Climate of the Sudan

The Sudan lies within the tropics between latitudes 3½°–22° N. and longitudes 22–38½° E. extending about 1,300 miles from north to south and about 1,000 miles from west to east. The north-eastern corner of the country is bounded by the Red Sea for nearly 500 miles and in some respects this coastal area is climatically different from the interior. It is convenient to divide the interior into three approximately equal zones running across the country from west to east—the northern Sudan lying north of Khartoum (i.e. about 15½°–22° N.), the central Sudan lying between the latitudes of Khartoum and Malakal (about 9½°–15½° N.) and the southern Sudan south of Malakal (about 3½°–9½°). These are of course arbitrary divisions but they do very roughly divide the Sudan into zones of nil-light rainfall (0–8 inches per annum), light–moderate rainfall (8–36 inches) and moderate–heavy rainfall (32–60 inches) from north to south. These zones are very approximate, particularly in the southern half of the country, where the mean annual isohyets show considerable irregularity and run far less regularly east to west than in the north. The tables below give meteorological data for Wadi Halfa in the extreme north (21° 55' N. × 31° 20' E.), Khartoum in the north-centre (15° 37' N. × 32° 32' E.), Malakal in the south-centre (9° 33' N. × 31° 39' E.), Juba in the extreme south (4° 51' N. × 31° 37' E.) and Port Sudan on the Red Sea coast (19° 37' N. × 37° 13' E.). Tables 2 and 3 are taken from A. W. Ireland's account of the climate of the Sudan (in 'Agriculture in the Sudan', Chapter 5); the remainder have been compiled from data supplied by Mr. Ireland.

Table 1. Mean annual rainfall, inches

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Except in the Red Sea area rainfall increases from north to south and ranges from nil to some 60 inches annually. There is corresponding increase in the length of the rainy season from north to south. Thus the months during which the major part of the season’s rain normally falls are July–August at Khartoum, April–October at Malakal, and March–November at Juba. In the wettest areas rain falls in most months of the year and such areas tend to show the equatorial double rainfall maximum in May–June and August–September. Rainstorms
occur mostly in the afternoons and evenings and seasonal variability of rainfall decreases from north to south, the mean annual variability being about 40 per cent. at Wadi Halfa, 35 per cent. at Khartoum, 20 per cent. at Malakal, 15 per cent. at Juba, and 55 per cent. at Port Sudan (mean annual variability being the amount by which the actual annual rainfall is as likely as not to differ from the mean annual rainfall). The Red Sea coastal area and the eastern slopes of the Red Sea Hills differ from the rest of the Sudan in that most of the rain falls in the winter months (November—December) although a little rain can fall in most months. Humidity roughly follows rainfall and increases from north to south reaching its maximum during the rainy season or, in rainless areas during the winter (December—January). As would be expected the Red Sea coastal area is fairly humid throughout the year—much more so than inland areas of similar latitude. Further the humidity of this maritime stretch, being associated with proximity to the Red Sea, does not show the sharp drop from early morning to noon such as occurs elsewhere in the Sudan where relative humidity drops as air temperatures rise during the morning hours. Thus at Port Sudan the mean annual relative humidity at midday is about the same.
as that at 6 a.m. and mean noon humidity along the Red Sea coast is higher than that recorded at any inland station in the Sudan. The occurrence of dews is discussed below. Temperatures in the Sudan range from just above freezing-

Table 5. Mean maximum and highest maximum temperatures, °F.

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<td>E. Sudan</td>
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<td>81</td>
<td>84</td>
<td>89</td>
<td>86</td>
<td>102</td>
<td>106</td>
<td>106</td>
<td>101</td>
<td>93</td>
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Mean maximum

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<td>96</td>
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</table>

Highest maximum

As a resultant of air temperature and humidity, heavy early morning dews tend to occur in the extreme north of the Sudan (e.g. Wadi Halfa) during the cold winter months. They also occur along the Red Sea coast where, although minimum winter temperatures are not as low as at Wadi Halfa, humidity is higher. Proceeding southwards, dew formation decreases until the heavy rainfall areas are reached. Dew formation is of some importance in relation to occurrence of fungi in the Sudan since it appears that heavy and prolonged dews can take the place of rain in providing the water film needed for germination of some fungus spores. This is discussed in the following section.

Hours of daylight range from about 10½–13½ in the extreme north to about 12 hours per day in the extreme south, seasonal variation increasing from south to north.

The numbers and distribution of Sudan fungi

Table 6 summarizes the numbers and composition of the fungi so far collected in the Sudan. These figures represent the results of preliminary and limited collecting at a relatively few places in the vast area of the Sudan. Large areas in the west (e.g. Darfur Province and the north-western half of Bahr el Ghazal
Province) are, mycologically speaking, unknown as also most of Upper Nile Province not in the immediate vicinity of the White Nile and almost all of the eastern half of Kordofan Province and the southernmost part of the Blue Nile Province. Many more genera and species await collection in the wetter and less accessible areas of the Sudan. Some 54 named species of *Cercospora* and 30 of *Puccinia* have been recorded in the Sudan but many more will be found. This applies also to the smut fungi and to such genera as *Uromyces*, *Meliola*, *Asterina*, *Phyllosticta*, *Ascochyta*, *Phyllachora*, *Alternaria*, and *Helminthosporium*. Most of

**Table 6**

<table>
<thead>
<tr>
<th>Phycomycetes</th>
<th>Named genera</th>
<th>Named species</th>
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<tr>
<td>Peronosporales</td>
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<td>16</td>
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<tr>
<td>Others</td>
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<td>Total Phycomycetes</td>
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<table>
<thead>
<tr>
<th>Ascomycetes</th>
<th>Named genera</th>
<th>Named species</th>
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<td>Erysiphales</td>
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<td>10</td>
</tr>
<tr>
<td>Dothideales</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Microthyriales</td>
<td>4</td>
<td>5</td>
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<td>Sphaeriales</td>
<td>22</td>
<td>23</td>
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<tr>
<td>Hypocreales</td>
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<tr>
<td>Others</td>
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<td>Total Ascomycetes</td>
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<table>
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<th>Basidiomycetes</th>
<th>Named genera</th>
<th>Named species</th>
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<td>Ustilaginales</td>
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<td>24</td>
</tr>
<tr>
<td>Uredinales</td>
<td>10</td>
<td>52</td>
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<tr>
<td>Agaricales</td>
<td>14</td>
<td>26</td>
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<tr>
<td>Others</td>
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<td>10</td>
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<td>Total Basidiomycetes</td>
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</table>

<table>
<thead>
<tr>
<th>Fungi Imperfecti</th>
<th>Named genera</th>
<th>Named species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sphaeropsidales</td>
<td>17</td>
<td>32</td>
</tr>
<tr>
<td>Melanconiales</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Moniliales</td>
<td>56</td>
<td>153</td>
</tr>
<tr>
<td>Total F. Imperfecti</td>
<td>78</td>
<td>193</td>
</tr>
</tbody>
</table>

| Total                 | 175          | 383           |

the fungi so far studied are leaf-spotting parasites, rusts, smuts, sooty moulds, powdery mildews, downy mildews, and other parasites. Saprophytic fungi have hardly been investigated and little is known of the numerous agarics, polypores, and Gasteromycetes which occur in the wetter parts of the country. Xylophilous and coprophilous fungi have not been investigated, whilst soil-inhabiting fungi (*Fusarium*, *Pythium*, *Aspergillus*, *Penicillium*, *Actinomyces*, &c.) have been studied to a limited extent only in the Gezira and nothing is known of those present in other Sudan soils. Aquatic and entomogenous fungi, Myxomycetes, mycorrhizal fungi, fungi on man, lichens, and the fungi associated with rots of textiles, leather, horn, and other organic matter all constitute fields of research as yet almost untouched in the Sudan. Bacterial and virus diseases of certain economic crops have been investigated (particularly those of cotton) and some suspected but unidentified bacterial and virus diseases have been listed. Many more undoubtedly await collection.

The intimate relationship between climatic factors (particularly rainfall) and
the natural vegetation throughout the Sudan has already been mentioned. This also applies to the fungus flora with the additional considerations that for parasitic fungi suitable host plants must occur and in the case of insect-transmitted virus diseases the distribution of the insect vector will be of importance. The Sudan is peculiarly favourable for the study of distribution and incidence of fungi and plant diseases in relation to climatic factors on account of the fact that a most important climatic factor, rainfall, ranges from nil to some 60 inches annually from north to south. Also the natural vegetation is fairly continuous in the wetter areas and even in the drier areas widespread irrigation along the Nile facilitates the spread of plant diseases—particularly so when the flatness of the country and the lack of any natural barriers to spread are considered. Possibly the large swampy area of the sudd south of Malakal constitutes such a barrier to an uncertain degree but it is of limited extent and there is little obstacle to spread of plant diseases west and east of it.

The distribution of any plant disease within the Sudan is therefore to be governed largely by the presence or absence of suitable host plants and suitable climatic conditions. However, other factors do undoubtedly play a part. Thus soil characteristics including pH, composition, temperature, and moisture content are important in root diseases as discussed in detail by S. D. Garrett ('Root Disease Fungi', Chronica Botanica, 1944). In many smut diseases initial infection of the seedling depends largely on soil temperature and moisture content (e.g. *Sphacelotheca sorghi* on sorghum). It is possible that the absence of any serious and specific root disease of the Egyptian cotton (*Gossypium barbadense*) grown in the intensively cultivated Gezira cotton fields may be associated with the high alkalinity and heavy texture of Gezira clay—whereas elsewhere (Egypt, India) cotton suffers from various wilt diseases including Fusarium wilt caused by *F. vasinfectum*. The latter fungus has been isolated from Gezira soil but it may be that it is a less pathogenic strain than those causing cotton wilt elsewhere. Occasional plants attacked by what appears to be a Fusarium wilt are to be found in the Gezira but the disease causes negligible damage. Similarly, sorghum millet is free from serious fungus root diseases in the Gezira and, as far as is known, in the rest of the country also. However, root diseases of plants other than cotton have not been studied and no certain conclusions can be drawn. It is known that such fungi as *Fusarium*, *Rhizoctonia*, *Macrophomina*, *Aspergillus*, *Penicillium*, and *Pythium* occur commonly in Gezira soils but others, e.g. *Verticillium*, *Botrytis*, have not been found—possibly soil temperatures in the Gezira are too high. In the irrigated areas of the northern Sudan the soil micro-flora must be such as to survive alternate flooding and drying out when the soil is under cultivation and the prolonged dry hot conditions when under fallow (i.e. not irrigated). Little is known of other soil organisms except that *Azotobacter* and *Rhizobium* occur in Gezira soils—and also nematodes, although these rarely cause more than slight and sporadic damage to cultivated plants, mostly vegetables. They have not been found attacking any major crop plant in the Sudan and consequently have not been seriously investigated. An investigation of Gezira soil fungi was carried out by T. W. Clouston in 1935–40 and is reported in the Research Division annual reports for those years.

The effects of climatic factors on disease distribution and incidence are complex and it is not possible completely to study each factor apart from the others.
In the northern Sudan there is a hot rainless ‘dead’ season of several months’ duration during which few crops are grown or survive, whilst in the extreme southern Sudan, where some rain falls in most months and temperatures are lower, crops are grown throughout a higher proportion of the year. Even when not cultivated, plants left after the crop has been harvested tend to survive to a greater extent in the south than in the north, largely because climatic conditions between crop seasons are much less severe in the south. This has an important bearing on the carry-over of disease from one crop to the next. Certain rusts occur in the wet central and southern Sudan, but not in drier areas except in the rainless extreme north which experiences heavy early morning winter dews associated with very low winter temperatures. Similarly certain fungal leaf spots and rusts occur on the humid Red Sea coast, are absent from inland areas with equivalent or higher rainfall, and occur again in the wetter areas of the central and southern Sudan; these apparent anomalies are associated with humidity-temperature factors and are discussed later. Temperature may also have a more or less direct effect as in blackarm disease (*Xanthomonas malvacearum*) of cotton which develops more rapidly in the high temperatures prevailing at and after sowing in the Gezira than in the lower temperatures obtaining at the corresponding time in the southern Sudan.

It has been mentioned that the distribution of parasitic fungi within the Sudan is likely to be governed largely by climatic factors (especially rainfall) and by the distribution of suitable host plants. Certain plants, e.g. sorghum millet, tomato, cotton, are cultivated as rain-grown or irrigated crops in most parts of the Sudan, whilst some weeds, e.g. nut-grass, cynodon-grass, occur throughout the country. The study of the distribution of diseases of such cultivated and wild plants can yield valuable information concerning the effects of climatic and other factors on parasitic fungi and plant diseases in general. The first analysis of this sort for the Sudan was made by A. S. Boughey (Mycological Paper No. 19, 1947, published by the Commonwealth Mycological Institute, Kew). He found a positive correlation between rainfall and diseases caused by smuts, fungi imperfecti, and bacteria and non-significant correlations for rusts (positive) and powdery mildews (negative). With virus diseases there was no clear correlation. This analysis included collections made during the years 1938–45 and his main conclusions are broadly confirmed by the results of more extensive collecting during the following seven years (1946–52).

For the purposes of studying fungus and disease distribution as affected by climatic factors the Sudan is here divided into five regions, (A)–(D) with mean annual rainfalls of 0–12 inches, 12–24 inches, 24–36 inches, and over 36 inches respectively, and (E) comprising the Red Sea coastal area. The approximate positions of these regions are indicated on the map. Very roughly the southern boundary of (A) runs just north of the line Fasher–El Obeid–Dueim–Rufaa–Kassala, i.e. (A) includes most of the northern half of the Sudan: the northern tip of the Gezira, the whole of Northern Province, the northern parts of Darfur and Kordofan Provinces, the northernmost tip of Blue Nile Province and all of Kassala Province except its southern tip. Region (B) lies south of (A) with its southern boundary running just south of Geneina, Nyala, Renk, and Singa and just north of Sungikai and Dilling (i.e. north of the Nuba Mountains). This region runs through the south-central parts of Darfur, Kordofan, and Blue Nile.
Provinces and includes much of the Gezira and the northern tip of the Fung area in southern Blue Nile Province. Region (C) lies South of (B) with its southern boundary running near the Bahr el Arab river in the east as far as a point just south of Malakal, thereafter turning sharply south to about 6° N. and then running into the south-eastern corner of the Sudan from where it turns directly north and runs near Gallabat and south of Roseires in the east. Within this region lie much of southern Darfur and southern Kordofan Pro-

<table>
<thead>
<tr>
<th>Table 7. Sudan fungi listed by rainfall area (named species only)</th>
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<tbody>
<tr>
<td><strong>Mean annual rainfall, inches</strong></td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td><strong>PHYCOMYCETES</strong></td>
</tr>
<tr>
<td>Peronosporaceae</td>
</tr>
<tr>
<td>Albuginaceae</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>ASCOMYCETES</strong></td>
</tr>
<tr>
<td>Erysipheaceae</td>
</tr>
<tr>
<td>Meliolaceae</td>
</tr>
<tr>
<td>Dothideales</td>
</tr>
<tr>
<td>Microthyriales</td>
</tr>
<tr>
<td>Sphaeriales</td>
</tr>
<tr>
<td>Hypocreales</td>
</tr>
<tr>
<td>Helotiales</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>BASIDIOMYCETES</strong></td>
</tr>
<tr>
<td>Ustilaginales</td>
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<td>Uredinales</td>
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<tr>
<td>Agaricales</td>
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<tr>
<td><strong>Total</strong></td>
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<td><strong>FUNGI IMPERFECTI</strong></td>
</tr>
<tr>
<td>Sphaeropsidales</td>
</tr>
<tr>
<td>Melanconiales</td>
</tr>
<tr>
<td>Moniliales</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
</tr>
</tbody>
</table>

vinces (including the Nuba Mountains), almost the whole of Upper Nile Province and all the southern Fung area. Region (D) comprises all the Sudan south of (C)—almost all of Bahr el Ghazal and Equatoria Provinces. Region (E) includes the Red Sea coastal area, the north-eastern fringe of Kassala Province. These regions correspond very approximately with the vegetational divisions described earlier in this book, region (A) being largely desert and Acacia desert scrub, (B) mostly Acacia short grass scrub, (C) mostly Acacia tall grass forest, and (D) mostly broad-leaved woodland and forest. In general terms much of (A) lies within what is commonly called the northern Sudan, (B) and much of (C), except its southern prolongation, together constitute the central Sudan whilst (D) and the southern part of (C) form the southern Sudan.
The numbers of named species of fungi, classified by families or orders, which are at present known to occur in these five areas are summarized in Table 7. This table does not include fungi isolated from soil since these have been studied only in the Gezira.

In considering these figures it must be remembered that the wetter parts of the Sudan (regions (C) and (D)) support a heavier natural vegetation with many more genera and species of potential host plants than the drier regions (A), (B) and (E) and would on this basis be expected to be attacked by greater numbers of parasitic fungi. On the other hand the drier regions (A), (B), and (E) are agriculturally more highly developed—being largely irrigated lands—than the wetter areas included in (C) and (D). The drier regions are more accessible and plant diseases present have been more thoroughly listed except on the Red Sea coast (E). The agricultural potentialities of region (C) are now being developed but the plant diseases present in the wetter parts of the region are as yet imperfectly known. Region (D), although containing a wide variety of vegetation and native crops, is as yet poorly developed agriculturally and the fungi and plant diseases present have been listed to only a limited degree.

To overcome these difficulties a list of plants which are cultivated or occur fairly widely throughout the Sudan and which have been reasonably adequately inspected in all five regions of the country was compiled. The distribution of certain diseases of these plants in the five regional areas described above was analysed. Only well-defined diseases which occur fairly commonly in the places where they do occur, i.e. such as are not likely to be overlooked if present, were

**Table 8. Phycomycetes and Ascomycetes**

<table>
<thead>
<tr>
<th>Fungus</th>
<th>Host</th>
<th>Mean annual rainfall, inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(A) 0-12</td>
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<tr>
<td><strong>PHYCOMYCETES</strong></td>
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</tr>
<tr>
<td>Pseudoperonospora</td>
<td>Cucurbitaceae</td>
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<tr>
<td>cubensis</td>
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<td></td>
</tr>
<tr>
<td>Sclerospora graminicola</td>
<td>Pennisetum typhoides</td>
<td>+</td>
</tr>
<tr>
<td>Cystopus portulacea</td>
<td>Portulaca</td>
<td></td>
</tr>
<tr>
<td><strong>ASCOMYCETES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erysiphe echoracearum</td>
<td>Various</td>
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</tr>
<tr>
<td>E. polygoni</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Leveillula taurica</td>
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<td>+</td>
</tr>
<tr>
<td>Sphaerotheca fuliginea</td>
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<td>+</td>
</tr>
<tr>
<td><strong>OTHER ASCOMYCETES</strong></td>
<td></td>
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</tr>
<tr>
<td>Phyllachora cynodontis</td>
<td>Cynodon</td>
<td>+</td>
</tr>
<tr>
<td>Eudarluca australis</td>
<td>Uredinales</td>
<td>+</td>
</tr>
<tr>
<td>Glomerella cingulata</td>
<td>Various</td>
<td>+</td>
</tr>
<tr>
<td>Tryblidiella rufula</td>
<td>Citrus, dead twigs, &amp;c.</td>
<td>+</td>
</tr>
</tbody>
</table>

Note: + indicates the presence of a disease, ± indicates that it occurs but rarely.
FUNGI AND PLANT DISEASES IN THE SUDAN

considered. Doubtful cases were not included. The results are tabulated and discussed here.

Only a few downy mildews (Peronosporaceae) have been collected in the Sudan and none is known to occur in the dry region north of Khartoum although Sclerospora graminicola appears in the humid Red Sea coastal area. Pseudoperonospora cubensis is widespread in the wetter parts of the Sudan and occurs as far north as Wad Medani (mean annual rainfall some 16 inches)—presumably areas with lower rainfall are not sufficiently wet to allow the spores of the fungus to germinate and infect the host. Thus Doran (Bull. Mass. agric. Exp. Sta., 283, 1932) found that about five hours on the wet surface of a leaf were necessary for infection to occur at temperatures between 9°-30° C. Further collection will no doubt show that many more downy mildews are to be found in the central and particularly the southern Sudan than in the dry north.

Powdery mildews (Erysiphaceae) show the opposite tendency and are more common in the dry northern Sudan than in the wetter areas. Thus Erysiphe cichoracearum and E. polygoni have not been found south of the Gezira, where mean rainfall rarely exceeds 18–20 inches annually. Leveillula taurica is very common on a wide range of hosts in the northern Sudan and Gezira, occurs less commonly in the Nuba Mountains area where mean rainfall may reach about 36 inches annually and is rarely found in areas of higher rainfall. Sphaerotheca fuliginea, however, occurs throughout the Sudan. The reasons for the occurrence of powdery mildews in dry rather than wet areas are not understood. Spread of these diseases is by wind-blown conidia and it has been reported that conidia of S. fuliginea germinate poorly or not at all in free water but do so readily in a saturated atmosphere and that optimum humidity for actual infection lies between 69–96 per cent. Spore formation although abundant at 76–96 per cent. humidity was much reduced in a saturated atmosphere (Hashioka, 1937). Yarwood (1936) found that conidia of E. polygoni could germinate even in a completely dry atmosphere and that conidia of E. polygoni, E. cichoracearum, and E. graminis could successfully infect at humidities as low as 25–55 per cent. Unlike most parasitic fungi these three powdery mildews seem to be especially well adapted to dry atmospheric conditions and such considerations may explain their restriction to the drier regions of the Sudan. It is possible that Cicinnobolus cesatii, a fungus often found heavily parasitizing powdery mildews, may reduce the incidence of the latter in the wetter parts of the Sudan. Thus the conidia of C. cesatii need free water for germination and in the Sudan this hyperparasite has been found only in areas with more than 24 inches mean annual rainfall. Heavy rain may wash powdery mildew conidia from the leaves of potential hosts and may also destroy the conidiophores and thus greatly check dissemination of the disease (Yarwood, 1936). Ascomycetes other than powdery mildews reach their maximum in the wetter areas of the Sudan, e.g. Meliolaceae and Asterina spp. have been found only in places of more than 35 inches annual rainfall, whilst only one species of Phyllachora (P. cynodontis) is known to occur in areas with less than about 25 inches annual rainfall. Other Ascomycetes—Sphaeriales, Hypocreales—are very much commoner in the wet central and southern Sudan than in the dry north. Undoubtedly many more species of Meliolaceae, Asterina, and Ascomycetes in general await collection in the wetter areas of the southern Sudan. In general these Ascomycetes often need free water for spore germination.
and infection to take place and their distribution is associated with this factor. Many smuts are seed borne or soil borne and infect the young seedling. In many of the cases investigated, successful invasion of the young seedling depends on soil conditions at and just after the time of sowing. Soil temperatures and moisture contents are important and, particularly with rain-grown plants, tend to be closely associated with climatic conditions. In general optimum infection conditions for many smuts are those which retard seedling growth in the very early stages but which favour germination of the smut spores. For

**Table 9. Basidiomycetes**

<table>
<thead>
<tr>
<th>Fungus</th>
<th>Host</th>
<th>Mean annual rainfall, inches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ustilaginales</strong></td>
<td>0-12</td>
<td>12-24</td>
</tr>
<tr>
<td>Cintractia limitata</td>
<td>Cyperus</td>
<td>±</td>
</tr>
<tr>
<td>Sphacelotheca</td>
<td>Sorghum</td>
<td>+</td>
</tr>
<tr>
<td>S. reiliana</td>
<td>. . . .</td>
<td>±</td>
</tr>
<tr>
<td>S. sorgi</td>
<td>. . . .</td>
<td>+</td>
</tr>
<tr>
<td>Tolyposporium</td>
<td>. . . .</td>
<td>+</td>
</tr>
<tr>
<td>ehrenbergii</td>
<td>. . . .</td>
<td>+</td>
</tr>
<tr>
<td>T. penicillariae</td>
<td>Pennisetum typhoides</td>
<td>. . . .</td>
</tr>
<tr>
<td>Ustilago cynodontis</td>
<td>Cynodon</td>
<td>. . . .</td>
</tr>
<tr>
<td><strong>Uredinales</strong></td>
<td>0-12</td>
<td>12-24</td>
</tr>
<tr>
<td>Puccinia cynodontis</td>
<td>Cynodon</td>
<td>+</td>
</tr>
<tr>
<td>P. heterospora</td>
<td>Sida</td>
<td>+</td>
</tr>
<tr>
<td>P. penniseti</td>
<td>Pennisetum</td>
<td>. . . .</td>
</tr>
<tr>
<td>P. purpurea</td>
<td>Sorghum</td>
<td>. . . .</td>
</tr>
<tr>
<td>P. romagnoliana</td>
<td>Cyperus</td>
<td>+</td>
</tr>
<tr>
<td>Uromyces appendiculatus</td>
<td>Phaseolus</td>
<td>±</td>
</tr>
<tr>
<td>U. vignae</td>
<td>Vigna</td>
<td>±</td>
</tr>
</tbody>
</table>

covered smut (*Sphacelotheca sorghi*) of sorghum millet Melchers & Hansing (1938) found that low soil temperatures were consistently associated with high infection and that soil moistures of 28 per cent. or more on the dry basis appeared to reduce infection even under favourable soil temperature conditions. In the Sudan winter-sown sorghum is commonly attacked more severely than that sown in summer, probably due to the lower soil temperatures in the former case, and covered smut often reaches its maximum incidence in the area of rain cultivation stretching from the Gash Delta in the east across the central Sudan to Darfur in the west. In this area sorghum is usually planted after heavy rain with attendant low soil temperatures. It may be that similar considerations hold for other Sudan smut fungi but their methods of infection and dissemination have not been studied. No doubt such factors play a considerable part in influencing distribution of Ustilaginales within the Sudan; as at present known, they appear to reach their maximum development in the wetter parts of the country and particularly in the central Sudan (regions (B) and (C) with 12–36 inches mean annual rainfall).

In the Sudan most *rusts* are probably spread by wind-disseminated uredospores which require either free water or a saturated atmosphere for several
hours before germination and infection can occur. Hence it is not surprising that
they are more numerous in the wetter parts of the country and show a positive
correlation with rainfall. *Puccinia cynodontis* appears to be an exception in that
it has not been found south of Sennar (mean annual rainfall just over 18 inches).
*Uromyces appendiculatus* and *U. vignae* are common in areas with annual rain-
fall over about 24 inches and particularly over 36 inches but do not occur in
drier areas except in the extreme north of the Sudan at Wadi Halfa where rain-
fall is usually nil. In the latter area the heavy early morning dews which occur
in winter when temperatures are low no doubt provide the film of water needed
for spore germination and infection to occur whereas farther south where dews
are lighter but rainfall heavier these rusts do not occur—until annual rainfalls
of some 24 inches or over are encountered. A similar case probably holds for
*Puccinia carthami* which occurs at Wadi Halfa but not elsewhere in the Sudan—
but *Carthamus* is not widely cultivated in the wetter parts of the country. A. S.
Boughey also recorded a *Peronospora* sp. on *Trigonella* at Wadi Halfa but not
collected elsewhere in the Sudan. The common occurrence of *Puccinia penniseti*,
*P. purpurea*, and *P. romagnoliana* in the humid Red Sea area but not at places
inland with equivalent or even considerably heavier rainfall is probably to be
explained similarly. Thus these three rusts are common on the Red Sea coast
at Tokar with mean annual rainfall about 3½ inches, whereas inland *P. penniseti*
and *P. purpurea* have not been found in areas with less than about 16 inches
rainfall and are not common until mean annual rainfall reaches 24 inches. *P.
romagnoliana* is common at Wad Medani (annual rainfall about 16 inches) and
also occurs in parts of the Gash Delta in the eastern Sudan with rainfall as low
as 7 inches annually but with high humidity. In the northern Sudan aecidial
stages of rusts have not been found and the seasonal carry-over of *Puccinia
graminis* is not understood since neither aecidia nor the barberry occur and the
uredospores are thought to be relatively short-lived; it is possible that wheat in
the northern Sudan is infected annually by uredospores carried by wind from
Egypt but there is no certain evidence for this. The aecidial stages of such rusts
as *P. cynodontis* (aecidial host Plantago), *P. graminis* (Berberis), *P. sorgii*
(Oxalis), *P. triticina* (Ranunculaceae), and *Uromyces striatus* (Euphorbias) have
not been found in the Sudan.

Detailed information regarding *Cercospora* spp. is given in Table 11 below.
Most Fungi Imperfecti are disseminated by wind and rain splash. Many pro-
duce spores which require free water or very high humidity for several hours for
germination and infection to occur. Hence they reach maximum development in
the wettest parts of the Sudan and occur but rarely in areas with less than about
12 inches of rainfall annually. In this respect they resemble Ascomycetes other than
powdery mildews—many Fungi Imperfecti are conidial states of Ascomycetes.
As was noted for some rusts certain Fungi Imperfecti, e.g. *Alternaria solani*, *A.
gossypina*, *A. zinniae*, *Cercospora calotropidis*, *C. cucurbitae*, and *Dichotomophtora
portulaceae*, occur in the humid Red Sea coastal area but not in inland areas with
equivalent or even considerably greater rainfall. This again is probably associated
with the high humidity and attendant dews in this maritime region.

Some 54 species of *Cercospora* have been identified in the Sudan and the dis-
tribution of species the hosts of which occur and have been reasonably adequately
inspected in all five rainfall regions of the country (with the possible exception
of the Red Sea coast) is summarized in Table 11. The increasing number of *Cercospora* spp. with increasing rainfall is well marked and in fact the only *Cercospora* leaf spot known to occur in areas with less than 12 inches annual rainfall (excluding the Red Sea area) is *C. zebrina* which has been recorded on

### Table 10. Fungi Imperfecti

<table>
<thead>
<tr>
<th>Fungus</th>
<th>Host</th>
<th>Mean annual rainfall, inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(A) 0–12</td>
</tr>
<tr>
<td><em>Sphaeropsidales</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cicinnobolus cesati.</td>
<td>Erysiphaceae</td>
<td>..</td>
</tr>
<tr>
<td>Septoria lycoperici</td>
<td>Lycopersicium</td>
<td>..</td>
</tr>
<tr>
<td><em>Melanconiales</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colletotrichum</td>
<td>Sorghum</td>
<td>..</td>
</tr>
<tr>
<td><em>graminicola</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Moniliales</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramularia areola</td>
<td>Gossypium</td>
<td>..</td>
</tr>
<tr>
<td>Alternaria brassicicola</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. cucumerina</td>
<td>Brassica, Raphanus</td>
<td>..</td>
</tr>
<tr>
<td>A. solani</td>
<td>Cucurbita</td>
<td>..</td>
</tr>
<tr>
<td>Cladosporium fulvum</td>
<td>Solanaceae, Ipomoea</td>
<td>..</td>
</tr>
<tr>
<td>C. herbarum</td>
<td>Lycopersicon</td>
<td>±</td>
</tr>
<tr>
<td>Helminthosporium</td>
<td>Various</td>
<td>+</td>
</tr>
<tr>
<td>turicicum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigrospora oryzae</td>
<td>Sorghum, Zea</td>
<td>..</td>
</tr>
<tr>
<td>Papularia *sphaero-</td>
<td>Various</td>
<td>..</td>
</tr>
<tr>
<td><em>sperma</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Cercospora</em> spp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(see Table 11)</td>
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<td>0</td>
</tr>
</tbody>
</table>

### Table 11

<table>
<thead>
<tr>
<th>Cercospora</th>
<th>Host</th>
<th>Mean annual rainfall, inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(A) 0–12</td>
</tr>
<tr>
<td>arachidicola</td>
<td>Arachis</td>
<td>..</td>
</tr>
<tr>
<td>brassicicola</td>
<td>Brassica</td>
<td>..</td>
</tr>
<tr>
<td>cajani</td>
<td>Cajanis</td>
<td>..</td>
</tr>
<tr>
<td>canescens</td>
<td>Leguminosae</td>
<td>..</td>
</tr>
<tr>
<td>capsici</td>
<td>Capsicum</td>
<td>..</td>
</tr>
<tr>
<td>cucurbitae</td>
<td>Cucurbitaceae</td>
<td>..</td>
</tr>
<tr>
<td>gossypina</td>
<td>Gossypium</td>
<td>..</td>
</tr>
<tr>
<td>hibisci</td>
<td>Hibiscus</td>
<td>..</td>
</tr>
<tr>
<td>longissima</td>
<td>Lactuca</td>
<td>..</td>
</tr>
<tr>
<td>mangiferae</td>
<td>Mangifera</td>
<td>..</td>
</tr>
<tr>
<td>nicotianae</td>
<td>Nicotiana, Lycopersiccon</td>
<td>..</td>
</tr>
<tr>
<td>personata</td>
<td>Arachis</td>
<td>±</td>
</tr>
<tr>
<td>reinella</td>
<td>Ricinus</td>
<td>..</td>
</tr>
<tr>
<td>sesami</td>
<td>Sesamum</td>
<td>..</td>
</tr>
<tr>
<td>solani-melongenae</td>
<td>Solanum</td>
<td>..</td>
</tr>
<tr>
<td>sorghi</td>
<td>Sorghum</td>
<td>±</td>
</tr>
<tr>
<td>sp.</td>
<td>Corchorus</td>
<td>..</td>
</tr>
</tbody>
</table>
lucerne (*Medicago sativa*) north of Khartoum in places with as little as 5 or 6 inches annual rainfall (Shendi) and in one instance at Nuri where mean annual rainfall is about an inch (collected by A. S. Boughey in November 1939).

**Bacterial diseases.** Many suspected bacterial diseases occur in the central and southern Sudan. The few which have been identified and investigated appear to be seed borne and to be spread largely by rain splash combined with driving wind. Hence they tend to be of little significance in the dry northern Sudan but can be severe in the central and southern Sudan.

**Virus diseases.** Of the many virus diseases which are to be observed in most parts of the Sudan only a few have been investigated. These appear to be largely insect transmitted and their distribution is linked with that of the insect vector. The effects of climatic conditions on distribution and severity of virus diseases in the Sudan are probably complex. Some, e.g. cotton leaf curl, tomato leaf curl (unidentified virus), occur throughout the Sudan, others, e.g. haricot bean curly top (unidentified virus), are most prevalent in the north whilst yet others, e.g. cassava mosaic, groundnut rosette, and maize streak, have been found only in the southern Sudan. In some cases higher temperatures appear to increase severity of virus attack, e.g. cotton leaf curl on okra and cotton, tomato leaf curl, and A. S. Boughey found a positive correlation between maximum shade temperatures and incidence of curly top disease of haricot beans in the Shendi area north of Khartoum. Although commonly observed the nature of this severity-temperature correlation of virus diseases is not understood.

In addition to its effect on distribution of fungi and plant diseases climate also influences their seasonal incidence and severity. Thus in the Gezira fungal leaf spots and rain-spread bacterial diseases are more widespread and severe in seasons with heavy, well-spaced rains than in seasons with below average rainfall. Powdery mildews tend to be more destructive in warm than in cold winters in the northern Sudan. The consideration of such effects can provide information of value in forecasting likely seasonal disease incidence and the application and timing of control measures, e.g. spraying. A. S. Boughey has investigated these relationships for blackarm and leaf curl diseases of cotton in the Sudan Gezira (see *Mycological Papers*, Nos. 21 and 22, 1947, published by the Commonwealth Mycological Institute, Kew).

**PART II**

**FUNGI**

**PHYCOMYCETES**

**CHYTRIDIALES**


on *Cyperus rotundus* (nut grass). F. W. A. (IMI 27865), 1938, no further details given.

**PERONOSPORALES: Pythiaceae**

*Phytophthora infestans* (Mont.) de Bary in *J. R. agric. Soc.*, 2, 12, p. 240, 1876. See Butler, p. 277; Butler & Jones, p. 514; Fitzpatrick, p. 205; Heald, p. 396; Roger, p. 626.

on *Solanum tuberosum* (potato). Equatoria, H. Ferguson (1941). Late blight;
occasionally found but rarely destructive in the Sudan. It occurs only in the high rainfall areas of the southern Sudan.


**P. aphanidermatum** (Edson) Fitzpatrick in *Mycologia*, 15, p. 168, 1923. See Butler & Jones, p. 584; Dickson, p. 377; Roger, p. 613; Sprague, p. 20.


**P. graminicola** Subram. in *Bull, agric. Res. Inst. Pusa*, 177, p. 5, 1928. See Dickson, p. 70; Gilman, p. 139; Padwick, p. 137; Sprague, p. 28.


**Pythium** spp.

on *Gossypium barbadense* (Egyptian cotton). Wad Medani, R. E. M. (1935), seedling wilt (possibly *P. afertile*).

on *Pisum sativum* (pea). Shambat, A. S. B. (1941), isolated from roots of wilting plants.

on *Raphanus sativus* (radish). Gezira, A. S. B.; several species of *Pythium* are associated with damping-off of radish seedlings.

**Peronosporales:** *Peronosporaceae*

**Peronospora favargeri** Mayor & Viennot-Bourgin in *Bull. Soc. mycol. Fr.*, 67, p. 115, 1951. (Fig. 1.)

on *Euphorbia hirta*. Bunziga JT 1838 (IMI 51176), 1952; Loka West JT 1424 (IMI 48763), 1951; Yambio JT 384 (IMI 45202), 1949. Downy mildew, reported also from Sierra Leone, Gold Coast, and Ivory Coast.

**Peronospora** sp.

on *Trigonella hamosa*. Wadi Halfa area, collected by A. S. Boughey (undated).
Plasmopara australis (Speg.) Swingle in *Trans. Kans. Acad. Sci.*, **11**, p. 72, 1889. See Fitzpatrick, p. 217. (Fig. 2.)


Plasmopara sp.

on *Achyranthes aspera*. Sennar JT 1710 (1952); Singa–Roseires road JT 1826 (IMI 51168), 1952. This downy mildew may be a 'new' species since there appears to be no previous record of *Plasmopara* on *Achyranthes* or related genera.

Pseudoperonospora cubensis (Berk. & Curt.) Rostowzew in *Ann. Inst. Agron. Moscow*, **9**, p. 47, 1903. See Bouriquet, p. 499; Butler, p. 311; Fitzpatrick, p. 218; Roger, p. 717. (Fig. 3.)
on *Coccinea grandis*. Adok JT 1306 (IMI 49968), 1951. Downy mildew.

on *Cucumis melo* (sweet melon). Dilling JT 952 (IMI 44843), 1950, JT 964 (IMI 44848), 1950. Occasionally found on this host and can cause considerable leaf shedding.

on *C. melo var. agrestis*. Abu Hagar JT 1788 (IMI 51139), 1952; Rashad JT 1013 (IMI 44876), 1950; Roseires JT 1827 (IMI 51169), 1952. Occasional.

on *C. sativus* (cucumber). Kadugli ASB 553 (1942), JT 154 (1947); Loka West JT 1543 (1951); Malakal ASB 721 (IMI 325), 1944; Shambe JT 696 (IMI 40012), 1949; Torit JT 242 (IMI 32449), 1948; Wad Medani ASB (1941). Downy mildew is commonly found and is often destructive on cucumber in the wetter parts of the country and as far north as Wad Medani.

on *Cucumis* sp. Tonj JT 643 (IMI 44828), 1949.

on *Cucurbita maxima* (pumpkin). Wad Medani ASB (IMI 304), 1939. Downy mildew occurs infrequently on this host in the Sudan.

on *Cucurbita* sp. (cultivated). Wad Medani JT 1702 (IMI 50605), 1952.

on *Luffa echinata*. Wad Medani JT 1691 (IMI 50598), 1952.

*Sclerospora graminicola* (Sacc.) Schrot. in Pilze Schles., 1, p. 236, 1886.

See Butler, pp. 203, 218; Dickson, pp. 73, 75, 99; Fitzpatrick, p. 212; Roger, p. 721; Sprague, p. 48. (Fig. 4.)

on *Pennisetum typhoides* (bulrush millet). Dam Gamid ASB (1944); Danaglia JT 889 (1950); Dueim JT 18 (1946); Fasher ASB (1944); Nyala ASB (1943); near Sennar JT 1708 (IMI 50608), 1952; Sungikai JT 946 (1950); Tokar R. E. M. (IMI 28062), 1929, ASB (IMI 231), 1941; Wad Medani JT 849 (1950); Wasaa ASB 615 (1944). Downy mildew and ‘green ear’. Both aspects of the disease occur in the Sudan, the latter being the more conspicuous. Central Sudan and Red Sea coast; it occasionally causes appreciable crop loss.

on *Sorghum vulgare* (sorghum millet). Red Sea Province ASB (undated). Rare on this host in the Sudan.

**Peronosporales: Albuginaceae**


See Butler, p. 316.

on *Achyranthes aspera*. Abu Hagar JT 1786 (1952); Kadugli JT 983 (IMI 44865), 1950; Malakal JT 1349 (IMI 48740), 1951; Torit–Katire road JT
1601 (IMI 48815), 1951; Wad Medani ASB (1939), JT 1701 (IMI 50604), JT 1727 (IMI 50624), (1952). White blister: common on *Achyranta* and other *Amaranthaceae* in the central and southern Sudan.

on *Alternanthera nodiflora*. Singa JT 1777 (IMI 51134), 1952.

on *Celosia populifolia*. Fasher–Nyala road JT 1944 (IMI 51524), 1953.

on *Pandiaka heudeletii*. Ghadambaliya JT 1677 (IMI 50585), 1952.


on *Cleome viscosa*. Ghadambaliya JT 135 (IMI 36300), 1948.

on *Gynandropsis gynandra*. Dilling ASB (1943); El Obeid ASB (1943); southern Gezira ASB (1943). *Cystopus candidus* is commonly found on wild plants of the family Capparidaceae in the central Sudan but has not been found on cruciferous plants.


on *Ipomoea cardiosepala*. Gezira ASB (1943); Kab el Gidad ASB (1943); Turabi ASB (1939); Wad Medani ASB (IMI 229), 1939, ASB (1940–4), JT 844 (IMI 44123), 1950; Wad Naaman ASB (1942).

on *I. pilosa*. Dilling JT 1017 (IMI 45221), 1950.

on *Ipomoea* sp. Khor el Atshan ASB (1942). This white blister is very common on *Ipomoea* spp. in the Gezira and central Sudan but has not been found on sweet potato (*I. batatas*) although elsewhere this plant is susceptible.

*C. platensis* Speg. in *Rev. argent. Hist. nat.*, 1, p. 32, 1891.

on *Boerhaavia repens*. Abu Usher ASB (1943); Gezira ASB (1943); Jebel Biyut ASB (1943); Kosti ASB (1943); Rabak ASB (1943); Wad Medani ASB (1939), ASB (IMI 232), 1941, ASB (1942–4), JT 828 (1950). White blister is common and destructive on this host in the Gezira and central Sudan.

on *Boerhaavia* sp. Wad Medani JT 1208 (IMI 47247), 1951.


on *Portulaca oleracea* (purslane). Gash Delta ASB (1942); Kagelu ASB (1942); Kosti ASB (1943), ASB 600 (1944); Melut JT 1338 (1951); Sennar ASB (1943); Shambat ASB (1941); Shendi ASB 539 (1939), ASB (1941), ASB 479 (1944); Suki ASB 576 (1944); Wad Medani ASB (IMI 228), 1939, ASB (1940–4), JT 316 (1949); Wad Naaman ASB (1942); Wau JT 661 (IMI 39983), 1949. Common and sometimes severe on purslane in most areas of the Sudan south of Khartoum.
Mucorales: Mucoraceae

Rhizopus stolonifer (Ehrenb. ex Fr.) Lind in Danish Fungi, p. 72, 1931 (R. nigricans Ehrenb.). See Fitzpatrick, p. 245; Gilman, p. 20; Roger, p. 588; Stevens (1913), p. 105, (1925), p. 85.

on Citrus nobilis (tangerine). Atbara ASB (1944), associated with soft rot of fruit in transit.

on Mangifera indica (mango). Merowe ASB (1939), associated with fruit rot.

from soil. Tayiba ASB (1940), in field of wilting cotton. This fungus is widespread throughout the Sudan on a number of hosts and substrata, particularly as a component of fruit rots. It is probably only weakly parasitic and enters through insect punctures, wounds, &c.

Mucorales: Choanephoraceae


from soil. Wad Medani ASB (1940).

Ascomycetes

Endomycetales

Eremothecium ashbyii Guiller. in Rev. mycol., 1, p. 115, 1936.

on Gossypium hirsutum (American cotton). Berber, R. E. M. (1933); associated with boll rot and staining of the lint. Apparently rare, collected on only one occasion, from which material the fungus was described. Also recorded from South Africa (see Progress Reports from Experiment Stations (Barberton), season 1938–9, Empire Cotton Growing Corporation, 1940).

? Nematospora spp.

on Gossypium hirsutum (American cotton). It is possible that Nematospora occurs in the wetter parts of the Sudan on cotton lint infested by Dysdercus spp., the insects which carry the fungus and thereby initiate the characteristic Nematospora lint staining such as occurs elsewhere in Africa. There is no specimen or culture in the herbarium and I know of no instance of Nematospora having been cultured and identified in the Sudan.

Eurotales


on Gossypium barbadense (Egyptian cotton). Wad Medani R. E. M. (1934); isolated from cotton rootlets.

Erysiphales: Erysipheceae

Perithecia of Erysiphaceae are very rarely found in the Sudan but those of Erysipe cichoracearum, E. polygoni, and Sphaerotheca fuliginea have been collected. This is discussed in detail under Oidium spp.
Funghi and Plant Diseases in the Sudan


This powdery mildew was listed by A. S. Boughey (1946) as parasitic on Citrullus vulgaris (water melon), Corchorus olitorius (Jew’s mallow, jute), Eruca sativa (salad rocket), Hibiscus esculentus (okra), and Papaver sp. (garden poppy) in the northern Sudan and as far south as the Gezira. Perithecia were found only once—at Nuri, ASB 760 (IMI 278), 1943, on Hibiscus esculentus. See also under Sphaerotheca fuliginea below.

E. graminis DC. in Lamarck & De Candolle, Flore Francaise, 6, p. 106, 1815.

See Butler, p. 173; Butler & Jones, p. 372; Dickson, p. 25; Sampson & Western, p. 14; Sprague, p. 78; Viennot-Bourgin, p. 264.

on Hordeum vulgare (barley). Shendi ASB 95 (IMI 300), 1942, occasionally found but not severe.

on Triticum vulgare (wheat). Debeira ASB (1943), ASB 438 (1944), ASB 506 (1944), ASB 513 (1944); Wad Medani ASB (IMI 308), 1943. Widespread on wheat in the northern Sudan but rarely severe.

E. polygoni DC. in Lamarck & De Candolle, Flore Francaise, 2, p. 273, 1805.

See Butler, p. 253; Butler & Jones, p. 456; Dickson, p. 317; Sampson & Western, p. 58; Viennot-Bourgin, p. 270.

Listed by A. S. Boughey (1946) on Brassica campestris var. sarson (colza), B. juncea (Indian mustard), B. naporapestris (swede), B. napus (rape), Daucus carota (carrot), Lathyrus sativus (vetch), Lens esculenta (lentil), Pisum sativum (pea), Trigonella foenum-graecum (fenugreek), Vicia faba (broad bean). This powdery mildew is common in the northern Sudan and as far south as the Gezira. Perithecia are rare but have been found at Wadi Halfa in the extreme northern Sudan where winter temperatures are low, once on Pisum sativum and once on Vicia faba, ASB (1941). There is no perithecial specimen of Erysiphe polygoni in the Sudan Mycological Herbarium.

Leveillula taurica (Lév.) Arn. in Ann. des Epiph., 7, p. 92, 1919. The conidial form is Oidiopsis sicula Scal. or O. taurica (Lév.) Salm. See Bouriquet, p. 487; Butler, p. 271. (Fig. 5.)

Perithecia have not been collected in the Sudan but the conidial stage is characteristic and widespread on numerous host plants in the northern and central Sudan. Its internal mycelium renders it more difficult to control by dusting or spraying than other powdery mildews, most of which have external mycelia only. This mildew is common in the Gezira and northern Sudan but is also occasionally found farther south. Among its numerous host plants in the Sudan are: Abutilon spp. (including

Fig. 5.
A. muticum and A. graveolens), Acacia spp. (including A. oforta and A. seyal), Allium sativum (garlic), Aristolochia bracteata, Brassica campestris (turnip), Cajanus indicus (pigeon pea), Calotropis procera, Capsicum annuum (chilli), Cicer arietinum (chick pea), Corchorus trilocularis, Coriandrum sativum (coriander), Crotonalicia juncea (sann-hemp), Cucurbita maxima (pumpkin), Cyamopsis psoraloides (cluster bean), Daucus carota (carrot), Delphinium sp. (larkspur), Eruca sativa (salad rocket), Euphorbia spp. (including E. acalyphoides, E. convolvuloides and E. heterophylla), Foeniculum vulgare (fennel), Gomphrena globosa (globe amaranth), Oenandropsis gynandra, Hibiscus esculentus (okra), H. obtusifolius, H. sabdariffa (roselle), Ipomoea sp., Lathyrus sativus (vetch), Linum usitatissimum (linseed), Lupinus termis (lupin), Lycopersicon esculentum (tomato), Malva parviflora, Medicago sativa (lucerne), Petroselinum crispum (parsley), Phacelia viscida, Phlox sp., Phyllanthus maderaspatensis, P. niruri, Physalis peruviana (cape gooseberry), Pisum sativum (pea), Rhynchosia menmonia, Ricinus communis (castor), Sesamum indicum (sesame), Solarum melongena (egg-plant), Solarum sp. (wild), Trigonella foenum-graecum (fenugreek), T. hamosa, Tropaeolum majus (nasturtium), Verbena sp., Vicia faba (broad bean).


Listed by Boughey (1946) on: Corchorus olitorius (Jew’s mallow, jute), Cucumis melo (sweet melon), C. sativus (cucumber), Cucurbita maxima (pumpkin), C. pepo (vegetable marrow), Hibiscus esculentus (okra), Lagenaria vulgaris (gourd), Phaseolus mungo (black gram), Sesamum indicum (sesame), Vigna unguiculata (cowpea). Common on a variety of hosts throughout the Sudan, probably more widespread in the north but by no means uncommon in the south. Specimens of other plants attacked by powdery mildews and marked by A. S. Boughey as S. fuliginea are also present in the herbarium. In some cases other records suggest that S. fuliginea is not the fungus concerned and that a later correction had been made but not indicated on the herbarium labels. I therefore list them below with the probable identity in brackets where appropriate: On Cassia occidentalis (Erysipe cichoracearum), Citrullus vulgaris (Oidium sp., q.v.), Corchorus fascicularis, Cucumis melo var. agrestis, Euphorbia sp., Lathyrus sativus (E. polygoni), Papaver sp. (E. cichoracearum), Pisum sativum (E. polygoni), Sonchus sp., probably cornutus, Trigonella foenum-graecum (E. polygoni), Vicia faba (E. polygoni), Vigna sp. These were recorded mostly from the northern Sudan and the Gezira. Perithecia have been collected on three occasions, in each case on Cucurbita pepo (vegetable marrow), from Debeira ASB 192 (1943); Nuri ASB 211 (1943); Wad Medani ASB (IMI 290), 1939.

Uncinula necator (Schw.) Burr, in Ell. & Ev., N. Amer. Pyren., p. 15, 1892.


on Vitis vinifera (grape vine). Wad Medani ASB 127 (IMI 239), 1942, ASB (1944). Powdery mildew, occasionally found on grape leaves in the Gezira but not on fruit, rarely severe. Only the conidial stage (Oidium tuckeri Berk.) has been recorded in the Sudan.
**FUNGI AND PLANT DISEASES IN THE SUDAN**

**ERYSIPHALES: Meliaceae**


on *Hibiscus sabdariffa* (roselle). Yambio JT 439 (IMI 40122), 1949. Sooty mould on leaves, occasionally found in Equatoria.


*M. malacotricha* Speg. in *An. Soc. dent, argent.*, **26**, no. 59, 1888.

on *Ipomoea cairica*. Sakkare JT 505 (IMI 36305), 1948. Sooty mould on leaves, occasional in Equatoria.

*Meliola* sp.


on *Ricinus communis* (castor). Yambio JT 370 (IMI 39942), 1949. As sooty mould covering the leaf surfaces.

*Schiffnerula* spp.

on *Harrisonia abyssinica*. Yambio JT 1932 (IMI 51516), 1952.


on *Strychnos innocua*. Amadi–Rumbek road JT 479 (IMI 40123), 1949.


No doubt many species of *Meliola* and other sooty moulds are prevalent in the southern Sudan but have not yet been collected.

**DOTHIDEALES**


on *Citrus nobilis* (tangerine). Kodok JT (IMI 22973), 1947. As sooty mould covering the leaves and saprophytic on honeydew following heavy insect infestation. Pyenidia present.

*Capnodium* spp.

on *Citrus sinensis* (sweet orange). Yei District JT 1587 (IMI 48203), 1951. Sooty mould on leaves, associated with insect honeydew and probably not parasitic.

on *Dolichos lablab* (dolichos bean), *Gossypium* sp. (cotton) and *Vigna unguiculata* (cowpea). Sooty moulds on the leaves and stems of these crops were described by R. E. Massey in 1921 as associated with heavy insect infestation (aphis and whitefly) in the northern Sudan. He noted *Cladosporium fumago* Link as the *Cladosporium* stage of *Fumago vagans* Pers., itself a conidial form of *Capnodium*. *Alternaria* and *Macrosporium* were also present; it is likely that the references were to sooty moulds consisting largely of *Cladosporium* (including *C. herbarum*) and *Alternaria* (including
26 FUNGI AND PLANT DISEASES IN THE SUDAN

_A. tenuis_ and saprophytic on insect honeydew. For further discussion of sooty mould see under _Cladosporium._


_on _Olyra latifolia._ Yei District JT 1590 (IMI 48206), 1951. Sooty mould on leaves.

_ophiodyorhella_ sp.

_on _Dalbergia melanoxylon._ About 40 miles south of Roseires JT 1917 (IMI 51215), 1952. On leaf spots.


_on _Afzelia africana._ Yei JT 1430 (IMI 48765), 1951. Black leaf spot on seedlings, moderately severe.


_on _Andropogon gayanus_ var. _squamulatus._ Rumbek–Yirrol road JT 676 (IMI 45331), 1949.


_on _Cynodon dactylon_ (cynodon grass). Amadi JT 468 (IMI 39953), 1949; Bor JT 97 (IMI 32452), 1948; Bouga JT 1291 (1951); Juba JT 554 (IMI 34252), 1948; Sennar JT 1621 (1951), JT 1716 (IMI 50615), 1952; Shambe JT 689 (IMI 39966), 1949; Wad Medani ASB 529 (1939), ASB 572 (1944), JT 861 (IMI 44135), 1950, JT 1111 (1950); Yambio JT 546 (1948). Black leaf spot on _Cynodon_ is very common throughout the Sudan except perhaps in the extreme north and Red Sea coast.

_p. digitariae_ Syd. apud Doidge in _Bothalia,_ ii. 4, p. 220, 1924.

_on _Digitaria longiflora._ Yei JT 346 (IMI 45173), 1949.


_on _Panicum maximum_ (guinea grass). Iwatoka JT 1499 (IMI 48789), 1951; Kagelu JT 350 (IMI 44822), 1949, JT 1647 (1951); near Katire JT 1442 (IMI 48773), 1951; Yei–Maridi road JT 358 (IMI 40128), 1949. Black leaf spot occurs very commonly on _Panicum_ in Equatoria, and is often parasitized by _Cryptodidymosphaeria clandestina._


_on _Pennisetum purpureum._ Katire JT 1378 (IMI 48747), 1951.

_on _Pennisetum sp._ Katire JT 1420 (IMI 49906), 1951.


_on _Brachiaria brizantha._ Kagelu JT 1924 (IMI 51219), 1951. Black leaf spot.

**Phyllachora** spp.

on *Khaya grandifolia* (African mahogany). Katire JT 1358 (IMI 48167), 1951. There appears to be no previous record of *Phyllachora* on *Khaya*.

on *Pennisetum maximum* (Guinea grass). Sakkare JT 507 (IMI 36306), 1948.

on *Panicum* sp. Juba JT 562 (IMI 34264), 1948; Katire JT 1418 (IMI 48761), 1951; Terrakeka JT 330 (IMI 40129), 1949.


on *Setaria chevalieri*. Gilo JT 1399 (IMI 48753), 1951.

**Trabutia** sp.


**Microthyriales** (Hemisphaeriales)

**Asterina radio-fissilis** (Sacc.) Theiss. in *Ann. mycol., Berl.*, 10, p. 22, 1912.

on *Combretum* ?*gueinzii*. Kagelu JT 1273 (IMI 47268), 1951. On leaves.


on *Syzygium* sp. Kagelu JT 1652 (IMI 49967), 1951. On leaves; probably many other species of *Asterina* occur in the wetter parts of the Sudan.

**Asterina** sp.

on ?*Combretum* sp. About 20 miles south of Roseires JT 1817 (IMI 51161), 1952. On leaves (conidial).

**Clypeolum** sp.


**Hysterostomella elaeicola** Maubl. in *Bull. Soc. mycol. Fr.*, 23, p. 143, 1907.


on *Grewia flavescens*. About 40 miles south of Roseires JT 1818 (IMI 51162), 1952. On leaf spots.

**Sphaeriales**


from soil. Wad Medani ASB (1940).

**Cochliobolus heterostrophus** (Drechsl.) Drechsl. in *Phytopathology*, 24, p. 973, 1934. See Dickson, pp. 85-88; Sprague, p. 68. (Fig. 6.)
on *Oryza sativa* (rice). Yambio JT 440 (IMI 45186), 1949: causing leaf spotting *Helminthosporium* stage present.


on *Zea mays* (maize). Bunziga JT 1870 (IMI 51196), 1952, leaf spotting of young plants; Yambio ASH 645 (IMI 270), 1944, on glumes of male inflorescence causing 'mouldy tassels'. *Helminthosporium* stage in both cases.

The conidial stage of this fungus (described as *Helminthosporium maydis* Nis. & Miyake) occurs on various grain crops in the wetter parts of the Sudan and can occasionally be severe. Perithecia have not been found in the Sudan.

*Cryptodidymosphaeria clandestina* Syd. in *Ann. mycol., Berl.*, 37, p. 196, 1939.

on *Phyllachora* spp. Katre JT 1418 (IMI 48761), 1951 on *Panicum* sp.; Sakkare JT 507 (IMI 36306), 1948 on *Panicum maximum* (guinea grass); Terrakeka JT 340 (IMI 40129), 1949 on *Panicum* sp. A common parasite on *Phyllachora* spp. in the southern Sudan; the pycnidial stage is usually found.


on *Citrus nobilis* (tangerine). Tonj JT 712 (IMI 39977), 1949, in twig die-back. on *C. sinensis* (sweet orange). Tonj JT 709 (IMI 39995), in twig die-back.

In both cases associated with other fungi in die-back of twigs, possibly parasitic.

*Diatrypella* sp.


on *dead twigs*. Yambio JT 604 (IMI 36330 & 34273), 1948.

In both cases associated with other fungi and probably saprophytic.

*Didymosphaeria* sp.

on *Erythrina* sp. Katre JT 1357 (IMI 48742), 1951. Quite severe leaf spotting

*Eudarluca australis* Speg. in *Rev. Mus. La Plata*, 15, p. 22, 1908. (Fig. 7.) on *Angiopsora hansfordii* (on *Acalypha bipartita*), near Katre JT 1446 (1951) on *Phakopsora apoda* (on *Pennisetum* sp.), Meridi-Amadi road JT 463 (IMI 45189), 1949.

on *Puccinia ?aristidae* (on *Aristida stipoides*), Sungikai JT 971 (1950).

on *P. erythraeënsis* (on *Hyparrhenia* sp.), Katre JT 1410 (1951); near Katire JT 1447 (IMI 48778), 1951.

on *P. lateritia* (on *Spermacoce (Borreria) compacta*), Sungikai JT 973 (1950).
on *P. lippiiivora* (on *Lippia adoensis*), Yambio JT 389 (IMI 45177), 1949.
on *P. pennisi* (on *Beckeropsis? uniseta*), near Katire JT 1450 (1951); (on *Pennisetum typhoides*, bulrush millet), Sungikai JT 943 (IMI 44378), 1950.
on *P. purpurea* (on *Sorghum vulgare*, sorghum millet), Katire JT 1405 (IMI 48177), JT 1415 (IMI 48522), 1951; Loka West JT 1541 (1951).

on *P. a. romagnoliana* (on *Cyperus digitatus*), Katire JT 1377 (1951); (on *C. esculentus*), Bor JT 1312 (1951); (on *C. rotundus*, nut-grass), Kadugli JT 996 (1950), Malakal JT 1301, JT 1572 (1951).
on *P. sorghi* (on *Zea mays*, maize), Gumbiri JT 1486 (1951); Katire JT 1363 (IMI 48168), 1951.
on *P. tricholaenae* (on *Rhynchelytrum sp.*), Katire JT 1371 (1951).
on *Uredo cenchricola* (on *Cenchrus catharticus*), Sungikai JT 970 (1950).
on *Uromyces andropogonis-annulati* (on *Dicanthium annulatum*), Wad Medani JT 878 (IMI 45205), 1950.
on *U. appendiculatus* (on *Phaseolus vulgaris*, haricot bean), Gumbiri JT 1476 (1951); Iwatoka JT 1513 (1951); Yambio ASB 636 (1944).
on *U. leptodermus* (on *Brachiaria lata*), Kadugli JT 985 (1950); (on *Urochloa panicoides*), JT 1909 (1952).
on unidentified rusts (on *Panicum maximum*, guinea grass), Iwatoka JT 1499 (IMI 48789), JT 1516 (1951); (on *Phyllanthus floribundus*), Kagelu JT 1234 (IMI 47266), 1951. This fungus is frequently found parasitizing rust uredosori and, less often, teleutosori in the wetter areas of the Sudan and occasionally as far north as the Gezira. The conidial stage (*Darluca filum*) is usually present but perithecia (*Eudarluca australis*) have been observed in the Sudan. Elsewhere attempts to utilize this hyperparasite for rust control have been made but have not been reported as successful.

**Eutypella citricola** Speg. in *An. Mus. nac. B. Aires*, 6, p. 245, no. 526, 1899.

on *Aleurites montana* (tung). Kagelu JT 1525 (IMI 48799), 1951. On leaf spots, possibly secondary.
on *Brassica oleracea var. gemmifera* (Brussels sprouts). Kadugli JT 924 (IMI 44366), 1950. On leaves, probably secondary.

on *Bridelia ferruginea var. orientalis*. Kagelu JT 1258 (IMI 47288), 1951. On leaves.

on *Carica papaya* (papaw). Kadugli JT 35 (IMI 21366), 1947; Yambio JT 931 (IMI 51124), 1949. On leaf petioles, said also to be associated with fruit rotting.


on *C. sinensis* (sweet orange). Sennar JT 1065 (IMI 46840), 1951. On dying-back twigs. The conidial *Colletotrichum* stage (probably *C. gloeosporioides*, q.v.) is found on citrus in the Sudan.

on *Mangifera indica* (mango). Yambio–Meridi road JT 447 (IMI 45187), 1949. On leaf spots (anthracnose) as conidial *Gloeosporium* stage, presumably *G. mangiferae*.

*Glomerella cingulata* occurs commonly on a variety of hosts and substrates in the wetter parts of the Sudan, having been found as far north as Wad Medani. In some cases it appears to be largely saprophytic, in others, e.g. leaf anthracnose and citrus wither-tip, it is parasitic. Only conidia (*Colletotrichum* or *Gloeosporium*) have been observed in the Sudan.

**G. gossypii** (Southw.) Edgerton in *Mycologia*, 1, p. 119, 1909. See under *Colletotrichum gossypii*, reported to be the conidial stage of *G. gossypii*.


on *Alternanthera nodiflora*. Adok JT 328 (IMI 40126), 1949. Causing leaf spotting, conidial stage.

**Hypoxylon haematostroma** Mont. in *R. de la Sagra, Fl. Cuba*, 1, p. 211, 1853.

on dead wood. Yambio JT 623 (IMI 34238), 1948.

**Hypoxylon** spp.


on dead wood. Disa Forest JT 1866 (IMI 51193), 1952; Yambio JT (1948), JT 612 (IMI 34237), 1948, JT 624 (IMI 34247), 1948; Yei JT 739 (IMI 45203), 1949.

*Hypoxylon* spp. occur commonly on dead wood in the wetter parts of the Sudan.

**Leptosphaeria** sp.


on *Fragaria* sp. (strawberry). Iwatoka JT 1514 (IMI 49193), 1951, causing severe leaf spotting; strawberries are rarely cultivated in the Sudan. Only conidia (== *Bamularia tulasnei* Sacc.) were present.

**Mycosphaerella** spp.


on *Cissus* sp. Kagelu JT 1233 (IMI 47265), 1951. On leaf spots.


on *Lycopepericon esculentum* (tomato). Wad Medani JT 1253 (IMI 47284), 1951. Leaf spotting.

on *Pachira* sp. (pachira nut). Kagelu JT 1522 (IMI 48532), 1951. Leaf spotting.

*Mycosphaerella* spp., usually associated with leaf spotting, are not uncommon in the southern Sudan.


on *Gossypium hirsutum* (American cotton). Yambio JT 1936 (IMI 51519), 1952, as orange saprophytic growth on wet cotton locks. Conidia only present.


on *Oryza sativa* (rice). Malakal JT 1568 (IMI 48197), 1951; Yambio ASB 641 (1944). Brown leaf spot, probably widespread on rice in the southern Sudan; only the conidial stage (*Helminthosporium oryzae*) has been collected in the Sudan. (Fig. 8.)


on *Citrus limonia* (lemon). Kagelu JT 1653 (IMI 49968), 1951, on dead branches.

on *Citrus* spp. Kagelu JT 87 (IMI 21387), 1947. Reported to occur on grapefruit (*C. grandis*), sweet and Navel orange (*C. sinensis*). On living branches, presumably parasitic.


on *Acalypha* sp. (cultivated shrub). Yei JT 737 (IMI 45200), 1949, on living branches.
P. citricola Penzig in Fung. agrum., No. 22, p. 25, 1882.

Pleospora spp.
   on Citrus aurantiifolia (lime). Barakat, ASB (1940), as saprophytic on dead branches.
   on C. grandis (grapefruit). Kadugli JT 1028 (IMI 44878, discarded), 1950; with other fungi on leaf spots.
   on Ipomoea sp. (cultivated). Wad Medani JT 1209 (IMI 47248, discarded), on leaf spots with other fungi.

Pseudoplea trifolii (Rostr.) Petrak in Ann. mycol., 19, p. 29, 1921. See Dickson, p. 319; Sampson & Western, p. 52. (Fig. 9.)

Rosellinia sublimbata (Dur. & Mont.) Pass, apud Thuem. in Contrib. ad Floram lusitanicum, 1878–81, No. 294, 1879.
   on dead grass stalks. Yambio JT 605 (IMI 34245), 1948.

Valsaria gemmata (Berk. & Rav.) Ell. & Ev. in N. Amer. Pyren., p. 562, 1892.

Xylaria sp.
   on Poinciana regia (flamboyante tree). Wad Medani ASB (1944), growing on trunk canker with Fomes sp.

Hypocreales

Claviceps sp. Conidia of Sphaecia sp., often imperfect forms of Claviceps, have been collected once on grain of Brachiaria sp. (see under Cerebella andropogonis) in Upper Nile Province. No perithecia or true ergots were found but it is possible that such occur in the wetter colder areas of the Sudan.

Gibberella fujikuroi (Saw.) Wollenw. in Z. Parasitenk., 3, p. 514, 1931.
   on Gossypium barbadense (Egyptian cotton). Tokar, R. E. M. (1936) as isolated from roots of wilting plants; Wad Medani R. E. M. (1933) from cotton rootlet.
   on Pennisetum typhoides (bulrush millet). Isolated from diseased heads (1937). No further details are available.
on *Vicia faba* (broad bean). The dominant isolate obtained from roots of wilting plants (F. W. A. & T. W. C., 1937) in Northern Province.

*Megalonectria pseudotrichia* (Schw.) Speg.—see *Thyronectria pseudotrichia*.

*Nectria* spp.

on *Azadirachta indica* (neem). Omdurman JT 47 (1947), on dying branches with other fungi.

on dead twigs of ?*Acacia* sp. Yambio JT 630 (IMI 36343), 1948.

*Thyronectria pseudotrichia* (Schw.). Seeler in *J. Arnold Arbor.*, 21, p. 438, 1940.

on *Aleurites montana* (tung). Kagelu JT (IMI 16234), 1947. On branch cankers, possibly a wound parasite.


on *Ficus platyphylla* (cloth bark tree). Yambio JT 622 (IMI 34244), 1948. On living tree which had been cut back.

on dead wood. Yei JT 723 (IMI 51123), 1949.

*T. pseudotrichia* is frequently found in the southern Sudan on a variety of hosts. In many cases it appears to be a wound parasite and associated with branch cankers; only the conidial stage described by Seeler as *Stilbella cinabarina* (Mont.) Wollenw. has been collected in the Sudan.

**HYSTSTIALES**

*Hysterium* sp. aff. *pulicare* Fr. in *Syst. Mycol.*, 2, 2, p. 579, 1823.

on dead wood. Yambio JT 594 (IMI 34243), 1948.

**HELOTIALES**


on *Acalypha* sp. (cultivated shrub). Yei JT 737 (IMI 45200), 1949, on living branches and presumably parasitic.

on dead twigs. Yambio JT 620 (IMI 34233), 1948.

*T. rufula* (Spreng.) Sacc. var. *microspora* Ell. & Ev. in *N. Amer. Pyren.*, p. 690, 1892.


on dead twigs. Yambio JT 604 (IMI 34273), 1948.

*T. rufula* is commonly found in the wetter areas of the Sudan on dead twigs and probably as a parasite on branches of various trees including *Citrus* spp. It may be responsible for extensive dying back of twigs and is often found with various other fungi (probably mostly saprophytes).
FUNGI AND PLANT DISEASES IN THE SUDAN

BASIDIOMYCETES

USTILAGINALES

Early Sudan specimens were identified as C. peribebuyensis Speg. For synonymy see Lee Ling, Mycologia, 42, p. 649, 1950. (Fig. 10.)
on Cyperus rotundus (nut-grass). Degein ASB 571 (1944); Dilling ASB 559 (1942), ASB (1943); El Obeid ASB (1943); Kadugli JT 45 (IMI 21371), 1947, JT 996 (1950); near Kassala JT 1942 (IMI 51522), 1952; Malakal JT 1301 (1951); locality not given ASB (IMI 31753), 1939. This smut produces greyish sori (which later break open to form a black spore mass) in the axils of the bracts at the base of the inflorescence (umbel). Widespread in central Sudan, not collected in the extreme south.

on Phoenix dactylifera (date palm). Barakat JT 1078 (1951); Berber R. E. M. (1923); Danaglia JT 1666 (1951); Dilling ASB (1943); Hawata ASB (1943); Khartoum R. E. M. (1923); Kosti ASB 601 (1944); Port Sudan ASB (1940); JT 1154 (1951); Sennar ASB (1939), JT 1619 (IMI 48829), 1951; Shambat ASB (1939); Um Ruaba ASB (1943); Um Sunnut JT 1669 (1951); Wad Medani ASB (1938, 1939), JT 1073 (1951). A common leaf parasite in most places where dates are grown in the Sudan; can occasionally be severe in areas of heavy rainfall. Causing ‘false smut’.

on Panicum repens. Adok JT 325 (IMI 40108), 1949. Head smut; completely destroying the inflorescence.

on unidentified grass (± Ischaemum sp.). Kagelu JT 1231 (IMI 48163), 1951. Grain smut.


S. ischaemoides (P. Henn.) Zundel in Mycologia, 29, p. 587, 1937.
on Hyparrhenia confinis. About 20 miles south of Roseires JT 1813 (IMI 51157), 1952. (Fig. 11.)
on Hyparrhenia sp. or spp. Juba–Torit road JT 1605 (IMI 48819), 1951;
Kadugli JT 984 (IMI 44866), 1950; Yousif Natscha JT 1607 (IMI 48821), 1951. Long spore sac replacing the grain.

**S. reilianum** (Kühn) McAlp., see *Sphacelotheca reiliana*.

**Sorosporium** spp.
- on *Aristida adscensionis*. Abdel Khallag JT 1804 (IMI 51150), 1952.
- on *Echinochloa pyramidalis*. Nuba Mountains ASB (1940); I did not find this specimen in Herb. I.M.I. or in the Sudan Mycological Herbarium.
- on *Panicum pyramideale*. R. E. M. (IMI 42343), 1921. Locality not given and the identity of the host is uncertain.

**Sphacelotheca cruenta** (Kühn) Potter in *Phytopathology*, 2, p. 98, 1912. See Butler, p. 212; Dickson, p. 175; Mundkur & Thirumalachar, p. 13; Roger, p. 768; Viennot-Bourgin, p. 771. (Fig. 12.)
- on *Sorghum vulgare* (sorghum millet). Numerous collections from the Gezira, e.g., JT 850 & JT 890 (1950); Fasher ASB 610 (1944); Gash Delta ASB (1942); Ghadambaliya JT 891 (1950); Luluba Hills ASB (1943); Malakal JT 1664 (1951); Nuba Mountains T. W. C. (1939); Roseires JT 1860 (1952); Tonj ASB (1943); Tozi JT 1859 (1952); Zalin-gei ASB (1943). Loose smut, completely destroying the grain. Widespread, especially in central Sudan, but rarely causes serious crop losses.
- on *Sorghum* sp. (wild). Gash Delta JT 893 (1950), occasional.

**S. ischaemicola** Ling in *Sydowia*, 3, p. 126, 1949.
- on *Andropogon gayanus*. Um Sugura JT 1262 (IMI 48166), 1951. Grain smut.
**S. monilifera** (Ell. & Ev.) Clint. in *J. Mycol.*, 8, p. 141, 1902. See Mundkur & Thirumalachar, p. 17; Zundel, p. 300. (Fig. 13.)

on *Heteropogon melanocarpus*. About 20 miles south of Roseires JT 1815 (IMI 51159), 1952; 40 miles south of Roseires JT 1816 (IMI 51160), 1952.

**S. reiliana** (Kühn) Clint. in *J. Mycol.*, 8, p. 141, 1902. See Butler, p. 214; Dickson, pp. 91, 178; Mundkur & Thirumalachar, p. 18; Roger, p. 772; Viennot-Bourgin, p. 773. (Fig. 14.)

on *Sorghum halepense* (Johnson grass). Berber R. E. M. (1923); Gezira ASB (1941); Tokar R. E. M. (1923).

Head smut, occasional.

on *S. vulgare* (sorghum millet). Dinder ASB (1943); Gedaref ASB (1943); Jebel Sagidi ASB (1939); Kongor JT 1914 (1952); Malakal JT 1665 (1951); Nuba Mountains T. W. C. (1939); near Rahad Bridge JT 1768 (1952); Sennar ASB (1943); Wad Medani ASB (1940), JT 848 (1950), JT 1675 (1952). Head smut, widespread in the central Sudan but not observed north of the Gezira, in Equatoria or on maize in the Sudan. Occasionally causes heavy local crop losses but usually not severe.

on *Sorhghum* sp. (wild). Gash Delta JT 312 (1948).

Head smut, occasional.

**S. sorghi** (Link) Clint. in *J. Mycol.*, 8, p. 140, 1902. See Butler, p. 208; Dickson, p. 177; Mundkur & Thirumalachar, p. 21; Roger, p. 765; Viennot-Bourgin, p. 769. (Fig. 15.)


on *S. sudanense* (Sudan grass). Wad Medani ASB (1943), JT 156 (1948). Covered smut, occasional.

on *S. vulgare* (sorghum millet). Numerous collections of covered smut of sorghum have been made and the disease occurs in all parts of the country. It can cause considerable crop losses and local sorghums vary greatly in susceptibility, some being very susceptible. Dwarf White Milo is reported to be resistant and effective control of covered smut can be obtained by seed treatment, copper carbonate powder being the standard method in the Sudan. Little is known regarding the strains of *S. sorghi* present in the Sudan.

**S. vanderysti** (P. Henn.) Ling in *Lloydia*, 14, p. 104, 1951.

on *Hyparrhenia* sp. Um Bileil JT 1263 (IMI 48165), 1951. Grain smut.

on *Heteropogon contortus*. Wisko JT 1931 (IMI 51515), 1952, covered smut.

**Sphacelotheca** sp.

on *Andropogon* sp. Jebel Fau JT 1929 (IMI 51513), 1952, covered smut of grain.


on *Panicum maximum* (guinea grass). Iwatoka JT 1516 (IMI 48795), 1951; Kagelu JT 100 (IMI 36477), 1948, JT 350 (IMI 44822), 1949, JT 1256 (1951); near Katire JT 1442 (IMI 48773), 1951; Torit–Katire road JT 1440 (IMI 48772), 1951; Yambio JT 523 (IMI 34271), 1948; Yei JT 1431 (IMI 48766), 1951. Grain smut.

on *Panicum* sp. Kagelu JT 1531 (IMI 48802), 1951. Grain smut caused by *T. ayresii* is very common on *Panicum* spp. in Equatoria Province. (Fig. 16.)


on *Setaria ? glauca*. Near Malakal JT 1567 (IMI 48811), 1951.

on *Setaria* sp. Yei JT 1433 (IMI 48767), 1951. Covered smut of grains. (Fig. 17.)

**Tolyposporium ehrenbergii** (Kühn) Pat. in *Bull. Soc. mycol. Fr.*, 19, p. 254, 1903. See Butler, p. 215 (as *T. filiferum*); Dickson, p. 178; Mundkur & Thirumalachar, p. 56; Roger, p. 776; Viennot-Bourgin, p. 837. (Fig. 18.)

on *Pennisetum typhoides* (bulrush millet). El Obeid JT 155 (1947); long smut of grain, rare on this host in the Sudan.

on *Sorghum lanceolatum*. Khor el Atshan ASB (1942); Nuba Mountains ASB (1939).

on *S. purpureo-sericeum*. Ghadambaliya JT 93 (IMI 22975), 1948, JT 1104 (1950); Jebel Moya JT 309 (IMI 32456), 1948; near Kodok JT 1563 (1951); Tozi JT 1849 (1952); Um Bileil JT 1648 (1951); Um Sugura JT 882 (1950).
Long smut is very common on this host in the 'central rainlands' area of the Sudan.

on *S. vulgare* (sorghum millet). Darwish JT 888 (1950); Fasher ASB 609 (1944); Ghaba ASB (1939); Mekali ASB (1943); Nuba Mountains T. W. C. (1939); Sennar JT 827 (1950). Long smut occurs occasionally on sorghum in the northern and central Sudan but causes only slight damage.

on *Sorghum* sp. Collected by R. E. M. (IMI 47554), 1930; no further details available.

![Fig. 18](image1.png)

![Fig. 19](image2.png)


**T. penicillariae** Bref. in *Unters. Gesammt. Mykol.*, 12, p. 154, 1895. See Butler, p. 224; Mundkur & Thirumalachar, p. 57; Roger, p. 775. (Fig. 19.)

on *Pennisetum typhoides* (bulrush millet). Alyman JT 1862 (1952); Dam Gamid ASB (1944); Dueim JT 24 (IMI 17834), 1946; El Obeid JT 155 (1947); El Obeid–Barra road JT 36 (1947); Fung ASB (1940); Kadugli ASB (1942); Kordofan R. E. M. (1924); Nahud ASB (1943); Nyala ASB (1943); Roseires JT 1861 (1952); Rumbek JT 704 (IMI 40014), 1949, JT 705 (IMI 40015), 1949; Sungikai JT 947 (1950); Tokar ASB (1942); Torit JT 702 (IMI 40016), 1949; Um Ruaba ASB (1943); Wasaa ASB (1944); Zalingei ASB (1943); locality not given R. E. M. (IMI 25217) 1922. Grain smut, widespread on bulrush millet in the central and southern Sudan and Red Sea coast. Since only isolated grains in the head are attacked the resulting loss of crop is usually negligible.

**Ustilago cynodontis** P. Henn. in Just’s Jber., 14, p. 369, 1891. See McAlpine (1910), p. 155; Mundkur & Thirumalachar, p. 28; Zundel, p. 289.

on *Cynodon dactylon* (cynodon grass). Juba JT 554 (IMI 34252), 1948, JT 1348 (1951); Renk JT 1305 (1951); Rumbek JT 489 (IMI 40107), 1949; Shambe JT 682 (IMI 39964), 1949. Head smut, common in the southern Sudan.
U. maydis (DC.) Corda in Icones Fungorum, 5, p. 3, 1842. See Butler, p. 194 (as U. zeae); Dickson, p. 89; Mundkur & Thirumalachar, p. 31; Roger, p. 746; Viennot-Bourgin, p. 813.

on Zea mays (maize). Berber R. E. M. (1924); Shendi ASB (1938). Common smut of maize is rarely found in the Sudan.

U. neglecta Niessl. in Rabenh., Fungi Europ., No. 1200, 1866. See Dickson p. 103; Mundkur & Thirumalachar, p. 32.


U. nuda (Jens.) Rostr. in Tidsskr. Landokon., 8, p. 745, 1889. See Butler, p. 185; Dickson, p. 45; McAlpine (1910), p. 148; Mundkur & Thirumalachar, p. 33; Roger, p. 759; Viennot-Bourgin, p. 776. (Fig. 20.)

on Hordeum vulgare (barley). Abidiya JT 1756 (1952); Berber R. E. M. (1924); Bouga JT 1760 (1952); Debeira ASB (1941); Gurier JT 1642 (1952); Khartoum R. E. M. (1924); Shambat ASB (1941); Shendi ASB (1940); Wad Medani ASB (1939); Wadi Halfa ASB (1939). Loose smut, common and occasionally severe on barley in the northern Sudan.


on Brachiaria obtusifolia. Yousif Natscha JT 1611 (IMI 48826), 1951. Grain smut.

U. trichophora (Link) Kunze in Flora, 12, p. 369, 1830. See Mundkur & Thirumalachar, p. 38; Zundel, p. 291. (Fig. 21.)

on Echinocloa colona. Wad Medani JT 86 (IMI 21386), 1947; near Yaraddi JT 1831 (IMI 51163), 1952.


U. tritici (Pers.) Rostr. in Overs. danske. Vidensk. Selsk. Forh., p. 15, 1890. See Butler, p. 163; Dickson, p. 222; McAlpine (1910), p. 149; Mundkur & Thirumalachar, p. 39; Roger, p. 757; Viennot-Bourgin, p. 782.

on Triticum vulgare (wheat). Berber R. E. M. (1924); Khartoum R. E. M. (probably IMI 39401), 1924. Loose smut, found on wheat in the northern Sudan in 1924 but not since observed; possibly the disease no longer occurs in the Sudan.

Ustilago sp.

UREDINALES


on *Crassocephalum (Gynura)* sp. Loka West JT 1548 (IMI 48806), 1951. Causing severe damage to stems and leaves.


**A. kaernbachii** P. Henn. in Engler, *Bot. Jb.*, 15, p. 5, 1892. [See also under *Uromyces ipomoeae*.]

on *Ipomoea* sp. Dinder ASB (1942).

**A. mitracarpi** Syd. in *Ann. mycol., Berl.*, 10, p. 79, 1912.

on *Mitracarpum scabrum*. Rumbek JT 486 (IMI 40104), 1949.


on *Acalypha bipartita*. Near Katire JT 1446 (IMI 48777), 1951.

**Hemileia vastatrix** Berk. & Br. in *Gdner's Chron.*, p. 1157, 1869. See Bouriquet, p. 137; Butler, p. 468; Doidge (1927), p. 140; Roger, p. 838; Viennot-Bourgin, p. 990. (Fig. 22.)

on *Coffea arabica* (coffee). Kagelu ASB 337 (1943), ASB 487 (1942), ASB 657 (1944); Meridi ASB (IMI 296), 1941.

on *C. robusta* (coffee). Iwatoka JT 1503 (1951); Kagelu ASB 653 (1944), JT 351 (IMI 45174), 1949, JT 1526 (1951); Yambio ASB 741 (1944), JT 517 (1948). Coffee leaf rust ("leaf disease") occurs commonly in the few places in Equatoria where coffee is grown. It can be severe, particularly on *C. arabica*, and might well cause heavy crop losses if coffee cultivation were extended and intensified. It is a serious disease of coffee in many tropical and sub-tropical countries.

**Melampsora helioscopiae** Wint. in Pilze Deutschl., p. 240, 1881. See Doidge (1927), p. 157. (Fig. 23.)

on *Euphorbia geniculata*. Yambio JT 511 (IMI 34265), 1948.


on *Ricinus communis* (castor). Iwatoka JT 1502 (IMI 48791), 1951. Leaf rust.

on *Pennisetum pedicellatum*. Alyman JT 1795 (IMI 51142), 1952; Dilling JT 966 (IMI 44850), 1950; Kadugli JT 1021 (IMI 45224), 1950; Wad el Mahi JT 1807 (IMI 51152), JT 1811 (IMI 51155), 1952.

on *P. polystachyum*. Wad el Mahi JT 1809 (IMI 51154), 1952.

on *Pennisetum* sp. Kadugli JT 1023 (IMI 45225), 1950; Meridi-Amadi road JT 463 (IMI 45189), 1949. Sub-epidermal leaf rust, common on *Pennisetum* spp. in the southern and central Sudan.


on *Wissadula rostrata*. Boing JT 1609 (IMI 48824), 1951.

P. andropogonicola Har. & Pat. in *Bull. Mus. Hist. nat., Paris*, 1909, p. 198, 1909. (Fig. 24.)

on *Andropogon* sp. Nyertiti JT 1947 (IMI 51526), 1953.


on *Hyparrhenia pseudocymbaria*. Dilling-Kadugli road JT 993 (IMI 45216), 1950. This rust is widespread in the central Sudan.

P. aristidae Tracy (probably) in *J. Mycol.*, 7, p. 281, 1893. See Arthur, p. 158.

on *Aristida stipoides*. Sungikai JT 971 (IMI 44854), 1950.

P. carthami Corda in *Icones Fungorum*, 4, p. 15, 1840. See Arthur, p. 349.

on *Cardhamus tinctorius* (safflower). Debeira ASB 389 (1944), ASB (IMI 315), 1944; Wadi Halfa ASB 58 (1941). Leaf rust, common in the extreme north but not found elsewhere in the Sudan.


on *Coreopsis* sp. Katire JT 1459 (IMI 48782), 1951.


on *Ctenolepis cerasiformis*. Wad el Mahi JT 1824 (IMI 51167), 1952, aecidia.


on *Cynodon dactylon* (cynodon grass). Abidiya JT 1755 (1952); Bouga ASB 381 (1944), JT 1291 (1951); Fugna ASB (1940); Gandettu ASB (1939); Gezira el Fil ASB 131 (1939); Nuri ASB (1939); Semnar JT 1716 (IMI 50615), 1952; Shambat ASB 596 (1944); Wad Medani ASB (IMI 293), 1939, ASB (1941, 1942, 1943), JT 857 (IMI 44133), JT 861 (IMI 44135), JT 1111 (1950), JT 1622 (1951); Zeidab ASB (1939). Widespread on *Cynodon* in the northern Sudan but not found south of the Gezira.


on Hyparrhenia sp. Katire JT 1410 (IMI 48757), JT 1416 (IMI 48760), 1951; near Katire JT 1447 (IMI 48778), 1951. Common in eastern Equatoria.


on Imperata cylindrica (spear grass). Gumbiri JT 1477 (IMI 48525), 1951.


on Euphorbia sp. Ghadambaliya JT 1101 (IMI 45239), 1950.

P. graminis Pers. in Syn. meth. Fung., p. 228, 1801. See Arthur, p. 173; Butler, p. 151; Butler & Jones, p. 343; Dickson, p. 231; Doidge (1927), p. 134; McAlpine (1906), p. 120; Roger, p. 884; Viennot-Bourgin, p. 1000.

on Hordeum vulgare (barley). Berber R. E. M. (1924); Khartoum R. E. M. (1924); Shendi ASB (IMI 294), 1944. Black (stem) rust occurs occasionally on barley in the northern Sudan but is of no economic importance on this host.

on Triticum vulgare (wheat). Abdel Magid ASB (1944); Berber R. E. M. (1924); Debeira ASB 505 & ASB 513 (1944), JT 1149 (IMI 46851), 1951; Dongola R. E. M. (1924); Gandettu ASB 167 & ASB 552 (IMI 316), 1943; Gurier ASB (1943); Hag Abdullah ASB (1943); Kab el Gidad ASB (1943); Nuri ASB 551 (1943); Shendi ASB (1941). Black stem rust is widespread on wheat in the northern Sudan and causes considerable crop losses in some years.


on Helianthus annuus (sunflower). Near Kodok JT 1561 (1951); Malakal JT 1579 (IMI 48200), 1951; Yambio JT 375 (IMI 39944), 1949. Leaf rust; probably widespread in the southern Sudan, sometimes severe.


on Mariscus sieberianus. Yambio JT 574 (IMI 34263), 1948.

P. heterospora Berk. & Curt. in J. linn. Soc. (Bot.), 10, p. 356, 1869. See Arthur, p. 144; Doidge (1927), p. 91; McAlpine (1906), p. 177. (Fig. 25.)

on Abutilon spp. Abu Hagar JT 1790 (IMI 51140), 1952; Sennar JT 1692 (IMI 50598), 1952; Wad Medani JT 1748 (1952).

on Sida alba (= S. spinosa). Abu Hagar JT 1789 (1952); Gandettu ASB (1939); Gezira el Fil ASB 115 (1939); Kadugli ASB 256 (1939); Sennar JT 1697 (1952); Shendi ASB (IMI 291), 1939; Wad Medani ASB (1939), JT 1070 (IMI 46841), 1951, JT 1107 & JT 1109 (1950), JT 1668 (1951); Yei–Meridi road JT 357 (IMI 40102), 1949.

on *S. rhombifolia*. Amadi JT 469 (IMI 40101), 1949.

on *Sida* spp. Kadugli JT 944 (IMI 44379), 1950; Khor Nabbak JT 942 (IMI 44377), 1950; Malakal JT 1346 (1951); Sennar JT 1239 (IMI 47270), 1951; Wad Medani JT 1920 (1952); Yei JT 341 (1949). This rust is very common throughout the Sudan except perhaps in the extreme north and Red Sea coast; the sori consist mostly of one-celled mesospores with only occasional two-celled teleutospores. Various saprophytic moulds (*Alternaria*, &c.) are often present in the sori.


on *Ipomoea* sp. Yambio JT 392 (IMI 40106), 1949.


on *Borreria (Spermacoce) compacta*. Sungikai JT 973 (IMI 44857), 1950.

on *Borreria (Spermacoce)* sp. Abdel Khallag JT 1802 (IMI 51148), 1952; Yousif Natscha JT 1610 (IMI 48825), 1951. This rust is probably widespread on *Borreria* in the central Sudan.


**P. leucadis** Syd. in *Monogr. Ured.*, 1, p. 281, 1904. See Doidge (1927), p. 76.


**P. lippiivora** Syd. in *De Wildeman, Flore du Bas-et Moyen-Congo*, 3, 1, p. 11, 1909. (=*P. lippicola* Pat. & Har.). See Doidge (1927), p. 83.

on *Lippia adoensis*. Yambio JT 389 (IMI 45177), 1949, JT 515 (IMI 34269), 1948.


**P. natalensis** Diet. & Syd. (near) in *Hedwigia*, 38, p. 130, 1899. See Doidge (1927), p. 82.

on *Lantana* sp. (cultivated). Katire JT 1366 (IMI 48169), 1951.

**P. penniseti** Zimm. in *Ber. Land.-u. Forstw. D.-Ostafr.*, 2, p. 16, 1904. See Butler, p. 223; Roger, p. 883. (Fig. 26.)

on *Beckeropsis uniseta* (probably). Near Katire JT 1450 (IMI 48781), 1951.

on *Pennisetum typhoides* (bulrush millet). Kagelu ASB 333 (1943); near Kodok JT 1555 (IMI 48538), 1951; Kordofan R. E. M. (1924), JT (1947); Malakal JT 1574 (1951); Port Sudan–Tokar road JT 1157 (IMI 45252), 1951;
P. polysora Underw. in Bull. Torrey bot. Cl., 24, p. 86, 1897. See Arthur, p. 117; Roger, p. 883. (Fig. 27.)

on Zea mays (maize). Roseires JT 1879 (IMI 51198), 1952. This destructive disease has been reported in various African countries only during recent years. P. sorghi also occurs on maize in the Sudan.

P. purpurea Cooke in Grevillea, 5, No. 33, p. 15, 1876. See Arthur, p. 124; Bouriquet, p. 384; Butler, p. 206; Doidge (1927), p. 131; McAlpine (1906), p. 129; Roger, p. 882; Viennot-Bourgin, p. 1076. (Fig. 28.)

on Sorghum halepense. R. E. Massey (Sudan Notes & Records, 4, pp. 219–20, 1921) has reported P. purpurea on wild ‘addar’ Andropogon halepensis Brot.

on S. vulgare (sorghum millet). Alyman JT 1891 (IMI 51203), 1952; Gumbiri JT 1496 (1951); Juba JT (1944); Juba–Torit road JT 1599 (IMI 48545), 1951; Kagelu ASB 340 (1943); Katire JT 1376, JT 1405 (IMI 48177), JT 1415 (48522), 1951; Loka West JT 1541 (1951); Roseires JT 1881 (IMI 51200), 1952; Sungikai JT 941 (IMI 44380), 1950; Tokar ASB (1941), JT 1166 (IMI 45257), 1951; Tozi JT 1850 (IMI 51186), 1952; Wad Medani ASB 614 (1944), JT 1927 (1952); Yambio JT 536 (1948); Yei ASB 732 (1944). Widespread on the Red Sea coast and in the southern and central Sudan as far north as the Gezira; not usually serious but occasionally severe locally. This rust appears to be confined largely to Sorghum vulgare in the Sudan and has been collected only once on wild Sorghum spp. (see above); specimen IMI 43591 is of P. purpurea on Sorghum sp. from the Sudan.

P. romagnoliana Maire & Sacc. in Ann. mycol., Berl., 1, p. 220, 1903. (Fig. 29.)

on Cyperus difformis. Yambio JT 549 (IMI 34257), 1948.

on C. digitatus. Katire JT 1377 (IMI 48746), 1951; Yambio JT 550 (IMI 34255), 1948.
on *C. esculentus* (probably). Bor JT 1312 (IMI 48734), 1951.

on *C. rotundus* (nut-grass). Degein ASB 571 (1944); Dilling ASB 559 (1942); Gezira el Fil ASB (1939); Kadugli ASB (1942), JT 996 (1950); Malakal JT 322 (IMI 40105), 1949, JT 1301 & JT 1572 (1951); Roseires JT 1884 (1952); Rumbek JT 494 (1949); Sennar JT 1717 (IMI 50616), 1952; Tokar ASB (IMI 301), 1942, JT 1162 (1951); Um Berembeita JT 904 (IMI 44356), 1950; Wad Medani ASB (1939), JT 306 (IMI 32445); 1948; Wau JT 671 (IMI 39945), 1949. This rust is extremely common and often severe on *Cyperus* spp. on the Red Sea coast and in the southern and central Sudan as far north as the Gezira.

**P. rottboelliae** Syd. in Monogr. Ured., 1, p. 800, 1904.  
See Doidge (1927), p. 125; McAlpine (1906), p. 117 (under *P. cacao*). (Fig. 30.)


on *Rottboellia* sp. Loka West JT 1536 (1951). Widespread on *Rottboellia* in the central and southern Sudan south of the Gezira.

**P. sorghi** Schw. in Trans. Amer. phil. Soc., Ser. 2, 4, p. 295, 1832. See Arthur, p. 116; Cunningham, p. 137; Doidge (1927), p. 136 (as *P. maydis*); Roger, p. 880; Viennot-Bourgin, p. 1074. (Fig. 31.)

on *Zea mays* (maize). Gumbiri JT 1486 (IMI 48529), 1951; Katire JT 1363 (IMI 48168), JT 1370 (IMI 48171), 1952. Probably widespread in the central and southern Sudan although only recently found, not usually severe.


on *Rhynchelytrum* sp. Katire JT 1371 (IMI 48745), 1951.

**P. triticina** Erikss. in Ann. Sci. nat., Ser. 8, 9, p. 270, 1899. See Butler, p. 156; Butler & Jones, p. 358; Eriksson, p. 160; McAlpine (1906), p. 132; Roger, p. 888; Viennot-Bourgin, p. 1042.

on *Triticum vulgare* (wheat). Debeira ASB 505 (IMI 314), ASB 513 (1944); Gandettu ASB 167 (1943); Hag Abdullah ASB (1943). Brown leaf rust; occasionally found in the northern Sudan but not serious.

**P. versicolor** Diet. & Holw. (probably) in Bot. Gaz., 24, p. 28, 1897. See Doidge (1927), p. 126. (Fig. 32.)
on *Heteropogon melanocarpus*. About 20 miles south of Roseires JT 1814 (IMI 51158), JT 1815 (IMI 51159), 1952.

on *Imperata cylindrica* (spear grass). Gumbiri JT 1477 (IMI 48525), 1951.

**Puccinia** sp.

on *Abutilon glaucum*. Sennar ASB (1942). Reported as teleutosori on the stems, causing small witches-brooms; very few sori on the leaves.


on *Acacia arabica*. Wad Medani ASB (1939), ASB (1941), as causing small swellings on various parts of the shoots; no specimens are available.


on *Cenchrus cathanicus*. Sungikai JT 970 (IMI 44853), 1950.

**Uromyces andropogonis-annulati** Syd. & Butler in *Ann. mycol., Berl.*, 5, p. 492, 1907.

on *Dicanthium annulatum*. Bouga JT 1290 (1951); Port Sudan JT 1156 (IMI 45251), 1951; Wad Medani JT 856 (IMI 44132), JT 878 (IMI 45205), JT 1112 (IMI 44879), 1950. Widespread in the Gezira and Red Sea coast.

**U. appendiculatus** (Pers.) Unger, *Exantheme der Pflanzen*, p. 279, 1833. See Arthur, p. 296 (as *U. phaseoli typica*); Bouriquet, p. 462; Butler, p. 260; Doidge (1927), p. 25; Roger, p. 872; Viennot-Bourgin, p. 965. (Fig. 33.)

on *Phaseolus mungo* (black gram). Yambio JT 366 (IMI 39968), 1949.

on *P. vulgaris* (Haricot bean). Ban Gedid JT 1128 & JT 1185 (1951); Debeira ASB 511 (1944); Dilling ASB 532 (1939), JT 951 (1950); Gumbiri JT 1476 (1951); Iwatoka JT 1513 (1951); Juba JT 565 (1948); Kagelu ASB (IMI 306), 1942; Katire JT 1382 (IMI 48174), 1951; Loka West JT 1540 (1951); Yambio ASB 343 (1942), JT 397 & JT 412 (IMI 48726), 1949; Yei ASB 343 (1942), JT 1432 (1951). Widespread in the southern and central Sudan south of the Gezira; this disease often causes severe damage. It has also been collected in the extreme north of the Sudan where low winter temperatures accompanied by heavy dews occur.


on *Bidens pilosa* (probably). Katire JT 1409 (IMI 48179), 1951.

on *Bidens sp*. Gilo JT 1386 (IMI 48748), 1951; Katire JT 1439 (IMI 48771), 1951. Common on *Bidens* spp. in eastern Equatoria.
U. blainvilleae Berk. in *J. linn. Soc. (Bot.)*, 14, p. 92, 1875.

on *Blainvillea prieuriana*. Khor Nabbak JT 976 (IMI 44856), 1950.


on *Commelina forskalaei*. Kadugli ASB (1942); Wad Medani ASB (1939).

on *C. kotschyi* (probably). Dilling JT 967 (IMI 44851), 1950.

on *Commelina* sp. Wau JT 652 (1949). Occasionally found on *Commelina* spp. in the Gezira, central and southern Sudan.


on *Vicia faba* (broad bean). Bouga ASB (1943); Khartoum R. E. M. (1923); Nuri ASB 477 (1944); Shambat ASB (1949); Wadi Halfa ASB (1941). Widespread north of Khartoum and often causes some leaf shedding and slight injury.


on *Ipomoea eriocarpa*. Abu Hagar JT 1787 (IMI 51504), 1952; Roseires JT 1828 (IMI 51509), 1952.

on *I. mombassana* (probably). Near Malakal JT 1565 (IMI 48810), 1951.

on *I. pilosa*. Alyman JT 1797 (IMI 51506), 1952.

[Recent collections indicate that teleutospores do not develop after aecidia, which merely become overrun with *Tuberculina* sp. The rust is now referred to *Aecidium kernbachii* P. Henn. q.v.]


on *Brachiaria lata*. Kadugli JT 985 (IMI 44867), 1950.

on *B. xantholeuca*. Sungikai JT 974 (IMI 44859), 1950.

on *Setaria pallide-fusca*. Kadugli JT 1012 (IMI 45219), 1950. Common on several grasses in the Nuba Mountains area.

on *Urochloa panicoides*. Juba JT 1909 (IMI 51212), 1952.


U. striatus Schroet. in *Abh. Schles. Ges.*, 48, p. 11, 1870. See Arthur, p. 299; Cunningham, p. 197; Dickson, p. 310; Doidge (1927), p. 24; Sampson & Western, p. 61; Viennot-Bourgin, p. 974. (Fig. 34.)
on *Medicago sativa* (lucerne). Aliab JT 1126 (IMI 45243), 1951; Bouga JT 1751 & JT 1761 (1952); Debeira ASB (1944); ASB 507 (1944); Ghaba ASB (1939); Gurier ASB (1941); Wad Medani ASB (1942); Wadi Halfa ASB 440 (1944). Widespread in Northern Province and may cause slight leaf shedding, occasionally found in the Gezira.

*U. vignae* Barcl. in *J. Asiat. Soc. Beng.*, 60, 2, p. 211, 1891. See Arthur, p. 297 (as *U. phaseoli vignae*); Fromme in *Phytopathology*, 14, p. 72, 1924; Roger, p. 874. (Fig. 35.)

on *Vigna unguiculata* (cowpea). Bunziga JT 1869 (IMI 51195), 1952; Debeira ASB 387 (1943); Dilling ASB (1939); near Kodok JT 1559 (IMI 48540), 1951; Nuba Mountains T. W. C. (1939); Talodi ASB 533 (IMI 261), 1939; Um Berembeita JT 909 (IMI 44360), 1950; Yambio JT 424 (1949), JT 532 (IMI 36319), 1948. Widespread on cowpea in the Nuba Mountains and southern Sudan but of little economic importance. Occasionally found in the extreme north of the Sudan where heavy winter dews occur.

on *V. vexillata* (cowpea). Yambio JT 421 (IMI 39973), 1949.

on *V. caerulea* (probably). Meridi–Yambio road JT 466 (IMI 45190), 1949.

on *Vigna* sp. (wild). Rashad JT 1011 (IMI 44875), 1950.

**Tremellales**

*Guepinia spathularia* (Schwein.) Fr. in *Elchenus Fungorum*, 2, p. 32, 1828. on *Acacia seyal*. Upper Nile Province JT 759 (1949), on logs.


on *Azadirachta indica* (neem). Singa ASB (1939), ASB (1942), as associated with root rotting of neem seedlings in a flooded nursery.

*Helicobasidium* sp.

on *Tectona grandis* (teak). Yambio JT 585 (IMI 34227), 1948. On base of trunk at and above soil level and on exposed roots, probably parasitic.

*Septobasidium* spp.


**FUNGI AND PLANT DISEASES IN THE SUDAN**

**Exobasidiales**


on *Commelina benghalensis*. Yambio JT 377 (IMI 39950), 1949, JT 541 (IMI 34235), 1948.

on *Commelina* spp. Gumbiri JT 1480 (IMI 48785), 1951; Kadugli JT 981 (IMI 44863), 1950; Khor Nabbak JT 995 (IMI 45218), 1950; Malakal JT 1340 (1951); Roseires JT 1832 (IMI 51172), 1952; Wau JT 652 (IMI 45197), 1949. Widespread on *Commelina* spp. in the wetter parts of the Sudan, parasitic on the leaves forming rather ill-defined leaf spots.

**Agaricales**

*Agaricus* sp.

on ground. Ghadambaliya JT 28 (1947).

*Boletus* sp.

on ground under *Acacia* sp. trees. Wad Medani ASB (1939).

*Corticium solani* (Prill. & Delacr.) Bourd. & Galz. in *Bull. Soc. mycol. Fr.*, **27**, p. 248, 1911. The mycelial (sclerotial) stage, *Rhizoctonia solani* Kühn, is common in the Sudan or a variety of substrata—in soil, associated with rotting roots, &c. See Butler, pp. 262, 370; Butler & Jones, pp. 524, 583; Dickson, p. 349; Roger, p. 979; Sprague, p. 130; Viennot-Bourgin, p. 1191.

on *Gossypium barbadense* (Egyptian cotton). Kassala and Shambat, R. E. M. (undated) as *R. solani* causing lesions on the hypocotyls of seedlings (‘sore shin’ disease); Gezira ASB (1942) as *C. solani* associated with wilting of mature plants, Gezira R. E. M. (1928) as *C. solani* isolated from rotted cotton roots. A common soil-inhabiting fungus in the Sudan. It appears able to attack seedlings growing under unfavourable conditions or roots weakened by, for example, prolonged waterlogging of the soil. It is rarely serious except in small localized patches, particularly so in the Tokar Delta and, to a lesser extent, in the Gash Delta. *C. solani* often causes rotting of the whole of the tap root including the hypocotyl and results in a characteristic brownish rot from which the cortical tissue flakes off to reveal the network of fibres beneath.

on *G. hirsutum* (American cotton). Gurier ASB (1939); Shambat ASB (1939); Zeidab ASB (1939) as *C. solani* associated with wilting of mature plants. Rarely serious.

on *Solanum tuberosum* (potato). Khartoum ASB (1940) as *R. solani* causing ‘black scurf’ on imported potato tubers; Shambat R. E. M. (undated) as *R. solani* causing stem rot of potato seedlings, probably introduced on imported tubers. Black scurf and stem rot are occasionally found on imported potatoes or seedlings grown from such infected tubers, not serious in the Sudan. Dried culture No. IMI 35169 is stated to be *Rhizoctonia solani* isolated from ‘lubia’ (possibly *Dolichos lablab*), dated 1927 and originating in the Sudan; no further details are given.
Daedalea unicolor (Bull.) Fr. in Syst. Myc., 1, p. 336, 1821.

on Nerium oleander (oleander). Wad Medani ASB (IMI 28376), 1939, on moribund stumps, probably weakly parasitic.

Fomes endotheius (Berk.) Cooke in Grevillea, 14, No. 69, p. 19, 1885.

on Acacia arabica. Abdel Magid JT 880, Wad Medani JT 1140 (1951), parasitic on branches.

on Azadirachta indica (neem). Wad Medani JT 42 (IMI 21368), 1947, parasitic on branches.

F. fastuosus (Lév.) Cooke in Grevillea, 14, No. 69, p. 18, 1885.


F. lignosus (Klotzsch) Bres. in Hedwigia, 53, p. 60, 1913. See Viennot-Bourgin, p. 1229.


F. rimosus (Berk.) Cooke in Grevillea, 14, No. 69, p. 18, 1885. See Boyce, p. 445; Roger, p. 1041.

on Acacia arabica. Kassala ASB (1944); Wad Medani ASB (1939). Parasitic on branches, causing heart rot.

on A. seyal. Gedaref ASB (1943); Wad Medani ASB (1939), heart rot of branches.

on A. sieberiana. Upper Nile Province JT 744 (1949), on logs.

on A. ?spirocarpa. Wad Medani ASB (IMI 40751), 1939, heart rot.

on Albizzia lebbek. Wad Medani ASB (1939), heart rot.

F. rimosus is widespread as a parasite on various trees in the Gezira and central Sudan but appears to attack only individual scattered trees, probably as a wound parasite.

Fomes spp.

on Acacia arabica. Upper Nile Province JT 745 (1949), on logs.

on Poinciana regia. Wad Medani ASB (1944), on trunk canker.

on dead wood. Torit JT 206 (1948).

No doubt many other Fomes spp. occur in the wetter parts of the Sudan (e.g. Equatoria) but few have been identified.

Ganoderma lucidum (Leyss) Karst. in Rev. mycol., 9, p. 17, 1881. See Boyce, p. 450; Cartwright & Findlay, p. 141; Roger, p. 1046.

on Acacia arabica. Kassala ASB (1944); Wad Medani ASB (= IMI 40787), 1939, ASB (1940). On dead stumps.

on Acacia sp. Kurmuk JT 25 (IMI 17835), 1945, on dead Acacia wood; Wad Medani JT 33 (IMI 21365), 1947, growing beneath Acacia trees.
on *Azadirachta indica* (neem). Sennar ASB (1944), on living stumps; Sennar (1952), on trunks.

on *Citrus* sp. Sennar JT (IMI 17828), 1947, on trunk just above soil level.

on *Khaya senegalensis* (mahogany). Sennar (1952), on trunks.

on *Poinciana regia*. Sennar (1952), on trunks.

on ground. Wadi Halfa JT 894 (1950).

*Ganoderma lucidum* occurs frequently on a number of trees in the Sudan, particularly in the wetter parts of the country. Often it appears to be a wound parasite.

**Hexagona discopoda** Pat. & Har. in *Bull. Soc. mycol. Fr.*, 9, p. 209, 1893.


on unidentified tree. Dinder JT 318 (IMI 34240), 1949, apparently parasitic.

**Irpex flavus** Kl. in *Linnaea*, 8, p. 488, 1833. See Roger, p. 1014.

on *Acacia arabica*. Zumurka JT 1144 (1951).

on dead wood. Um Girra Forest JT 1105 (1950), on *Acacia mellifera* wood; Upper Nile Province JT 741 (1949), on *A. seyal* timber, JT 740 (1949), on dead wood; Yambio JT 582 (IMI 34242), 1948, JT 728 (1949), on dead wood. Common on dead wood in the central and southern Sudan.

**Lentinus blepharodes** Berk. & Curt. in *J. linn. Soc.*, 10, p. 301, 1869.

on *Acacia seyal*. Upper Nile Province JT 757 (1949), on logs.

**Lentinus** sp.


**Lenzites palisoti** Fr. in Epicr. Syst. Myc., p. 404, 1836–8.

on dead tree stump. Yambio JT 597 (IMI 34236), 1948.


**Polystictus aratus** (Berk.) Cooke in *Grevillea*, 14, No. 71, p. 86, 1886.


**P. licnoides** (Mont.) Fr. in *Nov. Symb.*, p. 92, 1851.

on *Azadirachta indica* (neem). Shambe JT 720 (1949), on trunk of living tree.

**P. occidentalis** (Kl.) Fr. in *Nov. Symb.*, p. 90, 1851.


on *A. sieberiana*. Upper Nile Province JT 749 (1949), on logs.

on dead wood. Upper Nile Province JT 754 & JT 756 (1949); Wad Medani JT 315 (1948); Yambio JT 589 (IMI 34230), 1948.
**P. sanguineus** (L.) Fr. in Nov. Symb., p. 75, 1851.

on dead wood. Aloma Plateau JT 858 (1950); Kagelu JT 1655 (1951), on felled *Eucalyptus* logs; Katire JT 1658 (1951); Yambio JT 228 (1948), JT 724 (1949). Common on dead wood, felled timber, and tree stumps in Equatoria.

**Poria** spp.

on *Albizia lebbek*. Wad Medani JT 128 (1948), on cut trunk.

on *Citrus* sp. Kadugli JT 23 (1947), on roots of dead tree.

**Schizophyllum commune** Fr. in Syst. Myc., 1, p. 330, 1821. See Bouriquet, p. 436; Boyce, p. 450; Roger, p. 1099. Viennot-Bourgin, p. 1256.

on dead wood. Kadugli JT 44 (IMI 21370), 1947; Katire JT 1654 (1951), on felled tree trunks; Khartoum ASB (1942), on timber of *Mitragyna stipulosa* brought from Equatoria; Yambio JT 583 (1948); Yei JT 726 (1949). Very common on dead wood, felled tree trunks, and timber in the wetter parts of the Sudan.


on *Acacia arabica*. River Dinder JT 1139 (1951).

on *A. sieberiana*. Upper Nile Province JT 752 (1949), on logs.

on dead wood. Juba JT 600 (IMI 34239), 1948, causing dry rot of wooden beams; Kadugli–Dilling road JT 1051 (1950), on dead branches; Yirrole–Shambe road JT 721 (1949), on dead trees.

**T. corrugata** (Pers.) Bres. in *Hedwigia*, 51, p. 316, 1911.

on *Mangifera indica* (mango). Yambio JT 578 (IMI 34246), 1948, on living tree stump, probably wound parasite.

**T. hydnoides** Fr. in Epicrisis, p. 490, 1836–8.

on *Acacia arabica*. Upper Nile Province JT 743 (1949), on logs; Zumurka JT 1138 (1951).


**T. meyenii** Kl. in Nova Acta Leop. Carol., 19, Suppl. 1, p. 236, 1843.

on *Acacia seyal*. Blue Nile Province ASB (? IMI 40873), 1942, causing wood rot.

**T. occidentalis** Fr.—see *Polystictus occidentalis*.

**T. serpens** Fr. in Hymen. Europ., p. 586, 1874 (Ed. 2).


**HYMENOSTRALES**


on ground. Dilling ASB (1943); El Obeid–Dilling road ASB (1943); Shambat ASB (1939); Wad Medan ASB (1939, 1940, 1942, 1943, 1944). Common south of Khartoum during the rainy season.
**Fungi and Plant Diseases in the Sudan**


on ground. Gezira el Fil JT (IMI 17831), 1947.

**Phallales**

Phallus sp.

on ground. Gurier ASB (1939); Shambat ASB (1939, 1941); Wad Medani ASB (1939, 1942). Common in many parts of the Sudan during the rainy season.

**Lycoperdales**


on ground. Wad Medani ASB (1940).

**Sclerodermatales**


on ground. Wad Medani JT 37 (IMI 21367), 1947; occasionally found.

Tulostoma sp.

on ground. Wad Medani ASB (1939).

**Fungi Imperfecti**

**Sphaeropsidales (Phyllostictales)**


on *Hibiscus esculentus* (okra). Iwatoka JT 1518 (IMI 48796), 1951. Leaf spot.

A. caricae-papayae Tarr nom. nov. for *A. caricae* Pat. in *Bull. Soc. mycol. Fr.*, 7, p. 178, 1891, non Rabenhorst.

on *Carica papaya* (papaw). Katiare JT 1369 (IMI 48170), JT 1379 (IMI 48173), 1951; Loka West JT 1547 (IMI 48805), 1951. Leaf spotting, probably widespread in Equatoria but not usually severe.


on *Phaseolus aureus* (green gram). Wad Medani JT 1210 (IMI 47249), 1951; pycnidia immature.

on *P. vulgaris* (haricot bean). Katire JT 1382 (IMI 48174), 1951.

on *Philippisara (Phaseolus) trilobus*. Wad Medani JT 1213 (IMI 47252), 1951, JT 1928 (IMI 51512), 1952. Causing leaf spotting and widespread on leguminous plants in the central and southern Sudan. Usually only a few septate spores are found, the majority being unicellular.
A. sorghina Sacc. in *Michelia*, 1, p. 167, 1878. See Sprague, p. 161. (Fig. 36.)

on *Sorghum halepense* (Johnson grass). Wad Medani ASB (IMI 280), 1940.

on *S. vulgare* (sorghum millet). Malakal JT 1575 (IMI 48812), 1951.

on *Sorghum* sp. (Wild). Ghadambaliya JT 1250 (IMI 47281), 1951. Causing

‘rough leaf spot’, occasionally found on *Sorghum* spp. in the central and southern Sudan but of no economic importance.

Ascochytyulina sp.


Botryodiplodia theobromae Pat. in *Bull. Soc. mycol. Fr.*, 8, p. 136, 1892. See Bouriquet, p. 259; Butler, p. 385; Fawcett, p. 449 (on citrus); Nowell, p. 158 (as *Diplodia theobromae*); Sprague, p. 117; Viennot Bourgin, p. 1337; Wardlaw, p. 466 (on banana). (Fig. 37.)


on *dead wood*. Yei JT 723 (IMI 51123), 1949.
**B. theobromae** probably occurs on a wide variety of host plants in the wetter parts of the Sudan. It is common in the tropics and has a large host range, usually as a wound parasite.

**Camarosporium** sp.


**Cicinnobolus cesatii** de Bary in Morph. und Phys. d. Pilze, 3, p. 71, 1866.

*See Bouriquet, pp. 311, 312; Grove (1935), p. 150. (Fig. 38.)*

on *Oidium* spp. (powdery mildews). Bor JT 1467 (1951), on okra (*Hibiscus esculentus*); Dilling JT 964 (IMI 44848), 1950, on sweet melon (*Cucumis melo*); near Kodok JT 1561 (1951), on sunflower (*Helianthus annuus*); Malakal JT 1347 (1951), on *Justicia flava*; Melut JT 1464 (1951), on okra; Rashad JT 901 (IMI 44353), 1950, on okra; Roseires JT 1876, JT 1878, JT 1899 (1952), on okra.

on *Sphaerotheca fuliginea* (powdery mildew). Kadugli ASB 724 (1944), on pumpkin (*Cucurbita maxima*), ASB 733 (1944), on okra; Kagelu ASB (1944), on pumpkin; Talodi ASB 535 (1939), on sesame (*Sesamum indicum*). A common hyperparasite of powdery mildews in the central Sudan south of the Gezira and, to a lesser extent, in the southern Sudan. Not found on *Leveillula*.

**Diplodia** spp.

on *Citrus limonia* (Italian lemon). Tonj JT 713 (IMI 39998), 1949; associated with die-back of twigs.

on *Citrus* sp. Kadugli JT 43 (1947), on dead twigs with several other fungi, all probably secondary.

**Haplosporella ? hesperidica** Spec. in *Fungi Argent.*, 4, No. 299; p. 117, 1880.

on *Citrus aurantiifolia* (lime). Tonj JT 708 (IMI 39992), 1949, on dying twigs.

**Haplosporella** spp.

on *Citrus grandis* (grape fruit). Wad Medani JT 1205 (IMI 46863), 1951. On leaf blotches with several other fungi.

on *C. limonia* (lemon). Gumbiri JT 1488 (IMI 48531), 1951. On leaf spots.

**Macrophomina phaseoli** (Maubl.) Ashby in *Trans. Brit. mycol. Soc.*, 12, p. 141, 1927. See Fawcett, p. 140; Sprague, p. 183; Viennot-Bourgin, p. 1280; Wardlaw, p. 157. (Fig. 39.)

on *Carica papaya* (papaw). Sennar ASB (1939); Wad Medani ASB (1939). Stem rot just above ground level, occasional.

on *Clitoria ternata*. Wad Medani JT 1940 (IMI 51521), 1952, causing die-back of twigs.

on *Dolichos lablab* (dolichos bean). Gezira R. E. M. (1932) and numerous collections; Wad Medani ASB (IMI 230), 1939, JT (1946–52); unspecified locality R. E. M. (IMI 22114), 1929. Causes a characteristic wilt (‘ashy stem blight’). This disease is commonly found on irrigated dolichos in the Gezira and can be very destructive to leguminous crops growing under unfavourable soil or weather conditions.

on *Gossypium barbadense* (Egyptian cotton). Galil ASB (IMI 233), 1941, seedling wilt following spread from red leaf spot stage on the cotyledons; Gezira R. E. M. (1931), seedling wilt; Mekali ASB (IMI 248), associated with wilting of mature plants following stem-borer attack; Wad Medani R. E. M. (1932, 1933, 1934), T. W. C. (1937), isolated from rotting roots or causing red spot of cotyledons. Often associated with rotting roots of wilted plants in the Gezira and Gash Delta and with ‘red leaf spot’ of cotton seedlings in the Gezira; under suitable conditions these spots may extend to the stem, girdle it, and kill the plant. It is rarely serious except in small localized patches of cotton growing under unfavourable soil conditions (e.g. after prolonged waterlogging).

on *Ipomoea batatas* (sweet potato). Wad Medani JT 123, JT (IMI 32457), 1948. ‘Charcoal rot’ of stored tubers, not usually serious.

on *Phaseolus acutifolius* (Tepary bean). Wad Medani JT 1746 (IMI 50640), 1952. Ashy stem blight (wilt), can be very severe on this crop.

on *P. mungo* (black gram). Wad Medani JT 1215 (IMI 47254), 1951; Yambio ASB 647 (1944). Leaf spotting, occasional.

on *P. vulgaris* (haricot bean). Juba JT 602 (1948); Khartoum ASB (IMI 234), 1941; Shambat ASB (1941); Wad Medani ASB (IMI 235), 1941, JT 180 (IMI 32426), 1948, JT 1745 (IMI 50639), 1952. Ashy stem wilt, often severe in Gezira gardens.

on *Philippisara (Phaseolus) trilobus*. Wad Medani JT 1730 (IMI 50627), JT 1732 (IMI 50629), 1952. Leaf spotting.

on *Vigna unguiculata* (cowpea). Barakat ASB (1942); Wad Medani JT 302 (IMI 32429), 1948. Wilt, occasionally found in the Gezira, not usually severe.
from soil. Tayiba ASB (1940), isolated from soil around wilting cotton plants.

_Macrophomina phaseoli_ is a widely distributed root-invading fungus in the warmer parts of the world. It occurs in most Sudan soils and it is likely that it can invade roots damaged or weakened in some way, e.g. by waterlogging, inadequate soil moisture, or following insect injury. It is sometimes associated with leaf spotting but this aspect is rarely serious.

**Microdiplodia** sp.

on *Citrus grandis* (grape fruit). Kadugli JT 1028 (IMI 44878), 1950. With other fungi on leaf spots.

**Microxyphium** sp.

on *Coffea robusta* (coffee). Gilo JT 1398 (IMI 48752), 1951; Yei River district JT 1586 (IMI 48202), 1951. Sooty mould on leaves, stems, and berries; associated with heavy insect infestation and honeydew.

**Phoma destructiva** Plowr. emend Jamieson in *J. agric. Res.*, 4, p. 1, 1915. It is probable that this fungus is polymorphic, other pycnidial forms being _Ascochyta lycopersici_ and _Diplodina lycopersici_ with perfect (Ascomycete) stage _Didymella lycopersici_ (see Butler & Jones, pp. 53, 666–9). See also Grove (1935), p. 314; Viennot-Bourgin, pp. 545, 1304.

on *Lycopersicum esculentum* (tomato). Yambio ASB 350 (1943). Associated with leaf spotting and fruit rot, _Phoma_ stage; apparently not common in the Sudan.


on *Sorghum halepense* (Johnson grass). Listed by Boughey (1946) as widespread in the Gezira area and causing leaf spotting. No specimens are available.

on *S. vulgare* (sorghum millet). Dilling ASB (IMI 281), 1943. Listed by Boughey (1946) as widespread in the Gezira and Nuba Mountains and causing leaf spotting.

on *Sorghum* sp. (wild). Abu Hagar JT 1783 (IMI 51137), 1952.

**Phoma** sp.

from soil. Wad Medani ASB (1940).

**Phomopsis** sp.

on *Albizia lebbek*. Wad Medani JT 112 (IMI 32430), 1948, on dead twigs.


on *Ipomoea batatas* (sweet potato). Wau JT 669 (IMI 44830), 1949; Yambio ASB 739 (IMI 332), 1944, JT 516 (IMI 36311), 1948, JT 406 (1949). Leaf spot, widespread but not severe in the southern Sudan.

on *I. digitata*. Yambio JT 553 (IMI 36351), 1949, leaf spotting.
58  FUNGI AND PLANT DISEASES IN THE SUDAN

on *Ipomoea* sp. (cultivated). Wad Medani JT 1209 (IMI 47248), 1951, on leaf spots with other fungi.


on *Bauhinia alba*. Loka West JT 1427 (IMI 48764), 1951. Quite severe leaf spotting.

**P. briosiana** Trav. in *Ann. mycol., Berl.*, 1, p. 228, 1903.


**P. desmodii** Ell. & Ev. in *J. Mycol.*, 5, p. 146, 1889.


on *Desmodium scoriopirius*. Yambio JT 519 (IMI 36313), 1948. On leaf spots.


on *Dioscorea dumetorum* (probably). Jebel Dair JT 1769 (IMI 51131), 1952.

**P. glaucispora** Delacr. in *Bull. Soc. mycol. Fr.*, 9, p. 266, 1893.


on *Hibiscus* sp. (wild). Wad Medani JT 860 (IMI 44834), 1950. Leaf spot.

**P. phaseolorum** Sacc. & Spec. (probably) in *Michelia*, 1, p. 160, 1878.


on *Vigna unguiculata* (cowpea). Wad Medani JT 1230 (IMI 47263), 1951, on leaf spots.

**Phyllosticta** spp. have also been found associated with leaf spots of the following plants in the Sudan—*Adansonia digitata*, Rashad JT 1031 (IMI 46477), 1950; *Arachis hypogaea* (ground-nut), near Kodok JT 1558 (IMI 48539), Wad Medani JT 877 (IMI 44351), 1950, JT 1742 (IMI 50636), 1952; *Combretum hartmannianum*, 15 miles north of Kurmuk JT 1918 (IMI 51216), 1952; *Combretum sp.*, Wau JT 1767 (IMI 51130), JT 1933 (IMI 51517), 1952; *Dolichos lablab* (Dolichos bean), Wad Medani JT 1212 (IMI 47251), 1951; *Grewia betulaefolia*, Wad Medani JT 1075 (IMI 46842), 1951; *Hipppeastrum sp.* (Uganda lily), Wad Medani JT 1684 (IMI 50591), 1952, on withered tips of leaves; *Hyparrhenia pseudocymbaria*, near Yaraddi JT 1930 (IMI 51514), 1952; *Khaya grandifolia* (mahogany), Katire JT 1421 (IMI 48181), 1951; *Khaya senegalensis* (African mahogany), Dilling JT 937 (IMI 44375), 1950, Iwatoka JT 1585 (1951) on seedling leaf spots; *Mucuna pruriens* (velvet bean), Wad Medani JT 1211 (IMI 47250), 1950; *Mucuna sp.* (velvet bean), Kadugli JT 1037 (IMI 45230), 1950; *Phaseolus aureus* (green gram), Malakal JT 1552 (IMI 48808), 1951, Wad Medani JT 1737 (IMI 50634), 1952; *Pueraria*...
Hundreds of species of Phyllosticta occur as leaf-spotting parasites. A few have been identified in the Sudan but many more await collection and study. The genus differs from Phoma in that it is essentially a leaf parasite whereas Phoma usually occurs on stems—a somewhat unreliable distinction. On occasions Phyllosticta spp. appear to behave as saprophytes rather than as true parasites and are found on dead leaf tissue &c. Phyllosticta is a common leaf-spot fungus on a wide range of plants in the central and southern Sudan.

**Phyllostictina sp.**


**Pyrenochaeta sp.**

on *Abutilon* sp. About 20 miles south of Roseires JT 1843 (IMI 51180), 1952, on leaf spots.

**Septoria lactucae** Pass. in *Att. Soc. Crittog. Ital.*, 2, p. 35, 1879. See Stevens (1913), p. 522; Viennot-Bourgin, p. 1322, 1949. (Fig. 40.)


on *Lycopersicon esculentum* (tomato). Aloma Plateau ASB (1942); Gumbiri JT 1479 (IMI 48527), 1951; Juba JT 166 (1948); Kagelu ASB 642 (IMI 319), 1944, JT 72 (1947); Katire JT 1372 (IMI 48172), 1951; Loka West JT 1537 (1951); Wau JT 667 (1949); Yambio ASB (1944), JT (1948), JT
415 (1949); Yirol–Rumbek road JT (1948). Leaf spotting, occasionally quite severe. Widespread in the southern Sudan but apparently not present in the central or northern Sudan.

**Septoria** spp.

on *Ageratum* sp. Katire JT 1412 (IMI 48758), 1951. Leaf spot.

on *Khaya senegalensis* (African mahogany). Bunziga JT 1871 (1952); Dilling JT 915 (IMI 44363), 1950; Malakal JT 1901 (1952). Leaf spot, occasionally found in the central Sudan. There appears to be no previous record of a *Septoria* on *Khaya*.

on *Pupalia lappacea*. Boing JT 1650 (IMI 49965), 1951. Leaf spot. Of the many recorded species of *Septoria* only a few have been found in the Sudan, no doubt many more await discovery.

**Stagonospora phragmiticola** Hansford in *Proc. Linn. Soc. Lond.*, 157, p. 38, 1945. (Fig. 41.)

on *Phragmites communis*. Lado JT 332 (IMI 40125), 1949. Leaf spotting.

on *P. mauritianus*. Juba JT 559 (IMI 34250), 1948; Terrakeka JT 555 (IMI 34253), 1948. Probably widespread on *Phragmites* in the southern Sudan.

![Fig. 41.](image)

**Stagonospora** sp.

on *Ophiuros papillosus*. Hawata JT 896 (IMI 44840), 1950. On leaves and leaf sheaths.

**Melanconiales**

**Colletotrichum capsici** (Syd.) Butler & Bisby in ‘The Fungi of India’, Imper. Council of Agric. Res., Scient. Monograph 1, p. 152, 1931. See Butler, p. 352. (Fig. 42.)

on *Acalypha indica*. Wad Medani JT 1226 (IMI 47259), 1951. Leaf spotting.


![Fig. 42.](image)

on *Citrus aurantiifolia* (lime). Barakat ASB (1940), wither tip of twigs; Singa JT 1782 (IMI 51136), 1952, on leaf spots.

on *C. nobilis* (tangerine). Kagelu ASB (IMI 21031), 1943. Causing anthracnose of leaves. See also under *Glomerella cingulata*, only the *Colletotrichum* stage has been collected in the Sudan. There are reported to be numerous strains of *C. gloeosporioides*, some of which are parasitic, whilst others are probably saprophytic. In the Sudan it can cause severe leaf anthracnose and die-back of twigs but usually it is not severe.

C. gossypii Southworth in *J. Mycol.*, 6, p. 100, 1891. See Butler, p. 365; Nowell, p. 277; Stevens (1913), p. 271; Viennot-Bourgin, p. 607.

on *Gossypium* sp. (cotton). Reported in 1908 as causing anthracnose of cotton bolls (H. H. King in 3rd Report, Wellcome Research Laboratories, Khartoum, 1908, pp. 245–7 and R. E. Massey in Sudan Notes & Records, 4, p. 221, 1921). I have not been able to trace the specimens. This disease is very common in the U.S.A. and has been found in Egypt but it is doubtful whether it occurs in the Sudan; certainly it is of no importance.

C. graminicola (Ces.) Wilson in *Phytopathology*, 4, p. 110, 1914. See Butler, p. 217; Grove (1937), p. 242; Sprague, p. 286. (Fig. 43.)

on *Hyparrhenia pseudocymbaria*. Near Yaraddi JT 1930 (IMI 51514), 1952, on leaf spots.

on *Sorghum halepense* (Johnson grass). Hag Abdulla ASB (1943); Nuba Mountains ASB (1939); Wad Medani ASB (1939), ASB 496 (IMI 259), 1944. Red leaf spot.

on *Sorghum vulgare* (sorghum millet). Ghadambaliya JT 1674 (1952); Juba-Torit road JT 1599 (IMI 48545), 1951; Kadugli JT 920 (IMI 44365), 1950; Kodok JT 1556 (1951); Malakal JT 875 (IMI 44837), 1950, JT 1575 (IMI 48812), JT 1663 (IMI 49969), 1951; Melut JT 1337 (IMI 48515), 1951; Roseires JT 1881 (IMI 51200), 1952; Tonj ASB 323 (1943); Tozi JT 1850 (IMI 51186), 1952; Um Bileil JT 1645 (1951); Wad Medani ASB (1944), JT (IMI 17571), 1947, JT 1712 (IMI 50611), 1952. Red leaf spot (anthracnose) is widespread in the southern and central Sudan as far north as the Gezira. It can occasionally be severe on young sorghum, but so far no control measures have been necessary.

on *Sorghum* sp. Hag Abdulla ASB (1943); Jebel Moya ASB (1943); Kagelu ASB (1942); Wad Medani ASB (1939, 1940, 1943). Anthracnose.
Colletotrichum sp.
on *Annona squamosa* (custard apple). Kadugli JT (IMI 17575), 1947, on leaf spots.

*Cylindrosporium kilimandsharicum* Allesch. apud P. Henn., Pilze Ostaf., p. 35, in Engler, Die Pflanzenwelt Ostafrikas und der Nachbargebiete 1895.
on *Commelina krebsiana* (probably). Iwatoka JT 1508 (IMI 48793), 1951.
on *Commelina* spp. Gumbiri JT 480 (IMI 48785), 1951; Katire JT 1461 (IMI 48784), 1951. Leaf spot, probably widespread in the southern Sudan.

on *Manihot utilisima* (cassava). Dilling ASB 547 (1952). Leaf spotting, only once collected.

Pestalotiopsis sp.
on *Mangifera indica* (mango). Kagelu JT 1523 (IMI 48798), 1951, on leaves on *Terminalia* sp. Loka West JT 1594 (IMI 48542), 1951, on old gray leaf spots.

Stigmopsis sp.
on *Citrus aurantiifolia* (lime). Wad Medani JT 1687 (IMI 50594), 1952.

**Moniliales: Moniliaceae**

**Aspergillus.** For description of the *Aspergillus* spp. mentioned below, reference should be made to ‘A Manual of the Aspergilli’ by C. Thom & K. B. Raper (The Williams & Wikins Company, Baltimore, 1945), from which most of the species’ citations have been taken.


from soil. Tayiba ASB (1949); Wad Medani ASB (1939).


on Allium cepa (onion). Causing a slow black storage rot, widespread in the Sudan but rarely serious.

on Arachis hypogaea (ground-nut). Tozi JT 1943 (IMI 51523), 1952, associated with ‘crown rot’ of seedlings.

on Gossypium barbadense (Egyptian cotton). Associated with black boll rot following insect (e.g. bollworm) attack. Widespread on Egyptian cotton in the northern Sudan (e.g. Wad Medani, JT 1171, 1951) but rarely serious.

on G. hirsutum (American cotton). Um Bileil JT 1125 (1950); Um Sugura JT 1124 (1950); Zeidab JT 130 (1948). Causing black boll rot following insect punctures, widespread on American cotton throughout the Sudan.

on Gossypium spp. (cotton). Berber R. E. M. (1919, 1921, 1923); Gandettu ASB (1939); Kordofan R. E. M. (1921); Melut JT 1148 (1951); Nuri ASB (1939); Wad Medani ASB (1939); Zeidab ASB (1939). Black boll rot producing badly stained or worthless lint occurs on cotton throughout the Sudan and can occasionally be responsible for considerable damage. The fungus enters the bolls through insect holes (often bollworm punctures) or blackarm lesions (Xanthomonas malvacearum) and initiates rotting of the immature lint. Various other fungi, e.g. Penicillium spp., may be present.

on Mangifera indica (mango). Merowe ASB (1940). Causing fruit rot, the fungus entering through insect punctures or other breaks in the skin of the fruit. Fairly common but rarely serious in the Sudan.

from soil. Tayiba ASB (1940). Commonly found in Gezira soil. Aspergillus niger occurs throughout the Sudan in soil and on many other substrates, e.g. rotting fruit, vegetables, roots, &c. In most cases it appears to be largely saprophytic and unable to invade healthy intact tissues but becomes able to do so under favourable conditions through insect punctures, bruises, &c.


from soil. Wad Medani ASB (IMI 16059), 1940.


from soil. Wad Medani ASB (IMI 16138), 1940.


from soil. Tayiba ASB (1940); Wad Medani ASB (1939).

from soil. Wad Medani ASB (1939).

Cercospora spp.

on *Albizia* sp. Katire JT 1360 (IMI 48743), 1951. On leaves.

on *Clerodendron cordifolium*. Katire JT 1362 (1951); Rumbek–Tonj road JT 636 (IMI 39952), 1949; Yambio JT 372 (IMI 39982), JT 430 (IMI 39978), 1949, JT 524 (IMI 36316), 1948; Ye JT 572 (1948). Leaf spotting, common in Equatoria.

on *Ipomoea* sp. Malakal, JT 1343 (IMI 48516), 1951. Leaf spotting.

Chlamydomyces palmarum (Cooke) Mason in Annotated Account of fungi received at the Imperial Bureau of Mycology, 2, 1, p. 37, 1928.

on *Cajanus indicus* (pigeon pea). Kagelu JT 61 (IMI 21378), 1947, on leaf spots.


on *Citrus limonia* (lemon). Khartoum R. E. M. (IMI 7128), 1935, as isolated from twigs with witches broom symptoms.


Oidium

*Oidium* is a form genus comprising the conidial stages of powdery mildews (Erysiphaceae). In the Sudan perithecia of powdery mildews are very rare but those of *Erysiphe cichoracearum*, *E. polygoni*, and *Sphaerotheca fuliginea* have been collected (see Erysiphaceae). A. S. Boughey studied Sudan powdery mildews and concluded that these three could be distinguished on conidial characteristics even in the absence of perithecia. He recorded the following measurements (unpublished data). *E. cichoracearum*—mean conidial dimensions within the range 13–15×26–28 µ; *E. polygoni*—conidia oblong—ellipsoid, 11–14×5×31–37 µ; *Sphaerotheca fuliginea*—conidia doliform, 16–17×27–32 µ. In addition he listed another powdery mildew (on water melon) with wider conidia (18–19×29–30 µ) which could not be identified with any named mildew known to occur in the Sudan. In the absence of perithecia this was named *Oidium* sp. In the present author’s experience it is in many cases extremely difficult to determine with certainty these three species when only conidia are present. Particularly is this true of *S. fuliginea* and *E. cichoracearum*. 
which are stated to occur on certain hosts common to both, e.g. *Hibiscus esculentus*—in some cases considerable variation in conidial measurements, possibly associated with the existence of physiologic races, occurs and renders differentiation difficult and uncertain. *Leveillula taurica* has well-defined conidial characteristics whilst *Erysiphe graminis* and *Uncinula necator* (*Oidium tuckeri*) have characteristic host-ranges. Except, therefore, in the case of the last three powdery mildews and in the absence of perithecia the present author has preferred to use the term *Oidium* sp. whilst listing those collected by A. S. Boughey under the names he gave them. It is possible that yet other powdery mildews with conidia similar to those described by Boughey exist in the Sudan, their perithecia either not occurring or not having been collected. The powdery mildews of the Sudan are therefore listed under *Oidium* spp. and *Ovulariopsis* (Moniliaceae) and under *Erysiphe, Leveillula, Sphaerotheca,* and *Uncinula* (Erysiphaceae).

*Oidium* spp. have been collected on the following host plants in the Sudan: *Acalypha ciliata* (probably), *Bidens pilosa, Cassia occidentalis, C. tora, Citrulcus vulgaris* (water melon), *Cucumis melo* (sweet melon), *C. melo var. agrestis, Cucurbita maxima* (pumpkin), *C. pepo* (vegetable marrow), *Daucus carota* (carrot), *Euphorbia hirta, Gossypium Mrsutum* (American cotton, from Busata JT 800 (IMI 39955), 1950, on native-grown riverain cotton, the only record of powdery mildew on cotton in the Sudan), *Helianthus annuus* (sunflower, from near Kodok JT 1561 (1951), *Hibiscus esculentus* (okra), *Justicia flava, J. insularis, Sesamum indicum* (sesame), *Trichodesma zeylanicum, Triumfetta pentandra, Vicia faba* (broad bean), *Vigna unguiculata* (cowpea).


from soil. Tayiba ASB (1940).

**Ovulariopsis papayae** van der Bijl in *Trans. R. Soc. S. Africa,* 9, p. 189, 1921.

on *Carica papaya* (papaw). Gumbiri JT 1490 (IMI 51502), 1951, powdery mildew on leaves.


from soil. Wad Medani ASB (1939).

**Penicillium.** Reference should be made to ‘A Manual of the Penicillia’ by K. B. Raper & C. Thom (London, 1949), from which most of the species’ citations used here have been taken.


from soil. Wad Medani ASB (1940).

**P. glaucum** Link in *Magaz. d. Ges. naturf. Freunde, Berlin,* 1, p. 17, 1809. This species is not accepted by Raper & Thom, it having been used for green Penicillia in general.

**P. luteo-viride** Biourge in Monograph., *La Cellule*, 33, 1, p. 242, 1923. Not accepted by Raper & Thom, who consider it to be based on some member of the *P. funiculosum* series.

from *soil*. Tayiba ASB (1940).


from *soil*. Wad Medani ASB (1939).

**P. purpurogenum** Stoll in Beiträge zur morphologischen und biologischen Charakteristik von Penicilliumarten, Würzburg, p. 32, 1904. See Gilman, p. 254; Raper and Thom, p. 633.

from *soil*. Wad Medani ASB (1940).


from *soil*. Wad Medani ASB (1940).


from *soil*. Wad Medani ASB (1940).

**Piricularia grisea** (Cooke) Sacc. in *Michelia*, 2, p. 148, 1880. See Dickson, pp. 141–2 (as *P. oryzae*); Sprague, p. 415; Stevens (1913), p. 591 (1925), p. 395; Viennot-Bourgin, p. 1456. (Fig. 44.)

on *Digitaria* sp. Iwatoka JT 1507 (IMI 48792), 1951.
on *Echinochloa colona*. Wad Medani JT 1227 (IMI 47260), 1951.

on *Pennisetum typhoides* (bulrush millet). Roseires JT 1882 (IMI 51201), 1952; Tozi JT 1855 (IMI 51191), 1952. Leaf spot, occasional.

on *Setaria verticillata*. Sennar JT 1627 (IMI 48830), 1951; Wad Medani JT 1725 (IMI 50622), 1952.

*P. grisea* probably causes leaf spotting of a wide range of grasses in the Sudan.

**Piricularia** sp.

on *Amomum* sp. Yambio JT 404 (IMI 45182), 1949, on leaf spots.

**Ramularia areola** Atk. in *Bot. Gaz.*, 15, 168, 1890.

*Cercospora gossypii* Speg. is apparently an earlier name and the perfect (Ascomycete) stage is reported to be *Mycosphaerella areola* Ehrlich & Wolf in *Phytopathology*, 22, p. 228, 1932. Only the *Ramularia* stage has been found in the Sudan.

on *Gossypium hirsutum* (American cotton). Kadugli ASB 21 (IMI 292), 1939, ASB (1942); Kagelu ASB 335 (1943), ASB 650 (1944), JT 66 (1947); Meridi JT 537 (1948); Yambio JT 1690, JT 1749 (1952). Areolate or ‘frosty’ mildew on leaves, common on rain-grown American cotton in the Nuba Mountains and Equatoria. It rarely causes more than slight premature leaf shedding.

**R. tulasnei** Sacc.—see under *Mycosphaerella fragariae*.

**Ramularia** spp.

on *Peristrophe calyculata*. Bunziga JT 1836 (IMI 51175), 1952; Roseires JT 1798 (IMI 51144), 1952; Singa JT 1770 (IMI 51132), 1952; about 25 miles south of Wad el Nail JT 1899 (IMI 51208), 1952. Mildew on leaves, very common in the Fung area. Possibly a hitherto undescribed species.

on unidentified herb. Malakal JT 1336 (IMI 48739), 1951, as white growth on leaves.


on *Thea sinensis* (tea). Iwatoka JT 1500 (IMI 48790), 1951, on leaf blotches, probably saprophytic.

**Moniliales: Dematiaceae**

**Acrospeira** sp.

on *Mucuna* sp. (velvet bean). Yambio JT 407 (IMI 44823), 1949, on leaf spots, probably not parasitic.

**Alternaria brassicae** (Berk.) Sacc. in *Michelia*, 2, p. 172, 1880. See Viennot-Bourgin, p. 1545; Wiltshire (*Mycol. Pap. imp. mycol. Inst.*, 20, 1947) for descriptions of *Alternaria* spp. occurring on brassica crops. (Fig. 45.)
on *Brassica campestris* (turnip). Iwatoka JT 1515 (IMI 48194), 1951, leaf spotting.

on *Lactuca sativa* (lettuce). Yei ASB (IMI 1151), 1943, leaf spot, marked as *Alternaria cf. brassicae*.

**A. brassicicola** (Schwein.) Wiltshire in *Mycol. Pap. imp. mycol. Inst.*, 20, p. 10, 1947. (Fig. 46.)

*A. oleracea* Millbrath in *Bot. Gaz.*, 74, p. 320, 1922, is a synonym. See Viennot-Bourgin, p. 1544; Wiltshire loc. cit. The conidia of *A. brassicae* are much larger (76–350×11–42μ) than those of *A. brassicicola* (18–130×8–30μ). The latter species is the more frequently encountered in the Sudan.

on *Beta vulgaris* (beet). Yei ASB (IMI 1152), 1943, leaf spot, marked as *Alternaria oleracea*.


on *B. oleracea* var. *botrytis* (cauliflower). Bor JT 1463 (1951); Juba ASB (IMI 796), 1944, JT 561 (IMI 34270), 1948; Rumbek JT 497 (IMI 40001), 1949; Wau JT 659 (IMI 40002), 1949. A common and occasionally severe leaf spot disease of cauliflowers in the southern Sudan.

on *B. oleracea* var. *bullata* (cabbage). Bor JT 1353 (IMI 48519), 1951; Gumbiri JT 1472 (IMI 48523), 1951; Juba ASB (IMI 794), 1944, JT 556 (1948); Kadugli JT (IMI 17572), 1947, JT 923 (1950); Nagischot JT (1948); Rumbek JT 496 (IMI 40000), 1949; Yambio JT (1948). Widespread in the southern Sudan and Nuba Mountains.

on *B. oleracea* var. *gemmifera* (Brussels sprouts). Bor JT 1462 (1951); Kadugli JT 924 (1950).

on *B. oleracea* var. *gongylodes* (kohl-rabi). Juba ASB (IMI 795), 1944; Rumbek JT 499a (IMI 39976), 1949.

on *Raphanus sativus* (radish). Bor JT 1355 (IMI 48521), 1951.

*A. brassicicola* causes leaf spotting of various brassica vegetables in the Nuba Mountains and southern Sudan. The leaf spots are large and characteristically zonate (‘target board’) in appearance; when mature they are of a blackish colour due to spore production. This disease can occasionally be destructive. *A. brassicae* causes a similar leaf spotting of brassicas and can satisfactorily be distinguished only by microscopical examination.
A. citri Pierce in *Bot. Gaz.*, 33, p. 234, 1902. See Fawcett, pp. 296, 432; Viennot-Bourgin, p. 1547. (Fig. 47.)

on *Citrus aurantiifolia* (lime). Wad Medani JT 1206 (IMI 46864), 1951, leaf spots and blotches.

on *C. limonia* (lemon). Ban Gedid JT 1197 (IMI 46857), 1951; Wad Medani JT 1229 (1951), leaf blotching.

on *C. sinensis* (sweet orange). Sennar JT 1242 (IMI 47273), 1951; Wad Medani JT 1228 (1951), JT 1734 (IMI 50631), 1952. Leaf blotching. In some countries black rot of citrus fruit caused by *A. citri* can be destructive. As yet black rot has not been observed in the Sudan although the fungus occurs as a leaf parasite in the Gezira and central Sudan. It is associated with large irregular white-grey patches of dead leaf tissue and can cause some leaf shedding.

A. crassa (Sacc.) Rands in *Phytopathology*, 7, p. 337, 1917. (Fig. 48.)

on *Datura stramonium* (thornapple). Roseires JT 1801 (IMI 51147), 1952. Leaf spotting.

A. cucumerina (Ell. & Ev.) Elliott in *Amer. J. Bot.*, 4, p. 472, 1917. (Fig. 49.)

on *Cucurbita maxima* (pumpkin). Amadi JT 244 (IMI 36302), 1948; Kadugli ASB 724 (IMI 327), 1944; Rumbek JT 484 (IMI 39999), JT 495 (1949); Singa JT 1773 (1952). Leaf spot, widespread in the Nuba Mountains and southern Sudan.

on *C. pepo* (vegetable marrow). Dilling JT 933 (1950); Kadugli ASB 734 (1944).

on *Cucurbita* spp. (cultivated). Alyman JT 1893 (1952); Delami JT 914 (1950); Kadugli JT 921 (1950); Melut JT 1325 (1951); Um Berembeita JT 910 (1950). A common leaf-spotting fungus on *Cucurbita* spp. in the wetter areas of the Sudan. The spots are usually large and sometimes zonate. Occasionally severe but usually of little consequence.
(Fig. 50.)

on Gossypium barbadense (Egyptian cotton). Hashaba JT 1160 (IMI 45259), 1951, leaf spotting; Tokar JT 1160 (1951), leaf spotting, JT 1153 (IMI 45249), as sooty mould on leaves (with Cladosporium sp.) following insect attack (‘asal’—see under Cladosporium). This fungus has been described from Southern Rhodesia (Hopkins, loc. cit.) as causing brown boll rot and leaf spotting. Only the latter has been observed in the Sudan and the disease is of little significance. Apparently distinct from A. macrospora, which has also been recorded on cotton.

A. oleracea Milbrath—see A. brassicicola.

A. ricini (Yoshii) Hansford in Proc. Linn. Soc. Lond., 1942–43, p. 53, 1943. (Fig. 51.)
on Ricinus communis (castor). Malakal JT 1635 (IMI 49957), JT 1636 (IMI 49958), JT 1637 (IMI 49959), JT 1638 (IMI 49960); Wad Medani JT 1685 (IMI 50592), 1952. Leaf spot, probably widespread in the central Sudan and occasionally severe.

A. solani (Ell. & Mart.) Sorauer in Z. PflKrankh., 6, p. 6, 1896. See Bouriquet, p. 472; Butler, p. 287; Stevens (1913), p. 623 (1925), p. 412; Viennott-Bourgin, p. 1538. (Fig. 52.)
on Ipomoea sp. Um Sugura JT 1248 (IMI 47279), 1951; Yambio–Meridi road JT 454 (IMI 40117), 1949. Leaf spot.
on Lycopersicon esculentum (tomato). Gumbiri JT 1479 (IMI 48527), 1951; Kadugli JT 918 (IMI 45209), 1950; Port Sudan JT 1155 (IMI 45250), 1951; Rashad JT 902 (IMI 44354), 1950; Roseires JT 1877 (1952). Leaf spot, widespread in the central and southern Sudan and on the Red Sea coast; rarely severe.
on *Solanum melongena* (eggplant). Gumbiri JT 1485 (1951); Kadugli ASB (1942). Leaf spot, occasional.

on *S. tuberosum* (potato). Torit JT 225 (IMI 32450), 1948. Leaf spotting ('early blight'), occasionally found in Equatoria. *A. solani* occurs widely on Solanaceae and Convolvulaceae in the central and southern Sudan and in the Red Sea coastal area.

**A. tenuis** Nees in Pilze und Schwämme, p. 72, 1817 ex Wallroth. See Gilman, p. 311; Sprague, p. 301; Viennot-Bourgin, p. 1542. (Fig. 53.)

on *Bougainvillea* sp. (cultivated). Loka West JT 1425 (IMI 48184), 1951; Wad Medani JT 1718 (IMI 51125), 1952; on leaf spots and dead tissue at edges of leaves.

on *Cajanus indicus* (pigeon pea). Shendi JT 144 (IMI 32435), 1948, with *Cladosporium* sp. as sooty mould on leaves.

on *Dolichos lablab* (dolichos bean). Port Sudan JT 1150 (IMI 45246), 1951, associated with leaf spotting; Shendi JT 145 (IMI 32437), 1948, with *Cladosporium* sp. as sooty mould on leaves.

on *Gossypium barbadense* (Egyptian cotton). Tokar R. E. M. (IMI 1028), 1927, on leaves.

on *Pennisetum typhoides* (bulrush millet). Port Sudan—Tokar road, JT 1157 (IMI 45252), 1951, as sooty mould on leaves.

on *Sorghum vulgare* (sorghum millet). Tokar JT 1166 (IMI 45257), 1951, as sooty mould on leaves.

*A. tenuis* probably occurs throughout the Sudan and is commonly encountered in the Red Sea coastal area. It often occurs as a superficial black mould on old leaves (especially under very humid conditions) or on leaves infested by insects ('asal' or honeydew) with *Cladosporium* sp. In some cases it appears to be a true leaf parasite.


on *Cyperus rotundus* (nut-grass). Recorded as associated with brown spots on leaves (F. W. A., 1938), locality not stated but probably the Gezira.

**A. zinniae** Pape in *Angew. Bot.*, 24, p. 69, 1942. See Viennot-Bourgin, p. 1550. (Fig. 54.)

on *Zinnia elegans* (cultivated zinnia). Dilling JT 1047 (1950); Port Sudan JT 1152 (IMI 45248), 1951; Rashad JT 1042 (IMI 45231), 1950. Leaf and petal spotting, can be severe and very disfiguring. Occasionally found in the Nuba Mountains and Red Sea coastal area. The leaf spots are often small with white centres bordered by purple, somewhat resembling those caused by *Cercospora zinniae*. 
Alternaria spp.

on *Antirrhinum majus* (snapdragon). Shambat ASB (1941), associated with roots of wilting plants.

on *Cajanus indicus* (pigeon pea). Kadugli JT 957 (IMI 45213), 1950, on leaf spots.

on *Gossypium barbadense* (Egyptian cotton). Degein JT 898 (1950), with *Cladosporium herbarum* as sooty mould on leaves following insect attack. *Alternaria* spores are frequently found with other fungi (usually *Cladosporium*) in sooty mould on cotton leaves in the central and northern Sudan and in the Red Sea coastal area.

on *Hibiscus esculentus* (okra). Tokar ASB (1942), on leaf spots.

on *H. sabdariffa* (rozelle). Sungikai JT 969 (IMI 45215), 1950, on leaf spots.

on *Pennisetum typhoides* (bulrush millet). Tokar JT 1165 (1951), as sooty mould on leaves.

on *Philippisara (Phaseolus) trilobus*. Wad Medani JT 1730 (IMI 50627), 1952, on leaf spots with other fungi.

on *Phoenix dactylifera* (date palm). Semnar JT 1619 (IMI 48829), 1952, as black mould on old leaves.

on *Solanum dubium*. Tokar ASB (1942), on leaf spots.

on *Vigna unguiculata* (cowpea). Tozi JT 1854 (IMI 51190), 1952, on leaf spots.

Bispora sp.

on *Rosa* sp. (rose). Khartoum JT (1947), isolated from stem rot.

Cercospora.

The numerous species of *Cercospora* cause leaf spotting on a very wide range of plants. Thus Chupp in 1937 ('*Cercospora* species and their host genera', mimeographed list, Cornell University) listed some fourteen hundred species on more than eight hundred species of host plants; in some cases a dozen or more *Cercospora* spp. are recorded on one host genus. It is probable, however, that detailed study would considerably reduce the number of species. Recent statements (Johnson & Valleau, *Phytopathology*, 39, p. 763, 1949) in which morphology and host range as investigated by experimental inoculation were studied suggests that certain species hitherto regarded as distinct may be identical. Pending further investigation it seems better to follow the old system and such is the procedure adopted in this book. Doubtless some of the *Cercospora* spp. collected in the Sudan and not conforming to named species recorded on the host concerned could be described as 'new'—but at present it seems inadvisable to add to the already large number of *Cercospora* species recorded unless detailed study and experimentation can be carried out. *Cercospora* leaf spots are usually well defined and often with a whitish-grey centre. In colour they vary from white to dark brown but in some cases no sharply defined spot is formed, the fungus being present as small velvety grey-black angular patches on (usually) the undersides of the leaves. Most *Cercospora* spp. are true parasites but occasionally the fungus (e.g. *C. canescens*) is found growing on patches of dead leaf tissue apparently as a saprophyte.

on *Achyranthes aspera*. Malakal JT 1300 (IMI 49952), 1951; Terrakeka JT 331 (IMI 40120), 1949. Leaf spot, occasional.


The perfect stage has been described as *Mycosphaerella arachidicola* W. A. Jenkins in *J. agric. Res.*, 56, p. 324, 1938. See Bouriquet, p. 344; Viennot-Bourgin, p. 467. (Fig. 55.)

on *Arachis hypogaea* (ground-nut). Dilling ASB 495 (IMI 258), 1943, JT 930 (IMI 44372), 1950; Juba ASB 663 (1944); Kadugli JT 928 (IMI 44370), JT 929 (IMI 44371), 1950; Kagelu ASB (1942); Sungikai JT 927 (IMI 44369), 1950; Tonj ASB 320 (1943); Yambio JT 530 (1948); Yei ASB 634 (1944). This leaf spot disease is widespread in the Nuba Mountains and southern Sudan but has not been found in or north of the Gezira or in that part of the central Sudan ('central rainlands') east of the White Nile. In some cases it appears to cause considerable damage, in others it appears late in the season when the crop is reaching maturity. Local ground-nuts seem to be more tolerant than introduced varieties. *C. arachidicola* produces somewhat larger spots and has longer and thinner conidia than *C. personata*, which also occurs on ground-nuts in the Sudan.

C. atro-marginalis Atk. in *J. Elisha Mitchell sci. Soc.*, 8, p. 59, 1892.

on *Solanum nodiflorum*. Roseires JT 1829 (IMI 51170), JT 1834 (IMI 51173), 1952.

on *S. ? xanthocarpum* var. *Schraderi*. Alyman JT 1794 (IMI 51505), 1952; Roseires JT 1833 (IMI 51510), 1952.


on *Ipomoea cordofana*. Tozi JT 1897 (IMI 51206), 1952; Um Sugura JT 1249 (IMI 47280), 1951. Leaf spot.


on *Beta vulgaris* (beetroot). Kadugli JT 1004 (1950); Tonj JT 646 (1949); Wau JT 664 (IMI 39963), 1949; Yambio JT (1948).

on *B. vulgaris* (spinach beet). Juba JT 121 (IMI 32443), 1948; Rumbek JT 631 (IMI 40003), 1949; Shambe JT 693 (IMI 39974), 1949; Yambio JT 411 (1949); Yei ASB 633 (1944).

on *Spinacia oleracea* (spinach). Bor JT 1354 (IMI 45820), 1951. *Cercospora* leaf spot of *Beta*, although occasionally destructive elsewhere, is rarely destructive in the Sudan; it is widespread in the wetter areas of the country.
  on *Bidens pilosa*. Yambio JT 380 (IMI 40118), 1949, JT 571 (IMI 34258), 1948.
  on *Bidens* sp. Gilo JT 1386 (IMI 48748), 1951; Katire JT 1409, JT 1439 (IMI 48771), 1951; near Katire JT 1445 (IMI 48776), 1951; Loka West JT 1497 (1951).
  on *Chichorium endivia* (endive). Wad Medani JT 836 (IMI 44121), 1950.
  on *Sonchus* sp. Wad Medani JT 1106 (IMI 45241), 1950.
  on *Tridax procumbens*. Katire JT 1404 (IMI 48754), 1951. Leaf spotting caused by *C. bidentis* probably occurs throughout the central and southern Sudan on *Bidens* spp. and other Compositae.

  on *Brassica chinensis* (Chinese cabbage). Yambio JT 414 (IMI 40119), 1949.
  on *B. oleracea* var. *botrytis* (cauliflower). Wad Medani JT 1686 (IMI 50593), 1952.
  on *B. oleracea* var. *bullata* (cabbage). Kagelu JT (IMI 21381), 1947; Shambe JT 695 (IMI 40004), JT 698 (IMI 40005), 1949. Cercospora leaf spot is widespread but of little importance on brassica vegetables in the southern Sudan. The spots are much smaller and of a paler colour than those caused by *Alternaria brassicicola*.

C. cajani P. Henn. in *Hedwigia*, 41, p. 309, 1902.
  on *Cajanus indicus* (pigeon pea). Kagelu ASB 626 (IMI 266 and 8079), 1944; Meridi ASB 363 (IMI 8080), 1943; Yambio JT 373 (IMI 39972), JT 438 (IMI 39970), 1949. Leaf spot, widespread in Equatoria but rarely severe.

  on *Calotropis procera* (‘Dead Sea apple’). Bunziga JT 1868 (1952); Danaglia JT 1617 (1951); Hamadi–Sungikai road JT 1183 (1951); Kosti JT 1584 (1951); Port Sudan JT 1151 (IMI 45247), 1951; Port Sudan–Suakin road JT 1158 (IMI 45253), 1951; Sennar JT 1620 (1951), JT 1694 (1952); Um Ruaba ASB 489 (1943); Wad Medani ASB 723 (IMI 326), 1944, JT 1706 (IMI 50607), 1952; locality not stated IMI 8879 (1935). Causing large blackish circular leaf spots; common during the rainy season in the Gezira, central Sudan and on Red Sea coast.

C. canescens Ell. & Mart. in *Amer. Nat.*, 16, p. 1003, 1882. (Fig. 56.)
  on *Centrosema plumeri*. Yambio JT 393 (IMI 39088), 1949.
  on *Cyanopsis psoraloides* (cluster bean). Tozi JT 1853 (IMI 51189), 1952.
  on *Dolichos lablab* (dolichos bean). Ban Gedid ASB (IMI 279), 1944; Um Berembeita JT 908 (IMI 45207), 1950.
  on *Glycine max* (soya bean). Yambio JT 437 (IMI 45185), 1949.
  on *Lespedeza sp.* Tozi JT 1851 (IMI 51187), 1952.
  on *Phaseolus aureus* (green gram). Malakal JT 1552 (IMI 48808), 1951; Tozi JT 1844 (IMI 51181), 1952.
on *P. vulgaris* (haricot bean). Juba ASB 665 (1945); Kadugli JT 1036 (IMI 45229), 1950; Katire JT 1382 (IMI 48174), 1950; Loka West JT 1540 (1951); Tonj JT 650 (IMI 39969), 1949; Wau JT 660 (1949); Yambio JT 397 (1949).

on *Philippisara (Phaseolus) trilobus*. Wad Medani JT 1730 (IMI 50627), 1952.

on *Pisum sativum* (pea). Dilling JT 940 (IMI 44376), 1950; Kadugli JT 925 (IMI 44367), 1950.

on *Raphanus sativus* (radish). Rumbek JT 482 (IMI 45192), 1949.

on *Vigna unguiculata* (cowpea). Bor JT 1313 (IMI 48735), 1951; Bunziga JT 1874 (IMI 51197), 1952; Kadugli ASB 728 (IMI 329), 1944, JT 959 (IMI 44847), JT 1035 (IMI 45228), JT 1046 (IMI 46479), 1950; near Kodok JT 1559 (IMI 48540), 1951; Malakal JT 1553 (IMI 48536), 1951; Roseires JT 1880 (IMI 51199), 1952; Sungikai JT 949 (IMI 45210), 1950; Tozi JT 1845 (IMI 51182), JT 1846 (IMI 51183), 1952; Um Berembeita JT 909 (IMI 44360), 1950; Wad Medani JT 1723, 1724, 1726, 1729, 1736 (IMI 50620, 50621, 50623, 50625, 50626), 1952; Yambio JT 383 (IMI 39971), JT 424 (IMI 39959), 1949.

on *V. vexillata* (cowpea). Yambio JT 421 (IMI 39973), 1949.

on *Vigna* sp. (wild). Rashad JT 1011 (IMI 44875), 1950.

on *Vitis vinifera* (grape vine). Dilling JT 953 (IMI 44844); Kadugli JT 1005 (IMI 44873), 1950. On dead spots on leaves, probably secondary.

on *Voandzeia subterranea* (earthnut). Gumbiri JT 1481 (IMI 48189), 1951; Malakal JT 1581 (IMI 48813), 1951.

*C. canescens* causes leaf spotting on a wide range of leguminous plants in the Sudan, particularly on *Phaseolus* and *Vigna*. In a few cases (e.g. on *Vitis*) it appears to behave as a saprophyte rather than as a true parasite. Occasionally *Cercospora* leaf spot is severe on cowpea and haricot bean but the disease does not normally cause extensive damage. It is widespread in the southern and central Sudan and occurs as far north as Wad Medani (Gezira).


on *Capsicum annuum* (chilli). Wau JT 666 (IMI 39951), 1949; Yambio ASB 356 (IMI 249 & 8458), 1943. Occasionally found in the southern Sudan; leaf spot.


on *Celosia argentea*. Um Berembeita JT 988 (IMI 44870), 1950. Leaf spot.


on *Clitoria ternata*. Yambio JT 518 (IMI 36312), 1948. Leaf spot.
C. coffeicola Berk. & Cooke apud Cooke in Grevillea, 9, p. 99, 1881. See Bouriquet, p. 168; Butler, p. 485; Nowell, p. 228; Viennot-Bourgin, p. 1525. (Fig. 57.)

on *Coffea arabica* (coffee). Kagelu ASB 487 (1942), ASB 657 (IMI 273), 1944.

on *C. robusta* (coffee). Iwatoka JT 1503 (1951); Kagelu ASB 653 (IMI 272), 1944, JT 351 (IMI 45174), 1949, JT 1526 (1951); Yambio ASB 741 (1944). Brown eye spot occurs commonly on coffee in Equatoria and is occasionally quite destructive—this disease might become serious were coffee cultivation intensified in the southern Sudan.

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on *Dolichos lablab* (dolichos bean). Juba JT 117 (IMI 32434, as *Cercospora* sp.), 1947. Leaf spot and sooty mould on leaves.


on *Commelina kotschyi*. Ghadambaliya JT 1217 (IMI 47255), 1951. Leaf spot.

C. contraria Syd. in Flore Bas- et Moyen-Congo, 3, 1, p. 21, 1909.

on *Dioscorea dumetorum*. Kagelu JT 1232 (IMI 47264), 1951. Leaf spot.

C. cruenta Sacc. in *Michelia*, 2, p. 149, 1880. The perfect state has been described as *Mycosphaerella cruenta* (Sacc.) Latham in *Mycologia*, 26, p. 525, 1934. See Bouriquet, p. 468; Butler, p. 261; Stevens (1913), p. 629. (Fig. 58.)

on *Vigna unguiculata* (cowpea). Bunziga JT 1874 (IMI 51197), 1952; Shambe JT 686 (IMI 40006), 1949. In the Sudan both *C. cruenta* and *C. canescens* cause leaf spotting of cowpea but *C. canescens* is by far the commoner species. In many ways they are somewhat similar, both having unbranched conidiophores and acicular-obclavate conidia. In Sudan specimens *G. canescens* leaf spots are usually small, roughly circular, sharply defined, and often with grey centre and reddish border; those of *C. cruenta* tend to be larger, of irregular shape, darkish colour, and less well defined.


on *Ctenolepis cerasiformis*. Rashad JT 990 (IMI 44872), 1950.

on *Cucumis melo* (sweet melon). Dilling JT 964 (1950); Wad Medani JT 1254, JT 1259 (IMI 47289), JT 1630 (1951); JT 1680 (IMI 50588), 1952.

on *C. melo* var. *agrestis*. Abu Hagar JT 1788 (IMI 51139), 1952.

on *C. melo* var. ('tibish'). Wad Medani JT 1682, JT 1689 (IMI 50596), 1952.
on *G. sativus* (cucumber). Malakal JT 1345 (IMI 48517), 1951; Torit JT 238 (IMI 32447), JT 242 (IMI 32449), 1948.

on *Cucurbita maxima* (pumpkin). Kagelu ASB (1943); Meridi–Amadi road JT 458 (1949); Shambe JT 700 (IMI 40009), 1949.

on *C. pepo* (vegetable marrow). Ghadambaliya JT 1720 (IMI 50617), 1952; Wau JT 668 (1949).

on *Cucurbita* sp. (cultivated). Gumbiri JT 1482 (1951); Melut JT 1324 (1951); Wau JT 662 (IMI 44829), 1949.

on *Lagenaria vulgaris* (gourd). Alyman JT 1894 (IMI 51205), 1952; Juba JT 1911 (1952); Rumbeke JT 493 (1949); Shambe JT 699 (IMI 40008), 1949; Tokar ASB (IMI 237), 1942.

on *Luffa cylindrica* (loofah). Juba JT 1900 (1952); Sennar JT 1693 (IMI 50599), 1952; Wad Medani JT 1224 (IMI 47258), 1951.

on *Momordica balsamina*. Abu Hagar JT 1875 (IMI 51138), 1952.

on *M. foetida*. Abu Shendi JT 1842 (IMI 51179), 1952; near Alyman JT 1793 (IMI 51141), 1952.

on *Momordica* sp. Bunziga JT 1841 (IMI 51178), 1952. Leaf spotting caused by *C. cucurbitae* is widespread on cucurbits in the southern and central Sudan as far north as Wad Medani. It has also been collected in the Red Sea coastal area. It is rarely serious. The leaf spots are usually small and with whitish centres and may thus be distinguished from the larger, darker and sometimes zonate leaf spots caused by *Alternaria cucurbitae*.


**C. ficina** Tharp in *Mycologia*, 9, p. 109, 1917.

on *Ficus carica* (fig). Wad Medani JT 1739 (IMI 50635), 1952. Leaf spot.


on *Lantana* sp. Juba JT 1910 (IMI 51213), 1952, indistinct leaf spotting.


on *Pennisetum typhoides* (bulrush millet). Near Kodok JT 1555 (IMI 48538), 1951.

on *Setaria lancea*. Yei JT 535 (IMI 40121), 1949.

on *S. pallide-fusca*. El Obeid–Nahud road JT 1919 (IMI 51517), 1952. Leaf spotting, probably occurs on many grasses in the central and southern Sudan.


on *Gomphrena globosa* (globe amaranth). Yambio JT 418 (IMI 39948), 1949. Severe and disfiguring leaf and petal spotting.
C. gossypina Cooke in Grevillea, 12, No. 61, 1883. The perfect stage is reported to be Mycosphaerella gossypina (Atk.) Earle in Bull. Torrey bot. Cl., 18, p. 307, 1891. See Butler, p. 369; Stevens (1913), p. 248, (1925), p. 176; Viennot-Bourgin, p. 473.

on Gossypium hirsutum (American cotton). Dilling ASB 494 (1943); Kadugli ASB (1939), ASB 557 (1942); Lira–Juba road JT 1423 (IMI 48183), 1951; Meridi ASB (1939). Leaf spotting, occasionally found on cotton in the wetter parts of the Sudan, of no economic importance.

on Gossypium sp. (probably barbadense—Egyptian cotton). Recorded by R. E. Massey (Sudan Notes and Records, 4, 4, pp. 219–24) as Mycosphaerella gossypina, 'leaf blight' at Tokar; not since collected there.


on Steganothaenia araliacea. Kagelu JT 1644 (IMI 49962), 1951, on leaf spots and as diffuse growth on leaves.


on Manihot utilissima (cassava). Juba ASB 666 (1944), JT 1904 (1952); Kagelu ASB (1942), JT 57 (1947); Katire JT 1422 (IMI 48182), 1951; Shambe JT 701 (1949); Wau JT 670 (1949); Yambio ASB 639 (IMI 269), 1944, JT 544 (1948). A common leaf spot on cassava in the southern Sudan. It occurs mostly on old leaves and probably causes little more than slight shedding of these.

C. hibisci Tracy & Earle in Bull. Torrey bot. Cl., 22, p. 179, 1895. (Fig. 59.)

on Hibiscus esculentus (okra). Dilling JT 931, JT 932 (1950); El Obeid ASB 493 (1943), ASB 573 (1944); Juba ASB 727 (1944); Kadugli ASB 554 (1942), ASB 733 (1944), JT 917, JT 1003 (1950); Roseires JT 1876, JT 1878; JT 1889 (1952); Shambe JT 687 (1949); Um Berembeita JT 1002 (1950); Wad el Mahi JT 1887 (1952); Wau JT 657 (1949); Yambio ASB 726 (IMI 328), 1944, JT 239 (IMI 32448), 1948. Leaf spotting, typically in the form of somewhat angular brownish-green velvety patches on the lower leaf surfaces. This disease is very common on okra in the southern and central Sudan but has not been observed in the Gezira. It occasionally causes slight leaf shedding but is rarely serious. C. malayensis also occurs on Hibiscus in the Sudan but appears to be less common than C. hibisci.


on Rosa sp. (rose). Wad Medani JT 1688 (IMI 50595), 1952, slight leaf spotting.
C. ipomoeae Wint. in Hedwigia, 26, p. 34, 1887.

on Ipomoea cairica. Sakkare JT 505 (IMI 36305), 1948.

on I. cordofana. Sennar JT 1238 (IMI 47269), 1951.

on I. eriocarpa. Bunziga JT 1840 (IMI 51511), 1952; Yambio JT 522 (IMI 36315), 1948; near Yaraddi JT 1820 (IMI 51508), 1952.

on Ipomoea spp. (wild). Delami JT 1025 (IMI 45226), 1950; Katire JT 1414 (IMI 48759), 1951; Khor Nabbak JT 978 (IMI 44861), 1950; Sungikai JT 977 (IMI 44860), 1950.

on Merremia emarginata. Wad Medani JT 1108 (IMI 45242), 1950; Yousif Natscha JT 1612 (IMI 48827), 1951. Probably widespread in the southern Sudan as far north as the Gezira on Convolvulaceae. Not yet observed on sweet potato (Ipomoea batatas).


on Ceiba pentandra (kapok). Rashad JT 903 (IMI 44355, as Cercospora sp.), 1950, mild leaf spotting of seedling trees.

C. lippiae Ell. & Ev. in J. Mycol., 3, p. 20, 1887.

on Lippia nodiflora. Sennar JT 1247 (IMI 47278), 1951; Wad Medani JT 851 (IMI 44129, probably), JT 879 (IMI 46837), 1950, JT 1082 (IMI 46846), 1951. Leaf spotting, common in the Gezira area on lippia lawns.


on Lactuca sativa (lettuce). Bor JT 1466 (1951); Gumbiri JT 1478 (IMI 48526), 1951; Juba JT 560 (IMI 34256), 1948; Kadugli JT 956 (IMI 44845), JT 1033 (1950); Loka West JT 1538 (IMI 48533), 1951; Tonj JT 647 (IMI 39965), 1949; Yambio JT 417 (IMI 39962), 1949. Cercospora leaf spotting is widespread on lettuce in the Nuba Mountains and southern Sudan; occasionally it causes severe drying up of the leaves.

C. malayensis Stev. & Solh. in Mycologia, 23, p. 394, 1931. (Fig. 60.)

on Hibiscus esculentus (okra). Ghadambaliya JT 1122 (IMI 44880), 1950, JT 1676 (1952); Sennar JT 1709 (1952).


on H. subdariffa (rozelle). Wad Medani JT 1681 (IMI 50589), 1952. This leaf spot appears to be less common in the Sudan than C. hibisci. The two diseases may be distinguished by the smaller circular brown or grey spots of C. malayensis as compared with the larger angular greenish-brown velvety patches on the lower leaf surface in C. hibisci.
(Fig. 61.)

on *Mangifera indica* (mango). Kagelu ASB 357 (IMI 250 & 7709), 1943, ASB 486 (1942), JT 1523 (IMI 48798), JT 1551 (IMI 48807), 1951; Meridi–Yambio road JT 363 (IMI 45175), 1949. Leaf spotting, widespread in Equatoria but of little significance.

C. medicaginis—see *C. zebrina*.

C. melochiae P. Henn. in *Hedwigia, 43*, p. 395, 1904.

on *Melochia corchorifolia*. Near Malakal JT 1566 (IMI 48822), 1951; Sungikai JT 965 (IMI 44849), 1950. Leaf spot.

C. melongenae Welles in *Phytopathology, 12*, p. 63, 1922.

on *Solanum melongena* (eggplant). Kadugli JT 958 (IMI 44846), 1950. Leaf spotting caused by *C. solani-melongenae* also occurs in the Sudan.


on *Lycopersicon esculentum* (tomato). Bor JT 1318 (IMI 48736), 1951; Wad Medan JT 1722 (IMI 50619), 1952.

on *Nicotiana rustica* (tobacco). Katire JT 1615 (IMI 48828), 1951; Singa JT 1771 (IMI 51503), 1952.

on *N. tabacum* (tobacco). Kagelu ASB 338 (1943), ASB 652 (IMI 321), 1944, JT (1947); Wau JT 651 (IMI 40010), 1949; Yambio JT 535 (IMI 34267), 1948. ‘Frog-eye’ leaf spot is very common and sometimes severe on tobacco in the southern Sudan and in such cases the quality of the leaf is considerably lowered. Control of this disease would probably be necessary if tobacco cultivation on a commercial scale were started.

C. nigricans Cooke in *Grevillea, 12*, No. 61, p. 30, 1883.

on *Cassia tora*. Bunziga JT 1839 (IMI 51177), 1952; Roseires JT 1799 (IMI 51145), 1952.


on *Oryza sativa* (rice). Kagelu JT (IMI 21376), 1947, narrow brown leaf spot. This destructive disease is at present of little importance in the Sudan where only small areas of rice are cultivated. It might become severe if large-scale cultivation were initiated; at present it is rarely found.


on *Carica papaya* (papaw). Juba JT 1913 (IMI 51214), 1952; Kadugli JT 919 (IMI 44364), 1950; Loka West JT 1547 (IMI 48805), 1951; Sennar JT 1695 (IMI 50600), 1952; Um Berembeita JT 906 (1950). Leaf spotting, widespread but rarely severe in the central and southern Sudan.

C. personata (Berk. & Curt.) Ell. & Ev. in *J. Mycol., 1*, p. 63, 1885. The perfect state has been described in America as *Mycosphaerella berkeleyi* W. A.
on *Arachis hypogaea* (ground-nut). Dilling JT 926 (IMI 44368), JT 930 (IMI 44372), 1950; Gumbiri JT 1475 (IMI 48524), 1951; Kadugli ASB (1942), ASB 574 (IMI 264), 1944, JT (1947), JT 928 (IMI 44370), JT 929 (IMI 44371), 1950; Kagelu ASB 336 (1943), ASB 651 (1944); Kodok JT 1558 (IMI 48539), 1951; Malakal JT 1570 (1951); Roseires JT 1885 (1952);

Sungikai JT 148 (1948), JT 927 (IMI 44369), 1950; Tozi JT 1792 (1952); Wad el Mahi JT 1888 (1952); Wad Medani JT 883 (1950). This leaf-spot disease is very common on ground-nuts in the central and southern Sudan and in wet seasons may extend as far north as the Gezira. The losses of crop due to it are uncertain; in severe attacks they must be considerable. Local ground-nuts appear to be less affected than introduced varieties and quite often the disease appears late in the season when the crop is nearing maturity. See also under *C. arachidicola*, which also occurs on ground-nuts in the Sudan.


C. *pinnulaecola* Atk. in *J. Elisha Mitchell sci. Soc.*, 8, 2, p. 64, 1892.


C. ricinella Sacc. & Berl. in Atti. Ist. veneto, 6, p. 721, 1885. See Butler, p. 331 (as Cercosporella ricinella).

on Ricinus communis (castor). Bunziga JT 1873 (1952); Gumbiri JT 1492 (1951); Kagelu ASB 658 (1944); Malakal JT 865 (1950); Rashad JT 900 (IMI 44352), 1950; Terrakeka JT 1321 (1951); Yambio JT 371 (IMI 40011), 1950; Yei ASB 638 (IMI 268), 1944. Widespread in the central and southern Sudan and occasionally responsible for severe leaf spotting.


on Sesamum indicum (sesame). Dilling ASB 531 (1939), JT 938 (1950); Iwatoka JT 1517 (1951); Kadugli JT 556 (IMI 262), ASB 558 (1942), JT (1947), JT 962 (1950); Kagelu ASB 332 (1943), ASB 549 (1941), ASB 656 (1944), JT 52 (1947); Malakal JT 870 (1950), JT 1578 (1951); Melut JT 1322 (1951); Roseires JT 1886 (1952); Sungikai JT 939 (1950); Talodi ASB 535 (1939); Torit JT (1948); Tozi JT 1791 (1952); Um Gerba ASB 534 (1939); Yambio ASB (1944), JT 529 (1948). Cercospora leaf spot is extremely common on sesame in the southern and central Sudan south of the Gezira. It frequently causes severe spotting of the older leaves but the crop losses due to it are uncertain; elsewhere (e.g. India) it has been reported as a serious disease.

C. solani-melongenae Chupp apud Chupp & Doidge in Bothalia, 4, 4, p. 892, 1948. (Fig. 63.)

on Solanum melongena (eggplant). Juba ASB 348 (1943), ASB 730 (IMI 330), ASB 740 (IMI 333), 1944, JT 113 (IMI 34262), 1947, JT 558 (IMI 34261), 1948; Kagelu JT (1947); Tonj JT 644 (IMI 39960), 1949; Wau JT 656 (IMI 39961), 1949; Yambio JT 114 (IMI 34260), 1947; Yei ASB 735 (IMI 276), 1944. A common leaf spot in Equatoria and Bahr el Ghazal Provinces, occasionally but not usually severe. C. melongenae also occurs on eggplant in the Sudan but is less common than C. solani-melongenae.

C. sorghi Ell. & Ev. in J. mycol., 3, p. 15, 1887. See Sprague, p. 314. (Fig. 64.)

on Sorghum vulgare (sorghum millet). Alyman JT 1891 (IMI 51203), 1952; Dilling JT (1943); Gumbiri JT 1496 (1951); Juba JT 1906 (1952); Juba–Torit road JT 1599 (IMI 48545), 1951; Kadugli JT (1947), JT 1010 (1950); Kagelu JT (IMI 21379), 1947; Kodok JT 1556 (1951); Malakal ASB (1944), JT 887 (IMI 44839), 1950, JT 1333, JT 1334 (IMI 48514), JT 1575 (IMI 48812), 1951; Melut JT 1337 (IMI 48515), 1951; Roseires JT 1881 (IMI 51200), 1952; Rumbek JT 485 (IMI 44825), 1949; Tonj
ASB 323 (1943); Tozi JT 1850 (IMI 51186), 1952; Um Berembeita JT 1006 (IMI 44874), 1950; Wad Medani JT 1927 (1952); Yambio ASB 731 (IMI 331), 1944; Yei ASB 732 (IMI 69), 1944. A common leaf-spot disease of sorghum in the central and southern Sudan; normally it causes little appreciable loss of crop.

on *Sorghum* sp. (wild). Sennar JT 1700 (IMI 50603), 1952.

**C. subsessilis** Syd. in *Ann. mycol., Berl.*, 11, p. 329, 1913.

on *Azadirachta indica* (neem). Juba JT 1905 (IMI 51209), 1952.

on *Melia azedarach* (persian lilac). Kadugli ASB (IMI 303), 1942, JT 935 (IMI 44374), 1950; Katire JT 1456 (IMI 48187), 1951; Yei JT 1434 (1951). Leaf spotting, often quite severe and probably widespread in Equatoria and the Nuba Mountains, where this tree grows.

**C. zebrina** Passer. in *Hedwigia*, 16, 5, p. 124, 1877. See Dickson, p. 303; Stevens (1913), p. 630 (as *C. medicaginis*); Viennot-Bourgin, p. 1524.

on *Medicago sativa* (lucerne). Gandettu ASB (?IMI 8229), 1939; Nuri ASB (1939); Shendi ASB 752 (1944). Leaf spotting, occasionally fairly severe. *C. zebrina* is the only *Cercospora* sp. known to occur north of Khartoum with the exception of a few collected in the humid Red Sea coastal area. It has not been found south of Khartoum although lucerne is cultivated there (e.g. in the Gezira). North of Khartoum mean total annual rainfall ranges from almost nil to about seven inches and spread of *C. zebrina* during rainless months is presumably by wind and dew.

**C. zinniae** Ell. & Mart. in *J. mycol.*, 1, p. 20, 1885.

on *Zinnia elegans* (garden zinnia). Bor JT 329 (IMI 39946), 1949; Iwatoka JT 1511 (IMI 48192), 1951; Juba JT 1519 (IMI 48195), 1951, JT 1903 (1952); Shambe JT 680 (IMI 39947), 1949; Yambio JT 419 (IMI 39979), 1949. This disease appears to be widely distributed on zinnias in the southern Sudan. The spots occur on leaves, stem, and petals, and can be very disfiguring.

**Cercospora** spp.

on *Abutilon* spp. Wad Medani JT 853 (IMI 44131), 1950, on *A. glaucum*; Wad Medani JT 1136 (1950), on *A. pannosum*; Abu Hagar JT 1790 (IMI 51140), 1952, on *Abutilon* sp.; Sennar JT 1714 (IMI 50613), 1952, on *Abutilon* sp.

on *Annona chrysophylla*. Loka West JT 1593 (IMI 48541), 1951, on large grey zonate leaf spots with other fungi.

on *Cadaba rotundifolia*. Wad Medani JT 1093 (IMI 46848), 1950, JT 1200 (IMI 46858), 1951, JT 1733 (IMI 50630), 1952.
on *Capsicum annuum* (chilli). Iwatoka JT 1509 (IMI 48191), 1951; Juba JT 1907 (IMI 51210), 1952; Yei JT 1437 (IMI 48769), 1951. Distinct from *C. capsici*, the fungus forming small, dark, angular, felted patches on the lower leaf surfaces rather than well-defined spots.

on *Cedrela toona* (‘cedar wood tree’). Yei JT 1438 (IMI 44826), 1948, on *C. glaucescens*; near Katire JT 1444 (IMI 48775), 1951, and from Meridi–Amadi road JT 460 (IMI 40116), 1949, both on *Clematis* sp.

on *Corchorus* spp. Kadugli JT 77 (IMI 21383), JT 107 (IMI 32441), 1947, JT 955 (1950); Khor Nabbak JT 1040 (1950); Malakal JT 1573 (1951); Meridi–Amadi road JT 457 (IMI 39985), 1949; Rumbek JT 487 (IMI 39984), 1949; Sennar JT 1624 (1951), JT 1715 (IMI 50614), 1952; Shambe JT 697 (IMI 39949), 1949; Um Berembeita JT 905 (IMI 44357), 1950; Wad Medani JT 1728 (IMI 50625), 1952; Yambio JT 385 (IMI 39989), JT 399 (IMI 39987), JT 428 (IMI 39986), 1949; all the foregoing on *C. olitorius* (Jew’s mallow); Bunziga JT 1872 (1952) and Wad el Mahi JT 1808 (IMI 51153), 1952, both on *C. tridens*. This *Corchorus* leaf spot is very common throughout the southern and central Sudan and in wet seasons can be found as far north as Wad Medani. The leaf spots are small, brown, and rather inconspicuous. Apparently not *C. corchorica* or *C. corchori*, both of which have been recorded on *Corchorus*.

on *Coreopsis* sp. Um Sugura JT 1628 (IMI 48831), 1951.

on *Digera alternifolia*. Melut JT 1303 (IMI 48730), 1951.

on *Euphorbia* sp. Tonj JT 648 (IMI 40115), 1949.

on *Gutenbergia* sp. Kodok JT 1560 (IMI 48809), 1951.

on *Hyparrhenia* sp. Near Katire JT 1447 (IMI 48778), JT 1448 (IMI 48779), 1951.

on *Jacquemontia capitata*. Sungikai JT 968 (IMI 44852), 1950.

on *Leptadaenia* ?*heterophylla*. Bunziga JT 1835 (IMI 51174), 1952; Singa JT 1779 (IMI 51135), 1952.

on *Monechma* sp. Wad el Mahi JT 1810 (IMI 51507), 1952.


on *Ocimum* sp. Abu Shendi JT 1822 (IMI 51165), 1952.

on *Phyllanthus maderaspatensis*. Ghadambaliya JT 26 (IMI 21363), 1947.

on *Solanum melongena* (eggplant). Kodok JT 119 (IMI 32438), 1947, close to *Cercospora solani-torvi* Frag. & Cif. Some of the *Cercospora* spp. listed above appear to be ‘new’ in that no previous reference to *Cercospora* leaf spots on the host plants in question has been found, e.g. on *Cadaba, Cedrella, Digera, Gutenbergia, Leptadaenia*, and *Monechma*. In other cases the *Cercospora* does not agree with any previously described on the host plant concerned. Doubtless many more *Cercospora* leaf spots will be found in the central and southern Sudan, areas which, because of their climatic conditions and great diversity of vegetation, are prolific in leaf-spotting fungi.
**Circinotrichum** sp.

*on* Borassus aethiopum (dolcib palm). Alyman JT 1890 (IMI 51202), 1952, on dead leaves.

*on* Citrus nobilis (tangerine). Tonj JT 712 (IMI 39977), 1949.


**Cladosporium fulvum** Cooke in *Grevillea*, 21, p. 32, 1883. See Nowell, p. 355; Stevens (1913), p. 604, (1925), p. 400; Viennot-Bourgin, p. 1505. (Fig. 65.)

*on* Lycopersicon esculentum (tomato). Amadi ASB 361 (1943); Juba ASB 346 (1943), ASB 664 (1944); Kadugli ASB (1942), ASB 737 (1944), JT 152 (1947), JT 934 (IMI 44373), 1950; Kodok ASB 631 (IMI 322), 1944; Roseires JT 1877, JT 1883 (1952); Shambe JT 691 (IMI 39956), 1949; Suki ASB 584 (1944); Um Berembeita JT 1001 (1950). Causing leaf mould. This destructive disease is rarely serious in the Sudan but under favourable conditions it can cause considerable leaf shedding and some loss of crop. It is widespread in the southern and central Sudan as far north as Suki but has not been found in the Gezira.

*G. herbarum* (Pers.) Link ex Fr. in *Syst. myc.*, 3, p. 370, 1832. The perfect state has been described as *Mycosphaerella tulasnei* (Jancz.) Rother, but has not been found in the Sudan. See Butler, p. 177; Butler & Jones, p. 387; Padwick, p. 170; Sprague, p. 88; Stevens (1913), p. 247, (1925), p. 175; Viennot-Bourgin, p. 455. (Fig. 66.)

*on* Carica papaya (papaw). Bor JT 1351 (IMI 48518), 1951, on dead leaf tissue; Wad Medani JT 124 (IMI 32428), 1948, on moribund leaf petioles—probably saprophytic in both cases.

*on* Citrus grandis (grapefruit). Bor JT 1331 (IMI 48512), 1951, on leaf spots and dead areas of leaves.

*on* Coix lachryma-jobi (Job’s tears). Malakal JT 1554 (IMI 48537), 1951, on dead areas at margins and tips of leaves.

*on* Dolichos lablab (dolichos bean). Bouga ASB 380 (1944), JT 1296 (1951); Gandettu ASB 537 (1939), ASB (1941); Ghaba ASB (1939); Kassala ASB 566 (1944); Kitiab ASB 538 (1939). Sooty mould on leaves probably saprophytic on insect honeydew, common in the northern Sudan and Gezira.

*on* Gossypium barbadense (Egyptian cotton). Degein JT 898 (IMI 44841), 1950; Gash Delta ASB (1942); Hashaba JT 1169 (IMI 45259), 1951; Tebub JT 1094 (IMI 46849), 1951; Tendelai JT 899 (IMI 44842), 1950; Tokar ASB (1942). Sooty mould on leaves, stems, and bracts following insect infestation (often whitefly or aphids) and saprophytic on the honeydew.
thereby produced. This condition occurs in most areas of the northern Sudan where cotton is grown and can be quite severe, causing extensive leaf shedding. Various other fungi including *Alternaria* spp. are often present in the sooty mould.

on *Hibiscus esculentus* (okra). Tokar ASB (1942), as sooty mould on leaves; Wad Medani JT 147 (IMI 32427), 1948, on dead stems.

on *Oryza sativa* (rice). Malakal JT 869 (IMI 44838), 1950, JT 1569 (IMI 48198), 1951; Meridi JT 84 (IMI 21384), 1947. As black superficial mould on empty grains ("blast"), probably not parasitic. Widespread in the southern Sudan.

on *Pennisetum typhoides* (bulrush millet). Port Sudan–Suakin road JT 1167 (IMI 46852), 1951, as black mould on mature grain, with other fungi (*Alternaria, Helminthosporium*).

on *Saccharum officinarum* (sugar cane). Sakkare JT 509 (IMI 36308), 1948, on moribund shed leaves, probably saprophytic.

on *Sorghum vulgare* (sorghum millet). Katire JT 1415 (IMI 48522) 1951, slight black mould on dead leaf tissue; Mekali ASB (1942), on moribund but standing plants, probably saprophytic.

on *Tephrosia apollinea*. Kitiab ASB (1939); Zeidab ASB 536 (1939). Superficial black mould on leaves, stems, and pods.

on *Triticum vulgare* (wheat). Bouga ASB 382 (1944), black mould on leaves.

on *Vigna unguiculata* (cowpea). Debeira ASB 387 (1943), sooty mould on leaves and stems.

from soil. Wad Medani ASB (1940).

*Cladosporium herbarum* is common throughout the Sudan usually as a saprophyte on insect honeydew, dead or dying plant matter, dead leaf tissue, &c.

*Cladosporium* spp.

on *Arachis hypogaea* (groundnut). Tozi JT 1847 (IMI 51184), 1952, on leaf spots.

on *Cajanus indicus* (pigeon pea). Shendi JT 144 (IMI 32435), 1948, sooty mould on leaves. *Alternaria tenuis* also present.

on *Clitoria ternata*. Wad Medani JT 1940 (IMI 51521), 1952, as black mould on twigs.

on *Coffea* sp. (coffee). Kagelu JT (IMI 21375), 1947, on leaf spots, probably secondary.

on *Dolichos lablab* (dolichos bean). Shendi JT 145 (IMI 32437), 1948; Wad Medani JT 140 (IMI 32444), 1948. Sooty mould on leaves with other fungi.
(e.g. *Alternaria*). Widespread in the northern Sudan and Gezira, usually on insect honeydew, occasionally severe.

on *Elaeis guineensis* (oil palm). Yambio JT (IMI 36309), 1949, on leaf spots, probably secondary.

on *Ficus carica* (fig). Dilling JT 948 (IMI 46838), 1950, on leaves.

on *Medicago sativa* (lucerne). Bouga JT 143 (IMI 32436), 1947, sooty mould on leaves with other fungi.

on *Panicum maximum* (Guinea grass). Kagelu JT 350 (IMI 44822), 1949; superficial black mould on grains.

on *Phragmites* sp. Adok JT 1307 (IMI 48732), 1951, on leaf spots.

on *Setaria barbata*. Roseires JT 1800 (IMI 51146), 1952; Sungikai JT 975 (IMI 44858), 1950, black mould on grains.

on *S. chevalieri*. Yambio JT 528 (IMI 34251), 1948, black mould on grains.

on *Sida* sp. Bouga JT 1757 (IMI 51126), 1952, sooty mould associated with insect honeydew on leaves.

on *Zea mays* (maize). Tozi JT 1848 (IMI 51185), 1952, black mould on old leaves.

*Cladosporium* spp. occur on numerous plants in most parts of the Sudan. Except for *C. fulvum*, which is a true parasite, they usually behave as saprophytes and are found on the seed coats of grain, on insect honeydew, on dead leaf tissue, &c. They are a prominent component of sooty moulds but other fungi (e.g. *Alternaria*) are also commonly present. Sooty moulds occur commonly in the northern Sudan and Gezira but the significance of the various fungi present and their relationship to insect honeydew have not been investigated.

*Clasterosporium* sp.

on *Olea chrysophylla*. Gilo JT 1402 (IMI 48175), 1951, as circular patches of black mould on the upper surfaces of the leaves.

*Coniosporium* sp.

on *Annona chrysophylla*. Loka West JT 1593 (IMI 48541), 1951. On leaf spots with other fungi.

*Cordana musae* (Zimm.) Höhnel—see *Scoletotrichum musae*.

*Corynespora cassicola* (Berk. & Curt.) Wei in *Mycol. Pap.*, *C.M.I.*, 34, p. 5, 1950; *Helminthosporium cassicola*, *Cercospora melonis* and other names are given as synonyms. See Butler & Jones, p. 649 (as *C. melonis*). (Fig. 67.)

on *Aleurites montana* (tung). Yambio JT 367 (IMI 45176), 1949, mild leaf spotting of seedlings.

on *Lycopersicon esculentum* (tomato). Melut JT 1323 (IMI 48509), 1951, leaf spot.
on *Salvia leucantha* (cultivated ornamental). Iwatoka JT 1512 (IMI 48794), 1951, leaf spot.

*C. cassicola* probably occurs on other hosts in the southern Sudan.


on *Ipomoea* sp. (wild). Yambio–Meridi road JT 454 (IMI 40117), 1949, on leaf spots caused by *Alternaria solani*.

![Fig. 67.](image)

**C. lunata** (Wakker) Boedijn in Bull. Jard. Bot. Buitenz., Ser. 3, 13, p. 127, 1933. See Gilman, p. 304; Padwick, p. 172; Sprague, p. 327. (Fig. 68.)

on *Brassica oleracea* var. *botrytis* (cauliflower). Wad Medani JT 1223 (IMI 47257), 1951, with other fungi on leaf spots.

on *Dalbergia melanoxylon*. Abu Shendi JT 1823 (IMI 51166), 1952, on leaf spots.

on *Euphorbia* sp. Wau JT 653 (IMI 40114), 1949, on leaf spots.


on *Philippisara (Phaseolus) trilobus*. Wad Medani JT 1730 (IMI 50627), 1952, with other fungi on leaf spots.

![Fig. 68.](image)
on *Vigna unguiculata* (cowpea). Wad Medani JT 1723 (IMI 50620), 1952, on leaf spots with other fungi.


on *Gossypium barbadense* (Egyptian cotton). Tayiba ASB (1939), isolated from rotting roots.


on *Pennisetum pedicellatum*. Kadugli JT 1023 (IMI 45225), 1950; about 20 miles south of Roseires JT 1812 (IMI 51126), 1952, on leaf spots.

**Curvularia** sp.

from soil. Tayiba ASB (1940), isolated from soil around wilting cotton plants.

*Curvularia* spp. (especially *C. lunata*) are common soil-inhabiting fungi in the Sudan. Some occur as saprophytes on dead tissue whilst in other cases they appear to be more or less parasitic.

**Dendryphiella interseminata** (Berk. & Rav.) Bubák & Ranojevic in *Ann. mycol.*, *Berl.*, **12**, p. 417, 1914. See Gilman, p. 303 (as *Curvularia interseminata*). *Helminthosporium interseminatum* is a synonym. (Fig. 69.)

on *Vigna unguiculata* (cowpea). Yambio JT 738 (IMI 45201), 1949, on dead standing stems, probably not parasitic.

![Fig. 69.](image1)

![Fig. 70.](image2)

**Dichotomophthora portulacae** Mehrlich & Fitzpatrick in *Mycologia*, **27**, p. 550, 1935. (Fig. 70.)

on *Portulaca oleracea* (purslane). Bor JT 1319 (IMI 48508), 1951; Melut JT 1338 (1951); Tokar JT 1163 (IMI 45255), 1951. Causing extensive and at times severe leaf spotting. This disease is probably widespread in the southern and central Sudan and Red Sea coastal area.

**Fumago vagans** Pers. in *Myc. Eur.*, **1**, p. 9, 1822. Recorded by R. E. Massey on cotton and dolichos bean—see under *Capnodium* sp. (Dothideales).
Helminthosporium halodes Dreschsler var. tritici Mitra in *Trans. Brit. mycol. Soc.*, 15, p. 287, 1930. See Dickson, p. 216; Sprague, p. 366. (Fig. 71.)

on *Triticum vulgare* (wheat). Wad Medani JT (IMI 22971), 1948, isolated from foot-rot (damping off) of seedlings.

**H. maydis** Nis. & Miyake—see under *Cochliobolus heterostrophus*, reported to be the Ascomycete state of *H. maydis*.

**H. nodulosum** Berk. & Curt. apud Berk. in *Crypt. Bot.*, p. 298, 1857. See Butler, p. 241; Sprague, p. 369. (Fig. 72.)

on *Eleusine coracana* (finger millet). Kagelu ASB 659 (1944), causing leaf stripe.

**H. oryzae** van Breda—see under *Ophiobolus miyabeanus*, reported to be the Ascomycete state of *H. oryzae*.

**H. sativum** Pammel, King & Bakke in *Bull. Ia. agric. Exp. Sta.* 116, p. 178, 1910. The perithecial stage, not recorded in the Sudan, is reported to be *Cochliobolus sativus* (Ito & Kuribayashi) Dreschsler. See Butler & Jones, p. 437; Dickson, p. 37; Gilman, p. 305; Sprague, p. 376; Stevens (1913), p. 613, (1925), p. 405; Viennot-Bourgin, p. 564.

on *Hordeum vulgare* (barley). Northern Province (Berber), 1923, causing foot-rot (R. E. Massey).

on *Triticum vulgare* (wheat). Northern Province (Berber), 1923, causing foot-rot (R. E. Massey); Yambio ASB (IMI 9796), 1943, on stalks and glumes.

**H. torulosum** (Syd.) Ashby apud Mason in Annotated Account of fungi received at the Imperial Bureau of Mycology, List 2, fasc. 1, p. 35, 1928. See Viennot-Bourgin, p. 1515. (Fig. 73.)

on *Musa sapientum* (banana). Juba JT 1364 (IMI 48744), 1951, on leaf blotches.

**H. turcicum** Passer. in *Bol. Com. agr. Parmese*, No. 10, 1876. See Bouriquet, p. 304; Butler, p. 201; Dickson, p. 86; Padwick, p. 178; Sprague, p. 393; Stevens (1913), p. 613, (1925), p. 406; Viennot-Bourgin, p. 1512. (Fig. 74.)
on *Sorghum vulgare* (sorghum millet). Malakal JT 875 (IMI 44837), 1950; Tozi JT 1850 (IMI 51186), 1952; Wad Medani JT 1713 (IMI 50612), JT 1926 (1952).

![Fig. 73.](image)

![Fig. 74.](image)

on *Sorghum sp.* (wild). Renk JT 1302 (IMI 48729), 1951.

on *Zea mays* (maize). Bor JT 1315 (IMI 48506), 1951; Kadugli ASB 755 (IMI 277), 1942; Kagelu ASB 756 (1942); Loka West JT 1542 (IMI 48534), 1951; Malakal JT 868 (IMI 44836), 1950; Tozi JT 1848 (IMI 51185), 1952; Yambio ASB 643 (1944). Causing leaf spot and leaf stripe. This disease is widespread on sorghum and maize in the southern and central Sudan and sometimes as far north as the Gezira. In very wet seasons it can cause severe damage.

**Helminthosporium** spp.

on *Achyranthes aspera*. Ghadambaliya JT 138 (IMI 34268), 1948. Leaf spot.

on *Citrus* spp. Bor JT 1332 (IMI 48513), 1951, on *Citrus limonia* (lemon); Kassala JT 832 (IMI 44119), 1950, on *C. grandis* (grapefruit); Wad Medani JT 1204 (IMI 46862), 1951, on *C. aurantiifolia* (lime). In all cases on irregular greyish leaf spots and blotches with other fungi.

on *Euphorbia* spp. Danaglia JT 1631 (1951), Sennar JT 1261 (IMI 47291), 1951, JT 1696 (IMI 50601, as *Cercospora* sp.), 1952; all on *Euphorbia* spp.; Sennar JT (IMI 17576), 1947, on *E. acalyphoides*. Causing leaf spotting, common during the rainy season in the Gezira area.

on *Mangifera indica* (mango). Wad Medani JT 1203 (IMI 46861), with other fungi on leaf blotches and dead edges of the leaves.

on *Saccharum officinarum* (sugar cane). Sakkare JT 508 (IMI 36307), 1948, on leaf spots, possibly parasitic.


on *Borassus aethiopum* (Doleib palm). Alyman JT 1890 (IMI 51202), 1952, on dead leaves.

**Macrosporium** sp.

on *Gossypium barbadense* (Egyptian cotton). Tokar 1917, R. E. Massey, as ‘black rust’ on cotton leaves—possibly a reference to sooty mould.

**Mitteriella zizyphina** Syd. apud Syd. & Mitter in *Ann. mycol., Berl.*, 31, p. 95, 1933.

on *Zizyphus mauritiana*. Abu Shendi JT 1821 (IMI 51164), 1952; Juba–Torit road JT 1604 (IMI 48818), 1951; near Wad el Mahi JT 1806 (1952). Sooty mould on leaves, young thyriotheca but no mature asci have been found.

on *Z. spinha-christi* (near). Alyman JT 1796 (IMI 51143), 1952.

**Nigrospora oryzae** (Berk. & Br.) Petch in *J. Indian bot. Soc.*, 4, p. 24, 1924. See Dickson, p. 84; Padwick, pp. 92, 179; Sprague, p. 406; Viennot-Bourgin, p. 1478.

on *Bambusa* sp. (bamboo). Gumbiri JT 1483 (IMI 48528), 1951, on leaf spots caused by scale insects.

on *Beckeropsis uniseta* (probably). Near Katire JT 1449 (IMI 48780), 1951, slight leaf spotting.

on *Oryza sativa* (rice). Malakal JT 1571 (IMI 48199), JT 1634 (IMI 49956), 1951; Yambio JT 420 (IMI 45183), 1949. Leaf spotting.

on *Pennisetum typhoides* (bulrush millet). Terrakeka JT 1317 (IMI 48546), 1951, on leaf stripe.

on *Rosa* sp. (cultivated rose). Wad Medani ASB (1940), associated with leaf spotting.

In the Sudan *N. oryzae* usually appears to be only mildly pathogenic and is a common inhabitant of leaf spots, dead leaf tissue, &c. on a number of plants.


on *Oryza sativa* (rice). Yambio JT 520 (IMI 36314), 1949, on leaf spots.

on *Sorghum vulgare* (sorghum millet). Malakal JT 1663 (IMI 49969), 1951, on leaves.

*N. sphaerica* and *N. oryzae* are distinguished largely on spore size and are regarded by some as a single species.

? **Passalora** sp.

on *Tephrosia lathyroides*. Wad Medani JT 852 (IMI 44130), 1950.

on *T. uniflora*. Wad Medani JT 1113 (IMI 47246), 1950. In both cases forming black sooty mould on leaves and stems; the identity of the fungus concerned is uncertain.

on *Aleurites montana* (tung). Kagelu JT 1525 (IMI 48799), 1951, on leaf spots.
on *Cajanus indicus* (pigeon pea). Kagelu JT 61 (IMI 21378), 1947, on leaf spots.
on *Khaya grandifolia* (African mahogany). Yei JT 1435 (IMI 48768), 1951, on leaf spots of seedling trees with other fungi.
on *Mucuna pruriens* (velvet bean). Yambio JT 436 (IMI 39943), 1949, JT 534 (IMI 34254), 1948, on leaf spots.
on *Mucuna* sp. (velvet bean). Kagelu JT 60 (IMI 21377), 1947; Yambio JT 407 (IMI 44823), JT 410 (IMI 40109), JT 427 (1949), on leaf spots.
on *Phaseolus vulgaris* (haricot bean). Katire JT 1382 (IMI 48174), 1951, on leaf spots. 

*P. byssoides* occurs commonly in Equatoria on a wide range of plants, probably as a saprophyte or weak parasite on leaf spots and dead leaf tissue.

*P. lateralis* Ell. & Ev. in J. Mycol., 2, p. 104, 1886.
on *Cynodon dactylon* (cynodon grass). Sennar JT 1716 (IMI 50615), 1952; Shambe JT 689 (IMI 39966), 1949, on leaves.

*P. minutissima* Corda in Icones Fungorum, 1, p. 19, 1837.
on *Borassus aethiopum* (doleib palm). Alyman JT 1890 (IMI 51202), 1952, on dead leaves.

on *Aleurites montana* (tung). Yambio JT 593 (IMI 34234), 1948, as black mould on living twigs.
on *dead twigs* (?*Acacia* sp.). Yambio JT 630 (IMI 36343), 1948, as black mould.

on *Ageratam* sp. (wild). Kagelu JT 1530 (IMI 48801), 1951; Loka West JT 1498 (IMI 48788), 1951; Torit–Katire road JT 1600 (IMI 48814), 1951. Forming somewhat inconspicuous leaf spots; probably widespread in Equatoria.

*Ragnhildiana* sp.
on *Triumfetta* sp. Loka West JT 1520 (IMI 48797), 1951, growing on leaf hairs and forming brownish leaf spots.
Sarcopodium sp.

on *Annona chrysophylla*. Loka West JT 1593 (IMI 48541), 1951, on large grey zonate leaf spots with other fungi.

*Scoletotrichum musae* Zimm. in *Zbl. Bakt.*, *Abt. 2*, *8*, p. 220, 1902. See Viennot-Bourgin, p. 1508; Wardlaw, p. 305 (as *Cordana musae* (Zimm.) von Hohnel). (Fig. 75.)

on *Musa sapientum* (banana). Bor JT 1316 (IMI 48507), 1951. Causing leaf spotting and blotching. Elsewhere this disease can be destructive but its distribution and severity in the Sudan are not known.

**FIG. 75.**


on *Cajanus indicus* (pigeon pea). Kadugli JT 111 (IMI 32440), 1947, on leaf spots.

on *Ipomoea* sp. (cultivated hedging plant). Wad Medani JT 1209 (IMI 47248), 1951, on leaf spots with other fungi.

on *Vigna unguiculata* (cowpea). Wad Medani JT 1723 (IMI 50620), 1952, on leaf spots with other fungi.

**Stachybotrys subsimplex** Cooke in *Grevillea*, *12*, No. 61, p. 33, 1883.

on *Musa sapientum* (banana). Sennar JT 1252 (IMI 47283), 1951, on leaf blotches.

on Brachiaria brizantha. Kagelu JT 1236 (IMI 47267), 1951. False smut of grains. U. virens resembles ergot (Claviceps) in some ways, the flowers being replaced by spherical sclerotia; although its ascigerous stage is unknown some mycologists regard U. virens as an Ascomycete closely related to Claviceps.

**Moniliales: Stilbaceae**

Graphium sp.

on Azadirachta indica (neem). Omdurman JT 47 (IMI 21373), 1947, on dying branches with other fungi.


on Phaseolus vulgaris (haricot bean). Kagelu ASB 655 (IMI 323), 1944, JT 63 (1947), leaf spot, occasionally found in Equatoria but rarely severe.

Stilbella cinnabarina (Mont.) Wollenw.—see Thyronectria pseudotrichia.

Stysanus stemonites (Fr.) Corda in Icones Fungorum, 1, p. 22, 1837. See Oilman, p. 314; Viennot-Bourgin, p. 1552.

on Solanum tuberosum (potato). Northern Province ASB (1942), causing tuber rot of imported Indian seed potatoes.

**Moniliales: Tuberculariaceae**


on Brachiaria sp. Boing JT 1608 (IMI 48823), 1951, as black mould associated with Sphacelia sp. (often conidial states of Claviceps).

on Panicum maximum (Guinea grass). Kagelu JT 1646 (IMI 49963), 1951, as black mould on grains.

on Pennisetum typhoides (bulrush millet). Torit JT 702 (IMI 40016), 1949, as black mould on grains. Tolyposporium penicillariae (grain smut) also present.

*C. andropogonis* occurs on a wide range of grasses forming a black mould on the grains and associated with *Sphacelia* (often conidial stages of *Claviceps*) and the honeydew the latter produces. Probably widespread in the wetter areas of the Sudan.


**Fusarium**

This is a confused genus in which numerous species and varieties have been described; probably many are synonyms. Identification of *Fusarium* spp. is
often a complex and difficult problem involving prolonged study under strictly controlled cultural conditions—in many cases satisfactory determination can be made only by mycologists specializing in the study of *Fusarium* and allied genera. The genus was monographed by H. W. Wollenweber & O. A. Reinking ("Die Fusarien", Berlin, 1935) and page references to this monograph are quoted in the list of *Fusarium* spp. given below. Recent study (W. C. Snyder & H. N. Hansen in *Amer. J. Bot.*, 27, pp. 64–67, 1940; 28, pp. 738–42, 1941; 32, pp. 657–66, 1945; *Phytopathology*, 38, pp. 23–24, 1948) suggests that single spore cultures can eventually yield various 'species' at present regarded as distinct—it appears that drastic revision and rearrangement of the genus will be necessary. Fusaria are common inhabitants of Sudan soils and seem to flourish under the hot dry climatic conditions of the northern Sudan. Some species and strains are probably aggressive root and vascular parasites also able to survive in the soil. More, probably, are saprophytes or mild parasites able to invade damaged or weakened roots and thereby initiate root rotting with subsequent wilting and death of the plant. Sudan fusaria have been identified by or through the Commonwealth Mycological Institute, Kew, many by Dr. W. L. Gordon.

**Fusarium caeruleum** (Lib.) Sacc. in *Syloge Fungorum*, 4, p. 705, 1886. See Butler & Jones, p. 532; Gilman, p. 535; Viennot-Bourgin, p. 1565; Wollenweber & Reinking, p. 134.

on *Gossypium barbadense* (Egyptian cotton). Tayiba ASB (1939), isolated from rotted tap root. *F. caeruleum* is best known as the causal fungus of *Fusarium dry rot of potatoes*.


on *Hibiscus esculentus* (okra). Shendi ASB (1941), isolated from stem of wilted plant (with *Helminthosporium* sp.).


on *Musa sapientum* (banana). Kadugli JT (1947), isolated from petioles of wilted dying tree, with other *Fusarium* spp.

**F. equiseti** var. *bullatum* (Sherb.) Woll. See Gilman, p. 348.


**F. falcatum** App. & Woll. in Arb. k. biol. Anst. f. Land-und Forstw., 8, p. 175, 1913. Given by Wollenweber & Reinking as a synonym of *F. equiseti*.


**F. heterosporium** Nees ex Fries in *Systema mycologicum*, 3, p. 472, 1832. See Wollenweber & Reinking, p. 72.
on *Gossypium barbadense* (Egyptian cotton). Hag Abdulla ASB (1939), isolated from roots of wilting plant.

from soil. Tayiba ASB (1939), isolated from soil around wilted cotton plants.

**F. moniliforme** Sheldon—see under *Gibberella fujikuroi* (Wollenweber and Reinking, p. 98).

**F. oxysporum** Schl. ex Fr. em. Snyder & Hansen in *Amer. J. Bot.*, 27, pp. 64-67, 1940. See Sprague, p. 346; Wollenweber & Reinking, p. 117.

on *Pisum sativum* (pea). Borgeig JT (IMI 16231), 1947, isolated from rotted roots.

on *Solanum tuberosum* (potato). Kagelu JT (IMI 16232), 1947, isolated from rotting tubers.

**F. scirpi** Lamb. & Fautr. var. *caudatum* Woll. See Gilman, p. 349; Wollenweber & Reinking, p. 68.


**F. scirpi** var. *compactum* Woll. See Wollenweber & Reinking, p. 66.


on *Musa sapientum* (banana). Kadugli JT (1947), isolated from petioles of wilted dying tree with other *Fusarium* spp.

on *Vicia faba* (broad bean). Isolated from roots of wilting plants 1936-7, no locality given.

**F. scirpi** var. *longipes* (Woll. & Reink.) Woll. See Wollenweber & Reinking, p. 68.

from soil. Wad Medani ASB (1939).

**F. semitectum** Berk. & Rav. in *Grevillea*, 3, p. 98, 1875. See Gilman, p. 344; Wardlaw, p. 475; Wollenweber & Reinking, p. 58.

on *Musa sapientum* (banana). Kadugli JT (1947), isolated from rhizome of wilted dying tree with other *Fusarium* spp.


on *Musa sapientum* (banana). Kadugli JT (1947), isolated from petioles of wilted dying tree with other *Fusarium* spp. as *F. solani* sensu Snyder & Hansen (see *Amer. J. Bot.*, 28, pp. 738-42, 1941).

from soil. Wad Medani ASB (1940).
F. solani (Mart.) var. martii (App. & Woll.) Woll. See Butler & Jones, pp. 607, 620; Gilman, p. 338; Wollenweber & Reinking, p. 136.


from soil. Wad Medani ASB (1940).

F. solani (Mart.) App. & Woll. var minus Woll. See Gilman, p. 337; Wollenweber & Reinking, p. 134.


F. vasinfectum var. inodoratum Woll. in Phytopathology, 3, p. 29, 1913. See Wollenweber & Reinking, p. 125 (as F. vasinfectum f. 1 Woll.).


In some countries (e.g. U.S.A.) F. vasinfectum is the cause of a destructive wilt disease of cotton. Although this fungus has been cultured from rotting roots of wilting cotton plants in the Sudan, the incidence of Fusarium wilt is sporadic and rarely more than occasionally severe in small scattered patches. Many Fusarium spp. have been isolated from cotton roots and it is likely that most of them are soil-inhabiting fungi of varying but normally slight pathogenicity. Possibly they are unable to invade healthy well-developed undamaged roots of plants growing under favourable soil and climatic conditions with adequate but not excessive water, but can invade and rot damaged or weakened roots with subsequent wilting and death of the plant. In the Sudan Fusarium wilt of cotton does not appear as a single and well-defined disease as is the case in some countries. Wilting associated with Fusarium spp. can often be recognized by the reddish colour of the vascular cylinder in rotted roots, as seen when the root is cut longitudinally down the middle.


on Pennisetum sp. (wild). Wad el Mahi JT 1898 (IMI 51207), 1952, leaf spot.

on Sorghum vulgare (sorghum millet). Katire JT 1405 (IMI 48177), 1951; Malakal JT 887 (IMI 44830), 1950, JT 1575 (IMI 48812), JT 1663 (IMI 49969), 1951; Roseires JT 1881 (IMI 51200), 1952; Rumbek JT 485 (IMI 44825), 1949; Sungikai JT 941 (IMI 44380), 1950. Causing zonate leaf spotting. In many cases the sclerotia are mostly superficial as in Ramulispora but most of the conidia are unbranched and cannot therefore be
referred to *Ramulispora*, which has characteristically branched conidia. *Ramulispora sorghi* occurs in the Sudan but, pending further investigation, the forms with unbranched conidia are listed here under *Gloeocercospora*.

on *Sorghum* sp. (wild). Renk JT 1302 (IMI 48729), JT 1583 (IMI 49955), 1951, leaf spot.

? *Gloeocercospora* sp.

on *Eleusine coracana* (finger millet). Loka West JT 1546 (IMI 48535), 1951, leaf spot.


on *Phragmites communis*. Singa JT 1776 (IMI 51133), 1952.

on *Phragmites* sp. Adok JT 1535 (IMI 48804), 1951, on leaf spots.

*Myrotheciella* sp.

on *Loranthus* sp. Dilling JT 1053 (IMI 45235), 1950, on living stems.


from soil. Tayiba ASB (1940), isolated from soil around wilting cotton plants.

*Myrothecium* sp.

on *Carica papaya* (papaw). Loka West JT 1547 (IMI 48805), 1951, on leaves.

on *Lepidagathis* sp. Tonj JT 638 (IMI 45195), 1949, on leaf spots.

on *Mangifera indica* (mango). Wad Medani JT 1203 (IMI 46861), 1951, on leaf blotches and necrotic tissue at edges of the leaves, with other fungi.


on *Sorghum vulgare* (sorghum millet). Yambio JT 606 (IMI 34231), 1948, black mould on moribund stalks.

on *dried thatching grass*. Abu Shendi JT 1864 (1952), black mould. A common saprophyte on old grass stalks and bamboo in the central and southern Sudan.

*Pucciniopsis* sp.

on *Hyphaene thebaica* (dom palm). Khartoum R. E. M. (1934), probably not parasitic—no further details available.


on *Sorghum purpureo-sericeum* (wild ‘anis’ grass). Um Sugura JT 1651 (IMI 49966), 1951, leaf spot.

on *S. vulgare* (sorghum millet). Near Sennar JT 1711 (IMI 50610), 1952; Wad
Medani JT 1712 (IMI 50611), JT 1744 (IMI 50638), 1952, leaf spot and sooty stripe. Probably widespread on *Sorghum* spp. in the central and southern Sudan—see also under *Gloeocercospora*.

**Spegazzinia tessarttha** (Berk. & Curt.) Sacc. in *Sylloge Fungorum*, 4, p. 758, 1886. See Padwick, p. 182 (as *S. ornata* Sacc.).

on *Mangifera indica* (mango). Um Berembeita JT 911 (IMI 44361), 1950, on leaf blotches.

on *Pennisetum typhoides* (bulrush millet). Katire JT 1417 (IMI 48180), 1951, on leaf spots.

**Sphacelia** sp.

on *Brachiaria* sp. Boing JT 1608 (IMI 48823), 1951, on grain with *Cerebella andropogonis*. *Sphacelia* spp. are often conidial states of *Claviceps* but no true sclerotia (ergots) or perithecia have been found in the Sudan—it is possible that such occur in the colder wetter parts of the country.

**UNIDENTIFIED FUNGI**

Several unidentified fungi associated with plant diseases have been found, in most cases the sporing stage of the fungus concerned has not been present. The more important ones are listed below.

**Black leaf blotch of *Hyparrhenia* and *Imperata***.


The fungus is superficial but apparently parasitic and occurs as elongated black patches on the leaves. Possibly these are of a sclerotial nature and no spores have been observed. This disease is not uncommon in the southern Sudan and what appears to be the same fungus has been collected in West Africa on *Andropogon* and *Imperata*.

**Zonate leaf spot of leguminous plants.**

On *Crotalaria juncea* (sann-hemp), Yambio JT 434 (IMI 39958), 1949; *Phaseolus aureus* (green gram), Yambio JT 426 (IMI 39957), 1949; *P. lunatus* (Lima bean), Yambio JT 435 (IMI 39967), 1949; *P. mungo* (black gram), Yambio JT 366 (IMI 39968), 1949; *Vigna ? caerulea* (wild), Meridi-Mundiri road JT 466 (IMI 45190), 1949; *V. unguiculata* (cowpea), Yambio JT 383 (IMI 39971), 1949, JT 424 (IMI 39959), 1949, JT 532 (IMI 36319), 1948; *V. vexillata* (cowpea), Yambio JT 421 (IMI 39973), 1949.

The leaf spots are coarsely zonate in appearance, consisting of several concentric rings of dead tissue surrounding a small central white spot; the outer rings tend to become darker in colour. They vary greatly in size and sometimes reach a diameter of about 2 cm. In the centres of the spots numerous tiny black bodies are to be seen but no spores have been found. Sometimes
other fungi, e.g. *Cercospora canescens*, are also present. This disease is often severe and can lead to heavy leaf shedding and almost complete loss of crop, at times rendering cultivation unprofitable. It has been found only on leguminous plants and only in Equatoria Province. At first it was thought that the fungus might be *Aristastoma oeconomicum* (Ellis & Tracy) Tehon (in *Mycologia*, 37, pp. 37–45, 1945), which causes a zonate leaf spot on *Vigna* and *Phaseolus* in the U.S.A. The symptoms are very similar but no true pycnidia with spores have been found in the Sudan specimens—the tiny black bodies present in the latter appear to be sclerotia rather than pycnidia.

Seedling blight of *Daniellia*.

On *D. thorifera*, Yei JT 1428 (IMI 48185), JT 1521 (IMI 48196), 1951.

This is a very destructive disease causing extensive leaf necrosis and shedding. Numerous small dark raised fungus fructifications occur on the undersides of the leaves, in some cases almost completely covering the leaf surface. With these are associated extensive patches of dead and dying tissue. The fructifications are those of an Ascomycete with bicellular hyaline ascospores. There appears to be no previous record of this or similar disease on *Daniellia* and a suitable genus for the fungus has not yet been found.

**ALGAE**


See Bouriquet, p. 277; Butler, p. 413; Nowell, p. 152.

This alga occurs on various plants in the southern Sudan where annual rainfall is high. It can live epiphytically but is often a true parasite on leaves and stems. In the Sudan it is rarely serious and has been collected on *Anacardium occidentale* (cashew nut), Equatoria ASB (IMI 298), 1942; *Coffea arabica* (arabica coffee), Imatong Mountains JT 1299 (1951); *C. robusta* (robusta coffee), Iwatoka JT 1503 (1951), Kagelu ASB (IMI 297), JT 351 (1949); *Khaya senegalensis* (African mahogany), Tonj JT 640 (IMI 45196), 1944. *Mangifera indica* (mango), Kagelu ASB 660 (IMI 274), 1944, Yambio ASB 722 (1944). Causing ‘red rust’, widespread in Equatoria.

**BACTERIA**

There are many records of bacterial diseases of wild and cultivated plants in the Sudan, particularly in areas with moderate or heavy rainfall. In most cases they have been determined as bacterial on symptoms only, except for a few destructive bacterial diseases of crops. Bacterial diseases in which the causal organism has been cultured and identified or those which appear to be identical with described crop diseases are listed first, and suspected but unidentified bacterial diseases follow. In most cases the system of classification and nomenclature proposed by W. J. Dowson (*Manual of Bacterial Plant Diseases*, London, A. & C. Black, 1949) is adopted. This book and those by E. F. Smith (*Bacterial Diseases of Plants*, W. B. Saunders Co. Philadelphia and London, 1920) and C. Elliott (*Manual of Bacterial Plant Pathogens*, Chronica Botanica Co., Waltham, Mass., U.S.A., 1951) should be consulted for further information on some of the diseases listed below.
**Bacterium tumefaciens** Smith and Townsend in *Sci.*, N.S., 25, p. 671, 1907

See Dowson, p. 143; Elliott, p. 5 (as *Agrobacterium tumefaciens*); Smith p. 413.

Galls closely resembling those caused by the crown-gall bacterium, *B. tumefaciens*, have been found on rose (*Rosa* sp.) at Wadi Halfa and on Deccan hemp (*Hibiscus cannabinus*) at Wad Medani. The galls occur mostly on the root or stem just below soil level; this disease has not been investigated.

**Erwinia carotovora** (Jones) Holland in *J. Bact.*, 5, p. 222, 1920. See Dowson, p. 135 (as *Bacterium carotovorum*); Elliott, p. 39; Smith, p. 223 (as *Bacillus carotovorus*).

*E. carotovora* is a widespread wound parasite which causes characteristic soft rots of fleshy tissues, particularly of storage organs, e.g. carrots, turnips, potatoes, &c. In the Sudan it has been recorded only on the carrot (*Daucus carota*) and is occasionally found attacking waterlogged plants in the Gezira.

**Pseudomonas sesami** Malkoff in *Zbl. Bald.*, 16, p. 665, 1906. See Elliott p. 87 (Bacterium sesami, B. sesamicola, Phytomonas sesami, and P. sesamica are given as synonyms).

Known as *marad ed dum* (‘blood disease’) this disease is very common and often severe in areas of rain-grown sesame (*Sesamum indicum*). At times it can be responsible for heavy loss of crop. It occurs throughout the wetter parts of the Sudan as far north as about 14° N. and is widespread in the central rainlands and Nuba Mountains where large areas of sesame are grown. Little is known of this disease in the Sudan and it needs investigation. It is reported to occur in East Africa, Bulgaria, North and South America, Tanganyika, and Italian Somaliland; its only known host is *Sesamum*.

**Xanthomonas malvacearum** (E. F. Sm.) Dowson in *Zbl. Bakt.*, 100 (9/13), pp. 177–93, 1939. See Dowson, p. 117; Elliott, p. 122; Smith, p. 314 (as *Bacterium malvacearum*).

Blackarm disease occurs on Egyptian cotton (*Gossypium barbadense*) and American cotton (*G. hirsutum*) in the Sudan. It is also known as angular leaf spot, bacterial boll rot or gummosis. This is the most serious disease of cotton in the Sudan and attains its maximum destructiveness on susceptible Egyptian type cotton cultivated in the Gezira where elaborate control measures must be employed to minimize its devastating effects. American type cottons are on the whole more resistant, but blackarm can be responsible for considerable crop losses to rain-grown American cotton in the central rainlands, Nuba Mountains, and southern Sudan. It occurs throughout the Sudan except in the extreme north where annual rainfall is usually nil. Experimentally the disease has been transmitted to various species of *Gossypium*.

**X. phaseoli** (E. F. Sm.) Dowson in *Zbl. Bakt.*, 100 (9/13), pp. 177–93, 1939.

See Dowson, p. 125; Elliott, p. 128; Smith, p. 280 (as *Bacterium phaseoli*).

This bacterial blight is common and often severe on dolichos bean (*Dolichos lablab*) and probably on other leguminous plants in the Gezira and central Sudan—particularly in the former area where dolichos bean is the main fodder crop. On early sown dolichos it can be extremely destructive and to escape
FUNGI AND PLANT DISEASES IN THE SUDAN

its ravages the crop is often sown late, when the rains which spread the disease are drawing to a close. The disease is rarely serious in the drier areas north of Khartoum. What may be the same disease has been observed attacking cowpea (Vigna unguiculata) and soya (Glycine max). The disease on the latter may be X. phaseoli var. sojense (Hedges) Starr and Burkholder (see Elliott, p. 132). Suspected bacterial diseases have been noticed on several cultivated legumes including velvet bean (Mucuna spp.) and various species of Phaseolus but little is known of them and investigation is needed.


Leaf blight of castor (Ricinus communis) is widespread in the Gezira, central Sudan, and as far north as Khartoum and Kassala. It can be severe and control would probably be necessary if intensive castor cultivation were ever initiated in the Gezira or southwards. The disease occurs in Eastern Asia, Italian Somaliland, and Uganda, and is known to attack only Ricinus.

X. solanacearum (E. F. Sm.) Dowson in Trans. Brit. mycol. Soc., 26, pp. 4–14, 1943. See Dowson, p. 102; Elliott, p. 139; Smith, p. 177 (as Bacterium solanacearum).

Brown rot (wilt), caused by X. solanacearum, occurs mostly in tropical and sub-tropical countries. Its hosts include tobacco, potato, ground-nut, &c. In the Sudan it was recorded by R. G. Archibald (1927) as Phytomonas ricini Archibald, causing black rot of castor (Ricinus communis). See Trop. Agric. Trinidad, 4, pp. 124–5, 1927.

Other bacterial diseases

Suspected but unidentified bacterial diseases have been observed on many plants in the Sudan, including the following.

Cassia acutifolia, C. obovata, C. tora, and Cassia spp. in the central Sudan.
Numerous black spots and lesions occur on leaves, stems, and pods. This disease is widespread and often severe.

Corchorus fascicularis and C. olitorius (Jew’s mallow). Symptoms are black irregular leaf spotting. This disease is common during the rainy season in the Gezira and central Sudan.

Euphorbia acalyphoides and spp. Greenish ‘water-soaked’ spots occur on the leaves; later they become black. Common in the Gezira during the rainy season. What appears to be a similar disease occurs on Phyllanthus niruri in the Gezira.

VIRUS DISEASES

Plants showing symptoms strongly suggestive of virus diseases are frequently encountered. Some of the commoner virus diseases of crop plants in the Sudan have been identified, on symptoms, with similar crop diseases described from elsewhere and known to be virus in origin. These I have listed under the accepted names. Others which cannot be even approximately identified and which have not been investigated I have listed under ‘suspected virus diseases’. By and
large, virus diseases other than cotton leaf curl have not been studied in the Sudan and several suspected virus diseases of crop plants need detailed investigation. Information concerning the identified virus diseases will be found in the books by K. M. Smith (Textbook of Plant Virus Diseases, London, Churchill, 1937) and by F. O. Holmes (Handbook of Phytopathogenic Viruses, Burgess Publishing Co., Minneapolis, U.S.A., 1941).

Cotton leaf curl virus

Synonyms include Gossypium virus 1. Farquharson and Ruga gossypii Holmes.

See Holmes, p. 116; Smith, p. 90. This virus disease has recently been monographed (S. A. J. Tarr, Leaf Curl Disease of Cotton, The Commonwealth Mycological Institute, Kew, England, 1951).

Leaf curl is commonly found on various Malvaceous plants, especially Hibiscus esculentus, throughout the Sudan. It can cause heavy crop losses to Sakel cotton in the Gezira and elsewhere and to okra (Hibiscus esculentus) in most parts of the country. Its known hosts in the Sudan, including experimental transmissions, are listed below. Two sets of symptoms are known to be caused by this virus, (a) typical leaf curling with vein thickening and sometimes formation of enations (b) typical mosaic with leaf distortion and asymmetry but without vein thickening. In the Sudan (a) is more usual whilst (b) has been noted only on some varieties of Gossypium hirsutum; in the latter both may occasionally occur on the same plant. It may be that these two symptom pictures are caused by two strains of the virus; this needs investigation.

? on Abutilon. Abutilon sp. has on rare occasions been reported to show leaf curl symptoms but the present author, although he has examined many Abutilon plants growing amongst and near heavily infected cotton, has not seen infected Abutilon. All experimental attempts to infect it have failed—it must be very highly resistant.

on Althaea. Most species of Althaea tested were very susceptible to leaf curl, developing strongly curled leaves with thickened veins. They included A. kurdica, A. pontica, A. rosea, and A. sulphurea. Of these, A. rosea (cultivated hollyhock) is sometimes found with evident leaf curl symptoms in Gezira gardens. This genus seems to be very susceptible.

on Gossypium. The Sakellarides (‘Sakel’) variety and most other varieties of G. barbadense (Egyptian cotton) are very susceptible although resistant strains can be selected. Sakel cotton in the Gezira, Gash Delta, and Tokar can be severely attacked. American cottons (G. hirsutum) are somewhat more resistant and rarely suffer severely in the Sudan; some develop mosaic rather than leaf curl symptoms whilst others develop both. In general, Sakel and Sea Island cottons, and their hybrids, are susceptible to leaf curl disease. American cottons are on the whole less susceptible whilst most Asiatic cottons (e.g. G. herbaceum and G. arboreum) appear to be highly resistant.

on Hibiscus. In the Sudan wild Hibiscus spp. are rarely found with leaf curl symptoms. The cultivated H. esculentus (okra), H. sabdariffa (roselle), and
ADDENDUM

Cassava mosaic virus

Synonyms include *Manihot virus 1*. Dammer and *Ruga bemisiae* Holmes. See Bouriquet, p. 198; Holmes, p. 117; Smith, p. 94.

This destructive disease is extremely common in the southern Sudan and causes considerable crop losses. It has been reported as far north as Singa and Sennar but cassava is rarely cultivated this far north. In some parts of Equatoria almost every cassava plant shows infection, probably due to widespread distribution of cuttings taken from infected plants. Some control might be obtained by the exclusive planting out of cuttings from propagation plots kept free from mosaic by careful and repeated roguing but development of resistant cassava varieties, as elsewhere in Africa, would be a better method of control. In the Sudan *Manihot utilissima* (cassava), *M. aipi*, and (occasionally) *M. glaziovii* ('Ceara' rubber tree) show symptoms. Cassava mosaic is known to attack only *Manihot* spp. and has been reported from Java and many African countries.
H. cannabinus (Deccan hemp) are susceptible in that order. In experimental transmissions H. diversifolius and H. Huegelii have been infected but the latter appears to be resistant. H. esculentus is very susceptible and leaf curl causes heavy losses to this crop in most parts of the Sudan. In all cases leaf curl rather than mosaic symptoms occur.

on Lavatera. L. cretica has been experimentally infected and developed characteristic leaf-curl and vein-thickening symptoms.

on Malva. M. moschata developed slight vein thickening when experimentally inoculated.

on Malvaviscus arboreus. This ornamental shrub developed typical leaf curl symptoms when introduced into the Gezira some fifteen years ago. Transmission experiments indicate that it is a host plant of the cotton leaf-curl virus and its cultivation in the Gezira is now prohibited. Infected Malvaviscus has been noted at Wadi Halfa on the Sudan–Egyptian border in the extreme north of the Sudan but leaf curl has not been reported on cotton in Egypt, although susceptible varieties are cultivated there.

on Sida. S. alba (= S. spinosa) can with difficulty be infected experimentally with the cotton leaf curl virus and develops slight but definite vein thickening. Infected plants are only rarely found, and have been observed in the Gezira, Gash Delta, and at Shendi (Northern Province). S. cordifolia has on one occasion been reported with typical leaf-curl symptoms (in the Nuba Mountains).

The cotton leaf curl virus probably occurs throughout the Sudan, particularly in the northern half of the country. It is also found in West Africa but is not known to occur elsewhere; it appears to be restricted to the family Malvaceae.

Ground-nut rosette virus

Synonyms include Arachis virus 1. Zimmerman and Marmor arachidis Holmes. See Bouriquet, p. 338; Holmes, p. 67; Smith, p. 185.

The disease is reported by A. S. Boughey (1946) as common on ground-nuts in Equatoria Province of the Sudan. The symptoms associated with this virus show much variation, due, possibly, to the existence of several strains. In the Sudan it is rarely reported as serious, neither has it been recorded elsewhere than from Equatoria Province. In other countries it can cause heavy crop losses. It occurs in tropical and sub-tropical Africa and in Java. No other host plant is known with certainty although several, e.g. Petunia, Vinca, Calliopsis, and Calendula, are suspected. In the Sudan the disease has been determined on symptoms only.

Maize streak virus

Synonyms include Zea virus 2. Storey and Marmor maidis var. typicum Holmes. See Holmes, p. 56; Smith, p. 441.

Plants with typical maize streak symptoms are often seen in the southern Sudan and it is reported that this disease is occasionally severe. No experimental work has been carried out and the disease has been identified on
symptoms only. In other countries it can be responsible for heavy crop losses. It is known to occur in many parts of Africa but not elsewhere. Various grasses are thought to be susceptible, including *Digitaria horizontalis* and *Eleusine indica*, both of which occur in the southern Sudan.

**Tobacco leaf curl virus**

Synonyms include *Nicotiana* virus 10 Storey, Tobacco Kroepoek virus and *Ruga tabaci* Holmes. See Bouriquet, p. 321; Holmes, p. 115; Smith, p. 262.

Tobacco plants with symptoms unmistakably those of tobacco leaf curl are frequently encountered in the southern Sudan. This disease, although at present unimportant, might become very destructive if commercial cultivation of the crop were initiated. Tobacco leaf curl is widely distributed in tropical countries, occurring in many parts of Africa, India, Java, and Rumania. Its host range is fairly wide but appears to be restricted to the families Solanaceae and Compositae.

**Tomato spotted wilt virus**

Synonyms include *Lycopersicum* virus 3 Brittlebank and *Lethum australiense* var. *typicum* Holmes. See Butler & Jones, p. 683; Holmes, p. 136; Smith, p. 296.

This virus has a very wide host range and occurs in many parts of the world. Tomato plants with typical bronzing of the leaves are sometimes found in the Gezira and fruits may bear pale yellowish areas, usually roughly circular in outline. The condition has not been investigated—the tomato spotted wilt virus may be the cause.

**Other virus diseases**

Various suspected but unidentified virus diseases are noted under host plants below.

*Acalypha indica*. Leaf curl. Occasional plants with thickened curled leaves have been found in Kordofan and in the Gezira. In some cases slight vein thickening occurs.

*Bougainvillaea* sp. Mosaic. Marked yellow-green mosaic with slight leaf distortion. Occasionally found in the Wad Medani area.

*Carica papaya* (papaw). Described as ‘bunchy top’ and as occurring in the northern half of the Sudan by Boughey (1946). The young leaves form a dense whorl at the top of the tree and become cupped, the affected tree becomes sterile.

*Cassia tora* and *C. occidentalis*. Mosaic, severe leaf distortion and dwarfing. Common in the central Sudan.

*Citrullus vulgaris* (water melon). Leaves dwarfed, distorted, and with indistinct mosaic. Observed in the Gezira and Nuba Mountains. It resembles a suspected virus disease of *Cucurbita* spp. (see below).

*Clematis glaucescens*. Well-defined mosaic with slight leaf puckering. Recorded from Yambio.
Clitoria ternata. Pronounced yellow-green mosaic, no marked distortion or leaf curling. From Upper Nile Province.

Corchorus spp. Leaf asymmetry, curling and slight light-dark green mosaic. Noted on *C. fascicularis* at Wad Medani as quite common and on *C. olitorius* (Jew’s mallow) at Kadugli.

Cosmea sp. (cultivated cosmos). Narrowing and twisting of the young leaflets accompanied by some vein clearing. Observed by A. S. Boughey at Wad Medani.

Cucumis melo (sweet melon). Indistinct mosaic with slight leaf distortion and vein thickening—occasionally found in the Gezira.

Cucurbita spp. Marked brown-green blister mosaic with severe leaf distortion and puckering. On *C. maxima* (pumpkin) the leaf lobes were elongated and narrowed into strap-like processes with ‘frilled’ ends. Observed in the Nuba Mountains and elsewhere in the central Sudan, almost certainly a virus disease and very destructive. Various mosaic diseases are often to be observed on cucurbits in many parts of the Sudan. None has been investigated.

Datura stramonium (thornapple). Severe leaf distortion and mosaic are common on thornapple plants in the Roseires area.

Dolichos lablab (Dolichos bean). A sharply demarcated and striking bright yellow-green mosaic is widespread on Dolichos bean in the Gezira and northwards. The mosaic pattern is usually small and without vein thickening. Occasionally some leaf asymmetry is also present. This is almost certainly a virus disease and it has been suggested that its vector is the cotton whitefly (*Bemisia gossypiperda*).

Euphorbia heterophylla. This was recorded by Boughey, who observed it at Wad Medani. The youngest leaves showed lighter green raised venation but very little distortion.

Ipomoea batatas (sweet potato). A mosaic of this plant was described by Boughey (1946) as widespread in the southernmost province of the Sudan. The present writer has observed a sweet potato mosaic at Wad Medani, the leaves showing an inconspicuous light-dark green streak mosaic with no evident leaf distortion.

Lannea humilis. A conspicuous yellow-green mosaic without leaf distortion or thickening has been observed on this plant in the central rainlands.

Lycopersicon esculentum (tomato). Leaf curl: this unidentified but suspected virus disease is very common on tomatoes in many parts of the Sudan, particularly in the north. It is often responsible for heavy loss of crop and can in some seasons render tomato cultivation unprofitable. The symptoms vary considerably, and it may be that more than one virus is involved. The leaves are dwarfed and curled whilst the internodes tend to shorten, giving the plant a stunted bushy appearance. Leaf thickening is sometimes present but not vein thickening or mosaic. Infected plants become sterile but are not killed. The virus is thought to be transmitted by the cotton whitefly, *Bemisia gossypiperda*. It has not been found to be sap-inocuable or
transmitted through seed. Further investigation is needed since the symptoms of this disease do not tally with those produced by any of the numerous tomato viruses described in the literature. The most promising control methods are by breeding of resistant varieties and by enforcement of a close season between successive tomato crops, e.g. in May and June in the Gezira. Various mosaic diseases have been noted on tomatoes in most parts of the Sudan.

*Medicago sativa* (lucerne). A suspected virus disease, ‘little leaf’ has been recorded by Boughey (1946) as occurring occasionally in Northern Province and the Gezira. The present author has observed lucerne plants with yellow-green stripe mosaic in the northern Sudan. Nothing is known of these two virus diseases, if indeed they are such.

*Momordica cymbelaria*. Mosaic with vein clearing but little leaf distortion has been observed on this plant in the Gezira by A. S. Boughey.

*Ocimum basilicum*. Leaf curling with thickening and some distortion has been observed on this plant in the Gezira (ASB 1941, 1943).

*Petunia* sp. Virus symptoms are often to be found on this plant in the Gezira. They vary considerably from leaf thickening, cupping, and dwarfing to vein clearing and indistinct mosaic.

*Phaseolus* spp. (haricot bean, &c.). It is likely that several viruses attack this plant in the Sudan. The commonest is ‘curly top’ of haricot bean, *P. vulgaris*, the most serious disease of this crop in the Sudan. Symptoms are stunting and internode shortening thus leading to a characteristic bushy habit of growth. The leaves become dwarfed and cupped and show some thickening but no mosaic. Severely infected plants are completely distorted and sterile. The disease occurs throughout the northern half of the Sudan but is particularly severe and can cause heavy crop losses north of Khartoum. As with tomato leaf curl it reaches its maximum destructiveness in hot weather. Curly top is thought to be a virus disease and its destructive nature warrants detailed investigation. What appears to be a different disease has been observed in the Nuba Mountains on *P. vulgaris* and *P. acutifolius* (Tepary bean). Affected plants were severely stunted, the leaves being dwarfed, asymmetrical in shape and with a fairly distinct light-dark green mosaic. In many cases the leaf laminas were greatly narrowed and the plants sterile. This disease may be related to a similar disease recorded on *Vigna unguiculata* in the same area—see below.

*Physalis peruviana* (cape gooseberry). A suspected virus disease, ‘leaf curl’, has been recorded on this plant by Boughey (1946) as widespread in the Gezira and Khartoum areas. Symptoms include leaf distortion, narrowing and reduction, but no apparent mosaic.

*Sesamum indicum* (sesame). In recent years a serious suspected virus disease of sesame has been noted in the Nuba Mountains area. The leaves of infected plants become leathery and of a darker green colour with the veins sunken and thickened. They are reduced in size and curl over, thus becoming downwardly concave. Leaves and flowers tend to bunch at the top whilst the flowers remain green and sterile. This disease may be caused by
a virus but investigation is needed. A somewhat similar uninvestigated
disease has been reported in Uganda.

*Thunbergia* sp. (cultivated), ‘Black-eyed Susan’. A leaf-curl disease with vein
thickening has been observed on this plant in Wad Medani ASB (1941).

*Vigna unguiculata* (cowpea). A mosaic disease of cowpea has been recorded
by Boughey (1946) in the Gezira and northern Sudan; it may have affi-
nities with the *Dolichos* mosaic mentioned above but the symptoms in the
latter are much more striking.

A leaf curl disease of cowpea is common and often severe in the Nuba
Mountains and central Sudan, where it can cause heavy loss of crop.
Infected plants are badly distorted and the leaves are markedly curled,
asymmetric, puckered, and often show a more or less distinct light green
or brown–dark green strip mosaic. This disease needs investigation.

*Zinnia* sp. Zinnia mosaic has on occasions been observed in the Gezira;
nothing is known of it.

**NON-PARASITIC DISEASES**

Cases of leaf spotting or striping and other symptoms apparently not asso-
ciated with the presence of any parasitic fungus or bacteria are sometimes met
with in the Sudan as elsewhere. In some cases these conditions are almost
certainly ‘functional disorders’ or ‘non-parasitic diseases’. The commoner and
more important ones are listed below in alphabetical name order of the genera
concerned.

*Citrus* spp.

Among the commoner non-parasitic conditions are:

**Foliocellosis** (mottle leaf). This may in some cases be associated with zinc
deficiency but it has not been investigated in the Sudan. It has been
observed on *C. aurantium* (bitter orange), *C. grandis* (grape-fruit), *C. nobilis*
tangerine), and *C. sinensis* (sweet orange) in the central and northern
Sudan. See Fawcett, p. 353.

**Gum spot** on leaves. This malady can be induced by slight sun-burning and
also, it is said, by lack or excess of certain elements. It occurs on bitter
and sweet orange, grape-fruit, lemon (*C. limonia*), lime (*C. aurantiifolia*), and
tangerine in many parts of the Sudan and particularly in the north. See
Fawcett, p. 267.

**Twig gummmosis.** Splitting of twigs with accompanying gum production
and—sometimes—leaf shedding and death is occasionally observed on
various *Citrus* spp. in many parts of the Sudan, particularly on grape-fruit
and sweet orange in the north. Elsewhere these symptoms are sometimes
associated with the attack of certain fungi and bacteria but in the Sudan
it appears to be largely non-parasitic and often associated with the advent
of cold weather. See Fawcett, p. 333.

**Sun spot** of fruit. The spot is usually an irregularly rounded area up to
about an inch in diameter and occurring on the sunward side of the fruit.
Eventually it becomes brown and hard, consisting of dead sunburned tissue. Occasionally, under suitable climatic conditions, such sun spots may be invaded by various common saprophytic fungi. This condition has been observed on all *Citrus* spp. and is not uncommon in the northern Sudan during excessively hot dry weather. There is little doubt but that it is caused by sun-burning. See Fawcett, p. 576.

*Gossypium* spp. Among the functional disorders of Egyptian cotton, *G. barbadense*, are:

**Physiological wilt.** This sometimes occurs in the Gezira some three or four months after sowing. Boughey (*Ann. appl. Biol.*, 31, pp. 12–18, 1944) investigated this condition and concluded that it could be due to a reduction in the absorbing system of the plant with maturation accompanied by a decline in the amount of available soil water and increase in day temperatures and evaporation.

‘Purpling’ of leaves and bolls. Small somewhat irregularly shaped purple spots on leaves and bolls are frequently to be observed in the Gezira and elsewhere. In most cases so far examined no fungus or bacterial infection has been present and the spots appear to consist of pigmented living tissue. The cause of this functional disorder has not been ascertained; sometimes it may be associated with whitefly (*Bemisia gossypiperda*) infestation, in other cases not.

**Premature boll opening.** Widespread and sometimes severe on Gezira and White Nile cotton in some years. Recent observations suggest its association with prolonged cold weather—premature boll opening probably results from scorching of the young bolls by strong early morning sunlight during cold spells of winter when soil temperatures are low and the bolls are thereby unable to obtain sufficient water.

*Lycopersicon esculentum* (tomato). **Blossom end rot** is not uncommon on tomatoes in the Red Sea coast area. It is thought to be associated largely with the young fruits receiving insufficient water, e.g. due to damaged roots, insufficient watering or excessive transpiration in hot weather. See Butler & Jones, p. 678.

*Mangifera indica* (mango). **Shoulder spot** is almost certainly a non-parasitic condition due to exposure of the fruit to strong sunlight—a brown spot appears on the shoulder of the fruit where it is most exposed to the sun. Occasionally such spots may be invaded and rotted by various common saprophytic fungi, e.g. *Aspergillus niger* and *Rhizopus stolonifer*. Shoulder spot quite often occurs in the northern Sudan, especially north of Khartoum, during the hot dry months (May and June), but rarely causes much loss of crop.

*Sorghum vulgare* (sorghum millet). Non-parasitic **leaf striping** of sorghum millet is common in the Sudan. Often it is associated with development of purple or red pigment in streaks or spots. In some cases it is a varietal characteristic. See Dickson, p. 167.

*Vicia faba* (broad bean). ‘**Chocolate spot**’, which may be a non-parasitic condition, occurs throughout the northern Sudan and in the Gezira. In
some areas it can be very severe. Somewhat sunken brown spots appear on
the leaves and the latter tend to dry up and die. In Europe, Palestine, and
Egypt similar symptoms are caused by *Botrytis cinerea* and *B. fabae* but
*Botrytis* has not been found in the Sudan disease, neither is any fungus
likely to be the causal organism constantly associated with the disease. It
is unlikely to be bacterial and the symptoms are not characteristic of a
virus; it may be a ‘functional disorder’ but the cause is unknown.

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INDEX OF GENERA
(FUNGI, BACTERIA, AND ALGAE)

For virus diseases see pages 103–9, for non-parasitic diseases pages 109–11

Acrospeira, 67
Aecidium, 40
Agaricus, 49
Aithaloderma, 25
Albugo—see Cystopus
Alternaria, 67
Angioptora, 40
Ascochytulina, 54
Ascochytulina, 54
Aspergillus, 62
Asterina, 27

Bacterium, 102
Battanaea, 53
Bipora, 72
Boletus, 49
Botryodiplodia, 54
Broomeia, 53

Camarosporium, 55
Capniodium, 25
Cephalueros, 101
Cercospor, 72
Cercosporoidea, 64
Cerebella, 95
Chaetomium, 37
Chlamydomycetes, 64
Cicinnobolus, 34
Cinfacticia, 34
Circinotrichum, 85
Cladobotryum, 64
Cladosporium, 85
Clasterosporium, 87
Claviceps, 32
Clypeolum, 27
Cochliobola, 27
Colletotrichum, 60
Coniosporium, 87
Cordana, 87
Corticiota, 49
Cymespora, 87
Cryptodidymosphaeria, 28
Cryptovalsa, 28
Cunninghamella, 22
Curvularia, 88
Cylindrocarpon, 95
Cylindrosporum, 62
Cystopus, 20

Daedalea, 50
Dendryphiella, 89
Diatrypella, 28
Dichotomophthora, 89
Didymosphaeria, 28
Diploida, 55

Eremothecium, 22

Erwinia, 102
Erysiphe, 23
Eutardecia, 28
Eutypella, 29

Fomes, 50
Fumago, 89
Fusarium, 95

Ganodermata, 50
Gibberella, 32
Gliocladium, 64
Gloeocercospora, 98
Gloeosporium, 62
Glomerella, 29
Graphiola, 34
Graphium, 95
Guelpinia, 48
Guignardia, 30

Hadrotichium, 99
Haplosporella, 55
Helicobasidium, 48
Helminthosporium, 90
Hemileia, 40
Hexagona, 51
Hypoxylon, 30
Hysterium, 33
Hysterostromella, 27

Irophiella, 25
Irpex, 51
Isariopsis, 95

Kordyania, 49
Laccellina, 91
Lentinus, 51
Lenitzes, 51
Leptosphaeria, 30
Leveillula, 23

Macrophomina, 55
Macrosporium, 92
Megalactae, 33
Mellampora, 40
Mellampsorella, 40
Meliola, 25
Microdiplodia, 57
Microxiphium, 57
Mitteriella, 92
Moniliopsis, 64
Mycosphaerella, 31
Myrothecia, 99
Myrothecium, 99

Nectria, 33

B 3824
| Nematospora, 22 |
| Neohoenelia, 26 |
| Neurospora, 31 |
| Nigrospora, 92 |
| Oidium, 64 |
| Oospora, 65 |
| Ophiobolus, 31 |
| Ophiocarolla, 26 |
| Ovulariopsis, 66 |
| Paecilomyces, 65 |
| Papularia, 99 |
| Passalora, 92 |
| Penicillium, 65 |
| Periconia, 92 |
| Peronospora, 18 |
| Pestalotiopsis, 62 |
| Phaeobotryosphaeria, 31 |
| Phakopora, 41 |
| Phallus, 53 |
| Phoma, 57 |
| Phomopsis, 57 |
| Phyllachora, 26 |
| Phyllosticta, 57 |
| Phyllostictina, 59 |
| Physluospora, 51 |
| Physoderma, 17 |
| Phytophthora, 17 |
| Piericaria, 66 |
| Plasmopara, 19 |
| Pleospora, 32 |
| Pleurotus, 111 |
| Podaxon, 52 |
| Polystictus, 51 |
| Poria, 52 |
| Pseudomcactum, 93 |
| Pseudomonas, 102 |
| Pseudoperonospora, 19 |
| Pseudoplea, 32 |
| Puccinia, 41 |
| Pucciniopsis, 99 |
| Pyrenochaeta, 59 |
| Pythium, 18 |
| Ragnhildiana, 93 |
| Ramularia, 67 |
| Ramulispora, 99 |
| Raveneliana, 46 |
| Rhizoctonia, 49 |
| Rhizopus, 22 |
| Rosellinia, 32 |
| Sarcopeodium, 94 |
| Schiffnerula, 25 |
| Schizophyllum, 52 |
| Sclerospora, 20 |
| Scoletotrichum, 94 |
| Septobasidium, 48 |
| Septoria, 59 |
| Sorosporium, 34 |
| Spegazzinia, 100 |
| Sphaelia, 100 |
| Sphaelotheica, 35 |
| Sphaerotheca, 24 |
| Sporodesmium, 94 |
| Stachybotrys, 94 |
| Stagonospora, 69 |
| Stigmatea, 27 |
| Stigmospora, 62 |
| Stilbella, 95 |
| Stylosanthes, 95 |
| Thielavia, 22 |
| Thyronectria, 33 |
| Tilletia, 37 |
| Tolyposporium, 37 |
| Trabutia, 27 |
| Trametes, 52 |
| Tricothecum, 67 |
| Tryblidiella, 33 |
| Tuberculina, 47 |
| Tulostoma, 53 |
| Uncinula, 24 |
| Uredo, 46 |
| Uromyces, 46 |
| Ustilaginoidea, 94 |
| Ustilago, 38 |
| Valsaria, 32 |
| Xanthomonas, 102 |
| Xylaria, 32 |
**HOST AND SUBSTRATE INDEX**

**Abutilon glaucum** Webb.
- Cercospora sp.
- Puccinia sp.
- A. graveolens Wight & Arnott
  - Leveillula taurica

**A. muticum** Webb.
- Leveillula taurica

**A. pannosum** Webb.
- Cercospora sp.
- Abutilon spp.
  - Puccinia heterospora
  - Pyrenochaeta sp.
  - Cotton leaf curl virus

**Acacia arabica** Wild.
- Fomes endotheius
- F. fastuosus
- F. rimosus
- Fomes sp.
- Ganoderma lucidum
- Irpex flavus
- Polystictus aratus
  - P. occidentalis
- Ravenelia ? deformans
- Trametes cingulata
  - T. hydnoides

**A. oforta** (Forsk.) Schweinf.
- Leveillula taurica

**A. seyal** Del.
- Fomes rimosus
- Guepinia spathularia
- Lentinus blepharodes
- Leveillula taurica
- Trametes meyenii

**A. sieberiana** DC.
- Fomes rimosus
- Polystictus occidentalis
- Trametes cingulata

**A. ? spirocarpa** Hochst.
- Fomes rimosus

**Acacia** spp.
- Ganoderma lucidum

**Acalypha bipartita** Muell.-Arg.
- Angiopsora hansfordii

**? ciliata** Forsk.
- Oidium sp.

**A. indica** L.
- Colletotrichum capsici
- Phyllosticta brisianna
- Leaf curl (? virus)

**Acalypha** spp.
- Physalospora abdita
- Tryblidiella rufula

**Achyranthes aspera** L.
- Cercospora achyranthina
- Cystopus blitii

<table>
<thead>
<tr>
<th>Host Species</th>
<th>Substrate Index</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Helminthosporium</em> sp.</td>
<td>Plasmopara sp.</td>
</tr>
<tr>
<td><em>Adansonia digitata</em> L.</td>
<td><em>Phyllosticta</em> sp.</td>
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<td><em>Afzelia africana</em> Smith</td>
<td><em>Phyllachora afzeliae</em></td>
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<td><em>Ageratum</em> sp.</td>
<td><em>Raghibildiana agerati</em></td>
</tr>
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<td><em>Albizia lebbek</em> Benth.</td>
<td><em>Septoria</em> sp.</td>
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<td><em>Albizia sp.</em></td>
<td><em>Cercospora sp.</em></td>
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<td><em>Aleurites montana</em> L.</td>
<td><em>Corynespora cassicola</em></td>
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<td><em>Glomerella cingulata</em></td>
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<td><em>Phoma sp.</em></td>
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<td><em>Septobasidium sp.</em></td>
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<td><em>Thyronectria pseudotrichia</em></td>
<td><em>Allium cepa</em> L.</td>
</tr>
<tr>
<td><em>Aspergillus niger</em></td>
<td><em>Leveillula taurica</em></td>
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<tr>
<td><em>Acalypha indica</em> L.</td>
<td><em>Cotton leaf curl virus</em></td>
</tr>
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<td><em>A. pontica</em> Baker</td>
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<td><em>A. rosea</em> Cav.</td>
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<td><em>A. sulphurea</em> Boiss. &amp; Hohen.</td>
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<td><em>Amomum sp.</em></td>
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<td><em>Sphacelotheca ischaemicola</em></td>
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<tr>
<td><em>A. gayanus var. squamulatus</em> Stapf</td>
<td><em>Phyllachora assimilis</em></td>
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<td><em>Andropogon gayanus</em> Kunth.</td>
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<td><em>Andropogon</em> spp.</td>
<td><em>Puccinia andropogonicola</em></td>
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<tr>
<td><em>Angiopsora hansfordii</em> (Cumm.) Thirum. &amp; Kern</td>
<td><em>Eudarluca australis</em></td>
</tr>
</tbody>
</table>
HOST AND SUBSTRATE INDEX

Annona chrysophylla Boj.
    Cercospora sp.
    Coniosporium sp.
    Sarcocepodium sp.
A. squamosa L.
    Colletotrichum sp.
    Mycosphaerella sp.
Antirrhinum majus L.
    Alternaria sp.
Arachis hypogaea L.
    Aspergillus niger
    Cercospora arachidicola
    C. personata
    Cladosporium sp.
    Colletotrichum capsici
    Macrophomina phaseoli
    Phyllosticta sp.
    Groundnut rosette virus
Aristida adscencionis L.
    Sorosporium sp.
A. stipoides Lam.
    Puccinia ? aristidae
Aristolochia bracteata Retz.
    Leveillula taurica
Azadirachta indica A. Juss.
    Cercospora subsessilis
    Fomes endothelus
    Ganoderma lucidum
    Graphium sp.
    Helicobasidium ? compactum
    Hypoxylon sp.
    Nectria sp.
    Polystictus lonicoides
Bambusa sp.
    Nigrospora oryzae
    Papularia sphaerosperma
Bauhinia alba Buch.
    Phyllosticta bauhinicola
B. rufescens Lam.
    Cercospora phaeocarpa
Beckeropsis ? nubica Fig. & de Not.
    Ustilago sp.
B. ? uniseta (Nees) Stapf
    Nigrospora oryzae
    Puccinia peniceti
Beta vulgaris L.
    Alternaria ? brassicicola
    Cercospora beticola
Bidens pilosa L.
    Cercospora bidentis
    Oidium sp.
    Uromyces bidenticola
Bidens spp.
    Cercospora bidentis
    Uromyces bidenticola
Blainvillea prieuriana DC.
    Uromyces blainvilleae
Boerhaavia repens L.
    Cystopus platensis
    Boerhaavia sp.
    Cystopus platensis
Borassus aethiopum Mart.
    Circinotrichum sp.
    Lacellina graminicola
    Periconia minitissima
Borreria compacta Hochst.
    Puccinia lateritia
Borreria sp.
    Puccinia lateritia
Bougainvillaea sp.
    Alternaria tenuis
    Mosaic (? virus).
Brachiaria brizantha Stapf
    Ustilaginoidea virens
B. lata (Schumach.) Hubbard
    Uromyces leptodermus
B. obtusifolia
    Ustilago operta
B. xantholeuca (Hack.) Stapf
    Uromyces leptodermus
Bracharia sp.
    Cerebella andropogonis
    Sphaecelia sp.
Brassica campestris L.
    Alternaria brassicae
    A. brassicicola
    Leveillula taurica
B. campestris var. sarson Pr.
    Erysiphe polygoni
B. chinensis L.
    Cercospora brassicicola
B. juncea Coss.
    Erysiphe polygoni
B. naparapestris
    Erysiphe polygoni
B. napus L.
    Erysiphe polygoni
B. oleracea L. var. botrytis L.
    Alternaria brassicicola
    Cercospora brassicicola
    Curvularia lunata
B. oleracea var. bullata DC.
    Alternaria brassicicola
    Cercospora brassicicola
B. oleracea var. gemmifera DC.
    Alternaria brassicicola
    Glomerella cingulata
B. oleracea var. gongylodes L.
    Alternaria brassicicola
Bridelia ferruginea Benth. var. orientalis
    Hutchinson
    Glomerella cingulata
Cadaba rotundifolia Forsk.
    Cercospora sp.
Cajanus indicus Spreng.
    Alternaria tenuis
<table>
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<td>Mycosphaerella sp.</td>
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<td>Schrad.</td>
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<tr>
<td>Septobasidium sp.</td>
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<td>Sporodesmium bakeri</td>
<td>Mosaic (? virus)</td>
</tr>
<tr>
<td>Calotropis procera Ait.</td>
<td>Citrus aurantiifolia (Christm.) Sw.</td>
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<td>Cercospora calotropidis</td>
<td>Alternaria citri</td>
</tr>
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<td>Glomerella cingulata</td>
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<tr>
<td>Botryodiplodia theobromae</td>
<td>Haplosporella ?hesperidica</td>
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<td>Helminthosporium sp.</td>
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<td>Cercospora sp.</td>
<td>Pleospora sp.</td>
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<tr>
<td>Leveillula taurica</td>
<td>Stigmopsis sp.</td>
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<tr>
<td>Carica papaya L.</td>
<td>Trybliediella rufula</td>
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<tr>
<td>Ascochyta caricae-papayae</td>
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<tr>
<td>Cercospora papayaie</td>
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<td>Cladosporium herbarum</td>
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<td>Glomerella cingulata</td>
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<td>Macrophomina phaseoli</td>
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<td>Myrothecium sp.</td>
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<td>Ovulariopsis papayae</td>
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<tr>
<td>Bunchy top (? virus)</td>
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<tr>
<td>Carthamus tinctorius L.</td>
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<td>Colletotrichum capsici</td>
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<td>Puecinia carthami</td>
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<td>C. acutifolia Del.</td>
<td>Cassia acutifolia</td>
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<tr>
<td>Blight (? bacterial)</td>
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<td>C. obovata Collad.</td>
<td>C. aurantiifolia</td>
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<td>C. occidentalis L.</td>
<td>C. aurantiifolia</td>
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<td>Cercospora pinnulaeacola</td>
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<td>? Erysiphe cichoracearum</td>
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<td>Oidium sp.</td>
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<td>Mosaic (? virus)</td>
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<td>C. tora L.</td>
<td>Cassia sp.</td>
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<td>Cercospora nigricans</td>
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<tr>
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<td>Foliocellosis</td>
</tr>
<tr>
<td>Cercospora bidentis</td>
<td>Gum spot</td>
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<td>Citrus aurantiifolia</td>
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<td>(Christm.) Sw.</td>
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<td>Gum spot</td>
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<td>C. grandis Osb.</td>
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C. sinensis Osb.
  Alternaria citri
  Capnodium sp.
  Circinotrichum sp.
  Cryptovalsa citri
  Glomerella cingulata
  Phaeobotryosphaeria plicatula
  Polioecellosis
  Gum spot
  Sun spot
  Twig gummosis

Citrus spp.
  Circinotrichum sp.
  Diatrypella sp.
  Diplodia sp.
  Ganoderma lucidum
  Poria sp.
  Thyonectria pseudotrichia

Clematis glaucescens Fresen.
  Cercospora sp.
  Mosaic (? virus)

Clematis sp.
  Cercospora sp.

Cleome viscosa L.
  Cystopus candidus

Clerodendron cordifolium A. Rich.
  Cercospora sp.

Clitoria ternata L.
  Cercospora clitoriae
  Cladosporium sp.
  Macrophoma phaseoli
  Mosaic (? virus)

Coccinia grandis (L.) J. O. Voigt
  Pseudoperonospora cubensis

Coffeea arabica L.
  Cercospora coffeicola
  Hemileia vastatrix
  Cephaloecus moxocidea

C. robusta Lind.
  Cercospora coffeicola
  Hemileia vastatrix
  Microoxyphium sp.
  Cephaloecus moxocidea

Coffea sp.
  Cladosporium sp.

Coix lacryma-jobi L.
  Cladosporium herbarum

Combretum ?gueinzii Sond.
  Asterina radio-fissilis

C. hartmannianum Schweinf.
  Phyllosticta sp.

Combretum spp.
  Meliola sp.
  Phyllosticta sp.

Commelina benghalensis L.
  Kordyana celebensis

C. forskalaei Vahl.
  Uromyces commelinace

C. kotschyi Haak.
  Cercospora commelinicola
  Uromyces commelinace

C. krebsiana Kunth
  Cylindrosporum kilimanjariicum

Commelina spp.
  Cylindrosporum kilimanjariicum
  Kordyana celebensis
  Uromyces commelinace

Corchorus fascicularis Lam.
  ? Sphaerotheca fuliginea
  Blight (? bacterial)
  Mosaic (? virus)

C. olitorius L.
  Cercospora sp.
  Erysiphe cichoracearum
  Sphaerotheca fuliginea
  Blight (? bacterial)
  Mosaic (? virus)

C. tridens L.
  Cercospora sp.

C. trilocularis L.
  Leveillula taurica

Coreopsis sp.
  Puccinia coreopsidis

? Coreopsis sp.
  Cercospora sp.

Coriandrum sativum L.
  Leveillula taurica

Cosmea sp.
  Leaf distortion (? virus)

Crassocephalum sp.
  Aecidium crassocephali

Crotalaria juncea L.
  Leveillula taurica
  Zonate leaf spot

Ctenolepis cerasiformis (Stocks) Naud.
  Cercospora cucurbitae
  Puccinia cucumeris

Cucumis melo L.
  Cercospora cucurbitae
  Oidium sp.
  Pseudoperonospora cubensis
  Sphaerotheca fuliginea
  Mosaic (? virus)

Cucumis melo var. agrestis Naud.
  Oidium sp.
  Pseudoperonospora cubensis
  Sphaerotheca fuliginea

C. sativus L.
  Cercospora cucurbitae
  Pseudoperonospora cubensis
  Sphaerotheca fuliginea

Cucumis sp.
  Pseudoperonospora cubensis

Cucurbita maxima Duch.
  Alternaria cucumerina
<table>
<thead>
<tr>
<th>Host and Substrate Index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cercospora cucurbitae</strong></td>
</tr>
<tr>
<td><strong>Leveillula taurica</strong></td>
</tr>
<tr>
<td><strong>Oidium sp.</strong></td>
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<td><strong>C. pepo L.</strong></td>
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<tr>
<td><strong>Alternaria cucumerina</strong></td>
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<td><strong>Cercospora cucurbitae</strong></td>
</tr>
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</tr>
<tr>
<td><strong>Sphaerotheca fuliginea</strong></td>
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<td><strong>Cucurbita spp.</strong></td>
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<tr>
<td><strong>Altemaria cucumerina</strong></td>
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<td><strong>Cercospora cucurbitae</strong></td>
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<td><strong>Cyamopsis psoraloides DC.</strong></td>
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<tr>
<td><strong>Cercospora canescens</strong></td>
</tr>
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<td><strong>Leveillula taurica</strong></td>
</tr>
<tr>
<td><strong>Cymbopogon proximus (Hochst.) Stapf</strong></td>
</tr>
<tr>
<td><strong>Puccinia andropogonicola</strong></td>
</tr>
<tr>
<td><strong>Cynodon dactylon Pers.</strong></td>
</tr>
<tr>
<td><strong>Periconia lateralis</strong></td>
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<tr>
<td><strong>Phyllachora cynodontis</strong></td>
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<td><strong>Puccinia cynodontis</strong></td>
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<tr>
<td><strong>Ustilago cynodontis</strong></td>
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<td><strong>Cyperus difformis L.</strong></td>
</tr>
<tr>
<td><strong>C. digitatus L.</strong></td>
</tr>
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<td><strong>Puccinia romagnoliana</strong></td>
</tr>
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<td><strong>C. ? esculentus L.</strong></td>
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<td><strong>C. rotundus L.</strong></td>
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<td><strong>Alternaria tenuissima</strong></td>
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<td><strong>Cntractia limitata</strong></td>
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<td><strong>Physoderma ? Schroeteri</strong></td>
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<td><strong>Dalbergia melanoxylon Guill. &amp; Perr.</strong></td>
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<td><strong>Curvularia lunata</strong></td>
</tr>
<tr>
<td><strong>Ophiophotthella sp.</strong></td>
</tr>
<tr>
<td><strong>D. sissoo Roxb.</strong></td>
</tr>
<tr>
<td><strong>Fomes sp.</strong></td>
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<tr>
<td><strong>Daniellia thorifera Benn.</strong></td>
</tr>
<tr>
<td><strong>Seedling blight</strong></td>
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<tr>
<td><strong>Datura stramonium L.</strong></td>
</tr>
<tr>
<td><strong>Alternaria crassa</strong></td>
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</tr>
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<td><strong>Daucus carota L.</strong></td>
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<tr>
<td><strong>Erysiphe polygoni</strong></td>
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<td><strong>Leveillula taurica</strong></td>
</tr>
<tr>
<td><strong>Oidium sp.</strong></td>
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<tr>
<td><strong>Erwinia carotovora</strong></td>
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<td><strong>Dead grass stalks</strong></td>
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<tr>
<td><strong>Papularia sphaerosperma</strong></td>
</tr>
<tr>
<td><strong>Rosellinia sublimbata</strong></td>
</tr>
<tr>
<td><strong>Dead wood and twigs</strong></td>
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<tr>
<td><strong>Diatrypella sp.</strong></td>
</tr>
<tr>
<td><strong>Fomes sp.</strong></td>
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<tr>
<td><strong>Hypoxyton haematostroma</strong></td>
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<tr>
<td><strong>Hypoxyton spp.</strong></td>
</tr>
<tr>
<td><strong>E. pyramidalis H. &amp; C.</strong></td>
</tr>
<tr>
<td><strong>Sorosporium sp.</strong></td>
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<tr>
<td><strong>Echinocloa sp.</strong></td>
</tr>
<tr>
<td><strong>Ustilago trichophora</strong></td>
</tr>
<tr>
<td><strong>Elaeis guineensis Jacq.</strong></td>
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<tr>
<td><strong>Cercospora elaeidis</strong></td>
</tr>
<tr>
<td><strong>Cladosporium sp.</strong></td>
</tr>
<tr>
<td><strong>Hysterostomella elaeicola</strong></td>
</tr>
<tr>
<td><strong>Eleusine coracana Gaertn.</strong></td>
</tr>
<tr>
<td><strong>Gloeocercospora sp.</strong></td>
</tr>
<tr>
<td><strong>Helminthosporium nodulosum</strong></td>
</tr>
<tr>
<td><strong>Phyllachora eleusines</strong></td>
</tr>
<tr>
<td><strong>Dichanthium annulatum Stapf</strong></td>
</tr>
<tr>
<td><strong>Uromyces andropogonis-annulati</strong></td>
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<td><strong>Digera alternifolia (L.) Aschers.</strong></td>
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<tr>
<td><strong>Cercospora sp.</strong></td>
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<td><strong>Digitaria longiflora Pers.</strong></td>
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<td><strong>Phyllachora digitariae</strong></td>
</tr>
<tr>
<td><strong>Digitaria sp.</strong></td>
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<td><strong>Piricularia grisea</strong></td>
</tr>
<tr>
<td><strong>Dioecorea dumetorum Pax.</strong></td>
</tr>
<tr>
<td><strong>Cercospora contraria</strong></td>
</tr>
<tr>
<td><strong>Phyllachota dioecorea</strong></td>
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<tr>
<td><strong>Dolichos lablab L.</strong></td>
</tr>
<tr>
<td><strong>Alternaria tenuis</strong></td>
</tr>
<tr>
<td><strong>Capnodium sp.</strong></td>
</tr>
<tr>
<td><strong>Cercospora canescens</strong></td>
</tr>
<tr>
<td><strong>C. ? columnaris</strong></td>
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<td><strong>Cladosporium herbarum</strong></td>
</tr>
<tr>
<td><strong>Cladosporium sp.</strong></td>
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<tr>
<td><strong>Macrophomina phaseoli</strong></td>
</tr>
<tr>
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<tr>
<td><strong>Xanthomonas phaseoli</strong></td>
</tr>
<tr>
<td><strong>Mosaic (? virus)</strong></td>
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<tr>
<td><strong>Echinochloa colona Link</strong></td>
</tr>
<tr>
<td><strong>Piricularia grisea</strong></td>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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</tbody>
</table>
**Eruca sativa** L.  
- Erysiphe eichoracearum  
- Leveillula taurica  

**Erythrina** sp.  
- Didymosphaeria sp.  

**Euphorbia acalyphoides** Hochst.  
- Helminthosporium sp.  
- Leveillula taurica  
- Blight (? bacterial)  

**E. convolvuloides** Hochst.  
- Leveillula taurica  

**E. geniculata** Orteg.  
- Melampsora helioscopiae  

**E. heterophylla** L.  
- Leveillula taurica  
- ? virus  

**E. hirta** L.  
- Oidium sp.  
- Peronospora favargeri  

**Euphorbia** spp.  
- Cercospora sp.  
- Clavularia lunata  
- Helminthosporium sp.  
- Puccinia euphorbiae  
- Sphaerotheca fuliginea  
- Blight (? bacterial)  

**Ficus carica** L.  
- Cercospora ficina  
- Cladosporium sp.  
- F. platypylla** Del.  
- Thyronectria pseudotrichia  

**Foenum-culare vulgare** Mill.  
- Leveillula taurica  

**Fragaria** sp.  
- Mycosphaerella fragariae  

**Glycine max** (L.) Merr.  
- Cercospora canescens  
- ? Xanthomonas phaseoli  

**Gomphrena globosa** L.  
- Cercospora ? gomphrenae  
- Leveillula taurica  

**Gossypium barbadense** L.  
- Alternaria gossypina  
- Aspergillus niger  
- Cladosporium herbarum  
- Corticium (Rhizoctonia) solani  
- Curvularia lunata  
- C. maculans  
- Cylindrocarpon didymum  
- Fusarium coeruleum  
- F. equiseti  
- F. falcateum  
- F. heterosporium  
- F. scirpi  
- F. solani  
- F. vasinfectum  
- Gibberella fujikuroi  
- Gliocladium roseum  
- Macrophomina phaseoli  
- Macrosporium sp.  
- Moniliopsis aderholdi  
- Paecilomyces varioti  
- Pythium aereum  
- P. applanatum  
- P. gracie  
- P. graminicola  
- P. periplocum  
- P. proliferum  
- Thielavia basicola  
- Xanthomonas malvacearum  
- Cotton leaf curl virus  
- Leaf and boll purpling  
- Physiological wilt  
- Premature boll opening  

**G. hirsutum** L.  
- Aspergillus flavus  
- A. niger  
- Cereospora gossypina  
- Corticium (Rhizoctonia) solani  
- Eremothecium ashbyii  
- ? Nematospora sp.  
- Neurospora sitaphila  
- Oidium sp.  
- Penicillium glaucum  
- Ramularia areola  
- Xanthomonas malvacearum  
- Cotton leaf curl virus  

**Gossypium** spp.  
- Ascochyta gossypii  
- Aspergillus niger  
- Capnodium sp.  
- Cereospora gossypina  
- ? Colletotrichum gossypii  
- Xanthomonas malvacearum  
- Cotton leaf curl virus  

**Grewia betulaefolia** Juss.  
- Phyllosticta sp.  

**G. flavescens** Juss.  
- Stigmatea greevae  

**Gutenbergia** sp.  
- Cereospora sp.  

**Gynandropsis gynandra** (L.) Briq.  
- Cystopus candidus  
- Leveillula taurica  

**Harrisonia abyssinica** Oliv.  
- Schiuffnerula sp.  

**Helianthus anuus** L.  
- Oidium sp.  
- Puccinia helianthi  

**Heloperon contortus** (L.) Beauv.  
- Sphaerotheca zilligii  

**H. melanocarpus** Benth.  
- Puccinia versicolor  
- Sphaerotheca monilfera  

**Hibiscus cannabins** L.  
- ? Bacterium tumefaciens  
- Cotton leaf curl virus
**HOST AND SUBSTRATE INDEX 121**

**H. diversifolius** Jacq.
Cotton leaf curl virus

**H. esculentus** L.
Alternaria sp.
Ascochyta abelmoschii
Cercospora hibisci
C. malayensis
Cladosporium herbarum
Erysiphe cichoracearum
Fusarium dimerum
F. scirpi
Leveillula taurica
Oidium sp.
Sphaerotheca fuliginea
Cotton leaf curl virus

**H. huegelli** Endl.
Cotton leaf curl virus

**H. obtusifolius** Garecke.
Leveillula taurica

**H. ? obtusilobus** Garecke.
Cercospora malayensis

**H. sabdariffa** L.
Aecidium garckeianum
Alternaria sp.
Cercospora malayensis
Irenopsis molleriana
Leveillula taurica
Cotton leaf curl virus

**Hibiscus** sp.
Phyllosticta hibisci

**Hippeastrum** sp.
Phyllosticta sp.

**Hordeum vulgare** L.
Erysiphe graminis
Helminthosporium sativum
Puccinia graminis
Ustilago nuda

**Hypparrhenia confinis** (Hochst.) Anders.
Sorosporium ischaemoides

**H. filipendula** (Hochst.) Stapf
Aecidium kaernbachii
Alternaria solani
Cercospora ipomoeae
Cercospora sp.
Curvularia geniculata
Cystopus ipomoeae-panduratae
Leveillula taurica
Phyllosticta batatas
Pleospora sp.
Puccinia holosericea
Sporidesmium bakeri

**H. ? macrarrhena** Stapf
Black leaf blotch

**H. pseudocymbaria** Stapf
Colletotrichum graminicola
Phyllosticta sp.
Puccinia andropogonica

**H. rufa** Stapf
Black leaf blotch

**Hypparrhenia** spp.
Cercospora sp.
Puccinia erythreaensis
Sorosporium ischaemoides
Sphaerotheca vandyerysti
Black leaf blotch

**Hyphaene thebaica** Mart.
Puccinioopsis sp.

**Imperata cylindrica** Beauv.
Puccinia eucomis
P. versicolor
Black leaf blotch

**Ipomoea batatas** Lam.
Macrophomina phaseoli
Periconia byssoides
Phyllosticta batatas
Mosaic (? virus)

**I. cairica** Sweet.
Cercospora ipomoeae
Meliola malacotricha

**I. cardiosepalata** Hochst.
Cystopus ipomoeae-panduratae

**I. cordofana** Choisy
Cercospora batatae
C. ipomoeae

**I. digitata** L.
Phyllosticta batatas

**I. eriocarpa** R. Br.
Cercospora ipomoeae
Uromyces ipomoeae

**I. mombassana** Vatke
Uromyces ipomoeae

**I. pilosa** Sweet.
Cystopus ipomoeae-panduratae
Uromyces ipomoeae

**Ipomoea** spp.
Aecidium kaernbachii
Alternaria solani
Cercospora ipomoeae
Cercospora sp.
Curvularia geniculata
Cystopus ipomoeae-panduratae
Leveillula taurica
Phyllosticta batatas
Pleospora sp.
Puccinia holosericea
Sporidesmium bakeri

**I. Ischaemum** sp.
Sorosporium furcatum

**Jacquemontia capitata** G. Don.
Cercospora sp.

**Justicia flava** L.
Oidium sp.

**J. insularis** T. Anders.
Oidium sp.

**Khaya grandifolia** C. DC.
Aecochytulina sp.
Mycosphaerella sp.
Periconia byssoides
Phyllachora sp.
Phyllosticta sp.
Phyllostictina sp.

**K. senegalensis** A. Juss.
Ganoderma lucidum
Leptosphaeria sp.
Meliola khayae
Periconia byssoides
<table>
<thead>
<tr>
<th>Host/Species</th>
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<tr>
<td>Phyllosticta sp.</td>
<td>Alternaria brassicae</td>
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<td>Phyllostictina sp.</td>
<td>Cercospora longissima</td>
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<td>Schiffnerula sp.</td>
<td>Septoria lactucae</td>
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<td>Septoria sp.</td>
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<td>Cephaleuros mycoidea</td>
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<td>Lactuca sativa L.</td>
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<td>Septoria laotucae</td>
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</table>
?Monechma sp.
  Cercospora sp.

Morus nigra L.
  Cercospora sp.

Mucuna pruriens DC.
  Periconiabyssoides
  Phyllosticta sp.

Mucuna spp.
  Acrospera sp.
  Periconiabyssoides
  Phyllosticta sp.
  Uromycesmucucae
  Blight (?bacterial)

Musa sapientum L.
  Fusarium equiseti
  F. scirpi
  F. semitectixrn
  F. solani
  Helminthosporiumtorulosum
  Scoletotrichium(Cordana)musae
  Stachybotrys subsimplex

Nerium oleander L.
  Daeadalesunicolor
  Phyllostictaglaucispora

Nicotiana rustica L.
  Cercospora nicotianae

N. tabacum L.
  Cercospora nicotianae
  Tobacco leaf curl virus

Ocimum basilicum L.
  Leaf curl (? virus)
  Ocimum sp.
  Cercospora sp.

Oldium sp.
  Cieinmoulobus cesatii

Olea chrysophylla Lam.
  Clasterosporium sp.

Olyra latifolia L.
  Neohoenelialoiogtricha

Ophiuros papillosus Hochst.
  Stagonosporassp.

Oryza sativa L.
  Cercospora oryzae
  Cladosporiumherbarum
  Cochliobolusheterostrophus
  Nigrospora oryzae
  N. sphaerica
  Ophiobolus miyabeanus

Pachira sp.
  Mycosphaerella sp.

Pandika heudelotii (Moq.) Benth. & Hook.
  Cystopusbliti

Panicum maximum Jacq.
  Cerebella andropogonis
  Cladosporium sp.
  Phyllachora heterospora

  Phyllachora sp.
  Tilletia ayresii

? P. pyramide Lam.
  Sorosporiumsp.

P. repens L.
  Sorosporiumformosanum

Panicum spp.
  Phyllachora sp.
  Tilletia ayresii

Papaver sp.
  Erysiphe cichoracearum

Pennisetum pedicellatum Trin.
  Curvulariapalleceens
  Phakopspora apoda
  Phyllachora sp.

P. polystachyum Schult.
  Phakopspora apoda

P. ?purpureum Schum.
  Phyllachora penniseti

P. typhoides Staftp & Hubbard
  Alternaria tenuis
  Alternaria sp.
  Cercospora fusimaculans
  Cerebella andropogonis
  Cladosporiumherbarum
  Gibberellafujikuroi
  Nigrospora oryzae
  Pricularia grisea
  Puccinia penniseti
  Sclerospora graminicola
  Spexgazinnia tressartihra
  Tolyposporiumehrenbergii
  T. penicilliaria

Pennisetum spp.
  Gloeeocercospora sorghii
  Phakopspora apoda
  Phyllachora penniseti
  P. sphaerosperma

Peristrophe calculata Nees
  Ramularia sp.

Petroselimum crispum Nym.
  Leveillula taurica

Petunia sp.
  Cercospora ?petuniae
  ?virus disease

Phacelia viscida Torr.
  Leveillula taurica

Phakopspora apoda (Har. & Pat.) Mains
  Eudarluca australis

Phaseolus acutifolius A. Gray
  Macrophomina phaseoli
  Mosaic (? virus)

P. aureus Roxb.
  Aseochyta phaseolorum
  Cercospora canescens
  Phyllosticta sp.
  Zonate leaf spot

P. lunatus L.
  Zonate leaf spot
<table>
<thead>
<tr>
<th>Plant</th>
<th>Common Name</th>
<th>Pathogen</th>
<th>Disease</th>
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<td>P. mungo L.</td>
<td>Mung bean</td>
<td>Macrophomina phaseoli</td>
<td>Host and substrate index</td>
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<td>Sphaerotheca fuliginea</td>
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<td>Uromyces appendiculatus</td>
<td>Zonate leaf spot</td>
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<tr>
<td>P. vulgaris L.</td>
<td>Bean</td>
<td>Ascochyta phaseolorum</td>
<td>P. mungo L.</td>
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<td>Cercospora canecens</td>
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<td>Isariopsis griseola</td>
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<td>Macrophomina phaseoli</td>
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<td>Periconia byssoides</td>
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<td>Uromyces appendiculatus</td>
<td>Curly top (? virus)</td>
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<td>Mosaic (? virus)</td>
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<td>Macrophaomina phaseoli</td>
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<tr>
<td>P. vulgaris L.</td>
<td>Bean</td>
<td>Ascochyta phaseolorum</td>
<td>P. mungo L.</td>
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<td>Curvularia lunata</td>
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<td>Leveillula taurica</td>
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<tr>
<td>Physalis sp.</td>
<td>Tomato</td>
<td>Leveillula taurica</td>
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<tr>
<td>P. maurotianus Kunth</td>
<td>Mauritius bean</td>
<td>Stagonospora phragmiticola</td>
<td>P. mungo L.</td>
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<td>Cladosporium sp.</td>
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<td>Physialis minima L.</td>
<td>Tomato</td>
<td>Cladosporium sp.</td>
<td>P. mungo L.</td>
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<td>Cercospora phragiticola</td>
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<td>P. peruviana L.</td>
<td>Peruvian tomato</td>
<td>Cercospora phragiticola</td>
<td>P. mungo L.</td>
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<td>Leveillula taurica</td>
<td>Blight (? bacterial)</td>
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<tr>
<td>P. sativum L.</td>
<td>Sugar beet</td>
<td>Leveillula taurica</td>
<td>P. mungo L.</td>
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<td>Leaf curl (? virus)</td>
<td>Host and substrate index</td>
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<td>P. fusica L.</td>
<td>Cabbage</td>
<td>Cladosporium sp.</td>
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<td>Leveillula taurica</td>
<td>Host and substrate index</td>
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<td>Leaf curl (? virus)</td>
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<td>P. sativum L.</td>
<td>Sugar beet</td>
<td>Cercospora canecens</td>
<td>Host and substrate index</td>
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<td>Erysiphe polygoni</td>
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<td>Fusarium oxysporum</td>
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<td>Leveillula taurica</td>
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<td>Pythium sp.</td>
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<td>P. oleracea L.</td>
<td>Lettuce</td>
<td>Cladosporium sp.</td>
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<td>Leveillula taurica</td>
<td>Host and substrate index</td>
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<td>Leaf curl (? virus)</td>
<td>Host and substrate index</td>
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<td>P. pallide-fusca (Scho), Stapf &amp; Hubbard</td>
<td>St. lagus lupinus</td>
<td>Uromyces leptoderms</td>
<td>P. mungo L.</td>
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<td>Ustilago neglecta</td>
<td>-host and substrate index</td>
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</table>

**Additional Pathogens**:
- Puccinia spp.
- Euderluca australis
- Pueraria phaseoloides Benth. Phylosticta sp.
- Punica granatum L. Cercospora puniceae
- Pupalia lappacea (L.) Juss. Septoria sp.
- Raphanus sativus L. Alternaria brassieicola Cercospora canecens Pythium spp.
- Rhynchelytrum sp. Puccinia tricholaenae
- Rhynchosia mennonia DC. Leveillula taurica
- Ricinus communis L. Alternaria ricini Cercospora ricinella Leveillula taurica Melampsorella ricini Schizophyllum ricini Xanthomonas ricincola X. solanaeearum
- Rosa sp. Bispora sp. Cercospora hyalina Nigrospora oryzae bacteria
- Rottboellia exaltata L. Puccinia rottboelliae
- Rottboellia sp. Puccinia rottboelliae
- Saccharum officinarum L. Cladosporium herbarum Helminthosporium sp.
- Salvia leucantha Cav. Corynepora cassiicola
- Sesamum indicum L. Cercospora sesami Leveillula taurica Oidium sp. Sphaerotheca fuliginea Pseudomonas sesami virus disease
- Setaria barbata (Lam.) Kunth Cladosporium sp.
- S. chevalieri Stapf Cladosporium sp. Phylosticta sp.
- S. lancea Stapf Cercospora fusinaeulans
- S. pallide-fusca (Scho), Stapf & Hubbard Uromyces leptoderms Ustilago neglecta
S. verticillata Beauv.
  Piricularia grisea

Setaria sp.
  Tilletia echinosperma

Sida alba (spinosa) L.
  Puccinia heterospora
  Cotton leaf curl virus

S. cordifolia L.
  ? cotton leaf curl virus

S. ? grewioides Guill. & Perr.
  Puccinia heterospora

S. ? rhombifolia L.
  Puccinia heterospora

Sida spp.
  Cladosporium sp.
  Puccinia heterospora

Soil
  Agaricus sp.
  Aspergillus flavus
  A. fumigatus
  A. glaucus
  A. nidulans
  A. niger
  A. rugulosus
  A. sydowii
  A. terrus
  A. versicolor
  Battarrea stevenii
  Broomea ? conregata
  Chaetomium globosum
  Cladosporium herbarum
  Cunninghamella elegans
  Curvularia sp.
  Fusarium heterosporum
  F. scirpi
  F. solani
  Ganoderma lucidum
  Macrophomina phaseoli
  Myrothecium roridum
  Oospora egyptiaca
  Paeclomyces varioti
  Penicillium decumbens
  P. luteo-viride
  P. luteum
  P. purpureogenum
  P. rugulosum
  P. steckii
  Phallus sp.
  Phoma sp.
  Podaxon caricosomalis
  P. pistillaris
  Rhizopus stolonifer
  Tulostoma sp.

Solanum dubium Fr.
  Alternaria sp.

S. melongena L.
  Alternaria solani
  Cercospora melongenae
  C. solani-melongenae
  C. near solani-torvi
  Leveillula taurica

S. nodiflorum Jacq.
  Cercospora atro-marginalis

S. tuberosum L.
  Alternaria solani
  Corticium (Rhizoctonia) solani
  Fusarium oxysporum
  Phytophthora infestans
  Stysanus stemonites

S. ? xanthocarpum var. schraderi Dunal.
  Cercospora atro-marginalis

Solanum sp.
  Leveillula taurica

Sonchus ? cornutus Hochst.
  Sphaerotheca fuliginea

Sonchus sp.
  Cercospora bidentis

Sorghum halepense L.
  Ascochytara sorghina
  Colletotrichum graminicola
  Phoma insidiosa
  Puccinia purpurea
  Sphaelotheca reiliana
  S. sorghi

S. lanceolatum Stapf
  Tolyposporium ehrenbergii

S. purpureo-sericeum Aschers. & Schweinf.
  Ramulispora sorghi
  Tolyposporium ehrenbergii

S. sudanense Stapf
  Sphaelotheca sorghi

S. vulgaris Pers.
  Alternaria tenuis
  Ascochyta sorghina
  Cercospora sorghi
  Cladosporium herbarum
  Cochliobolus heterostrophus
  Colletotrichum graminicola
  Gloeocercospora sorghi
  Helminthosporium turicicum
  Nigrospora sphaerica
  Papularia sphaerosperma
  Phoma insidiosa
  Puccinia purpurea
  Ramulispora sorghi
  Sclerospora graminicola
  Sphaelotheca cruenta
  S. reiliana
  S. sorghi
  Tolyposporium ehrenbergii
  Leaf stripe

Sorghum spp.
  Ascochyta sorghina
  Cercospora sorghi
  Colletotrichum graminicola
  Gloeocercospora sorghi
  Helminthosporium turicicum
  Phoma insidiosa
  Sphaelotheca cruenta
  S. reiliana
  Tolyposporium ehrenbergii
<table>
<thead>
<tr>
<th>Host or Substrate</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spermacoce—see Borreria</td>
<td></td>
</tr>
<tr>
<td>Sphaerotheca fuliginea (Schlecht.) Poll.</td>
<td>Ceininnobulus cesatii</td>
</tr>
<tr>
<td>Spinacia oleracea L.</td>
<td>Cercospora beticola</td>
</tr>
<tr>
<td>Steganotaenia araliacea Hochst.</td>
<td>Cercospora hamosensis</td>
</tr>
<tr>
<td>Stryclnos innocua Del.</td>
<td>Schifmerula sp.</td>
</tr>
<tr>
<td>Syzygium ? guineensis DC.</td>
<td>Phyllosticta sp.</td>
</tr>
<tr>
<td>Syzygium sp.</td>
<td>Asterina syzygiicola</td>
</tr>
<tr>
<td>Tectona grandis L.</td>
<td>Fomes lignosus</td>
</tr>
<tr>
<td>Tephrosia apollinea DC.</td>
<td>Cladosporium herbarum</td>
</tr>
<tr>
<td>T. lathyroides Guill. &amp; Perr.</td>
<td>?Passalora sp.</td>
</tr>
<tr>
<td>Terminalia sp.</td>
<td>?Pestalotiopsis sp.</td>
</tr>
<tr>
<td>Thea sinensis L.</td>
<td>Trichotheicum roseum</td>
</tr>
<tr>
<td>Thunbergia sp.</td>
<td>Leaf curl (?virus)</td>
</tr>
<tr>
<td>Trichodesma zeylanicum R.Br.</td>
<td>Oidium sp.</td>
</tr>
<tr>
<td>Tridax procumbens L.</td>
<td>Cercospora bidentis</td>
</tr>
<tr>
<td>Trigonella foenum-graecum L.</td>
<td>Erysiphe polygoni</td>
</tr>
<tr>
<td></td>
<td>Leveillula taurica</td>
</tr>
<tr>
<td>T. hamosa L.</td>
<td>Leveillula taurica</td>
</tr>
<tr>
<td></td>
<td>Peronospora sp.</td>
</tr>
<tr>
<td>Triticum vulgare H.C.</td>
<td>Cladosporium herbarum</td>
</tr>
<tr>
<td></td>
<td>Erysiphe graminis</td>
</tr>
<tr>
<td></td>
<td>Helminthosporium halodes var. tritici</td>
</tr>
<tr>
<td></td>
<td>H. sativum</td>
</tr>
<tr>
<td></td>
<td>Helminthosporium sp.</td>
</tr>
<tr>
<td></td>
<td>Puccinia graminis</td>
</tr>
<tr>
<td></td>
<td>P. triticina</td>
</tr>
<tr>
<td></td>
<td>Ustilago tritici</td>
</tr>
<tr>
<td>Triumfetta pentandra A. Rich.</td>
<td>Oidium sp.</td>
</tr>
<tr>
<td>Triumfetta sp.</td>
<td>Ragnhildiana sp.</td>
</tr>
<tr>
<td>Tropaeolum majus L.</td>
<td>Leveillula taurica</td>
</tr>
<tr>
<td>Unidentified cucurbit</td>
<td>Plasmopara australis</td>
</tr>
<tr>
<td>Unidentified herb</td>
<td>Ramularia sp.</td>
</tr>
<tr>
<td>Unidentified trees and shrubs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hexagona discopoda</td>
</tr>
<tr>
<td></td>
<td>H. dregaeana</td>
</tr>
<tr>
<td></td>
<td>Schifmerula sp.</td>
</tr>
<tr>
<td></td>
<td>Trabutia sp.</td>
</tr>
<tr>
<td>Uredo cenchricola P. Henm.</td>
<td>Eudarluca australis</td>
</tr>
<tr>
<td>Urochloa panicoides Beauv.</td>
<td>Uromyces leptodermus</td>
</tr>
<tr>
<td>Uromyces spp.</td>
<td>Eudarluca australis</td>
</tr>
<tr>
<td>Verbena sp.</td>
<td>Leveillula taurica</td>
</tr>
<tr>
<td>Vicia faba L.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Erysiphe polygoni</td>
</tr>
<tr>
<td></td>
<td>Fusarium scirpi</td>
</tr>
<tr>
<td></td>
<td>Gibberella fujikuroi</td>
</tr>
<tr>
<td></td>
<td>Leveillula taurica</td>
</tr>
<tr>
<td></td>
<td>Oidium sp.</td>
</tr>
<tr>
<td></td>
<td>Uromyces fabae</td>
</tr>
<tr>
<td></td>
<td>Chocolate spot</td>
</tr>
<tr>
<td>Vigna ? caerulea Baker</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uromyces vignae</td>
</tr>
<tr>
<td></td>
<td>Zonate leaf spot</td>
</tr>
<tr>
<td>V. sesquipedalis W. F. Wight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>?Xanthomonas phaseoli</td>
</tr>
<tr>
<td>V. unguiculata (L.) Walp.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alternaria sp.</td>
</tr>
<tr>
<td></td>
<td>Capnodium sp.</td>
</tr>
<tr>
<td></td>
<td>Cercospora canescens</td>
</tr>
<tr>
<td></td>
<td>C. cruenta</td>
</tr>
<tr>
<td></td>
<td>Cladosporium herbarum</td>
</tr>
<tr>
<td></td>
<td>Curvularia lunata</td>
</tr>
<tr>
<td></td>
<td>Dendryphiella intersemnata</td>
</tr>
<tr>
<td></td>
<td>Macrophomina phaseoli</td>
</tr>
<tr>
<td></td>
<td>Oidium sp.</td>
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<tr>
<td></td>
<td>Phyllosticta ?phaseolorum</td>
</tr>
<tr>
<td></td>
<td>P. ?vignae</td>
</tr>
<tr>
<td></td>
<td>Phyllosticta sp.</td>
</tr>
<tr>
<td></td>
<td>Sphaerotheca fuliginea</td>
</tr>
<tr>
<td></td>
<td>Sporodesmium bakeri</td>
</tr>
<tr>
<td></td>
<td>Uromyces vignae</td>
</tr>
<tr>
<td></td>
<td>Zonate leaf spot</td>
</tr>
<tr>
<td></td>
<td>?Xanthomonas phaseoli</td>
</tr>
<tr>
<td></td>
<td>Mosaic (?virus)</td>
</tr>
<tr>
<td>V. vexillata Benth.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cercospora canescens</td>
</tr>
<tr>
<td></td>
<td>Phyllosticta sp.</td>
</tr>
<tr>
<td></td>
<td>Uromyces vignae</td>
</tr>
<tr>
<td>Vigna spp.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cercospora canescens</td>
</tr>
<tr>
<td></td>
<td>Sphaerotheca fuliginea</td>
</tr>
<tr>
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<td>Uromyces vignae</td>
</tr>
<tr>
<td></td>
<td>Zonate leaf spot</td>
</tr>
<tr>
<td>Vitis vinifera L.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cercospora canescens</td>
</tr>
<tr>
<td></td>
<td>Uncinula necator</td>
</tr>
<tr>
<td>Voandzeia subterranea Thou.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cercospora canescens</td>
</tr>
<tr>
<td></td>
<td>Colletotrichum capsici</td>
</tr>
<tr>
<td></td>
<td>Phyllosticta sp.</td>
</tr>
<tr>
<td>Wissadula rostrata Planch.</td>
<td>Puccinia abutili</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Zea mays</strong> L.</td>
<td></td>
</tr>
<tr>
<td>Cladosporium sp.</td>
<td></td>
</tr>
<tr>
<td>Cochliobolus heterostrophus</td>
<td></td>
</tr>
<tr>
<td>Helminthosporium turcicum</td>
<td></td>
</tr>
<tr>
<td>Puccinia polysora</td>
<td></td>
</tr>
<tr>
<td>P. sorghi</td>
<td></td>
</tr>
<tr>
<td>Ustilago maydis</td>
<td></td>
</tr>
<tr>
<td>Maize streak virus</td>
<td></td>
</tr>
<tr>
<td><strong>Zinnia elegans</strong> Jacq.</td>
<td></td>
</tr>
<tr>
<td>Alternaria zinniae</td>
<td></td>
</tr>
<tr>
<td>Cercospora zinniae</td>
<td></td>
</tr>
<tr>
<td><strong>Zinnia sp.</strong></td>
<td></td>
</tr>
<tr>
<td>Mosaic (? virus)</td>
<td></td>
</tr>
<tr>
<td><strong>Zizyphus mauritiana</strong> Lam.</td>
<td></td>
</tr>
<tr>
<td>Mitteriella zizyphina</td>
<td></td>
</tr>
<tr>
<td><strong>Z. ? spina-christi</strong> Willd.</td>
<td></td>
</tr>
<tr>
<td>Mitteriella zizyphina</td>
<td></td>
</tr>
</tbody>
</table>