

## THE UTILIZATION OF THE SWORD-BEAN AND JACK-BEAN AS FOOD.

C. CHARAVANAPAVAN, M.Sc. (Lond.), B.Sc. (Lond.),  
D. I. C., A.I.C.

RESEARCH ASSISTANT IN FOOD TECHNOLOGY.

**T**HE sword-bean and jack-bean are known to contain a toxic substance which causes nausea and vomiting. This substance has been found to be a saptotoxin. Methods are described for the use of these beans as food after destroying the saptotoxin.

### INTRODUCTION

The investigation described in this paper was the outcome of a suggestion by Mr. R. K. S. Murray, Deputy Director of Agriculture, that it might be possible to make greater use of the sword-bean and jack-bean as human food, if they can be rendered free from the injurious substance present in them.

The sword-bean and jack-bean belong to the genus *Canavalia* which is found in most parts of the tropics. They were regarded as identical at one time but owing to certain characteristic differences becoming apparent, they are now classified as separate species. (1), (2), (3). The sword-bean (*Canavalia gladiata*) is a perennial climber while the jack-bean (*Canavalia ensiformis*) is an annual bush. The seeds of the sword-bean are generally pink and the hilum or scar is nearly as long as the seed, while the seeds of the jack-bean are always white and the hilum or scar is about half as long as the seed.

These plants are easily grown and their seeds are nutritious, being rich in protein, carbohydrates, and minerals. (4). The use of these beans, however, has been restricted owing to the presence of a toxic principle in them, causing mild symptoms of poisoning.

### THE TOXIC PRINCIPLE

The seeds of all species of *Canavalia* are known to contain a toxic principle. It is reported that a dog fell seriously ill after eating the cooked seeds of the sword-bean. (2). It is also reported that young rats fed on the ground meal of jack-bean seeds died as a result of definite toxic effects—haemorrhage of the mucous lining of the stomach. (5). The presence of a toxic principle in these beans was confirmed by the author by subcutaneous injection of aqueous extracts of the seeds ground into a meal, on toads. The toads died in a few hours.

Chemical investigations on the composition of the sea-bean (*Canavalia obtusifolia*) carried out at the Imperial Institute, London, showed that the poisonous principle is neither an alkaloid nor a cyanogenetic glucoside. (2). The seeds of the sword-bean and jack-bean were chemically examined by the author and found to contain a saptotoxin—a saptotoxin is a toxic saponin. A saponin has been reported to be present in soya-beans. (6).

The distribution of the saptotoxin in the pods of the sword-bean and jack-bean was studied. It occurs in appreciable quantities in the endosperm of the seeds while the rest of the pod is practically free from saptotoxin. The tiny seeds in the tender pods are also practically free from saptotoxin.

The properties of the saptotoxin were studied. It is soluble in water and causes frothing which is characteristic of all saponins. It is destroyed by heat (thermolabile) under certain conditions. Saponins are known to behave in this manner. (7).

It is reported that the seeds of the jack-bean ground into a meal, are non-injurious when cooked and fed to young rats. (5). This is apparently contradictory to the earlier observation that the cooked seeds are injurious. This was investigated by the author, and it was found that the testa and the peripheral layer of the endosperm of the mature seed are impermeable to water, and the seeds do not soften even after prolonged boiling. The saptotoxin is therefore occluded in the endosperm and is not brought into solution to be completely destroyed on cooking. At the ordinary temperature of boiling water, the saptotoxin should be brought into solution to enhance its rate of destruction. In the case of the seeds ground into a meal, the saptotoxin is brought into solution during the cooking and destroyed. It is easily destroyed when the seeds are roasted, owing to the high temperatures developed.

#### USES AS FOOD

The sword-bean and jack-bean can be rendered free from saptotoxin and utilized as nutritious food. Since the saptotoxin is destroyed by heat, it is not necessary to strain off the water after boiling the seeds. But the saptotoxin should be brought into solution by suitable treatment, in the case of the mature seeds, before they are cooked. This is done by grinding the seeds into a meal before cooking. The saptotoxin in the mature whole seeds can be brought into solution by boiling the seeds, soaked overnight in water, with sodium carbonate or wood ash. The seeds become soft quite rapidly and the saptotoxin is destroyed. Methods are described below for the utilization of the sword-bean and jack-bean as human food.

1. The tender pods and the under-mature seeds can be cooked and eaten as a vegetable or made into a curry. This is the normal method of eating these beans.

2. The mature seeds should be ground into a meal, boiled for about half an hour in water and then made into a curry or used for making savoury cutlets. Savoury cutlets are prepared by adding spices, onions, chillies and salt to taste and frying in oil in the usual way. If a fairly hard savoury cutlet is required, a good proportion of ground maldive-fish or ground dried prawns should be added.

3. The mature whole seeds should be soaked overnight in water to make them swell up, and then boiled with sodium carbonate or wood ash till they are quite soft. About two teaspoonfuls of sodium carbonate or two tablespoonfuls of wood ash will suffice for a pound of the seeds. The seeds are boiled in fresh water to remove traces of the sodium carbonate or wood ash. The seeds so prepared can be eaten as a vegetable or made into a curry. They can be mashed into a paste and used as a substitute for mashed potatoes.

4. The mature seeds on gently roasting develop a bitter taste which makes them unsuitable for ordinary food purposes. But it is reported that they have been roasted and used as a coffee substitute. (1). The seeds are roasted in the same manner as coffee with the addition of a few drops of gingelly oil, coconut oil or ghee, during the early stages of the roasting. The roasted seeds are ground into a powder which gives a drink with an agreeable coffee-like flavour.

#### REFERENCES

- (1) U. S. A. Department of Agriculture, Circular (1920), No. 92 page 3.
- (2) A dictionary of the economic products of the Malay Peninsula, Vol. I. page 432, by I. H. Burkill.
- (3) The Queensland Agricultural Journal, 1943, Vol. 57, part I., page 25.
- (4) Tropical Planting and Gardening, 4th Edition, page 300, by H. F. Macmillan.
- (5) The Chemical Abstracts (American), 1942, Vol. 36, No. 12, page 3532.
- (6) The Analyst, 1935, Vol. 60, page 186.
- (7) The Chemical Investigation of plants, page 57, by L. Rosenthaler.

## BOTANIST'S SELECTIONS

In terms of Departmental Circular No. 95 of March 13, 1940, the following Botanist's selections are notified. Agricultural Officers should report in what villages and to what extent they expect to be able to propagate the cultivation of the new strains. They should also bring to my notice as early as possible any unfavourable reports or opinions on the selections, whether formed by themselves, their field staff or by the general public. The absence of any such comments by an officer will be regarded as approval of the selection by that officer and by the public in his area. The popular names are those by which the selections will become known to the general public, and the Index Nos. are for Departmental use only.

2. The following will be the procedure with regard to the supply of seed :

The Botanist will maintain the purity of the seed of each selection and produce a certain quantity of it each season. The Divisional Officers will obtain enough seed once a year, or every season, or every two years as they may decide in direct consultation with the Botanist, and multiply in their own stations. They will use for extension work in the villages seed multiplied in their own stations.

Crop.	Popular Name.	Index No.	Where Suitable.	Season.	Spacing.	Other Cultural Details.	Purity Maintained.	Qualities.
Green Gram	Green Glossy கிடுகிடு பச்சை மணி	.. PA. 178..	Dry zone	.. Yala and Maha	.. 1 ft. by 1 ft. if grown pure	—	.. Botanist's Station, Tabbowa	Large, glossy, uniformly green seeds; age 2-2½ months
Cowpea	Polon Prolific பொலெய் வெந்தை சொரி புடையன்	.. V. 4	Wet and dry zones	Yala (wet zone) and Maha (wet and dry zones)	.. 2 ft. by 2 ft.	Plants may be allowed to trail on the ground, but a higher yield is obtained if the plants are staked	.. Botanist's Station, Peradeniya	area, High yield; age 2½ months type <i>pototm</i>
Cowpea	Early Murunga வெட்டுவெந்தை இளவெண் கூந்தல்	.. V. 443	Wet and dry zones	Yala and Maha	.. 2 ft by 2 ft.	Should be staked	.. Botanist's Station, Matale	Selection for quality and earliness; age 2 months; produces very long, attractive pods of the asparagus bean (Murungame) type; particularly suitable for rotation with paddy
Brinjal	Hardy Purple கடிந்தெழு வச்சிர பானல்	.. SM. 164..	Wet and dry zones	Yala (wet zone) and Maha (wet and dry zones)	.. 3 ft. by 3 ft.	Six-weeks-old seedlings should be transplanted from nurseries	.. Botanist's Station, Matale	Resistant to bacterial wilt; high-yielding; fruit of excellent quality

Crop.	Popular Name.	Index No.	Where Suitable.	Season.	Spacing.	Other Cultural Details.	Purity Maintained.	Qualities.
Bitter Gourd	Fly-resistant பி.கி சைலிடி கர்லிசு கிருமியிலி	.. MC. 42	Wet and dry zones	Yala (wet zone) and Maha (wet and dry zones)	6 ft. by 6 ft.	Should be trained on to trellis	a Botanist's Station, Matale	Resistance to fruit fly and high yield
Snakegourd	Giant Matale பொலெட் கைர்டி பகைர்சு பன்னுகப் பூதம்	.. TA. 77	Wet and dry zones	Yala (wet zone) and Maha (wet and dry zones)	6 ft. by 6 ft.	Should be trained on to trellis and young fruits weighted	Botanist's Station, Matale	Selected for quality and yield; the selection, though susceptible to fruit fly, is less so than other varieties tested
Bandakka	Bountiful படுலெர் பெ.கிசை பெருவள்ளல்	.. H. 10	Wet and dry zones	Yala (wet zone) and Maha (wet and dry zones)	3 ft. by 3 ft.	—	.. Botanist's Station, Tabbowa	High-yielding and of good quality
Papaw	—	.. CP. 124	From sea-level up to 3,000 ft.	Perennial	10 ft. by 10 ft. to 12 ft by 12 ft.	Seed sown at stake or seedlings transplanted; male plants must be rogued	Botanist's Station, Matale	High yield of papain
Castor	Double Pink டெர்லு சிவீர் இணைமலர்	.. IRC. 34	Wet and dry zones	In the dry zone, plant in Maha and treat as an annual; perennial in wet zone	4 ft. by 4 ft.	2-3 seeds dibbled per hill	.. Botanist's Station, Tabbowa	High yield, oil content over 45 per cent.
Soybean	Yellow-1 கலை டிரிகாஜு சையா சவரணச் சோய்	.. —	Dry and wet zones	Yala (wet zone), and Maha (dry and wet zones)	In drills 12 in. apart; plants spaced 3 in. apart within the drill	Seed should preferably be inoculated with an efficient strain of the nodule bacterium	Botanist's area, Peradeniya	Large-seeded and edible; average yields
Do.	34.S. 51 கலை டிரிகாஜு சையா	.. —	—	—	—	—	—	—
Do.	Chame லெலிசையா சேமிச்சோய்	.. —	—	—	—	—	—	—