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# New fungi described from north east Africa and other Arab countries since 1940. What conclusions could be drawn from this scientific activity ?

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## Abstract

The eastern part of the mediterranean sea is the maritime facade of the geopolitical Middle East. Its fifteen states cover around 9 million $km^2$, all subjected to an arid climate. Research on local mycobiota led to the discovery of taxa then regarded as being new to Science. Since 1940, simply 209 taxonomic units were introduced. For most, collecting sites are in Egypt, Palestine-Israel or Irak ; only one quarter relates to eight other states. All novelties are linked with 122 genera comprising 51 Ascomycetes, 41 deuteromycetes and 15 Basidiomycetes; only half of the latter are plant pathogenic forms. Zygomycetes, Oomycetes and Chytridiomycetes are less represented. Ten new genera of Ascomycetes and deuteromycetes were proposed with original sites almost limited to the former three states.

Minor taxonomic divisions have thus not received proper attention though following the prevalent aridity interesting discoveries should be expected. For Ascomycetes and deuteromycetes, more interest was

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directed to the soil-borne representatives than to their plant-related forms including standing crops. Basidiomycetes proved to be less explored on the regional scale, despite of a fair number of rust and smut fungi being of economic importance. On the basis of their ecology, a limited fraction of introduced taxa exhibits notable thermotolerant abilities and some even qualify as thermophiles; in comparison definitely less xerotolerant fungi were disclosed.

Since 1940, less than four taxonomic units were thus proposed per annum. This underlines the limiited interest given to the biodiversity of fungi in the Middle East, an area presumed to harbour a specific mycoflora. Most proposals were achieved by mycologists active in Egypt, Israel and Irak. However, a scrutiny of authors' names stress the absence of any collaboration among local taxonomists. These entertain sporadic links with colleagues of the near-by European centres and less so with far ones in North America or elsewhere. The present dominant situation needs to be reversed by promoting inter-state contacts to share present expertise and favour information exchange.

Finally, in view of the overwhelming implication of mycology in the fields of biotechnology, adequate knowledge of the Middle East mycoflora is essential. The establishment of a regional centre of fungal taxonomy provided with long standing collaborative links with foreign laboratories should be a decisive appropriate measure.

Key-Words: novel fungi, documentation, biodiversity, taxonomy, phytopathogens, oomycetes, chytridiomycetes, zygomycetes, ascomycetes, basidiomycetes, deuteromycetes, Middle East, Egypt, Irak, Palestine-Israel.

# Introduction

This research project started a number of years ago following my Ph.D. thesis on soil fungi inhabiting arid lands of the New Valley depressions in Egypt. The telluric fungal communities of Kharga and Dakhla oases were then investigated. A number of interesting living cultures were obtained in the course of this study. Trials to put a name on each proved several to represent species being new to science. In order to provide a legal valid binomial for these taxa pure taxonomic work had to be undertaken.

Taxonomic work on soil fungi of the New Valley area resulted in the proposal of several taxa new to science (Mouchacca 1995 ). This activity developed the idea of analysing the outcome of similar research undertaken at the Middle East level. The first relevant published account was prepared from data that had accumulated since my doctorate degree on mainly new soil-borne fungi of the region. The account concerned about 40 species (Mouchacca 1995). The second step was to retreive names of all other fungi with original localities situated in this zone. These amounted to a hundred and fifty with most being obligate parasites of plants or animals (Mouchacca 1999b ) .

The third step implies a synthesis of data characterizing names treated in both contributions in an attempt to extract interesting correlations on the Middle East level, a geographic zone submitted to specific arid climatic conditions (Mouchacca 2001). This synthesis is a good example of how to inventorize natural resources of a particular group of living organisms inhabiting a particular region as the one under consideration. The present project will, however, be pursued by the preparation of a similar critical list of fungi for the three north west African countries. The final goal would be a check-list of novel fungi described from the Arab World since 1940.

# Mycology In The Middle East Region

The three countries of north east Africa, namely Egypt, Lybia and The Sudan constitute with the other Arab states of western Asia the geopolitical region termed The Middle East. The area is an assemblage of 15 political states with a total surface area of about 9 millions km_, all submitted to an arid climate. In this vast zone, agriculture is subject to the presence of regular volumes of superficial running waters originating from sources situated outside the region, as the river Nile, or due to the discovery of important amounts of underground fossil water.

Interest in the fungi of this area became marked after the first world war (Reichert 1921). The trend related in particular to fungi pathogenic to natural plants or to crops of economic importance. For soil-borne fungi the pioneer work of Y.S. Sabet on Egyptian soil fungi published in 1935 and 1939 is now accepted as the starting point of research on these particular communities. The exploration led to the proposal of three species new to science. Their description is due to van Beyma in 1933 (van Beyma 1933 a & b). Original strains examined by the Dutch mycologist are still maintained alive in the major living culture collection of the Centraalbureau voor Schimmelcultures, Baarn (now at Utrecht), The Netherlands.

At the present time, a global document on fungi of the Middle East is not available. But on a state level, few lists of fungi parasitic on plants have been prepared following the second world war (Johnston & Booth 1983). These defnitely require a complete revision of their contents. Nowadays, there is a move to propose critical checklists of known fungi at the local level. Available partial contributions are due to Moustafa (1975, 1978) for Kuwait and to El-Abyad (1997) for Egypt. A similar but exhaustive document for

Libya is authored by El-Buni and Rattan (1981). At the regional level, Moubasher made the first attempt to bring together data on soil fungi in an interesting book that appeared in 1993.

## New Binomials Introduced

To prepare a list of fungi considered as being new to science at the moment of their description the Index of Fungi has to be scanned. This twice a year publication is issued by the CABI Bioscience Egham Centre (formerly the International Mycological Institute, Kew, UK). The title started in 1940 under the name The Review of Applied Mycology. Before 1940, names of new fungi were not constantly compiled and published alltogether. To prepare this index copies of all mycological journals are continuously examined and new names retreived. For each, the index provides the original bibliographic reference with notes on the locality of origin, the taxonomic group, the legal taxonomic status of the coined binomial and features of the material studied.

## Discussion

The scope of this contribution on new fungi originating from the Middle East is far from being a simple compilation. Indeed, for each name introduced the maximum effort was displayed to re-assess not only its nomenclatural state but also its taxonomic position. This reappraisal is crucial for a critical checklist: the status of all names have to be updated by going through all presently available taxonomic books and publications.

Each name has a nomenclatural and a taxonomic status. The first implies applications of articles of the Code of Botanical Nomenclature governing the publication of a name. Omissions of Latin diagnosis (Art. 36 ICBN) or type designation (Art. 37) (or both) is a fault

commonly encounterted in early literature or made by unexeperienced authors leading to the taxon being invalidly published. Once specified illegitimate binomials should no longer be used to designate a fungus.

Regarding the taxonomic status, two situations are commonly encountered: the species is reported to be a later synonym of a previously described taxon; the taxon might have made the object of a generic change. Ultimately the name has not received any further attention. Furthermore for fungi taxonomic implications are a bit more complicated when compared to any other group of living organisms since a fungus may possess both an anamorphic and a teleomorphic states. In the present work the justification of many infraspecific taxa (new formae or new varieties) was considered insufficient to be distinctive from their host species. Several synonymies were also proposed for unwarranted taxonomic decisions ( Mouchacca 1995, 1999 ) .

Taxonomic changes affecting introduced binomials are best exemplified by the three Egyptian-borne taxa established by van Beyma (Beyma 1993 a & b) in relation to the work undertaken by Sabet (Sabet 1935, 1939). The generic affinities of two have undergone changes as more taxonomic revisions were accomplished since their introduction. For *Penicillium egyptiacum* van Beyma, the binome *Eupenicillium egyptiacum* (van Beyma) Stolk & Scott should now be used sinc this *Penicilllium* readily produces ascomata in culture. Oospora *egyptiaca* van Beyma is now better accomodated as *Acremonium egyptiacum* (van Beyma) W.Gams.

No name change was, however, discovered for the third binomial *Cryptomela acutispora* van Beyma. In fact the fungus was only reported once since its description. The report is due to Ali (1977) from soil collected in a desert valley near Riyadh City, Saudi Arabia. However, this finding is most prabably a case of misidentification.

Re-examination in 1994 of the corresponding original strain proved it rather represents *Myrothecium verrucaria* (Albertini & Schweinitz) Ditmar:Fries (Mouchacca 1995). This is a simple case of misidentification frequent in the early literature since mycologists were then deprived of the presently available updated critical books on the taxonomy of fungi. These situations clearly stress the study of fungi is not a simple straightforward system.

It follows that when preparing a regional checklist a large number of documents either recent or less recent should be scrutinized by a specialist having a good level of taxonomic expertise. This mass of publications is available only in a few large specialized libraries. Unfortunately such a shortcoming in developing countries hinders this type of basic research. Several names could thus be still in use for the same organism. This is most critical when fungi pathogenic to plants are concerned.

## Chronology of introductions and original localities

For the fifteen states of the Middle East, interestingly only 209 proposals were formulated in the last six decades (Tab. 1). The chronology of these introductions discloses a continuous interest in the fungi of the area starting from 1940 with a mean of 35 cases each ten years. The rate of introduction is, however, not stabilized around the mean. It shows a decrease in the fifties followed by an increase in the next two decades and a subsequent slackening around the mean. The overall tendancy suggests the absence of a correlation between the activity of describing new species of fungi and the recent economic development of the region.

At the level of the three major geographic subdivisions of the Middle East, proposals originating from the Arabian Peninsula (6,70%) appear meaningless. On the other hand, relative contributions

of countries situated north of the peninsula, i.e. the near east region, attains the two-thirds of the total; the remaining third is due to the three states of north east Africa.

At the state level, four from the Arabian Peninsula (the present Yemen and the Gulf states) are not associated with a single proposal. At this point, it is evident the relative contribution of the north east African states is mainly due to studies relating to Egyptian fungi. For the near east states, the complex Palestine-Isreal is leading. These two basic units cumulate almost two-thirds of the entire proposals; the remaining third is mainly generated by the Iraki and Syrian contributions. State contributions mark the relative importance of work undertaken on fungi in Egypt and the complex Palestine-Israel. Concomitantly, similar interest seems to be totally lacking in countries with marked surface areas as The Sudan, Lybia, Saudi Arabia and even Syria.

Now let us view the same data by considering two parameters simultaneously. The first possibility is to correlate localities of origins with dates of introduction. Three state groups could thus be delimited. Six have individual rates of proposals respectively lower than 3.35 %; also their introductions were in general made starting from 1970. Lebanon and Syria exhibit close percentages but their proposals were made either in the forties for Lebanon and in the sixties for Syria, i.e. before any proposal of the former six states with the lowest relative contributions..

For the remaining three states relative shares disclose a different trend. The complex Palestine-Israel exhibits a continuous deceleration since the fifties. For Irak there is a gradual but slow progression starting from the sixties. For Egypt a similar progression is observed only up to the seventies and before a serious reduction. This

differential trends are presumed to reflect local policies in terms of studies of cryptogams. But the real factors behind such evolutions are, however, not simple linear parameters. This is basically due to the intervention of mycologists active in taxonomic centres situated outside the region.

## Taxonomic characters and localities of origin

When viewing the same proposals but based on the taxonomic characters of fungi described, seven taxonomic divisions are delimited (Tab. 2). Pending their relative contributions divisions Ascomycetes and deuteromycetes are the two dominant ones; they disclose similar percentages amounting to two-thirds of all introductions. The Basidiomycetes ranks third with a relative contribution almost equal to the total of the four remaining divisions. Evidently more interest was directed to the study of Ascomycetes and deuteromycetes in this wide arid zone.

Correlations between taxonomic characters and localities of origin are also interesting to debate. The three divisions with lowest rates suggest exclusive links with the complex Palestine-Israel. The Middle East region thus remains largely inexplored regarding some specific groups of fungi as the Chytrids, the Zygomycetes and the Oomycetes. In other words, a total absence of interest for these divisions prevails among local mycologists. Alternatively no foreign specialist developed such interest for that region. Chytrids and Oomycetes and less so for Zygomycetes are, however, known as parasites of plants and animals able to induce severe losses in some infection cases.

The division Basidiomycetes displays a global trend approximating that of the former divisions. It deviates, however, by the few taxa with original localities situated in Irak and Syria. It

follows not a single Basidiomycete new to science was thus proposed in that period either from Egypt or from the seven other remaining states.

The Ascomycetes and the deuteromycetes, the best two contributing divisions, are represented in almost all states but with dissimilar frequencies. Highest figures for the former are overwhelming in Egypt and Irak and less so for the complex Palestine-Israel. For the deuteromycetes marked values relate to Egypt and the complex Palestine-Israel but here Syria ranks third. For both divisions present data reflect the degree of interest of local mycologists for their members plus the contribution of foreign specialists.

## Substrate type and taxonomic divisions

Fungi proposed from the Middle East were observed developing on substrates of varying nature (Tab. 3). The examined material could tentatively be separated into three groups: organs of living plants (leaves, roots, trunks, seeds, bulbs, etc..) and their decomposing remains; soil supporting a natural or cultivated plants or without a vegetation cover; and other types of substrates as material of animal origin and infected insects. Basidiomycetes with basidiocarps developing on the soil surface were integrated in the second group.

Correlations between substrate types and taxonomic characters clearly underline plant material and soil are the two major sources of almost all described fungi. Names proposed for taxa of other substrates simply amounts to 15% of total introductions. Interestingly plant material and soil exhibit equal high total figures but this similarity is apparently casual.

When considering both previous parameters interesting links could be extracted. Proposals of soil Ascomycetes and deuteromycetes are found to outnumber corresonding figures from plant material. Soils of the Middle East region thus appear to go a good reservoir for new fungi of both taxonomic divisions. Inversely, mycological investigations favoured the study of soil fungi rather than fungi developing on cultivated or natural plants and their remains. It should also be noted that substrates other than soil and plants have developed a good number of new Ascomycetes but comparatively less new deuteromycetes.

On the other hand the reduced figures of newly described Chytrids and Oomycetes are related to plant material only. Fungi of both divisions are parasites of plants and animals. Their respective low rates add weight to the former observation on both divisions: there is a marked absence of taxonomic expertise in these fungi at the Middle East level. The Zygomycetes seems to have simply been studied in relation with other substrates. These fungi are also known to inhabit soil but knowledge of their presence in those of the Middle East has not been developed in the last decades.

## Genera represented

Binomials introduced for fungi of this arid region relate to 122 genera (Tab. 3). Their distribution following the species numbers per genus confirm almost 75% of these genera are connected with one species; only 18 genera are associated with three species. This is a clear statement no monographic taxonomic work was undertaken on fungal genera intimately associated with the land and vegetation of the arid Middle East region. Monographic work on a genus in a particular area generally produce a fair number of new species.

The Ascomycetes and the deuteromycetes, the two dominant divisions in terms of contributions, also have highest generic numbers. But in this respect, the Ascomycetes ranks first. Thus the mean number of ascomycetous species/genus is lower than the corresponding figure of the deuteromycetes. Indeed the latter division has higher cases of genera with more than 3 species. For the Basidiomycetes, the 30 proposals are linked to to 15 genus only.

## Genera new to science

Among the genera observed 11 proved to be new to science at the time of their proposition (Tab. 4). Their type species are thus based on material collected in the Middle East. Six have original localities in Egypt, others are from Iraq, Kuwait, Lebanon and Palestine-Israel. Individual generic histories are a good example of the astonishing diversity of routes leading to the discovery and the description of a new fungus. Few cases could be considered.

The binomial *Neobroomella ciliata* was introduced by the Austrian F. Petrak in 1947. This ascomycete developed on dead stems of *Phlomis brevilabris* collected by J. Bornmüller in 1897 in Lebanon and Syria; specimens were then deposited at the Natural History Museum of Wien. The genus has still only one species attached to it, i.e. a unispecific genus. The deuteromycete *Desertella globulifera* was described in 1979 by J. Mouchacca. It was based on living cultures isolated from a soil sample collected years ago in the oasis of Kharga, Western Desert of Egypt, hence the generic name. These soils were investigated at the Natural History Museum of Paris. Both cases correspond to work undertaken by mycologists operating outside the Midle East region but who became interested for one reason or another to the local mycobiota.

The deuteromycete Hyalocladium moubasherii was introduced by the Egyptian A.F. Moustafa in 1976. The original living culture was obtained during a survey of the fungal air spora of the state of Kuwait. The species was dedicated to A.H. Moubasher, Professor of Mycology at Assiut University. Moustafa later on undertook some research on Egyptian fungi during his subsequent stay at the Suez Canal University, Ismailia City. There a small taxonomic unit was initiated. Presently this unit definitely requires institutional support. The hyphomycete Thermophymatospora fibuligera Udagawa, Awao and Abdulla was described in 1986 from living cultures isolated by S.K. Abdullah from an Iraki date palm plantation. The project was a sound cooperation between a local mycologist and colleagues of a far away country such as Japan.

## Distribution of genera following substrate types and localities of origin

Only data relating to the three major taxonomic divisions will be considered. Ascomycetous genera are found to originate mainly from Egypt, Irak and the complex Palestine-Israel; elements from the six other states form a subgroup of 20 units (Tab. 4). Less than one third is linked to other substrates: dung material and two insect parasites. The genera *Arnium* Nitschke ex G.Winter, *Coprinus* Korf & Kimbr., Preussia Fückel, *Podospora* Ces. and *Saccobolus* Boud. are well known for their tight links with dung material. Thus for Preussia, *Podospora* and *Saccobolus*, 2-3 species were respectively described. The genera *Chaetomidium* (Zopf) Sacc. and *Chaetomium* Kunze comprise soil-borne fungi and species developing on dead plant material. Some Ascomycetes were thus isolated in pure culture; the dung related species were mostly defined from material developing in humid chambers.

Also slightly more genera were reported from soil than from plant material. Soil genera also comprise most units with more than one species. The present high proportion of soil-borne ascomycetes underlines the notable interest of mycologists for natural or cultivated lands of this wide area. For the plant related ascomycetes, more species were observed on decomposing plant material or on seeds (*Chaetomium dreyfussii* von Arx and *Setosphaeria khartoumensis* ElShafie & J.Webster) as compared to species developing on standing crops. This pattern confirms the limited interest awarded to plant pathogenic ascomycetes.

In comparison, deuteromycetous taxa are related to a lower total of genera. This is due to 10 units each having two taxa or more. *Penicillium* Fr. alone is distinguished by 12 propositions followed by *Aspergillus* Link with 6 species. Members of this division exhibit marked affinities with soil. This substrate has also provided the 5 relevant genera new to science. Both observations add weight to the former one about the leading status of soil studies undertaken in the area.

On plant substrates the deteuromycetes are represented by 21 genera. 16 have phytopathogenic attributes but only few could be qualified as obligate phytopathogens: *Cercospora* Fresen., *Cercosporina* Speg., *Oidium* Ehrenb., *Phaeoramularia* Munt.-Cvetkovic and Septoria Sacc.; remainders are simply secondary parasites able to sporulate on normal laboratory cultures. Deuteromycetes of other substrates are an assemblage of taxa isolated from larvae, horse hair and soil nematodes. *Aspergillus flaschentraegeri* Stolk is a notable member of this last group. The fungus was isolated from larvae of Prodenia litura in Alexandria City but never reported again in the literature.

From a taxonomic point of view, deuteromycetes are either hyphomycetes or coelomycetes. The latter are known to be important plant pathogens of natural plants or of crops of economic importance. They are here represented by 7 genera only: *Ascochyta* Lib., *Ascochytella* Tassi, *Cytosporina* Sacc., *Diplodia* Fr., *Phoma* Sacc., *Phyllosticta* Pers. and *Stegonsporium* Corda. It is apparent research on coelomycetes have not yet attracted the attention of local specialists. This is mostly unfortunate due to the particular local botanical flora be natural or cultivated. Attention to coelomycetous taxa should lead to interesting discoveries. In fact the overall features of the deuteromycetous genera recorded clearly reflects the prevailing low level of regional taxonomic expertise regarding their phytopathogenic forms.

The fifteen basidiomycetous genera exhibit a preferential link to plant material. The genera *Agaricus* L., *Russula* Pers. and *Tricholoma* (Fr.) Staude harbour species producing carpophores on the soil surface. These hymenomycetes were collected exclusively in the complex Palestine-Israel in forests of *Quercus calliprinos* and *Pinus halepensis*. *Crepidotus variabilis* var. *stercorarius* developed on horse dung. Among the genera linked with plant material, species of *Galzinia* Bourdot, *Hyphoderma* Fr., *Lepiota* (Pers.) Gray and *Macowanites* Kalchbr. developed on decomposing plant parts.

Regarding the 7 remaining genera of the division, their representatives are either rusts or smuts. The 5 smuts are species of *Entyloma* de Bary, *Tilletia Tul.* & C.Tul. and *Ustilago* (Pers.) Roussel. The 11 reported rusts rather belongs to *Puccinia* Pers. and *Uromyces* (Link) Unger since for *Aecidium* Pers. and *Uredo* Pers. only one proposition was established. This low number of introduced rusts and smuts implies such fungal forms have not received appropriate

attention at the regional level. Consequently limited information is presently available on these obligate parasites of natural plants or of crops of economic importance grown in this vast arid region.

## Centres of taxonomic expertise in the region

A scrutiny of the nationality of specialists behind the 209 proposals determines potential centres of taxonomic expertise. It also delimits respective interest of local mycologists and of external ones. Again this analysis will also underline the diversity of individual routes with final issues being the description of a new taxon.

The 3 deuteromycetes with original localities in Saudi Arabia disclose all possible combinations. The recently described *Cercospora saudii* was introduced by a local mycologist, *Ramichloridium mackenziei* was jointly characterized by a visiting professor and a local colleague; it was isolated from an old female suffering brain abscesses; now it is recognized as a synonym of another member of the genus. *Alternaria selinii* was named by an american mycologist and based on a specimen collected by a British botanist during a foray in Saudi Arabia subsequently deposited at Kew Gardens (London).

Among the 3 Jordanian taxa, collection and description of *Cylindrotrichum gorii* is due to an Italian mycologist; original strains of the other two were obtained by Egyptian mycologists but *Coniochaeta nodulisporioides* was described by a British specialist.

Three out of four Omanese ascomycetes developed from local dung material kept in humid chambers in Spain leading to a joint published work; the soil-borne *Emericella omanensis* was isolated and precised by two Japanese taxonomists. About the 4 Libyan taxa, only the one isolated from a nematode implies a local mycologist while visiting a British centre.

The 6 taxa originiating from The Sudan are due to European specialists though the local ElShafie assisted in the characterization of *Drechslera gedarefensis* during a stay in UK. The 7 Kuwaiti units were proposed between 1973 and 1989; they result from work undertaken by the Egyptian mycologist A.F. Mostafa at the Department of Botany of Kuwait University; the recent Chrysosporium zonatum correspond to a joint study with a Dutch colleague.

The situation is dissimilar when considering Lebanon with 10 binomials introduced in the sole years 1946 and 1947 by F.Petrak from Vienna based on J. Bornmüller collections and by T. Rayss based on material deposited at the Herbarium of the Hebrew University of Jerusalem. Rayss also authored the description of *Tilletia sphenopodis* collected in 1931 in Syria. For this country, the 13 proposals of *Penciillium* resulted from the Ph.D. thesis of Baghdadi submitted in 1968 in the Soviet Union; interestingly this author ceased his taxonomic activity upon his return.

For the former states, it is clear respective introductions are definitely not correlated with any developing centre of taxonomic expertise.

For Irak (29 proposals), the first 5 introductions - due from 1941 to 1966 - were made by European mycologists. But from 1976, S.K. Abdullah will initiate a taxonomic unit at Basrah University. An interesting series of publications will then be produced focusing on the Systematics of the Ascomyetes. No effort will, however, be undetaken to survey local plant pathogenic forms. Published work will be achieved partly in collaboration with Indian, Japanese, British and more recently with Spanish colleagues.

For Egypt (52 proposals) the first binomial was coined in 1952 for the Chytrid *Rhizophydium racemosum*; this is also the sole local discovery of a non eumycotan fungi. Interest of external mycologists mostly European ones accounts for half of the new taxa being either Ascomycetes or deuteromycetes; research leading to the proposal of the second half was achieved at the Department of Botany, Suez Canal University. For the Nile Valley, most introductions have a soil origin; only few were observed on plant or dung material. Simply 4 binomials concern phytopathogenic forms and these were characterized by local specialists. This shortcoming stress the need to develop local research on destructive agents of standing crops.

Introductions of the complex Palestine-Israel (77 proposals) could be dispatched pending publications dates in two parts. The years from 1941 to 1961 correspond to the active period of T. Rayss, who authored practically all relevant binomials. She studied fungi of soil and plant material belonging to most taxonomic divisions except the Hymenomycetes. After 1961, a series of new authors will demonstrate their interest to pathogenic forms of the divisions Basidiomycetes, Chytridiomycetes or Zygomycetes. Nonetheless, these late proposals from this small area appear not to be correlated with the emergence of any well established taxonomic centre.

## Ecological attributes of introduced taxa

Fungi differ in their ability to develop at high temperatures. Thermophilic species grow at the range of temperatures from 20!C-60!C. Thermotolerant taxa have a temperature growth range from ca. 8°C-45°C or even 52°C. But the number of fungi developing at high temperatures is reduced in comparison to the mass of mesophilic species able to grow only in the range from 5°C-35°C.

Now when examining the ecological attributes of the Middle East novel fungi, some proved their ability to develop under conditions of temperatures and osmotic pressures commonly unfavourable for growth of mesophilic species. All over 21 members exhibit such features (Tab. 7). Most are thermotolerants but few qualify as thermophiles. This group also comprise a xerotolerant ascomycete, i.e. a fungus able to grow in notable dry conditions, and two osmothermotolerant members, i.e. fungi developing at high temperatures in a dry environment.

This small ecological group represents 10% of all taxa introduced for the region. Its 5 thermophilic members correspond to 15% of all presently known thermophiles (Mouchacca 1997, 1999a). All its members have a common soil origin. The discovery of soil-borne fungi with particular physiological attributes is definitely related to the arid conditions prevailing in the Middle East region, part of the large North African desert belt that also extends far away to the east of Egypt. The marked aridity of this zone is behind the development of living forms able to survive an environment too often extreme for common forms of life. The isolation of new thermophiles and thermotolerant fungi is also particularly interesting in terms of biotechnological potential. New fungal molecules are nowadays continuously seeked for the production of products with high enzymic or antibiotic activities.

## Conclusions

Now what conclusions could be extracted from the analysis of informations conveyed by names of fungi introduced in the last sixty years from localities situated in the Middle East region.

First, the simple total of 209 introductions corresponds to a mean value of less than four cases per year. This is a meaningless value when compared to the present annual volume of descriptions; the latter turns around a figure of two thousand species. Clearly interest in the study of fungi in this region is definitely limited not to say rather inexistant. Such a dominant tendancy ought to be reversed on the simple fact this wide arid area do harbour a specific mycobiota.

However, the former major observation should be tempered by the fact the majority of present introductions resulted from efforts undertaken by local mycologists. These efforts gain weight if we also consider introductions resulting from cooperation with colleagues external to the area. In the Middle East, taxonomic mycologists have been principally active in Egypt, Irak and the complex Palestine-Israel. Unfortunately their respective specialists have now attained a retiring age with no evidence of replacement by younger candidates. The present level of taxonomic achievements will thus not even be maintained at its actual low state.

Available data underlines a significant absence of data on particular divisions of fungi. This is evident for Protoctistan and Zygomycetous fungi. Both divisions have definitely not received any attention although their representatives in such a dry region should disclose interesting discoveries. The Ascomycetes and the deuteromycetes were better investigated. Clearly their plant related forms were less explored in comparison to the soil inhabiting components. Indeed few attention has been given to fungi of both divisions developing on standing plants being natural or under cultivation.

The Basidiomycetes proved to be the least studied major taxonomic fungal division. The situation is particularly of deep concern especially with regard to their phytopathogenic forms being the rusts and the smuts. The potential local biodiversity of these parasites awaits to be surveyed. Several are known to be agents of severe economic losses of standing crops.

On another topic, a complete absence of cooperation between local mycologists is manifest. The only links that surfaced during the present analysis are those sporadically entertained most commonly with European mycological centres. Contacts between mycologists of the Middle East ought to be favoured by all means. Such would enhance the sharing of present local expertise and expedite exchange of information.

The implication of fungi in the various fields of modern biotechnology is actually expanding very rapidly. In this respect, the establishment of a regional centre of fungal taxonomy should be a decisive action in order to accelerate our knowledge of the Middle East mycobiota. This centre should, however, be provided with specific continuous flow of resources ensuring durable links with major taxonomic institutions present in Europe or elsewhere.

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Tab. 1. Localities of origin and chronology of introductions.

| State /Years 1940 to | -50 | -60 | -70 | -80 | -90 | 90> | T | % |
|---|---|---|---|---|---|---|---|---|
| SAUDI-ARAB. (SA) | - | - | - | - | 1 | 32 | 3 | 1.43 |
| JORDAN (JO) | - | - | - | 3 | - | - | 3 | 1.43 |
| OMAN (OM) | - | - | - | - | - | 4 | 4 | 1.92 |
| LYBIA (LY) | - | - | - | 4 | - | - | 4 | 1.92 |
| SUDAN (SU) | - | - | - | 1 | 4 | 1 | 46 | 2.87 |
| KUWEIT (KU) | - | - | - | 4 | 3 | - | 7 | 3.35 |
| LEBANON (LE) | 9 | - | - | 1 | - | - | 10 | 4.78 |
| SYRIA (SY) | 1 | - | 13 | - | - | - | 14 | 4.70 |
| IRAK (IR) | 1 | - | 4 | 3 | 7 | 14 | 29 | 13.88 |
| EGYPT (EG) | - | 1 | 10 | 24 | 13 | 4 | 52 | 24.88 |
| PALES./ISRAEL (PI) | 21 | 15 | 18 | 5 | 9 | 9 | 77 | 36.84 |
| Total/decade (Y=35) | 32 | 16 | 45 | 45 | 37 | 34 | 209 | |

Tab. 2. Localities of origin and taxonomic divisions (TD).

| TD/State | SA | OJ | OM | LY | SU | KU | LE | SY | IR | EG | PI | T | (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chytridiomycetes | - | - | - | - | - | - | - | - | - | 1 | 3 | 4 | 1.91 |
| Zygomycetes | - | - | - | - | - | - | - | - | - | - | 8 | 8 | 3.83 |
| Oomycetes | - | - | - | - | - | - | 1 | - | - | - | 10 | 11 | 5.26 |
| Ascomycetes | - | 1 | 4 | 3 | 5 | 2 | 5 | - | 18 | 27 | 11 | 76 | 36.37 |
| deuteromycetes | 3 | 2 | - | 1 | 1 | 5 | 4 | 13 | 5 | 24 | 19 | 77 | 36.85 |
| Basidiomycetes | - | - | - | - | - | - | - | 1 | 6 | - | 23 | 30 | 14.35 |
| Agonomycetes | - | - | - | - | - | - | - | - | - | - | 3 | 3 | 1.43 |
| Total/State | 3 | 3 | 4 | 4 | 6 | 7 | 10 | 14 | 29 | 52 | 77 | 209 | |

For state abbreviations, see Tab. 1. ; T: = Total

Tab. 3. Taxonomic divisions (TD) and substrate types (ST).

| TD/State | | Plant | Soil | Other | Total |
|---|---|---|---|---|---|
| Chytridiomycetes | ( 3 ) | 3 | 1 | - | 4 |
| Zygomycetes | ( 5 ) | - | 1 | 7 | 8 |
| Oomycetes | ( 3 ) | 11 | - | - | 11 |
| Ascomycetes | ( 51 ) | 20 | 38 | 18 | 76 |
| deuteromycetes | ( 44 ) | 30 | 40 | 7 | 77 |
| Basidiomycetes | ( 15 ) | 21 | 8 | 1 | 30 |
| Agonomycetes | ( 1 ) | 3 | - | - | 3 |
| Total/State | ( 122 ) | 88 | 88 | 33 | 209 |

Figures between ( ) correspond to numbers of genera represented

Tab. 4. New genera introduced (in chronological order).

| | |
|---|---|
| Neobroomella ciliata Petrak 1947 Thryptospora | Lebanon, ascomycete |
| singularis Petrak 1947 | Lebanon, ascomycete |
| Adlerocyctis parkeri Feld.-Muhen & Havivi 1963 | Palestine-Israel, zygomycete |
| Rhexothecium globosum Samson & Mouchacca 1975 | Egypt, ascomycete |
| Hyalocladium moubasherii Moustafa 1976 | Kuwait, deuteromycete |
| Desertella globulifera Mouchacca 1976 | Egypt, deuteromycete |
| Clavispora lusitaniae Rod. De Miranda 1979 | Palestine-Israel, yeast ascomycete |
| Thermophymatospora fibuligera Udagawa et al. 1986 | Irak, deuteromycete |
| Setosporella mahmoudii Moustafa & A.-Wahid 1989 | Egypt. deuteromycetc |
| Chaetomiopsis dinae Moustafa & A.-Wahid 1990 | Egypt, ascomycete |
| Mucobasispora tarikii Moustafa & A.-Wahid 1990 | Egypt, Deuteromycete |

Tab. 5. Distribution of genera following substrate types and localities of origin.

| PLANT | | SOIL ASCOMYCETES | | OTHERS | |
|---|---|---|---|---|---|
| Arxiomyces | IR | Achaetomium | EG | Arnium | EG |
| Astrocystis | SU | Ascobolus | EG | Chaetomidium | OM |
| Caenothyrium | PI | Chaetomiopsis* | EG | Chaetomium | PI |
| Chaetomium | PI | Chaetomium (6) | EG,IR | Coprotus | OM |
| Chaetosphaeria | SU | Coniochaeta | JO | Corynascella | IR |
| Clavispora * | PI | Coonemeria | IR | Iodophanus | IR |
| Didymella | LE | EmericellA (4) | EG,OM,IR | Laboulbenia | LY |
| Erysiphe | LE | Eupenicillium | EG | Podospora (2) | EG, IR |
| Gauemannomyces | EG | Eurotium | EG | Preussia (2) | IR |
| Guignardia | LE | Gelasinospora | EG | Saccobolus (3) | PI , LY |
| Leptosphaeria | PI | Gymnoascus | EG | Stigmatomyces | LY |
| Neobroomella * | LE | Lasiobolidium | EG | Strattonia | IR |
| Plagiosphaera | SU | Melanocarpus | IR | Thecotheus | OM |
| Preussia | IR | Microascus (3) | PI | Zygopleurage | EG |
| Setosphaeria | IR | Monascus (2) | IR | | |
| Sphaerulina | IR | Pseudoallescheria | KU | | |
| Syspastospora | IR | Pseudeurotium | EG | | |
| Thryptospora | LE | Rhexothecium * | EG | | |
| Zopfiella | IR | Sphaerodes | IR | | |
| | | Talaromyces | EG | | |
| | | Thielavia (6) | EG, PI, KU | | |
| | | Zopfiella | EG | | |

## DEUTEROMYCETES

| | | | | | |
|---|---|---|---|---|---|
| Alternaria (2) | EG, SA | Alternaria (2) | EG | Aspergillus | EG |
| Ascochyta | LE | Aspergillus(6) | EG,SY,PI | Chrysosporium | KU |
| Ascochytella | IR | Bipolaris (2) | PI, EG | Cirrenalia | KU |
| Botrytis | EG | Cladorrhinum (2) | EG | Hyalocladium * | KU |
| Cercospora (3) | PI, SA | Descrtella * | EG | Nematoctonus | LY |
| Cercosporina | PI | Embellisia | EG | Ramichloridium | SA |
| Cylindrotrichum | JO | Fusariella | EG | Stachybotrys | IR |
| Cytosporina | PI | Gilmaniella (2) | EG | Trichosporon | EG |
| Exserohilum(3) | IR,SU,EG | Humicola | JO | | |
| Fusariella | PI | Idriella | EG | | |
| Fusarium | PI | Mucobasispora* | EG | | |
| Geotrichum | EG | Penicillium (12) | SY | | |
| Oidium (2) | PI | Periconia | PI | | |
| Penicillium | EG | Scopulariopsis | EG | | |
| Pestalotia | LE | Setosporella* | EG | | |
| Phaeoramularia | PI | Sporothrix | KU | | |
| Phoma | LE | Thermophymatospora* | IR | | |
| Phyllosticta | PI | Trichocladium | EG | | |
| Septoria (4) | PI | Trichurus | IR | | |
| Sphaeropsis | PI | | | | |
| Stegonsporium | LE | | | | |

## BASIDIOMYCETES

| | | | | | |
|---|---|---|---|---|---|
| Aecidium | IR | Agaricus (4) | PI | Crepidotus | PI |
| Entyloma (3) | PI | Russula | PI | | |
| Galzinia | IR | Tricholoma | PI | | |
| Hyphoderma | IR | | | | |
| Lepista | PI | | | | |
| Macowanites | PI | | | | |
| Puccinia (3) | PI, IR | | | | |
| Tilletia | SY | | | | |
| Uredo | IR | | | | |
| Uromyces (9) | IR, PI | | | | |
| Ustilago | PI | | | | |

* genus new to sceince

( ) number of species/genus

Tab. 6. Distribution of taxa following localities of origin and dates of publication ( invalid taxa are underlined ) .

| | |
|---|---|
| *Cercospora saudii* M.S. Mohammed 1988 | **SAUDI ARABIA** |
| *Ramichloridium mackenziei* C.K. Campbell & Al-Hedaithy 1993 | |
| *Alternaria selini* E.G. Simmons 1995 | |
| *Coniochaeta nodulisporioides* D. Hawksworth 1978 | **JORDAN** |
| *Cylindrotrichum gorii* Lunghini 1979 | |
| *Humicola hyalothermophila* Moubasher, Mazen & Abdel-Hafez 1979 | |
| *Chaetomidium khodense* Cano, Guarro & ElShafie 1993 | **OMAN** |
| *Coprotus dhofarensis* Gené, ElShafie & Guarro 1993 | |
| *Thecotheus harasisus* Gené, ElShafie & Guarro 1993 | |
| *Emericella omanensis* Y. Horie & Udagawa 1996 | |
| *Nematoctonus tripolitanus* Giuma & R.C. Cooke 1972 | **LYBIA** |
| *Laboulbenia feliciscaprae* W. Rossi 1974 | |
| *Saccobolus parvisporus* van Brummelen 1976 | |
| *Saccobolus purpureus* van Brummelen 1976 | |
| *Exserohilum gedarefense* (ElShafie) J. Alcorn 1983 | **SUDAN** |
| *Setosphaeria khartoumensis* ElShafie & J. Webster 1981 | |
| *Chaetosphaeria anglica* J. Fisher & O. Petrini 1983 | |
| *Plagiosphaera nilotica* M. Monod & J. Fisher 1983 | |
| *Stigmatomyces ligabuei* W. Rossi 1984 (1986) | |
| *Asctrocystis hughesii* Laessoe & Spooner 1994 | |
| *Pseudoallescheria desertorum* (v. Arx & Moustafa) Mac Ginnis et al. 1988 | **KUWAIT** |
| *Gilmaniella macrospora* Moustafa 1975 | |
| *Hyalocladium moubasherii* Moustafa 1976 | |
| *Thielavia coactilis* Nicot (= Thielavia kuwaitensis Moustafa 1976) | |
| *Sporothrix ranii* Moustafa 1981 | |
| *Cirrenalia basiminuta* Raghu-Kumar & Zainal 1988 | |
| *Chrysosporium zonatum* Al-Musallam & C.S. Tan 1989 | |
| *Ascochyta pisi Libert* (= Ascochyta orobi f. macrocarpa Rayss 1946) | **LEBANON** |
| *Erysiphe cruciferarum* Opiz ex Junell (= *Erysiphe communis* f. fibigiae Rayss 1946) | |

*Steganosporium centaureae* Rayss 1946

*Guignardia euphorbiae* Rayss 1946

*Didymella syriaca* Petrak 1947

*Pestalotia insueta* Petrak 1947

*Phoma syriaca* (Petrak) Boerema et al. (= *Plenodomus syriacus* Petrak 1947)

*Neobroomella ciliata* Petrak 1947

*Thryptospora singularis* Petrak 1947

*Pythium orthogonon* Ahrens 1971

*Tilletia sphenopodis* Rayss 1946

**SYRIA**

*Aspergillus subsessilis* Raper & Fennell (= Aspergillus kassunensis Baghdadi 1968)

*Penicillium chrysogenum* Thom (= Penicilium harmonense Baghdadi 1968)

*Penicillium cremeogriseum* Chalabuda (= Penicilium yarmokense Baghdadi 1968)

*Penicillium decumbens* Thom (= Penicilium arabicum Baghdadi 1968)

*Penicillium dierckxii* Biourge (= Penicilium benbitarianum Baghdadi 1968)

*Penicillium manginii* Duché & Heim (= Penicilium syriacum Baghdadi 1968)

*Penicillium moldavicum* Milko & Beliakova (= Penicilium kabunicum Baghdadi 1968)

*Penicillium quercetorum* Baghdadi 1968

*Penicillium simplicissimum* (Oudem.) Thom (= Penicilium es-suveidense Baghdadi 1968)

*Penicillium sizovae* Baghdadi 1968

*Penicillium steckii* Zaleski (= Penicilium baradicum Baghdadi 1968)

*Penicillium westlingii* Zaleski (= Penicilium gorlenkoanum Baghdadi 1968)

*Penicillium westlingii* Zaleski (= Penicilium damascenum Baghdadi 1968)

*Ascochytella thymi* Petrak 1941

**IRAK**

*Aecidium tami* Z. Urban 1966

*Uredo fragrantissima* Z. Urban 1966

*Uromyces acnatholimonis* Sydow var. zagrosica Z. Urban 1966

*Puccinia hadacii* Z. Urban 1966

*Galzinia cystidiata* Rattan & Abdullah 1976 (1977)

*Iodophanus basraneous* Abdullah, Ismail & Rattan 1977

*Hyphoderma puberis* var. dactyliferum Rattan & Al-Dboon 1980

*Stachybotrys guttulispora* Muhsin & El-Helfi 1981

*Strattonia mesopotamica* Abdullah 1983

*Trichurus dendrocephalus* Udagawa, Y.Horie & Abdullah 1985

*Podospora euphratica* Abdullah 1987

*Thermophymatospora fibuligera* Udagawa, Awao & Abdullah 1986

*Chaetomium subcurvisporum* Abdullah & Al-Bader 1989

*Emericella similis* Y.Horie, Udagawa, Abdullah & Al-Bader 1990

*Melanocarpus thermophilus* (Abdullah & Al-Bader) Guarro et al.

(≡Thielavia minuta var. thermophila Abdullah & Al-Bader 1992)

*Exserohilum curvisporum* Sivanesan, Abdullah & Abbas 1993

*Chaetomium mesopotamicum* Abdullah & Zora 1993

*Arxiomyces zubairiensis* Abdullah & Al-Saadoon 1994

*Sphaerodes irakuiensis* Abdullah & Abbas 1994

*Syspastospora tetraspora* Abdullah & Al-Saadoon 1994

*Monascus pallens* Cannon, Abdullah & Abbas 1995

*Monascus sanguineus* Cannon, Abdullah & Abbas 1995

*Zopfiella cephalothecoidea* Guarro, Abdullah, Al-Saadoon & Gené 1996

Zopfiella *submersa Guarro*, Al-Saadoo, Gené & Abdullah - 1997

*Preussia aquilirostrata* Guarro et al. 1997

*Preussia constricta* Guarro, Al-Saadoon & Abdullah 1997

*Preussia hexaphragmia* Guarro, Al-Saadoon & Abdullah 1997

*Corynascella arabica* Guarro, Al-Saadoo, Gené & Abdullah - 1997

*Rhizophydium racemosum* Gaertner 1954 **EGYPT**

Botrytis septospora El-Helaly, Elarosi, Assawah & Kilani 1962

*Harpophora maydis* (Samra et al.) W.Gams

(≡ *Cephalosporium maydis* Samra, Sabet & Hingorani 1963)

*Aspergillus flaschentraegeri* Stolk 1964

*Geotrichum candidum* (= Geotrichum novakii El-Masry & Zsolt 1966)

*Chaetomium gelasinosporum* Aue & E.MŸller 1967

*Chaetomium uniporum* Aue & E.MŸller 1967

*Chaetomium mareoticum* Besada & Yusef 1968 (1970 ?)

Alternaria macrospora A. Zimmerman (= Macrosporium macrosporum (A. Zimmerman) Morsy 1969)

*Zygopleurage faiyumensis* N. Lundqvist 1969

*Podospora aegyptiaca* N. Lundqvist 1970

*Alternaria mouchaccae* E.G. Simmons (nom. nov.: Ulocladium chlamydosporum Mouchacca 1971).

*Pseudeurotium desertorum* Mouchacca 1971

*Aspergillus egyptiacus* Moubasher & Moustafa 1972

*Idriella desertorum* Mouchacca 1972

*Fusariella aegyptiaca* Mouchacca 1973

*Alternaria chlamydospora* Mouchacca 1973

*Bipolaris subpapendorfii* (Mouchacca) J. Alcorn ( ≡ Drechslera subpapendorfii Mouchacca 1973)

*Gymnoascus desertorum* (Moustafa) von Arx. ( ≡ Arachniotus desertorum Moustafa 1973)

*Thielavia arenaria* Mouchacca 1973

*Thielavia microspora* Mouchacca 1973

*Thielavia subthermophila* Mouchacca 1973

*Zopfiella karachiensis* (Ahmed & Asad) Guarro (= *Podospora faurelii* Mouchacca 1973)

*Arnium bellum* Lundqvist 1974

*Aspergillus peyronelii* Sappa (= *Aspergillus floriformis* Samson & Mouchacca 1975)

*Aspergillus ustus* var. pseudodeflectus (Samson & Mouchacca) Kozakiewicz (≡ *Aspergillus pseudodeflectus* Samson & Mouchacca 1975)

*Emericella desertorum* Samson & Mouchacca 1975

*Emericella purpurea* Samson & Mouchacca 1975

*Eurotium xerophilicum* Samson & Mouchacca. 1975

*Rhexothecium globosum* Samson & Mouchacca 1975

*Ascobolus egyptiacus* Mouchacca 1977

*Embellisia didymospora* Munt.-Cvetkovic (= Ulocladium microsporum Moubasher & Abdel-Hafez 1977)

*Talaromyces trachyspermus* var. *assiutensis* (Samson & Abdel-Fattah) Yaguchi & Udagawa

(= Talaromyces assiutensis Samson & Abdel-Fattah 1978)

*Desertella globulifera* Mouchacca 1979

*Achaetomium strumarium* (= Achaetomium cristalliferum Faurel & Locquin-Linard 1980)

*Eupenicillium sinaicum* Udagawa & Ueda 1982.

*Coonemeria aegyptiaca* (Ueda & Udagawa) Mouchacca
( ≡ Thermoascus aegyptiacus Ueda & Udagawa 1983)
*Exserohilum oryzinum* A. Sivanesan 1984
*Lasiobolidium aegytiacum* Moustafa & Ezz El-Din 1989
*Chaetomium sinaiense* Moustafa & Ezz El-Din 1989
*Gilmaniella multiporosa* Moustafa & Ezz El-Din 1989
*Penicillium allii* M.A. Vincent & J.I. Pitt 1989
*Setosporella mahmoudii* Moustafa & Abdel-Wahid 1989
*Mucobasispora tarikii* Moustafa & Abdul-Wahid 1990
*Scopulariopsis hanii* Moustafa & Abdul-Wahid 1990
*Trichocladium ismailiense* Moustafa & Ezz-El-Din 1990
*Thielavia aegyptiaca* Moustafa & Abdul-Wahid 1990
*Chaetomiopsis dinae* Moustafa & Abdul-Wahid 1990
Trichosporon pharoni Ahmed, Ghanem & Reffaat 1992
*Cladorrhinum bulbillosum* W. Gams & Mouchacca 1993
*Cladorrhinum phialophoroides* Mouchacca & W. Gams 1993
*Gelasinospora hippopotama* Krug, Khan & Jeng 1994

Oidium matthiolae Rayss 1940 **PALESTINE-ISRAEL**

Synchytrium helianthemum Karling (= Synchytrium aureum Rayss 1942)
*Urophlyctis astomae* Rayss 1942
*Urophlyctis eryngii* Rayss 1942
*Phaeoramularia dissiliens* (Duby) Deighton (= Cercospora judaica Rayss 1943)
*Phyllosticta fusiformis* Nicolas & Aggéry (= Phyllosticta fusiformis f. microcarpa Rayss 1943)
Cytosporina crataegi Allescher (= Cytosporina crataegi f. obesispora Rayss 1943)
*Septoria koeleriae* Cocconi & Morini (= Septoria koeleriae var. macrocarpa Rayss 1943)
*Septoria urticaepiluliferae* Rayss 1943
*Ustilago jehudana* Zundel 1944
*Peronospora veronicaecymbulariae* Rayss 1945
*Actinomucor elegans* (= Actinomucor corymbosus f. palaestina Rayss 1946)
*Peronospora medicaginisorbicularis* Rayss 1946
*Peronospora rumicisrosei* Rayss 1946

Saccobolus kerverni (Crouan) Boud. f. minor Rayss 1947

*Rhizoctonia bataticola* (Taubenh.) Butler (= Sclerotium bataticola ssp. intermedium Reichert & Hellinger 1947)

*Rhizoctonia bataticola* (Taubenh.) Butler (= Sclerotium bataticola ssp. sesamica Reichert & Hellinger 1947)

Rhizoctonia bataticola (Taubenh.) Butler (= Sclerotium bataticola ssp. bataticola Reichert & Hellinger 1947)

*Cercospora cephalariae* Rayss 1950

*Septoria crodii* Rayss 1950

Rhopalomyces elegans var. minor (Rayss) Ellis (= Rhopalomyces elegans f. minor Rayss 1950).

Puccinia rimosa f. nattrassii Rayss 1951

*Uromyces anthyllidis* f. *trigonellae Rayss* 1951

*Entyloma ambrosiaemaritimae* Rayss 1952

*Entyloma parietariae* Rayss 1952

*Sphaerulina serograpta* var. *calliprinos* Rayss 1953

*Cercosporina hierosolymitana* Rayss 1955

*Cercospora rhagadioli* Bubak (= Cercospora rhagadioli var. palestina Rayss 1955)

*Septoria withaniae* Rayss 1955

*Puccinia crucianellae* Desm. var. *crucianellaemacrostachyae* Petrak 1957

Periconia pycnospora Fresen. f. israelitica Rayss & Borut 1958

*Thielavia terricola* (= Thielavia terricola f. minor Rayss & Borut 1958

*Uromyces poae* Rabenh. f. sp. *asiaticihackelii* Rayss & Chabelska 1958

*Crepidotus variabilis* var. *stercorarius* Reichert & Avizohar-Herschenzon 1959

Lepista sordida (Fr.) Singer var. gracilis Reichert & Avizohar-Herschenzon 1959

Tricholoma wcizianum Reichert & Avizohar-Herschenzon 1959

Agaricus meleagris Genevier var. fibrillosus Avizohar-Herschenzon 1961

Oidium arachidis Chorin 1961

Peronospora trifoliicherleri Rayss 1961

Peronospora trifoliiclypeati Rayss 1961

*Peronospora trifoliiformosi* Rayss 1961

Peronospora trifoliipilularis Rayss 1961

Peronospora trifoliipurpurei Rayss 1961

Adlerocystis parkeri Feldman-Muhsam & Havivi 1963

Adlerocystis ornithodori Feldman-Muhsam & Havivi 1963

*Fusariella huguesa* Chabelska-Frydman 1964

*Sclerophthora lolii* R.G. Kenneth 1964

*Sclerophthora rayssiae* R.G. Kenneth. Koltin & Wahl 1964

*Caenothyrium citri* Reichert & Chorin 1965

*Uromyces christensenii* Anikster & Wahl 1966

*Uromyces oliveirae* Anikster & Wahl 1966

*Uromyces rayssii* Anikster & Wahl 1966

*Uromyces reichertii* Anikster & Wahl 1966

*Uromyces viennotbourginii* Anikster & Wahl 1966

*Macowanites galileensis* Moser, Binjamini & Avizohar-Hershenzon 1977

*Russula carmelensis* Moser, Binyamini & Avizohar-Hershenzon 1977

*Entomophthora turbinata* Kenneth 1977

*Clavispora lusitaniae* Rodrigues de Miranda 1979

*Erynia erinacea* (Ben-Ze'ev & Kenneth)Remaud.&Henn. ( ≡ Zoophthora erinacea Ben-Ze'ev & Ken. 1979).

*Erynia orientalis* ( Ben-Ze'ev & Kenneth ) Humber , Ben-Ze'ev & Kenneth ( ≡ Zoophthora orientalis B.Z.& K. 1981)

*Entyloma taraxaci* K. Vanky 1983

*Entomophthora israelensis* Ben-Ze'ev & Zelig 1984

*Chaetomium dreyfussii* J.A. von Arx, in von Arx, Guarro & Figueras 1986

*Chaetomium oblatum* M. Dreyfuss & J.A. von Arx, in von Arx, Guarro & Figueras 1986

*Uromyces scillarum* (Baxter) Winter f.sp. pancratii Anikster 1987

*Fusarium oxysporum* f.sp. heliotropii D. Netzer & C. Weintal 1987

Spaheropsis sapinea (= Diplodia pinea f.sp. cupressi Solel et al. 1987)

*Leptosphaeria pimpinellae* Lowen & Sivanesan 1989

Microascus desmosporus var. macroperithecia Sage, Steiman, Seigle-Mur. & Guiraud. 1995

Microascus dimonotus Sage, Steiman, Seigle-Mur. & Guiraud 1995

Microascus trigonosporus var. macroperithecia Sage, Steiman, Seigle-Mur. & Guiraud 1995

*Agaricus bonei Wasser* 1995

*Agaricus nevoi* Wasser 1995

Aspergillus homomorphus Steiman, Guiraud, Sage & Seigle-Mur. 1995

Aspergillus pseudo-heteromorphus Steiman, Guiraud, Sage & Seigle-Mur. 1995

*Bipolaris israeli* Steiman, Guiraud, Seigle-Murandi & Sage 1996

*Agaricus herinkii* Wasser 1996

Tab. 7. Thermophile, thermotolerant and/or osmophilic fungi.

## THERMOPHILE

**scomycetes**

*Chaetomium mesopotamicum* Abdullah & Zora 1993 .

*Coonemeria aegyptiaca* (Ueda & Udagawa) Mouchacca 1997 .

*Melanocarpus thermophilus* (Abdullah & Al-Bader) Guarro et al. 1996 .

**deuteromycete**

*Humicola hyalothermophila* Moubasher et al. 1979 .

*Thermophymatospora fibuligera* Udagawa et al. 1986 .

## THERMOTOLERANT

**ascomycete**

*Chaetomiopsis dinae* Mustafa & Abdel-Wahid 1990 .

*Chaetomium subcurvisporum* Abdullah &Al-Bader 1989 .

*Emericella desertorum* Samson & Mouchacca 1975 .

*Emericella omanensis* Y.Horie & Udagawa 1996 .

*Emericella similis* Y.Horie et al. 1990 .

*Monascus pallens* Cannon et al. 1995 .

*Monascus sanguineus* Cannon et al. 1995 .

*Rhexothecium globosum* Samson & Mouchacca 1975 .

*Talaromyces trachyspermus var. assiutensis* (Samson & A.-Fattah) Yaguchi & Udagawa 1994 .

*Thielavia aegyptiaca* Mustafa & Abdel-Wahid 1990 .

*Thielavia arenaria* Mouchacca 1973 .

*Thielavia microspora* Mouchacca 1973 .

*Thielavia subthermophila* Mouchacca 1973 .

**deuteromycete**

*Cladorrhinum bulbillosum* W.Gams & Mouchacca 1993 .

*Desertella globilifera* Mouchacca 1979 .

*Gilmaniella macrospora* Mustafa 1975 .

## XEROTOLERANT

**ascomycete**

*Eurotium xerophilicum* Samson & Mouchacca ;

## OSMOTHERMOTOLERANT

**deuteromycete**

*Aspergillus egyptiacus* Moubasher & Mustafa;

*Aspergillus peyronelii* Sappa (= A. floriformis Samson & Mouchacca 1975) .

# الفطريات الجديدة الموصوفة من شمال أفريقيا و البلاد العربية الأخرى منذ عام ١٩٤٠ *


## للأستاذ الدكتور جان مشقع

معمل الفطريات، المتحف الوطنى للتاريخ الطبيعى، باريس، فرنسا



### ملخص

تقع البلاد العربية المطلة على البحر المتوسط، و مساحتها حوالى ٩ مليون كم٢، فى نطاق المناخ الجاف. و قد تم اكتشاف فقط ٢٠٩ نوع من الفطريات فيها منذ عام ١٩٤٠، كان معظمها من مصر و فلسطين و العراق. و تنتمى هذه الأنواع إلى ١٢٢ جنس، منها ٧-٨ أجناس فقط ممرضة للنباتات الراقية. و لم تتم اكتشافات ذات بال للمجموعات التقسيمية الصغرى، و إن كان المناخ الجاف ينبئ بأنها قد تتواجد بأعداد لا بأس بها. و هناك اهتمام أكبر بالأنواع الموجودة فى التربة، أكثر من الأنواع المرتبطة بالنباتات. و هناك عدد محدود من الأنواع يبين ملاءمة خاصة لدرجات الحرارة المرتفعة، بل يمكن القول إن بعضها محب للحرارة المرتفعة. و بالمقابل، فإن عددا أقل من هذه الأنواع المكتشفة يتحمل الجفاف. و يمكن القول إنه منذ عام ١٩٤٠ كان معدل الاكتشافات حوالى ٤ وحدات تقسيمية فى العام. و ذلك على الرغم من أن المنطقة يمكن أن تكون واعدة بالمزيد من الاكتشافات نظرا لموقعها المتميز و لمناخها الخاص.

و يدل فحص أسماء المكتشفين على أن التعاون فيما بينهم كان نادرا. وبالمقابل فإن التعاون بينهم و بين علماء الدول الأوربية المجاورة كان أكثر وضوحا. و هناك تعاون بدرجة أقل مع زملائهم فى أمريكا الشمالية أو فى غيرها. و يجب تغيير هذا الوضع السائد حاليا من خلال تشجيع تبادل المعلومات و الاتصالات بين الدول العربية و التشارك فى الخبرات.

و أخيرا، فبالنظر إلى الفوائد الكبيرة لعلم الفطريات فى مجالات البيوتكنولوجى، فإن المعرفة الكافية عن فطريات الدول العربية أمر فى غاية الأهمية. و لا بد من إقامة مركز إقليمي لعلم الفطريات و لعلم تقسيمها فى الدول العربية، و أن تكون له اتصالات مستديمة بالمعامل الأجنبية، الأمر الذى يجب أن يكون حاسما فى نشاطه.


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