SOME OBSERVATIONS ON THE BUD-ROT DISEASE OF COCONUT PALMS ON THE EAST COAST OF AFRICA.

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This brief paper embodies some observations made and recorded during the years 1913 to 1920 in the vicinity of Mombasa on plantations of coconut palms laid out under European supervision. Many of these were examined on account of the presence of bud-rot disease, but two, in particular, were visited a considerable number of times. One of these lay

30 miles to the north of Mombasa, about half-a-mile from the sea, and the other some 30 miles to the south and about the same distance from the sea. The first contained palms mostly of local origin, but a few acres had been laid out with palms raised from nuts imported from Ceylon. The second had been planted up with local African and with Zanzibar nuts.

The cultivation of both plantations can only be described as poor, as the palms were growing in rank grass and weeds, chief of which was the doum palm (*Hyphæne thebasca*). Occasionally these were cleared and burnt as labour became available, but cultivating was hardly ever done regularly. Under such conditions palms generally commenced to bear nuts in their seventh year, and it was just at this period that the disease made its appearance with devastating results. Older palms in full bearing, in either European or native owned plantations, were not attacked so far as we know. An early and striking symptom of the disease, obvious at a distance, was the bending downwards and yellowing of the outermost (and therefore the oldest) leaves. The appearance of the rest of the foliage was normal, with the exception of the innermost unexpanded frond or spear, the exposed portion of which was dried up, brown in colour, and dead. The concealed part, covered by leaf bases, exhibited various stages of rotting.

This part was soft and not firm, slimy, and when removed emitted a most offensive odour, indicating the presence of putrefactive bacteria. No spotting was observed on the leaf bases such as occurs in the Indian disease investigated by Butler(1), although the basal parts of the yellowish leaves were discoloured by large brown irregularly shaped blotches. These did not penetrate any depth into the tissues beneath. The facilities for a careful microscopical examination were insufficient to permit of a detailed study being attempted, but bacteria were found in the neighbourhood of the advancing edge of the rot, and copious mycelium was present in the more distal portions of the central unexpanded frond. Roots and stems, so far as could be ascertained, appeared healthy, and at the time I was of the opinion that infection had commenced somewhere on the youngest leaf, and had travelled downwards.

Apart from the examination of individual trees, data were collected in connection with the incidence of the disease which seem worth recording, particularly as they indicate the lines along which the control of the disease should be followed on the east coast of Africa.

Three observations were made which impressed me very much at the time as being connected with the occurrence and severity of the disease. One was the striking fact that whereas the doum-palm grew nearly everywhere along the coastal belt, the coconut palm did not, but occurred only in patches; some of these palmless areas which I examined were certainly swampy, but whatever the cause may be, the local Swahili natives asserted that they or their forefathers had tried to grow palms on these vacant spots, but always without success. Now it is largely these areas which are acquired by the European planters, and this brings me to my second observation.

In a number of instances which came under my notice, immature nuts had been planted, a practice which cannot be too strongly condemned. The planting out of young palms raised from immature nuts into swampy

ground generally resulted in other diseases besides rot, such as foot-and root-rot, becoming prevalent.

The third and most important point was the effect of sanitation and drainage. On both the plantations mentioned, the manager's house and the huts of the native labourers were, for reasons of health, placed upon the highest and therefore the best drained ground. Palms planted round about the houses and between the huts were much larger, more vigorous and altogether better looking than any others planted at the same time. The former were *always* kept clean, in fact the ground was practically bare of other vegetation; the latter, as recorded above, were growing in rank grass. Furthermore, the former commenced to bear in the fifth year, whereas the latter never showed signs of bearing before the seventh year after planting. Bud-rot could not be found and had never been observed in the more vigorous palms about the houses and in the native encampment, whereas but a short distance away the disease was rife and the palms of Ceylon origin were without doubt the most susceptible.

From these facts, the conclusion may be drawn, that from every point of view, the planting of smaller areas and keeping them constantly clear of weeds is more profitable than laying out very large, sometimes swampy areas which cannot be kept properly cultivated for want of labour, and planting them up with immature nuts.

In conclusion, I would like to direct attention to the similarity between the bud-rot disease of coconuts in East Africa and the Panama disease of bananas, so far as outward symptoms go. In both diseases one of the earliest noticeable signs is the drooping and yellowing of the outer leaves, which in the banana disease Brandes (2) has shown is probably due to the effects of toxic substances secreted by *Fusarium cubense* at the base of the plants.

A similar thing may happen in the East African but-rot, and a thorough examination for parasitic fungi in the stems and roots of affected palms is much to be desired as far as the east coast of Africa is concerned. At the same time, it is usually unsafe to argue from analogy, particularly in view of Dixon's (3) work on the *descent* of sap, indications of which have also been observed by Brooks (4) and myself (5). The yellowing of the outer leaves in the East African disease *may* be due to the downward movement of toxic substances emanating from an upper and more central seat of infection such as the youngest folded leaf.

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