

before ascending. The secondary tubers produced later all ascended. The surface of these tubers is rather rooty: the flesh is white but there is a very distinct layer with magenta sap under the skin. The average yield in 1916 was 9 lbs. 8 oz. (4309 grammes).

Race No. 34 possesses the same habit of turning upwards but instead of producing one long tuber and a few much shorter secondary tubers, it produces several similar tubers which do not attain any great length. It was figured on p. 301 of the Bulletin under the No. 4. It yielded on the average 3 lbs. 15 oz. (1786 grammes) in 1916.

The bottom figure of plate 6 represents race No. 72 which behaved in a different way to the others, in that it grew upwards first and then obliquely downwards or else horizontally as is there shown. Its flesh is white, but with a distinct layer holding magenta sap under the skin: its skin is rather rooty. The average yield in 1916 was 6 lbs. 13 oz. (3100 grammes).

Plate 6 shows the yam beds, and in the lower block the supports of wood which had to be used to build up the mounds for the earthing of Nos. 38 and 72. The yams it will be observed are allowed poles to grow over about eight or nine feet high.

There is some diversity in the leaf characters of these up-growing yams; for Nos. 28, 34 and 38 have the auricles of the largest leaves rounded; but the others have them more or less subacute. None have thorny stems.

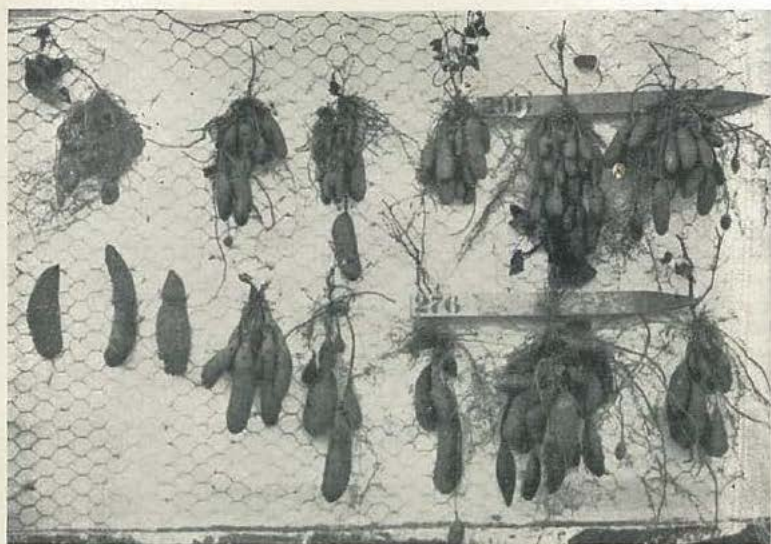
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THE LESSER YAM,—DIOSCOREA ESCULENTA.*

The Lesser Yam, here illustrated by three plates, is quite unlike the Greater Yam in foliage, and in the production of many relatively small tubers. Economically it is less important: it is less widely known, less extensively grown, and has not been carried across oceans to the remote islands and continents which the Greater Yam has reached. Fiji for instance, seems to be its eastward limit, whereas the Greater Yam has been taken to the easternmost islands of the Pacific; and Mauritius seems to be its western limit, whereas the Greater Yam has reached Africa and has been carried also to the Tropics of the New World.

As far as can be guessed, its domestication had beginnings not less remote than the Greater Yam's, or perhaps even more remote: for the seed-forming habit has been eliminated from it quite as much as from the Sugar-cane and the Pineapple; it has for instance, never been known to fruit, which the Greater Yam does at rather rare intervals. Moreover its parentage is much more obscure than that of the Greater Yam.

**Oncus esculentus*, Loureiro: *Dioscorea aculeata*, Linnaeus in 1754, but not in 1753: *D. fasciculata*, Roxburgh,



The Lesser Yam. No. 290, a race from Saigon known as Khoai Chach. No. 276, a race from the Philippine Islands.



No. 292, race from Saigon, grown under the name of Tu-cu. No. 288, a race from Saigon known as Khoai Tu-Bua.

Not only does it not fruit, but the production of female flowers is very rare, and the production of male flowers is apparently only common in one known race.

The three plates illustrate some of its races, in particular showing how they are to be distinguished from each other by their tubers.

In the upper block of Plate 7 is shown the Saigon race, Khoai chach, cultivated experimentally in the Botanic Gardens, Singapore, under the Garden's number 290, and below it is shown a race from the Province of Bataan, in the island of Luzon, which bears the Gardens' number 276 and was received without a vernacular name. Again in the lower block of the same plate, in its upper row, with the Gardens' number 292, is a second Saigon race received under the name of Tu-gu. It will be observed at a glance that the three numbers 290, 276 and 292, have in common neat cylindrical tubers in closely packed bunches. They, however, are not identical, No. 276 from the Philippine islands having a bitter taste, not developed in the Saigon races; and the two Saigon races being distinct in some slight morphological characters, as well as in the first being a more palatable vegetable than the second.

The Philippine race is that of which one tuber was figured on p. 303 of the Bulletin, fig. 2, and again in the Philippine Agriculturist and Forester iii. 1915, p. 207 fig. 2.

All the three races produce spinous roots: but it seems that the spines in the Philippine race are larger than in the two Saigon races.

The lowest line of figures on plate 7 represents the Saigon race Khoai bua (No. 288), and the lower block of plate 8 the Assamese race Moa alu, (No. 286) both having lobed tubers. The name "Moa alu" which means "Sweet tuber" is of Sanskrit origin. It is well applied for the tubers are distinctly sweet.

Other races with lobed tubers have been or are being cultivated. Thus No. 274 of the Gardens' plots which gave figure 1 on p. 303 of this Bulletin and figure 4 on page 207 of the Philippine Agriculturist and Forester, has lobed tubers. It is of Philippine origin, having been received from the Province of La Union in Luzon. And a race with lobed tubers has been grown which came from Lower Burma under the name of Tah-dwe-u or "Letter-dyam." The distribution therefore of lobed races is at any rate more or less continuous from Assam to the Philippine islands via Burma and Saigon. But it is yet to be ascertained to what degree there are distinct races over this area: if, for instance, all are sweet like the Assamese Moa alu, etc. In regard to the name Moa alu, which is used along side that of China alu for another race, it is uncertain whether it originates in a contrasting of the sweet Moa alu with the race China alu, or in a contrasting of *Dioscorea esculenta* with other yams such as the Greater Yam which is never markedly sweet to the taste like Moa alu.

The number of tubers on a plant of Khoai bua is less than on a plant of one of the three races first named, viz. 290, 276 and 292, and at the same time they are individually larger. Moa alu again has fewer and larger tubers than Khoai bua: of them one for instance

in the small crop raised in 1916, attained the weight of 3 lbs. 5 oz. (1502 grammes). The irregularity of the tubers may be considered as imperfect branching: but no branching of the slender part, the stalk-like part, of the tuberous root occurs,—only of the swollen apical part.

On the upper part of Plate 8 are figures of three Indian races, which in 1916 had their growth interfered with: as a consequence of which the roots appear comparatively poor: but the habit is nevertheless truly represented. The uppermost of the three is a Chittagong race, received from India in 1913 under the name of Pora alu or "Oar tuber." In its first year in Singapore it returned so heavily from a small bed as to yield at the rate of 21,851 lbs. per acre, the number of tubers on a plant being on the average twenty-five (vide this Bulletin, pp. 302-303.) The race has roots armed freely with rather small thorns.

Under Pora alu on plate 8 are represented, as No. 296, the Goradu of Berar, and, as No. 298, the China alu of Jorhat in Assam. This latter goes unarmed or almost so: but Goradu has long formidable thorns on its protective roots, which overlie the tuberous roots. In these three Indian races the length of the tuber bears a fairly constant relation to the diameter. Their tubers are shorter and rounder than those of the trio 290, 276 and 292.

The rest of the races to be referred to, may be arranged conveniently in a series commencing with those whose tubers are relatively small and ending with those that are the largest. No. 278 figured at the top of plate 9 leads thus to No. 280 which is figured below it. Both came from the Philippine islands, the No. 278 from Tarlac under the name of Tugui, and No. 280 from the island of Palawan under the name of Invod. In both races there are formidable spiny roots and in both the flavour of the tubers is slightly bitter.

The lowest block on plate 9, represents the most distinct of all the races, a plant which produces the biggest tubers of all and bears them very diffusely: moreover it is the race which freely produces male flowers.

It occurs in the Philippine islands, whence it has been obtained and grown from four localities, *e.g.*

No. 272 Luzon, but the exact locality unrecorded.

No. 282 from cultivation in the Province of Batangas, where it is called Tugui

No. 270 from cultivation in the Province of Pangasinan, where it is called Carat

No. 284 from the Mountain Province, where it occurs wild, and is called Buga.

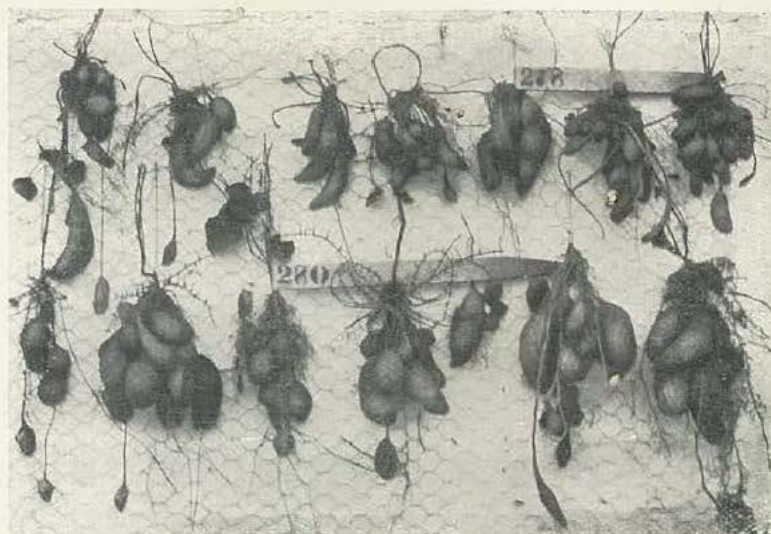
The large characteristic tubers have attained in the Singapore plots the weight of 5 lbs. 6 oz. (2438 grammes), and the longest stalk of any one measured was just over a metre in length. The tubers are densely covered with short rootlets. At the base of the stem may be found very formidably armed spiny roots but they in no way cover the diffuse tubers which lie far beyond their protection. And what is interesting about these tubers is that they may be formed quite close to the surface of the soil as if inviting the attack of pigs.



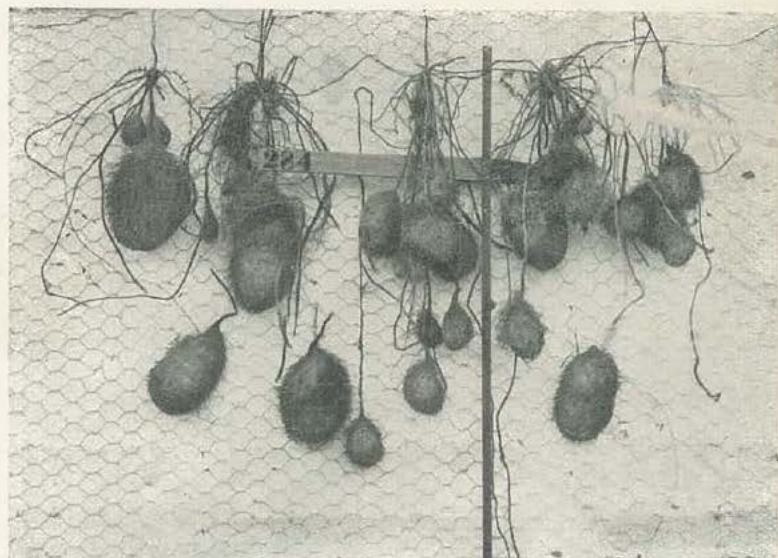
Three Indian races. No. 300, grown under the name of Pora alu, origin Chittagong.
 No. 298, China alu from Jorhat in Assam. No. 296, Goradu from Berar.



No. 286. Moa alu from Jorhat in Assam.



No. 278. A Philippine race grown under the name of Tuqui, origin Terlac in the Island of Luzon. No. 280, a race from the Island of Palawan, called there Invod.



No. 284. A peculiar race of the Philippine Islands, where it seems to be common, and to occur wild (? run wild) as well as in cultivation. It has large diffusely placed tubers.

The tubers with the longest stalks are those formed latest in the season.

It might be claimed for this race that its free flowering suggests a primitive type; and in support be adduced that it is recorded above as wild in the Mountain Province of Luzon. Further it might be said that it appears to be somewhat extensively wild as male flowers may be found in herbaria on specimens from various localities in the Philippine islands which appear quite likely to be of this race and are not recorded as cultivated plants. But *Dioscorea esculenta* certainly persists in India for awhile on the sites of abandoned cultivation: and this particular Philippine race of it by reason of its diffuse tubers is the one of all most likely to be left behind in the soil when the land is abandoned to revert to jungle, under which view doubts at once arise as to the validity of any argument from its occurrence in an uncultivated condition that it is indigenous in Luzon: and then again its remarkable peculiarity that the purpose of the protective spiny roots is not fulfilled by reason of the spreading of the tubers beyond them suggests that it is not primitive. We are consequently left in as much uncertainty as regards the original home of the plant as we were: and are in need of new light.

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GERMINATION OF THE SEEDS OF *ERYTHRINA* BEFORE FALLING.

In the very wet weather that occurred in Singapore unseasonably through February, and March, 1917, the seeds of *Erythrina lithosperma* in Tanglin germinated while attached to the open legume-walls still hanging on the tree.

SCOLIA ERRATICA, Smith, A PARASITE OF THE RED-COCONUT-WEEVIL (*RHYNCHOPHORUS* *FERRUGINEUS*).

Near Bemban, Malacca, on November 28th, 1916, in the course of an inspection of Coconut palms for the Red Weevil and the Black Rhinoceros beetle, two pupating parasites were obtained from within pupa cases of the Weevil: and these having hatched out on November 28th in a breeding cage, were determined by Dr. R. Hanitsch as *Scolia erratica*, Smith.

Professor Maxwell Lefroy in his Indian Insect Life (Calcutta, 1909) p. 183 says of the Scoliidæ, to which it belongs, "as to the habits of this family in India, as a whole they are probably parasitic upon the larvae of Coleoptera in the soil; they persistently fly over the soil, but none have been reared; Froggatt (Agric. Gazette, N. S. Wales, 1902) records *Dielis formosa*, Guen., as an enemy of the beetle *Xylotrupes australicus*, Thoms.,* in Queensland; the wasp burrows down to the grub in the soil, stings and

*The species of *Xylotrupes* are Rhinoceros beetles allied to the Black Coconut beetle.