REMARKS ON SOME FUNGI WHICH CAUSE DISEASE IN THE TROPICS.

By ALDO CASTELLANI, M.D.,

Director, Government Clinic for Tropical Diseases, Colombo (Ceylon).

It was suggested to me by one of our past Presidents, that I should give a short communication on the results of my work on certain fungi, and the disease which they cause in the tropics. I am afraid I am not in a position to bring forward any very new observations as most of my researches have already been published in various papers; but perhaps it may interest you to see the cultures of these various fungi, and some lantern slides of the conditions which they cause. I will limit my remarks to the following mycoses:—

1. Thrush.
2. Bronchomycosis.
3. Certain dermatomycoses.

THRUSH.

I mention thrush to again emphasise the fact that the condition is due not to a single species of fungus, but to several species.

Those interested in the subject of monilia will note the widely different description the various authors give of the thrush fungus, *monilia albicans*, the organism previously known by the name of *oidium albicans*. Some authorities (HEWLETT, etc.), state that the organism liquefies gelatine, others affirm the reverse. Several writers give it as clotting milk, others as having no action on this medium. The sugar reactions have apparently been very little investigated, only a few sugars having been used. The fact is—as I hope I have already demonstrated in various publications—man may be affected by a number of different species of *monilia*, and that in the past the term *monilia albicans* (*endomyces albicans*, *oidium albicans*) has been used to cover a number of different species, in the same manner that the term *B. coli* was for years applied to a multitude of different intestinal bacteria, when a few fermentation tests only were carried out. The classification of the

endomyces cannot be based purely on their morphology as used to be done in the past; their sugar reactions should be studied as well as their action on milk, gelatine, serum. The strains found in thrush will be collected in a table, together with those found in bronchomycosis.

BRONCHOMYCOSIS.

Affections of the bronchi and lungs due to fungi are very common in the tropics, though very little attention has been paid to them till recently. These conditions may be due to a variety of fungi belonging to the following genera:—

1. *Monilia*.
2. *Nocardia*.
3. *Aspergillus*, *sterigmatocystis penicillium*.
4. *Mucor* and *Rhizomimcor*, *Lichtheimia*.
5. *Sporotrichum*.
6. Undetermined fungi.

The symptoms are somewhat similar whatever fungus is the etiological factor; in mild cases there are signs of slight bronchitis with muco-purulent expectoration, in which the fungi are found. In severe cases the patient presents all the symptoms of phthisis with hectic fever and hæmorrhagic expectoration.

Mild cases may become cured spontaneously, they are often benefited by potassium iodide. I will describe in detail the form of bronchomycosis due to fungi of the genus *monilia*, as this type of bronchomycosis being extremely common in Ceylon, it has been possible for me to investigate it more completely.

BRONCHOMONILIASIS.

Syn. *Bronchooidiosis* CAST.; *Bronchoendomycosis* CAST.

Definition.—An infection of the bronchial mucosa, due to fungi of the genus *monilia*.

Historical.—Since 1905 I have published many cases, recognising a mild type and a severe type of the disease, and describing several new species of *monilia*.

Ætiology.—In Ceylon, according to my researches, the malady is generally due to *monilia tropicalis*, described by me. I have found the same fungus in cases coming from Southern India and the Malay States.

or under appropriate treatment. Those of the malignant type usually end fatally.

Diagnosis.—The diagnosis of moniliasis is based on finding the fungus in the sputum. It is absolutely necessary that this should be collected in sterile petri dishes and examined as soon as possible, as sputum exposed to the air becomes contaminated with all sorts of fungi in the tropics.

In fresh preparations of the expectoration, spore-like roundish or oval cells, 4 to 6 micron, are seen, and some mycelial particles. The fungus is gram-positive.

To identify the fungus cultural researches are necessary. A particle of the sputum is smeared on maltose or glucose agar plates; after two or three days, white, rather large, roundish colonies appear, easily distinguishable, even macroscopically, with a little practice, from the colonies of cocci, etc. The fungus colonies are further investigated by inoculating maltose agar, ordinary agar, gelatine, serum, and a set of sugar broths. All the species of *monilia* found in my cases grow well on ordinary agar, but much more abundantly on maltose and glucose agar, especially if slightly acid. On these media the growth—which is generally white with a smooth surface when young, slightly crinkled when old—is composed practically of globular yeast-like cells, while in the water of condensation globular cells and mycelial particles are found together. A little mycelium may, however, be found also occasionally in the growth on the slope. On serum all the strains produce at first a white growth, but some later on induce a peculiar brownish black discolouration of the medium round the growth. Most species do not liquefy the medium.

On *gelatine* all the species grow fairly well, a few, including *monilia candidans* produce liquefaction of this medium. In milk some do not produce either acid or clot, others induce a temporary or permanent acidity, others clot the milk or peptonise it. The reactions of the various sugar broths are important, and in association with the action of the fungi on serum, gelatine, and milk give the data on which to differentiate the various species.

Differential diagnosis.—Primary bronchomoniliasis, as described in this chapter, should be distinguished from the secondary bronchomoniliasis occasionally met with in cachectic patients suffering from cancer, diabetes, tuberculosis, etc. In such cases there is generally

thrush of the oral mucosa, and the thrush *monilia* spreads to the pharynx, larynx, and bronchial mucosa, while in primary bronchomoniliasis the oral mucosa is not, as a rule, affected.

From pulmonary tuberculosis the condition is distinguished by the absence of the tubercle bacillus in the sputum and the negative animal inoculations. Cases of mixed infection, however, tuberculosis and moniliasis, are occasionally met with, the sputum containing both the tubercle bacillus and the *monilia* fungus. Moniliasis differs from bronchospirochætosis by the absence of spirochætes, from endemic hæmoptysis by the absence of the ova of *paragominus Westermanni* KERBERT.

Treatment.—Mild cases and those of medium gravity respond quickly to potass. iodide (gr. 10 to 20), given well diluted in water or milk, three times daily. When potass. iodide causes severe symptoms of iodisini, saiodin in the same doses (in cachets) may be administered. In the cases of malignant type we have seen no improvement from the many different treatments tried. Potass. iodide, however, should always be tried in these cases as well as balsamics. The diet should be nourishing; hypophosphates and glycerophosphates, etc., may be tried to keep up the strength of the patient, as in phthisis.

Tea-factory Cough.—This affection, for which the above term is commonly used in Ceylon, is probably a form of bronchomycosis and moniliasis. Coolies working in tea factories are occasionally observed to deteriorate in their general health, losing flesh and becoming easily tired, at the same time they develop a cough with muco-purulent expectoration. The physical examination of the chest reveals nothing except occasionally a few coarse *râles*. If these coolies are taken away from the factory and sent to work in the fields, all the symptoms slowly disappear.

A similar affection may be observed in tea-tasters. Tea-tasters, in order to judge of the quality of teas, not only taste infusions, but frequently fill their hands with the leaves and bury their noses in it, snuffing it up; in this way a certain amount of tea-dust enters their nasal cavities, and with the tea-dust the micro-organisms which are found in it. According to my researches, tea and tea-dust in Ceylon contain—

1. Fungi of the genus *monilia* constantly.
2. Fungi of the genus *aspergillus*, *sterigmatocystis* and *penicillium* frequently.

3. A peculiar *streptococcus*, somewhat different from *S. pyogenes*, frequently.

It is interesting to note that such germs are very rare in samples of tea examined in Ceylon. The same organisms may be found, in Ceylon, in nasal cavities of tea-tasters; in their expectoration the *monilia*-like fungi are practically constant, the *streptococci* very frequent, while *aspergillus* and *penicilli* fungi are rare. Guinea-pigs in whose nostrils tea-dust is daily insufflated for months, develop a broncho-alveolar moniliasis.

TROPICAL DERMATOMYCOSES.

The subject of tropical dermatomycoses is a large one; I will therefore limit myself to recapitulate the results of my investigations on the following: *Tinea cruris*, *Tinea capitis tropicalis*, *Tinea flava et nigra*, *Intertrigo saccharomycetica*, *Tinea imbricata*.

Tinea cruris has been known to tropical practitioners for many years under the name of dhobie itch. In 1905 I suggested that it should be separated from the ordinary forms of *Tinea corporis*, and MACLEOD suggested the name *Tinea cruris*. For the fungus most commonly found in such cases, characterised by the peculiar yellowish colour of its colonies, I suggested the term *Trichophyton cruris*. In 1907 SABOURAUD investigated very completely the condition in France which he called *Tinea inguinalis*. There can be no doubt that this is the dhobie itch of tropical authors, or *Tinea cruris*. SABOURAUD and PINOY, having examined my cultures, have come to the conclusion that *Epidermophyton inguinalis* and *Ep. cruris* are the same fungus. *Ep. cruris*, though most frequently observed in *Tinea cruris*, is not the only fungus which can give rise to the condition; *Tinea cruris* may be caused by several species of fungus, each of which gives rise to a slightly different variety of the disease. Up to the present I have observed the following organisms: *Ep. cruris*, *Ep. perneti*, *Ep. rubrum*, *Trichophyton nodiformans*.

Epidermophyton cruris CAST. 1905; Syn. *Ep. inguinalis* SABOURAUD 1907; *Tr. castellanii* BROOKE 1908; causes the commonest and best known type of the disease as described by all tropical authors, and in Europe by SABOURAUD. The condition is characterised by large festooned patches with elevated margins on the *scroto-perineal* region, and inner surface of the thighs. As already stated by me (British Journal of Dermatology, 1906)

is an error to consider *Tinea cruris* as always localised to the groin and armpits; in many cases it spreads to other parts of the body (excepting only the scalp); it may start on the chest and arms and spread to the groin and armpits—or it may even not affect these regions at all.

Epidermophyton perneti CAST. 1907: was discovered by PERNET. Somewhat resembles *Ep. cruris*, but grows quicker on maltose agar, and the cultures have at first a delicate pinkish colour.

Epidermophyton rubrum CAST. 1909; Syn. *Ep. purpureum* BANG 1911.—This fungus is characterised by the beautiful deep red pigmentation in SABOURAUD and Glucose agar. It induces a type of dhobie itch which has a great tendency to spread from the groins and axillæ to other parts of the body. The eruption has often an eczematoid appearance.

Trichophyton nodoformans CAST. 1911 is characterised by the peculiar brick-red colour of the cultures on SABOURAUD's agar; this colour is lost in sub-cultures. It induces a peculiar type of dhobie itch with deep nodules along the edge of the eruption.

Tinea capitis.—This form is comparatively rare in Ceylon. All the cases I saw were of the same type, and due to the same *endo-ectothrix trichophyton*: the scalp presented in all cases numerous white patches covered by an enormous number of *pityriasis* whitish squamæ. The patches remain bald permanently. The fungus is a *Trichophyton endo-ectothrix*, practically identical with *T. violaceum* of SABOURAUD.

Intertrigo saccharomycetica.—The affection is apparently rare. It was described in Ceylon by me several years ago. It generally attacks the scroto-crural and axillary regions. The affected skin is red and there may be slight exudation. The borders of the eruption are fairly well marked but never elevated. In most cases there is little itching, and the condition may recover spontaneously. In scrapings a *saccharomyces*-like fungus *S. samboni*, CAST., 1907 is found, which is easily cultivated on sugar media. According to recent researches, however, the fungus may have to be placed in the genus *monilia*.

Tinea flava.—This dermatomycosis is confused by several authors with the *pityriasis versicolor* of temperate zones, but the researches of JEANSELME and myself tend to prove that it is a separate entity. The disease, which is extremely common in Ceylon, is characterised by the presence of bright yellow patches found on various parts of the body.

It is very difficult to cure. The fungus is a *malassezia M. tropica*, CAST., 1905, which so far has not been grown.

Tinea nigra.—Was first described in 1872 by MANSON in China, but his observations were forgotten, as they were not quoted by him in his subsequent publications. It was redescribed in 1905 by me in Ceylon. It is characterised by the presence of black patches, due to a fungus *Foxia mansonii*, CAST., 1905.

Tinea imbricata.—The etiology of this disease has been the subject of numerous controversies. In recent years the general opinion has been that *aspergillus*-like fungi are its real cause. From the investigations I have made I consider that *aspergilli* and *aspergillus*-like fungi have nothing to do with the condition, and that when they are present they are merely saprophytes or contaminations. By using a special technique I have succeeded in growing what I consider the true fungi causing the disease. They are not trichophytons; they resemble more the achorions, as justly remarked by SABOURAUD, who has examined my cultures. They will probably have to be placed in a separate genus, I suggested the term *Endodermophyton*. I believe that there are several species of *Endodermophyttons*; I have so far isolated two—*End. concentricum* and *End. indicum*.

On glucose agar (4 per cent.), *Endodermophyton concentricum* shews a growth with cerebriform or crinkled surface of an amber colour; in young cultures duvet is generally absent. On the same medium, *Endodermophyton indicum* shews a growth somewhat convoluted; the central portion is generally of a deep orange, red-orange or pink-orange colour, the rest of the growth appearing white and powdery, being covered by a very short white delicate duvet. I have reproduced the disease typically in man by inoculating pure cultures of both fungi.

Trichomycosis flava, rubra et nigra of the axillary regions.—The affected hairs present nodular formations, plainly visible to the naked eye, of rather soft consistency, easily removable by scraping with a triangular needle or any similar instrument. The formations are either yellow or black, or less frequently red; they may be very abundant, and form a yellow or black or red sheath round the hair. By the use of the microscope these nodules are seen to consist—in the yellow variety—of enormous numbers of bacillary-like bodies, imbedded in an amorphous

menting substance; in the red and black varieties large groups of cocci observed as well.

According to my researches the yellow variety is due to a *Nocardia* (*N. tenuis*), the mycelial segments of which, being very thin, have a bacilliary appearance. I have not succeeded in growing the fungus. The black variety is due to a symbiosis between the same *Nocardia*, and a black pigment producing coccus, which I have described under the name of *Micrococcus nigrescens*. The red variety is caused by a symbiosis between the same *Nocardia* and a red pigment producing coccus.

Diagnosis.—The condition must be differentiated from the various forms of *Trichosporosis* (*pie*dra, etc.), and from *Leptothrix* of temperate climates. It is easily distinguished from the former by the fact that *Nocardia tenuis* in contrast to the various species of *Trichosporon*, is an extremely thin fungus; it differs from the latter by the nodules being soft, easily removed, and by the hairs not becoming brittle; moreover it is easily curable.

Treatment.—A good method of treatment is dabbing the hair two or three times daily with a solution of formalin in spirit (5i. to ʒvi.), and applying a sulphur ointment (2 to 5 per cent.) at night.