The Agricultural Department, Madras

Bulletin No. 23

25 JUL 1939

GRASS FARMING IN COIMBATORE

BY

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MADRAS

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

PRICE, 2 *annas*

1931

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GRASS FARMING IN COIMBATORE.

In Coimbatore district grass is successfully cultivated as a fodder; sometimes when rains are continuous and growth is good, the grass is cut and made into hay but for the greater part, it is grazed by live-stock. In many other districts the system of allowing grasses such as Hariali (*Cynodon Dactylon*), Chengali (*Andropogon lacium*), Nendra (*Iseilema laxum, Hack*) and Karu (*Andropogon contortus*), etc., to grow for grazing is known and practised but nowhere in the south is such systematic planting and grazing of grass practised as in some parts of Coimbatore district, e.g., in the taluks of Dharapuram, Erode, Gobichettipalaiyam, Coimbatore and Palladam. The system is seen at its best in the Kangayam tract of Dharapuram and the type of grass mainly utilized is Kolukatti (*Pennisetum Cenchroides*).

The origin of the name "Kolukattai" is obscure. Literally it means a preparation of fried coconut scrapings or gingelly mixed with jaggery enclosed in a covering of rice flour and then steamed. It is a soft and nutritious South Indian delicacy. On the other hand, "Kolukatti" means "proof against plough share" and some contend that this is more likely to be the origin of the name than "Kolukattai". This grass is recognized in other parts of India for its feeding value. It is known as "Damam" in the Punjab and "Anjan" in the United Provinces.

The grass is mostly cultivated under conditions of low rainfall. In Kangayam the rainfall varies from 10·96 inches to 34·51 inches with an average of 23·21 inches, during the last 30 years. The grass will flourish in areas of greater rainfall, e.g., on the light red soils of Tinnevelly and in the Gobichettipalaiyam taluks but with the increasing pressure of population on the land, the grazing area appears to be decreasing and grass is being substituted by hardy food grain crops like cumbu and cholam. There are, however, considerable areas of cultivable waste land where this grass could be more largely utilized.

Factors for success.—The success of the Kolukattai pastures in Coimbatore district mainly depends on two factors, viz.—

(1) Fencing and
(2) Proper grazing.

Fencing is common in this district and is also found in parts of Salem bordering Coimbatore and in the Palni taluk of the Madura district also bordering Coimbatore. The fences used are most commonly live hedges composed of Mullukiluvai (*Balsamodendron Berryi*), prickly-pear and various other species of cactus and Euphorbia. While incidentally supplying some fuel, the main uses of these hedges are—

(1) Protection against wind,
(2) Control of cattle and grazing.

High winds are common in the district and if the country is left bare and unprotected, the rate of evaporation is considerably increased. When each field is protected by hedges and in many cases by growing trees like babul in the fields themselves, evaporation of moisture from the surface of the soil is reduced, thereby leaving more for the growth of plants.

Control of cattle and grazing.—Communal grazing common to every village which has a common grazing ground. Such grazing grounds are almost without exception overstocked, they are never vested to give the grass a chance to grow and consequently are little more than exercise grounds for the cattle. Generally the grazing is conspicuous by its absence. With effectively fenced fields, however, the situation is entirely changed. The cattle can be moved from one field to another as occasion demands, thereby giving the grass a chance to recover and to renew its growth.

Soils.—The grass will grow on varying types of soil; but generally speaking, the poorer the soil the poorer the growth of grass. Grey loamy soil called Sambal Mannu (சாம்பல் மண்ணு) which is comparatively rich in lime is considered best. Next comes red loamy and sandy soils. Friable black cotton soils and soils rich in kankar will also grow quite good Kolukattai grass. Old villages-ites are also good. The grass cannot stand stagnant water and therefore soils should have sufficient slope to allow surface water to run off easily or suitable measures for drainage adopted. On steeper land, bunds are thrown across on contour in order to prevent too quick run off and to retain more moisture but generally if the water is allowed to stand more than one day the grass shows the effects of waterlogging. In low hollows where drainage is poor, Kolukattai is generally superseded in a short time by hariali and other grasses. Stiff heavy soils which are too retentive of moisture and difficult to drain are unsuitable.

The type of soil on which Kolukattai thrives best must also vary with the rainfall. Where the rainfall is low, it will thrive on heavier clayey soils but where the rainfall is heavier with greater chances of waterlogging, lighter and sandier soils are to be preferred.

Laying down the pasture.—Seed is sown at the rate of 10—16 lb. per acre. One well-packed gunny bag of ordinary size holds about 16 lb. and costs on the average Rs. 2—Rs. 3. The seed is seldom sown by itself but with gingelly, cholam and more seldom with cumbu. It can also be sown in the last year of a Nadam Cotton crop. When sown with cumbu it is not sown at the same time as cumbu but during the last intercultivation. The seed is broadcasted on the surface and if moisture conditions are good, it may be left there with prospects of a good germination. If moisture conditions are poor, the seed may be lightly harrowed in with a triangular harrow or a brush harrow.

There are two seasons for sowing, namely, the Kar (early) and Paruvam (late). If there are good sowing rains in the Kar season, sowing at this time gives the best results but very often rains are poor and consequently sowing is often done in the Paruvam season. Where possible sowing should be done in the Kar season as the grass gets a good start and makes full use of the following Paruvam rains and consequently stands a much better chance of coming through the following dry weather successfully. Manuring of the land previous to sowing the seed helps considerably in obtaining a thick stand of grass. At intervals of 3—5 years the grassland may be ploughed after a shower of rain and before the tussocks show signs of growth. There is little damage of the grass being killed out by this operation unless the soil is very dry and rain holds off for a long period after ploughing is done.

In Kangayam the land is well ploughed in the main season and the seed sown mainly with cholam as a nurse crop from August to October.

On account of the uncertainty of the early (Kar) rains, this practice though not so good as the early sowing, is common. If there is sufficient moisture, germination occurs in about six days after sowing and North-east monsoon rains enable the grass to get a good hold of the soil. Normally after the harvest of the cholam, the young grass is very tender and easily damaged and consequently no grazing is allowed until after the rains in the following year. Occasionally, however, with good rains on good soil the grass has been known to grow to a height of 3 feet in 3—4 months after sowing and when established under similar conditions of soil and rainfall may, within the first year, attain a man's height. On the other hand in poor soil and poor rainfall the grass may seed at a height of 6 inches and produce very little fodder.

When a pasture is being laid down more or less permanently a few Palmyra trees may be allowed to grow. Babul (*Acacia arabica* "*Lencophloca*") is also allowed to grow and in some cases the seed is sown. These babul trees are not only useful for shade to the cattle during the hottest part of the year, but their fruit which is produced in considerable quantity also forms a very satisfactory subsidiary food for the cattle during February and March when the grazing begins to get somewhat dry and scanty. The babul does not interfere with the growth of grass immediately underneath as is the case, for instance, with the Tamarind (*Tamarindus Indica*). The grass grows right up to the trunk.

Various other grasses such as Vennai Mattankay (*Cy. Egyptica*), Ibi (*P. Marginatim*), Sowrikodi and Naripayathankodi are often found growing naturally in the pastures after a little time. Leguminous plants such as *Indigofera enneaphylla* (Tamil, Cheppooneringie) and *Phaseolus trilobus* (Telugu, Pillipesaru) also grow naturally in suitable places. Such leguminous plants are liked by cattle and should be encouraged, as a mixture of grass and legumes is considered better feed than grass alone. In addition, the grass benefits from the Nitrogen accumulated in the legume roots.

Grazing.—As these pastures are left for long periods from 5—40 years, cattle as a rule are not allowed into the fields to graze for at least six months, and more generally for a year after sowing as there is considerable danger of the young plants being pulled out by the roots. Sheep, goats and horses are carefully kept off the young grass as they are close grazers and can do considerable damage. Regular grazing commences only from the third year.

10—20 days after rain, cattle are allowed in to graze. The poorer class of ryots put all their cattle in to graze together and graze continuously except for a short period just before and after the summer rains and after the late rains. If there is more grass at any period than can be consumed by the livestock, it is cut after flowering and made into hay.

Large stock breeders like the Pattagar of Palayakottai, however, run their cattle on a regular grazing rotation. Cattle, which are being got into condition for sale, are put on to fresh pasture first for a period of about two weeks. They are then shifted into another fresh paddock. In the paddock which they have just vacated, there is still a considerable amount of food left and into this paddock are put the less valuable cattle or cattle which have not to be got into sale condition, e.g., cows with calves, pregnant and dry cows.

Recent experiments with grass in England show that grass up to three weeks old contains a large amount of proteins and may be compared in feeding value to concentrated foods like linseed cake. It is found that the variation in composition does not change greatly for the first three weeks of growth, but if the grass is allowed to grow for three weeks before cutting or grazing instead of one week, there is a very great increase in the actual amount of grass produced. After three weeks the grass begins to get more fibrous and woody and is not such a concentrated food. As the grass gets older and flowers, the feeding value is further depreciated.

Kolukattai pastures, when there is young growth of grass after rain, produce excellent feed and cattle rapidly grow and fatten and soon take on that sleek and glossy appearance which are typical of well doing stock.

Area of grazing required per head.—The area of grazing required per head will vary annually with the distribution of rainfall. If there are good showers early in the season, there is a more continuous growth of grass and the amount of outside fodder required during the hot weather is reduced and also the area of grazing per head.

Young stock and cows generally graze from sunrise to sunset but from January to March, they are turned out to graze very early as the grass then being hard and dry, is best eaten when it is still damp with dew. During the heat of the day the cattle seek shelter from the sun in the shade of the trees. Ordinarily cattle are not left in the grazing ground during the night for fear of snakes and thieves. Under such circumstances a vallam of good land (3·82 acres) will support in a good season 20 heads of cattle for 30 days during the year so that about $2\frac{1}{2}$ acres of such land will be sufficient per head per annum. The Pattagar of Palayakottai allows on the average $3\frac{3}{4}$ acres per head for 9 months, grazing. For young cattle grazing throughout the year about 5 acres per head are necessary. The monigars of Kavandampalaiyam and Kangayam find that under average conditions $4\frac{1}{2}$ acres have to be provided per head in the absence of any other fodder supply.

Hay-making.—When Kolukattai grass is cut and made into hay, 2 to 3 cuttings depending on the rainfall can be taken. The yield per acre under favourable circumstances will amount to 200—250 bundles of 9 feet girth per annum. The average yield is about 100 bundles of green grass of about 50 lb. each a total of $2\frac{1}{4}$ tons per acre.

Experiments carried out by the Physiological Chemist, Bangalore, show that early cut hay gave better production when fed to livestock than mature hay due partly to better consumption and partly to its high digestibility. These facts should be borne in mind when Kolukattai grass has to be made into hay. Early cutting gives better feed.

Conclusion.—The practice of fallowing poor land for 2 and 3 years is common in South India. If the land be simply left waste, grasses of various kinds grow spontaneously but a given area of such grasses supports far less stock than an equal area of Kolukattai grass. If land be sown down to Kolukattai, it is not advisable to bring it under cultivation again in 2—3 years as it takes at least a full year for the grass to establish itself and if ploughed up in 2—3 years the full benefit of laying down the pasture is not realized. Fallowing is generally carried out to enable the land to recover its fertility or to

save up moisture from one year to the next in order to collect sufficient to grow a good crop. The fertility of soils can be maintained and increased by the correct use of manure and therefore there is a general need for making increased quantities of cattle manure and by preserving it properly by improved methods of cultivation the amount of moisture retained in the soil is increased and by correct methods of intercultivation and mulching the amount of moisture lost by evaporation is decreased thereby increasing the amount of moisture available to the growing crop. By these means the actual amount of fallowing requiring to be done is decreased and part of the area thereby saved could be put under Kolukattai grass. Even a small area under the grass would prove of value to a ryot as after rain, there would be some good grazing for his cows and calves and his work cattle when not working thereby enabling him to conserve his fodder for the dry periods.

As has been already stated, the grass is widely distributed in India. In Madras it has done well as far south as Tinnevelly and as far east as Saidapet. It was grown on the old Agricultural College Farm at Saidapet and the Principal's report was that it was found to be one of the hardiest grasses there and that even in April and May the driest months at Saidapet, the plot under the grass was well covered. On paddocks at the Agricultural College Farm, Coimbatore, it has also done fairly well. The Forest Department have tried it in one or two places in the reserve forests on the north side of the Bhavani and reports are promising. In the Vellamundi Forest where the soil is very light and thin, a plot put down two years ago, germinated well, but examination after the following hot weather showed that a considerable proportion of the plants had died out for lack of moisture or had been grazed out.

These facts show, however, that there is considerable scope for extension of the area under this valuable fodder grass.

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GRAFT MANGO GARDENS—HOW TO START AND MAINTAIN THEM.

INTRODUCTION.

The mango is a large evergreen tree easily grown in the tropics from the sea level up to an altitude of about 3,000 feet. The drier tracts of this presidency that receive less than 40 inches of rain in the year and where the rain ordinarily ceases sufficiently long before the blossoming season, appear to be well suited to the mango.

2. The mango is now extensively grown over large areas in the Vizagapatam, Gōdāvari and Kistna districts in the Circars as also in the Nellore, Chittoor and Salem districts. Waste lands which were once overgrown with shrub jungle are now thus fetching as much income as any other good land.

VARIETIES.

3. Every seedling tree perhaps produces fruit differing from that of another, and may thus be considered a variety by itself. The variation in the offspring from the seeds of the same tree is due to the mango flower being naturally liable to cross fertilization. It is this factor that necessitates "grafting" to enable trees true to any selected type to be obtained. This method of propagation is believed to have been introduced into India by the Moghuls or the Portuguese.

4. The varieties now under cultivation are numerous, each tract having a number considered suitable to the locality and to the tastes or fancies of the people.

5. According to the quality of the fruit mangoes are usually classified into—

(*a*) Juicy mangoes, the pulp of which can be sucked, e.g., Rajumanu, and Chinnarasam. These have more or less fibre.

(*b*) Table mangoes in which the pulp is firm even when ripe and can be cut into pieces with a knife. This class is the most popular and largest grown. Jahangir, Himayuddin, Banganapalli, Andrews (Mulgoa), Black Andrews, Hamilton (Sannakulu) and Ganneru are some of the best of this class. The fruit of this class has little or no fibre.

(*c*) Intermediate varieties, in which the fruit can be eaten either way, e.g., Goa, Suvarnarekha, and Dilpasand.

(*d*) "Sweet" mangoes, which are fairly sweet and of a good flavour even when raw, e.g., Peta Thiyyamamidi and Nuzvid Thiyyamamidi.

(*e*) Pickle mangoes, which are very sour when raw, e.g., Baramasi (Asakapalli), Kolanka Goa, and Ooragayamamidi.

6. According to the time of ripening, they may be classified as very early (e.g., Rajumanu) early (e.g., Suvarnarekha) medium (e.g., Dilpasand) late (e.g., Banganapalli, Jahangir, Himayuddin, Black Andrews, and Hamilton) and very late (e.g., Mulgoa, Ganneru, Kolanka Goa, Bangalora and Nilam). To these classes may be added "out of season" varieties. Some of these, e.g., Nilam, bear a second time in November-December, while other varieties, e.g., Baramasi (all the year round, or, literally, twelve months' varieties) bear at irregular times thus prolonging the season all through the rest of the year.

7. Some of the well-known varieties have been named above, under one class or other. Of these Jahangir, Himayuddin, and Banganapalli are noted for their excellent flavour ; Rajumanu, Suvarnarekha and Kolanka Goa for their steady bearing. Suvarnarekha is also noted for its very good keeping and transporting quality, ripening off to a fairly good taste and flavour even when plucked some time before reaching maturity. Bangalora, Nilam, Kolanka Goa and Banganapalli come next in order in this respect. Taking all points into consideration Suvarnarekha and Banganapalli have been chosen as the chief commercial varieties in the Vizagapatam and Gōdāvari districts, these accounting for about 60 per cent and 80 per cent respectively of the trade in the two districts.

8. Grafts of these and other varieties are available of nursery men at Allamanda in the Vizagapatam district, Kadiam in the Gōdāvari district and at Salem.

SOIL.

9. As observed above, the mango grows on almost any kind of soil, provided it is sufficiently deep and well drained. A red loam fairly deep with a substratum of loose gravel is ideal. Here, there is an uninterrupted development of the root system as well as free drainage essential for the length of life and bearing capacity. The peroxide of iron in this class of soils exerts a beneficial influence. It increases the vigour of the tree and sweetens the fruits.

10. In sandy soils as met with on the sea coast, the mango grows well, but the tree does not live long and the fruit is inferior. The addition of silt improves conditions favourable for its growth.

11. In clay soils, especially of an alluvial nature, the tree puts on heavy foliage and produces little fruit. Rich lands under cultivation with other crops are not recommended for the same reason.

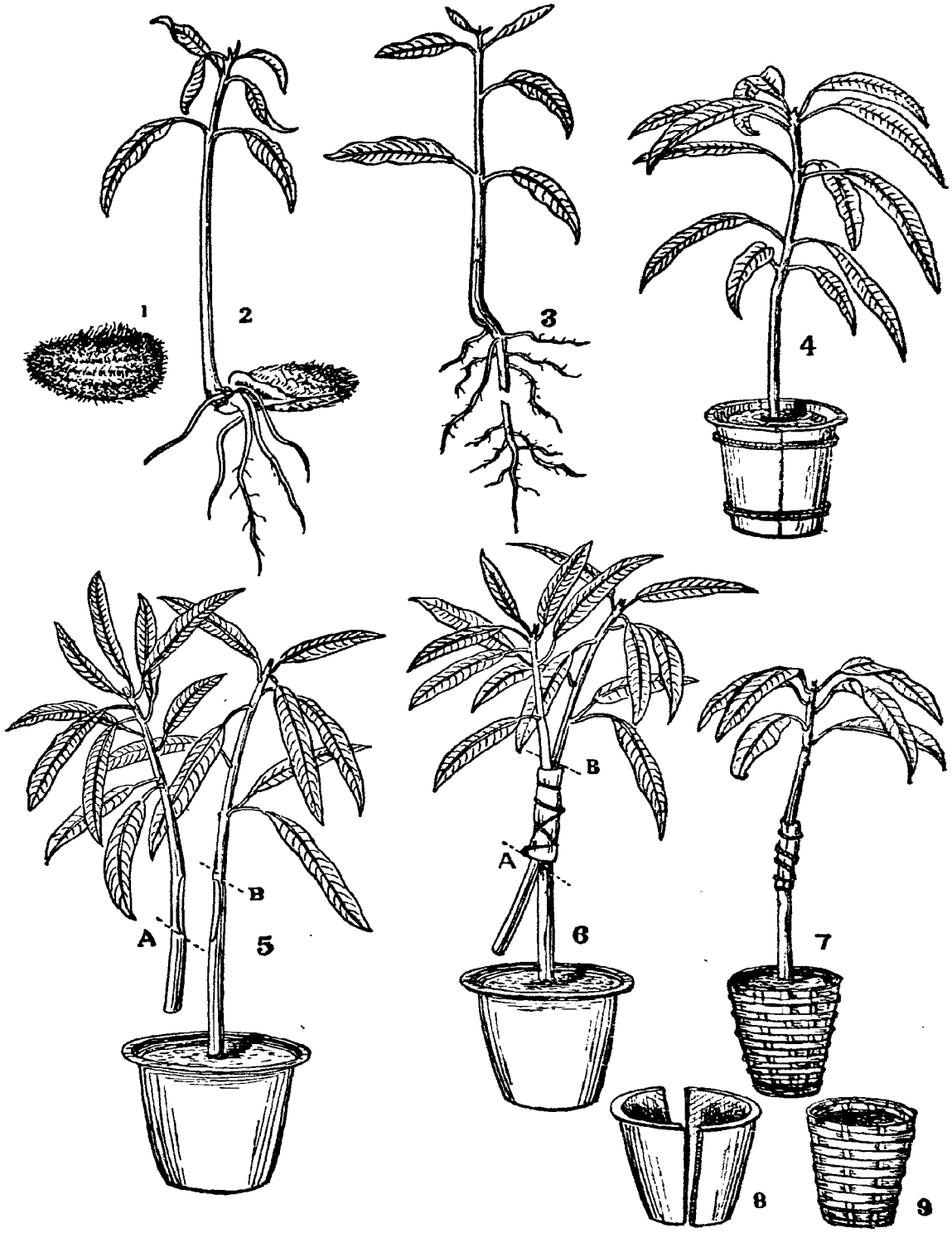
12. In shallow soils, the root growth is checked as soon as a hard rock is reached. Unless the land falls steeply, water-logging and imperfect aeration in the rainy season ensue, but if the slope is steep there is insufficient moisture in dry weather. From either of these causes growth is arrested and the plantation is short-lived. The presence of a considerable number of small stones such as are found in the soils at the foot of the hills, does not affect growth, provided the soils are otherwise suitable.

PROPAGATION.

13. As already indicated, propagation from seed does not ensure the offspring coming true to type. It is therefore desirable to plant "grafts". The most common method of grafting in vogue in the Circars is "inarching" which is a very simple process. A short account of this method is given below (See Plate I). In the fruiting season, the seeds (Fig. 1) are planted very thickly on heavily manured, well prepared soil. The seedlings (Fig. 2) when five to six months old are lifted, their tap roots are cut off (Fig. 3) and planted a span apart on fresh seed-beds. This encourages the development of surface roots and helps in potting which is usually done when 18 months old. To economise water, the potted plants, hereafter known as "stock," are buried flush with the ground in beds of convenient size, packed close, the intervening spaces being filled with sand or earth. So far as grafting is concerned the age of the stock does not matter much. Stocks three months to three years old have been

PLATE I.

INARCHING.



(From the seed to the graft ready for sale.)

1. The seed.
2. A young seedling.
3. A five months old seedling (note tap root cut before potting).
4. A potted plant (pot is in two halves tied together).
5. A, the scion ; B, the stock.
6. The stock and scion brought together and tied up.
7. The graft ready for transport.
8. The split halves of a pot.
9. Bamboo basket for transport.

very successfully used, as far as union is concerned, but as the roots suffer from confinement in a pot, it is advisable to retain this cramped condition for as short a time as possible. When these stocks (Fig. 4) have sufficiently established themselves, the process of grafting begins. This consists in slicing off the bark and part of the wood for two to three inches along the stem of the stock and of the twig of the parent tree, known as "scion" (Fig. 5-A), bringing them together and securing them tight with a bandage of wax cloth or dry plantain sheaths (Fig. 6) to exclude air and water from the cut surfaces. In doing this, the cut edges of the cambium—a very thin active layer of tissue between the bark and wood—of the stock and scion are brought together and when these layers of tissues are retained for a time in close apposition, union of the two parts takes place and the wound heals by the natural process. For speedy success the stock and the twig operated upon should be of the same thickness. The union is complete in about three months, and the scion is severed from the tree in three or four stages at intervals of a week so that little harm is done to it. When complete severance has been effected, the graft (Fig. 7) is ready for planting. The grafts are then buried in the ground the pots touching one another to facilitate easy watering. They remain in this bed till they are sold and the scions that did not unite properly wither and gradually dry off.

14. In potting it is usual to use whole pots. This entails breakage and wastage in the transport of plants from place to place. To obviate this defect, it is recommended that pots in halves (Fig. 8) should be prepared and placed in juxtaposition while potting and tied with string as in Fig. 4. For transporting these pots can be removed and bamboo baskets of the same size (Fig. 9) inserted which reduces damage and renders these pots available for further use.

15. Experience has shown that the methods adopted hitherto in preparing grafts and planting them are capable of improvement. Gardeners are now convinced that the use of seed of all sorts indiscriminately for raising stocks results in the production of fruits of varying and uncertain quality, though the scions used are of the same quality. By such variation, uniformity in the maturity of fruit of even the same variety is lost. Some trees fruit off, while others just begin to flower or ripen. This raises the watching bill and reduces the chances of brisk demand for export. Growers therefore, now incline to the view that the selection of seed for raising stock is also necessary in addition to the selection of the scion.

16. Secondly, the cutting of the tap-root results ultimately in shortening the period of bearing of the grafts, as only surface roots are developed, the trees thereby having a less grip on the soil, and the area tapped for the abstraction of food ingredients becoming smaller. Unless heavy manuring is given every year, and careful attention paid, gardens deteriorate. Once deterioration sets in, renovation is not possible except at a prohibitive cost and renewing the plantation becomes more economical.

17. To obviate the above two defects, some experienced gardeners tried the following innovations. They selected seeds of varieties with desired qualities, planted them directly in pits in the future garden. To the seedlings thus raised as stocks they grafted the scions of potted grafts the qualities of the scions of which are definitely known, but the qualities of the stock of which, having been raised from seeds indiscriminately, were not known. This was believed to ensure definiteness

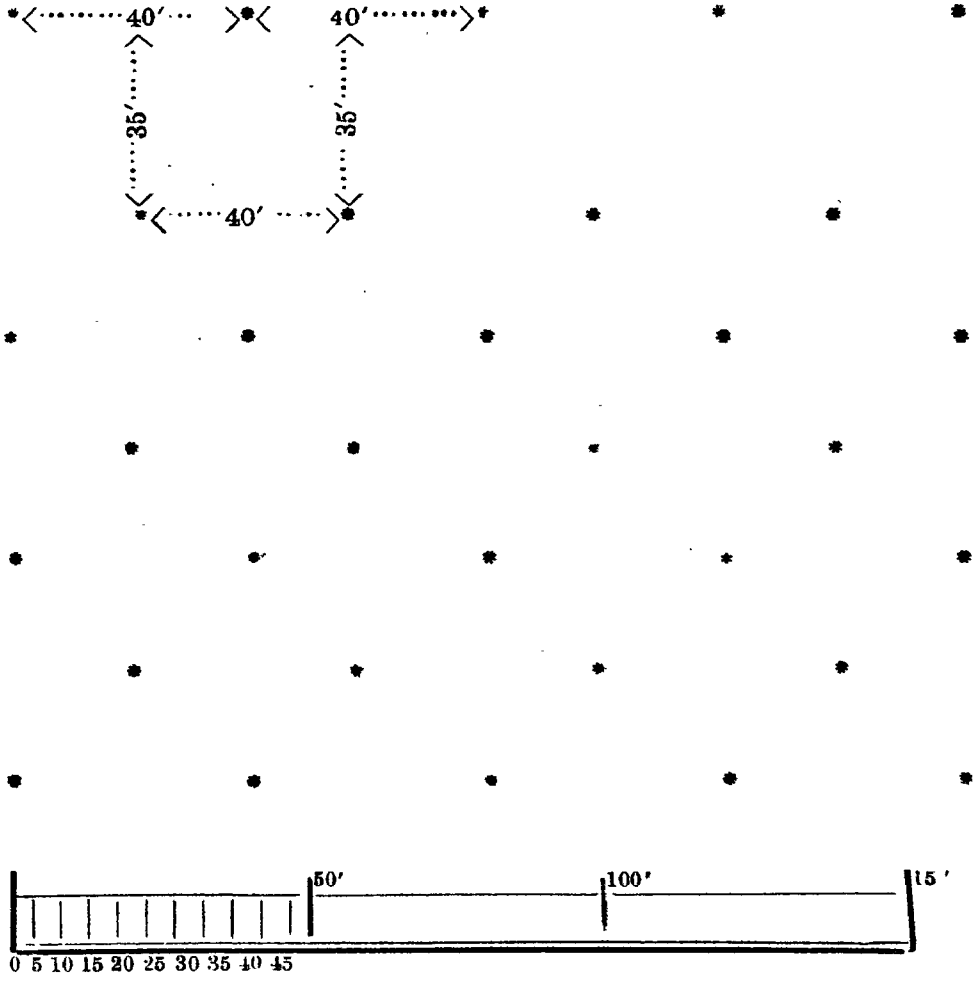
of characters in both the stock and the scion used and secure vigour, as the tap-root of the stock was not cut off. The life of the plantation was also thus expected to be lengthened.

18. Another device adopted to retain the tap-root is to put the seed in long narrow pots (about 18″ deep) and graft on the seedlings thus raised without potting them from a ground nursery. This system, of course, involves grafting on fairly young plants.

19. There is a new school of thought however, which from experience gained of late by adopting the above methods, is, of opinion that the cutting of the tap-root is not so much responsible for the shortening of the life of the tree or for its stunted growth, as the operation of inarching, which is believed to weaken the system of the plant and prevent the tree from growing to the size of a seedling. This aspect however has to be more carefully studied before the above opinion can be finally accepted.

PLANTING.

20. Each variety or a number of varieties that ripen at one time should be planted together in one block, to facilitate watering and gathering fruit. The number of plants to the acre varies with the soil. On rich soils where the trees spread well, 20 to 25 are planted while on gravelly soils where the growth is rather stunted, up to 50 trees to the acre are put in. The best average distance is 40 feet apart in rows 35 feet apart, the plants being arranged quincuncially whereby 32 go to the acre.



Scale 1″ = 50 feet.

21. In good deep red loamy soils mango grafts have been found to make good progress when planted in pits just sufficient to receive the ball of earth in the pot in which it is growing. Usually, however, pits three feet wide are dug. The lower subsoil is kept separate from the top soil. The pits are left exposed to the sun for some weeks to effect complete drying. Some growers burn rubbish in them to shorten this period and to minimise the ravages of white-ant attack. When ready the pits, are, filled in with good surface soil to a sufficient depth. When available, dry canal or tank silt may be added. A mixture of silt and crushed bones is also recommended to be placed at the bottom. The earth is allowed to settle down for some time. If no rain falls the pits are thoroughly watered once and the graft planted. The pot is deftly broken, and broken pieces of pot, tile, or brick adhering removed and the plant with the ball of earth imbedding the root system is gently placed in the hole scooped out, flush with the ground. The soil in the pit is well pressed and a soaking watering given.

AFTER TREATMENT.

22. Subsequent waterings are given every evening for about ten days when alternate days become the rule. Bamboo or earthen tubes about three inches in diameter and a span in length may be inserted in the pit about nine inches from the plant so that the water is made available to the lower layers as well whereby economy in watering can be secured. When the graft has struck root, the bandage is removed, as otherwise the stem is constricted in growth. The portion of the stock above the point of union if it was not removed at the time of grafting, is also cut off. To protect the young grafts from strong winds propping is necessary till the plants grow to a sufficient size to protect themselves ; some strong, thin jungle wood posts or bamboos may be used as standards for propping.

23. Any shoots that may grow from the stem below the point of union should be removed as often as they appear, otherwise the grafts suffer and inferior fruits are produced, from such shoots.

24. Flowers that appear should be nipped off for four to five seasons to promote the growth of the tree. During the dry weather the land should be ploughed constantly and kept clear of weeds. For the first four to five years, until the plantation grows to a fair height and covers the ground, ordinary annual crops can be raised by liberal manuring and with the help of irrigation water when available. When this cannot be had, horse-gram and other pulses can be grown to arrest growth of weeds.

25. During this period well rotten farmyard manure and green-leaf may be applied to assist the growth of the tree. The latter may be applied during the rains as soon as sufficient leaf is available and the former about the middle of January when fresh growth commences.

THE CARE OF THE GARDEN IN THE BEARING STAGE.

26. Though the grafts begin to flower from the year of planting, regular bearing should not be allowed till the tree attains a good size, which it usually does in about five years. Thereafter the treatment that is given to a garden should aim at—

(1) regular flowering every year,

(2) good setting and retention of such a number of fruit as the tree can bear.

27. The flowering is generally good in years in which the rainfall during the north-east monsoon is light and ceases at an early date. The influence of these factors however differs somewhat with different varieties and soils, as also the bearing of the tree in the previous season. The chief way in which the cultivator can induce flowering of the tree in general is to ensure good drainage by digging drains and seeing that the soil of the garden dries off fairly well sufficiently long before the flowering season. This is especially necessary in stiff clays which are retentive and do not attain this stage early enough. In a season of heavy or late rainfall, leaving the land fallow after the rain helps flowering while interculturing retards it.

28. Other means sometimes adopted are deep trenching around individual trees (about 3 to 9 ft. from the trunk according to the size of the tree) and thus pruning off the roots which cross the trench, and application of about three or four pounds of common salt. These operations are all intended to reduce the vegetative growth of the tree. Making incisions in the bark of the tree also induces it to flower, by reducing the flow of the sap from the leaves downwards, and concentrating it in the flowering branches. It is a matter of common observation that for the same reason, trees bored by the mango beetle flower early and bear more profusely than other trees in the garden.

29. The setting of fruit depends upon the nature of the variety, weather conditions, and incidence of the mango hopper and mildew. The effects of the last two may to a certain extent be controlled by spraying (vide leaflet No. 3 of 1917 for details).

30. The retention of a reasonable number of fruit till the ripening stage depends upon the weather and soil conditions. Fruit fall in the early stages may occur if there is heavy rain after setting, but this occurs rarely. In the later stages fruit fall is the result of the soil not retaining sufficient moisture or of the exhaustion of trees. This can be prevented to a certain extent by interculturing the garde thoroughly and at the right time, to retain moisture. The effects of dust storms may to a certain extent be minimised by effective wind breaks all round the garden. Exhaustion of the trees generally occurs only in poor soils and may be prevented by ploughing in green manure crops, such as daincha, sunnhemp, cowpea or groundnut, and by the application of bone-meal with the green manure. The carting of tank or river silt to such gardens also keeps up the bearing capacity of the trees. The manuring of individual trees with silt or cattle manure mixed with 5 to 6 lb. of bone-meal or superphosphate may also be beneficial in some cases.

YIELD.

31. Though the grafts are allowed to bear from the sixth year, they are in full bearing only from the eleventh year. The value of subsidiary crops grown during the first five years and of fruit obtained the next five years, can be set off against the cost of the plantation and its maintenance until the eleventh year, from which time it is reasonable to strike a balance sheet. Even with the best of care, the flowering, the setting of the fruit and its development are largely matters of uncertainty. Allowing for this 200 to 300 fruits worth about Rs. 6 may be estimated to be a fair yield. But in a big garden, taking into consideration trees of varying bearing capacities, an average income of Rs. 2½ per tree per year is a modest estimate. Instances are not

uncommon in which with regular root pruning, manuring, and watering, yields of fruit worth up to Rs. 25 or more per tree are obtained.

COST OF CULTIVATION.

32. The cost of planting and maintaining a garden may be estimated as below :—

First year.

	Rs.	A.	P.
Digging pits—32 at one anna each	2	0	0
Filling in with good earth, manuring and planting grafts at As. 4 per pit	8	0	0
Cost of 32 grafts delivered on the spot at As. 8 each	16	0	0
Watering, hoeing, watching, etc.—100 men at As. 6 each	37	8	0
Two ploughings at Rs. 1-6 per ploughing * ...	2	12	0
Pots, " kavidis," etc., for watering	2	0	0
Total ...	68	4	0

Second year.

Watering, hoeing, watching, etc.—100 men at As. 6.	37	8	0
Manure (cattle manure and green leaf) and their application	5	0	0
Two ploughings *	2	12	0
Pots, " kavidis," etc., for watering	2	0	0
Total ...	47	4	0

Third, fourth and fifth years.

Watering, hoeing, backward plants, watching, etc., per year—60 men at As. 6 each	22	8	0
Two ploughings*	2	12	0
Pots, " kavidis," etc.	1	0	0
Total for each year ...	26	4	0
Total for the first five years ...	194	4	0

From the sixth year onwards.

Watching, digging, round plants, etc.—40 men at As. 6	15	0	0
Four ploughings	5	8	0
Green manure seed to be sown in about 1/3 of the area every year	0	8	0
Total ...	21	0	0
Average yield from sixth to tenth year at Rs. 1½ per tree	48	0	0
Average yield from the eleventh year at Rs. 2½ per tree	80	0	0

* NOTE.—Only ploughings at the beginning of the rains are taken into account ; horse-gram can be grown at the end of the rains.

THE MANGO TRADE.

33. From the Circars as well as the Central districts, there is a considerable export trade in mangoes, besides a large local sale and consumption. From the Gōdāvari and Vizagapatam districts, large quantities are sent to Orissa, Bengal, United Provinces, Punjab and even to Sindh. Of late, there has been some export to Burma also. The total value of mangoes exported from the Vizagapatam district alone is estimated at four to eight lakhs of rupees every year according to the crop and prices.

34. The producers bring the fruit into the marketting places, where brokers arrange for its disposal to middlemen or merchants from the tracts referred to above, who dictate their own prices.

35. The fruit is packed with some paddy straw in bamboo baskets holding about 50 to 100 fruits according to their size. For export to Calcutta and places nearer, they are sent by road goods but to places beyond, they are booked by passenger trains or the parcel express. A considerable number of fruit is damaged in transit for which the producer is made to provide extra. Packing in dealwood cases as recommended in leaflet No. 2 of 1930 of the Department of Agriculture, Bombay, may be worth a trial. The railway authorities have also to be induced to provide well ventilated waggons and for their quick transport. The interference of brokers and middlemen who deprive the producers of more than a fair share of their dues may also be eliminated at least partly, if the latter organize themselves into co-operative export societies for each centre of trade which in turn may all affiliate themselves to a central organization to ensure concerted action in all matters and prevent competition among themselves.

APPENDIX.

NOTES ON SEVEN PRINCIPAL VARIETIES OF MANGO.

(See Plates II—VIII)

1. *Rajumanu.*—A small sized very early juicy variety of local selection ripening yellow ; sweet fairly thin juice of good taste and flavour ; small seed with very little fibre; fruit keeps moderately well ; tree not quite hardy but bearing generally steady and profuse ; fetches a fair price for the size on account of its earliness ; largely consumed locally but also exported to some extent.

2. *Goa.*—Locally known as *Chinna Goa* ; one of the varieties originally introduced by the Portuguese ; a small sized early variety ripening off yellow with a red colour on one side ; suitable for the table as well as for sucking ; of a fine subacid sweet taste when fully ripe ; fibreless small seed ; fruit keeps well ; tree hardy and vigorous ; but bearing uncertain and rather poor ; once largely grown, but of late being given up.

3. *Suvarnarekha.*—Sometimes called *Chinnasuvarnarekha* to contrast it with *Peddasuvarnarekha* from which it is said to have been evolved ; a small fruited early variety ripening of yellow with a bright red colour on one side, which is one of its chief attractions ; a fine sweet taste and good flavour when ripe ; suitable for the table as well as for sucking ; ripens off to a fairly good subacid taste even when plucked somewhat immature ; medium sized seed with very little fibre ; stands transport admirably well on account of its thick skin ; the most largely exported variety from the

Vizagapatam district; a rather slow growing tree of moderate vigour; but bears regularly and fairly profusely; not much affected by weather conditions and the mango hopper pest.

4. *Hamilton.*—Locally known as *Sannakulu*; a late table variety of medium size, the fruit being very short as compared with its breadth; ripens off yellow with a firm flesh; sweet and of a good flavour of its own; fruit keeps well and stands transport; fibreless small seed; tree hardy but generally poor in bearing; badly affected by weather conditions and hopper pest; not largely grown of late.

5. *Kolanka Goa.*—Also a late table variety of local selection; medium sized fruit ripening yellow; of rather poor flavour; fibreless small seed; fruit keeps well and stands transport; a hardy tree bearing steadily and profusely; not affected much by weather conditions and hopper; fairly large export trade.

6. *Banganapalli.*—A well known late table variety of medium size; fruit rather broad and flat, ripening of bright yellow (fetches a high price); pulp firm and of an excellent taste and flavour; fruit keeps and stands transport fairly well; the chief commercial variety in the Gōdāvari district; tree hardy, and quick growing; bearing moderate but fairly steady.

7. *Bangalora.*—Locally known as "Collector"; a very late variety with a medium sized long and peculiarly shaped fruit; ripens off yellow, often with a red tinge on one side; pulp very firm and skin thick; fruit keeps very long and stands transport well; fruit can be retained on the tree itself and thus rendered available for a long time after the season; though poor in flavour, fetches a good price on account of its availability out of season; fairly largely cultivated and exported.

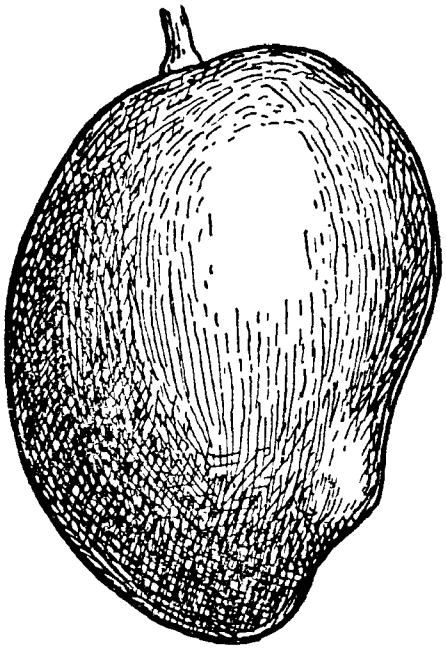
NOTES.—1. Fruits weighing below 6 oz. are considered very small; 6 to 12 oz. small; 12 to 24 oz. medium; 24 to 42 oz. large; and above 42 oz. very large.

2. The seed is considered very small when its weight is not more than 5 per cent of the weight of the fruit; small when it is between 5 and 10 per cent; medium when it is between 10 per cent and 15 per cent; large when it is between 15 per cent and 20 per cent and very large when it is over 20 per cent.

3. The fruit is considered to be very short when its height is less than that of its breadth; short when it is less than 25 per cent longer than the breadth; medium when it is between 25 to 50 per cent longer than its breadth; long when it is 50 per cent to 100 per cent longer than its breadth; and very long when the height exceeds double the breadth.

PLATE II.

RAJUMANU.



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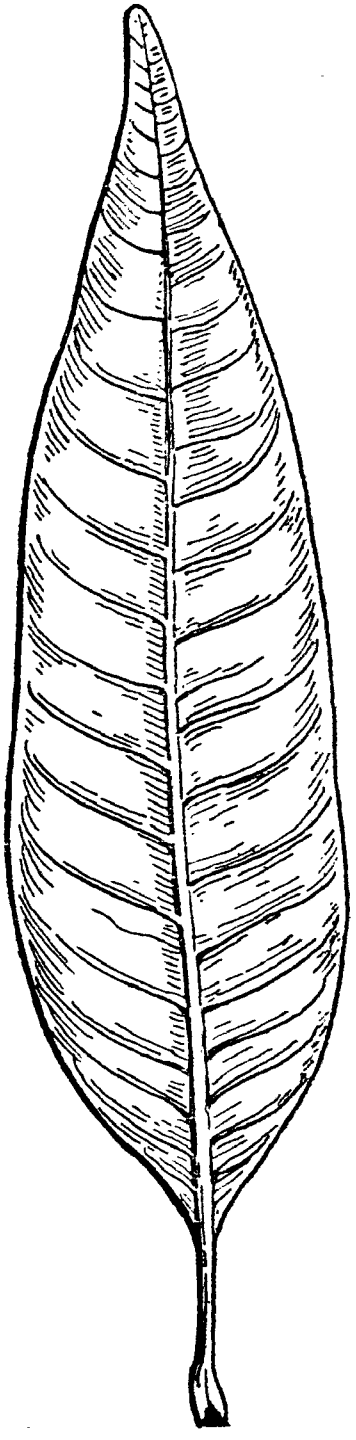

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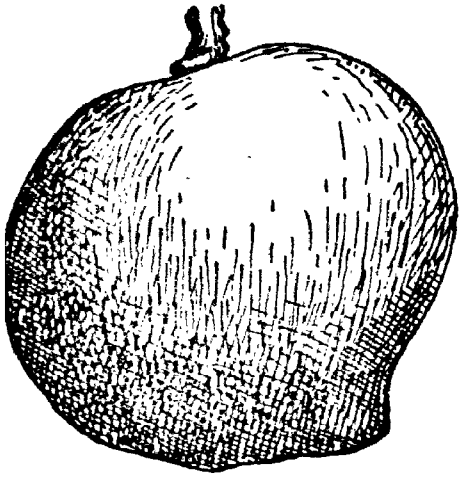
PLATE III.

CHINNA GOA.



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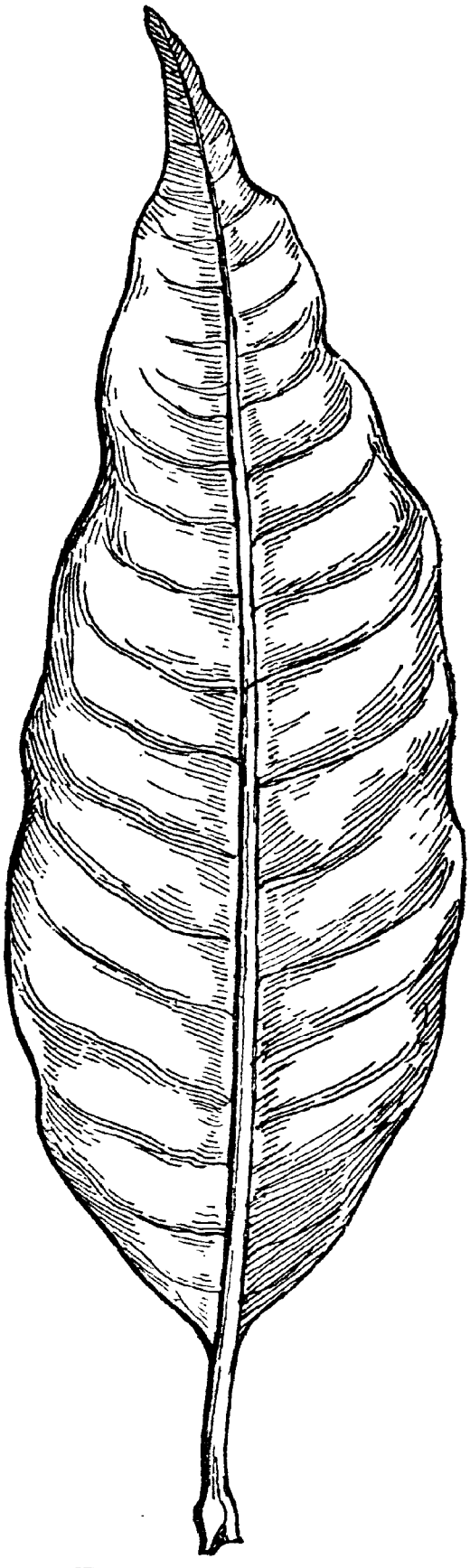

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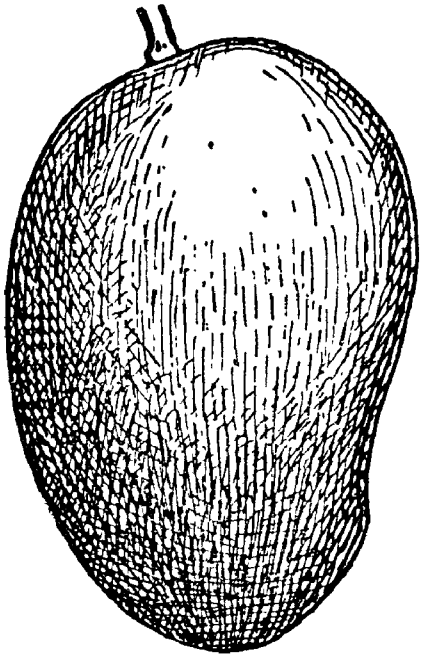
PLATE IV.

CHINNA SUVARNAREKHA.



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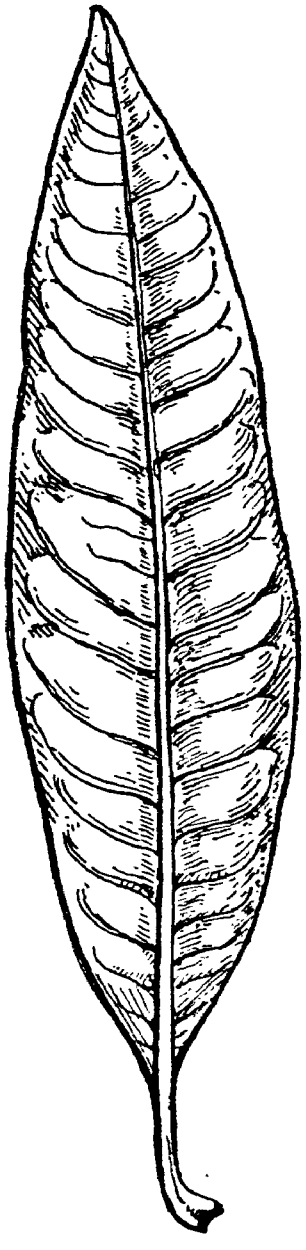

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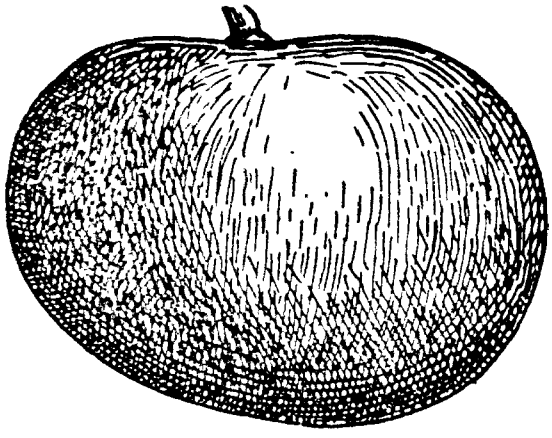
PLATE V.

HAMILTON OR SANNAKULU.



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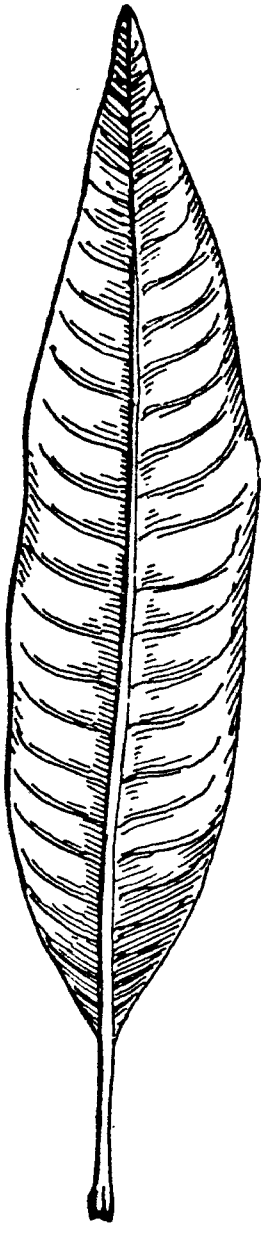

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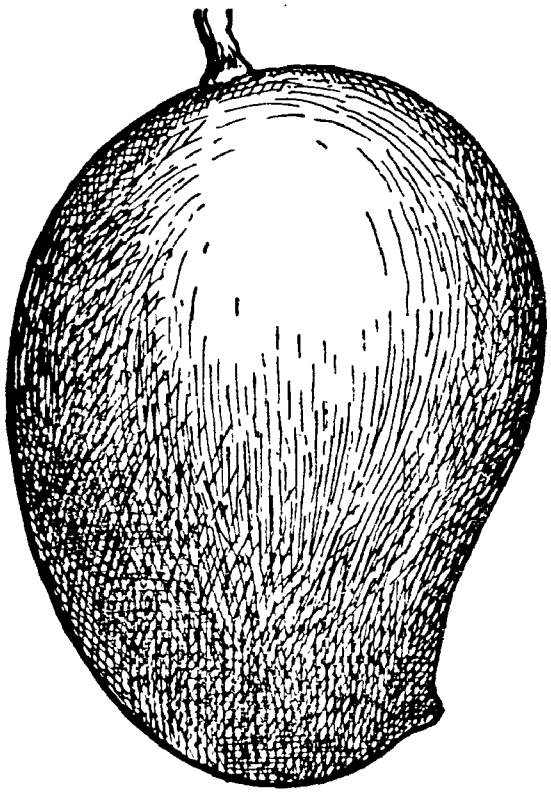
PLATE VI.

KOLANKA GOA.



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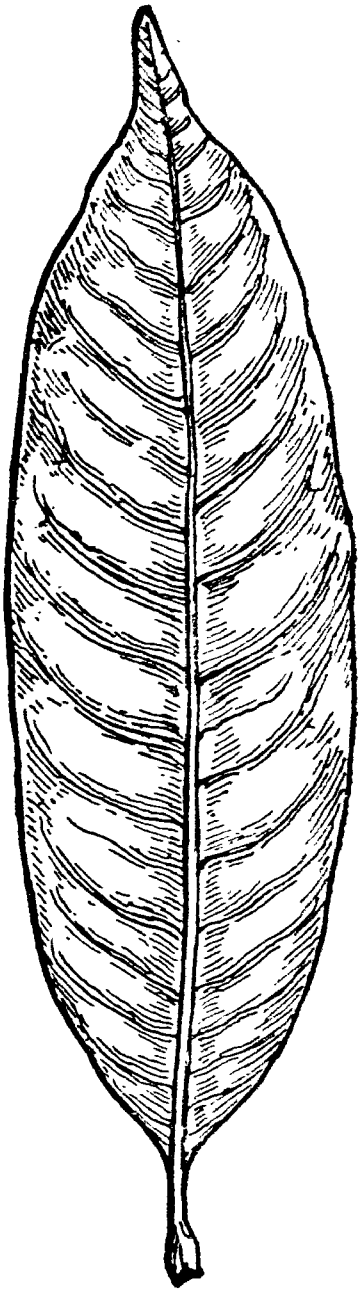

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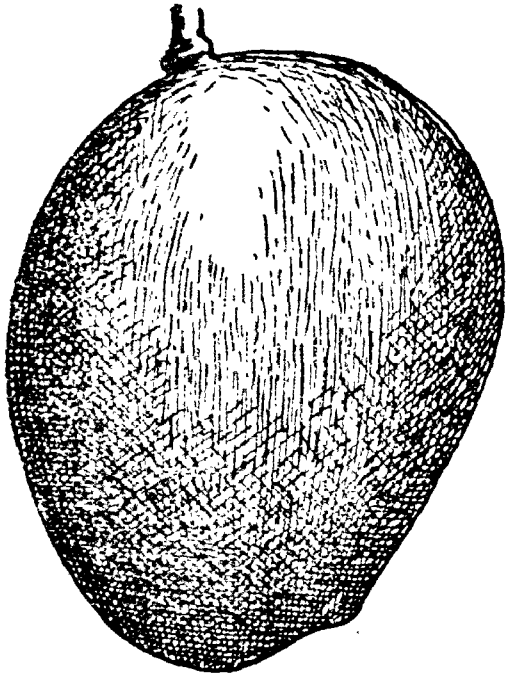
PLATE VII.

BANGANAPALLI.



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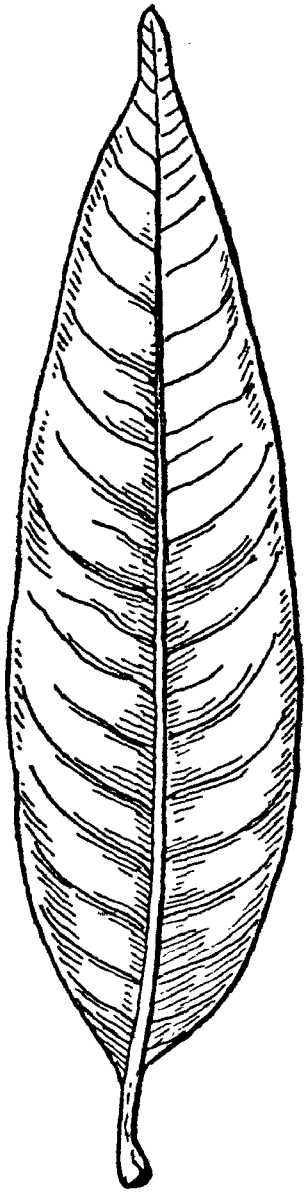

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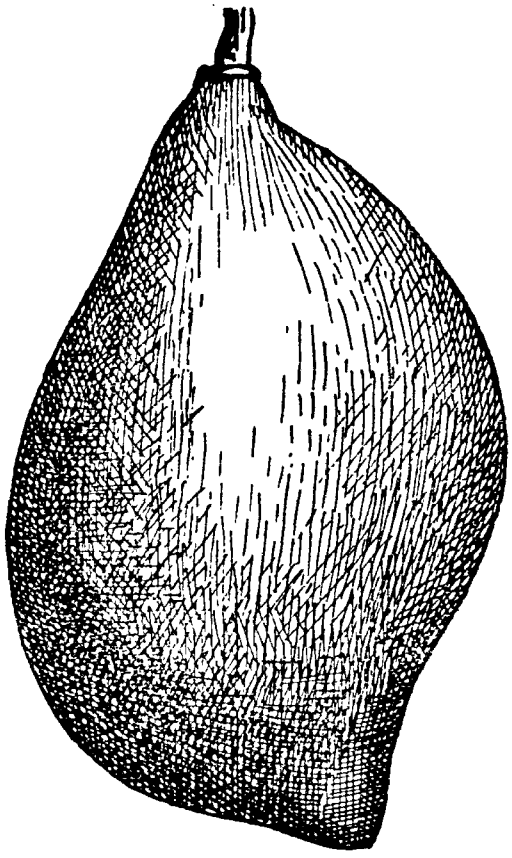
PLATE VIII.

BANGALORA *or* COLLECTOR.



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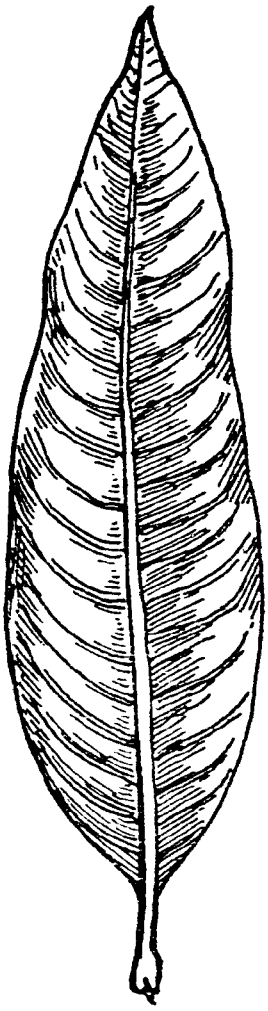

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PREFACE.

WITHIN a year after Mr. T. B. Fletcher joined his appointment as Entomologist, Madras, he prepared a "Note on insects attacking the paddy plant in South India" and this was issued as Bulletin No. 67 by the Department of Agriculture, Madras, in 1913. As one of the earliest entomological publications of the department the note was very useful and served its purpose very well during the early years. But there is hardly any doubt that during these eighteen years since its issue our knowledge of paddy insects in this province has increased considerably and has consequently made Mr. Fletcher's note very much out of date on the subject. This new bulletin is an attempt to present a short account of the insects so far known to affect paddy in South India and bring our knowledge of these forms up to date as far as possible.

Though the treatment of each insect in this paper is more or less as in Fletcher's note, the arrangement followed is quite different. Besides, much more matter has been added not only in the shape of additional information on previously known insects, but also by way of fresh records of pests and other items of information regarding the bionomics of paddy insects. While no claims are made to the effect that this paper includes each and every insect noted on paddy in the province, no efforts have been spared to include all the important forms so far known and make the list up to date. With all its inevitable defects it is believed that this bulletin may be of some help to the South Indian paddy farmer to know something of his paddy pests and get some hints to control them.

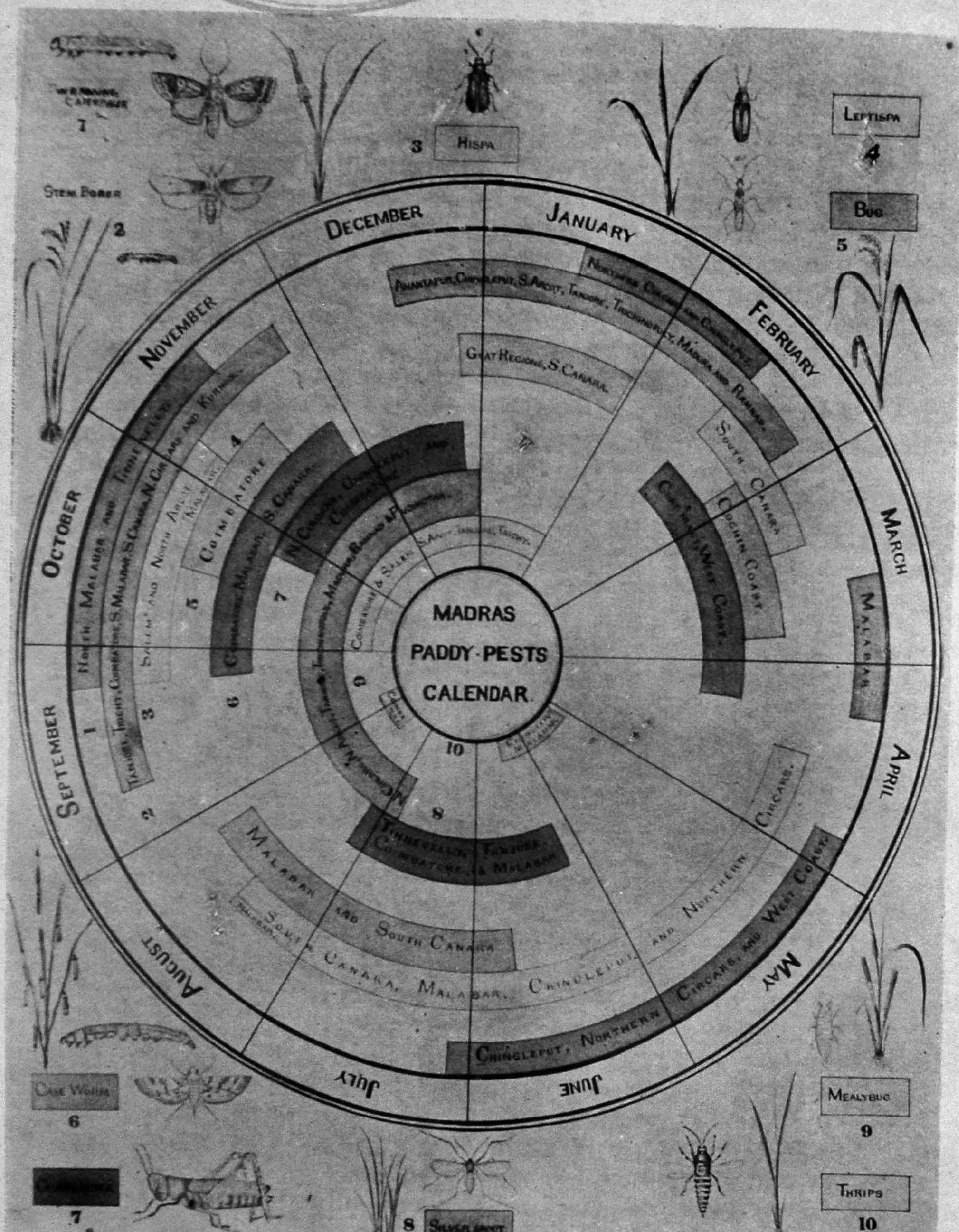
MADRAS
PADDY-PESTS
CALENDAR.
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
HISPA
LEPTISPA
BUG
STEM BORER
CASE WORM
MEALYBUG
THRIPS
Ghat Regions, S. Canara.
South Canara
Cochin Coast
Malabar
Circars.
Malabar and South Canara
Chingleput, Northern Circars, and West Coast.
Coimbatore
1
2
3
4
5
6
7
8
9
10

Fig. 1.

INSECTS AFFECTING THE PADDY PLANT IN SOUTH INDIA.

Status of paddy in South India.

From time immemorial paddy has been the most important cultivated plant in South India. As the staple food crop of the population, it is now grown on an area of over thirteen million acres in this province, and it is practically the only important crop in some of the delta tracts of the Northern Circars and the Tamil districts. Though we possess no regular statistical records to gauge the extent of damage caused in various ways to this important crop or the consequent loss sustained by the paddy cultivator, it is well known that insects of different kinds levy a heavy toll on the paddy plant year after year and that in some years such a loss in some tracts has been very considerable. To avert or at least minimize such periodical losses to a great extent, the rice cultivator will do well to acquire some familiarity with at least some of the more important insects injurious to growing paddy and the different measures that may be adopted to control them. Equipped with this information and backed up by a few years of experience, an intelligent cultivator may be in a position, not only to control these pests to a great extent, but even to predict or forecast pest outbreaks in any tract fairly accurately and prepare an insect-pest calendar on the model of the one prepared by the writer a few years ago* and reproduced here (Fig. 1). This paddy-pest calendar is in the form of a circular diagram to indicate in a picturesque manner ten of the important paddy insects of the Presidency, their distribution in the province and the month or months of the year in which they generally appear as pests. The calendar does not pretend to be very accurate or complete ; but in spite of the inevitable defects, it is believed such calendars will help the farmer to some extent to know the probable time of appearance of important insect pests during the year. Such a knowledge will serve as a sort of warning to him to be on the lookout for the expected pest and be prepared to adopt proper control measures the moment the insect is seen or even just before it is expected to appear. In this booklet an attempt is made to present in a connected manner a brief account of the insects so far known to affect the paddy plant in South India. The information given below under each insect is mainly intended to help the paddy cultivator to recognize the insect, to note correctly the nature of the damage it causes to the plant, to get some idea of the life-history of the insect, and to adopt timely and suitable measures of control. Of about three dozen insects noted below as affecting paddy in South India, only about a third can be considered to be important or major pests which appear almost regularly every season and cause the greater portion of the damage to the plant ; of the rest some are occasionally

Loss due to pests.

Advantage of entomological knowledge.

Paddy-pest calendar.

Aim of this pamphlet.

Number of insects—major and minor pests.

* Bull. No. 80—1921—Madras Agricultural Department.
Bull. No. 131—1922—Pusa.

found harmful, while others appear now and then as sporadic pests only during certain years. These latter may be called pests of minor importance. The insects noted in the paddy-pest calendar referred to above may be regarded as some of the major pests of paddy in South India.

Mode of feeding and external symptoms of damage.

Before dealing with the different pests individually, some remarks may be added regarding paddy insects in general. All insects feeding on the paddy plant (in fact all members of the group "insecta") fall into two main groups according to their feeding habits. Firstly those that feed by biting and chewing the different parts of the plant such as grasshoppers, beetles and caterpillars, and secondly those which suck up the plant juice as liquid food, such as shoot bugs, earhead bugs, leaf hoppers and mealy bugs. If the pest concerned belongs to the first category the external symptoms of damage are a partial or entire defoliation of the plant, cutting off of the earheads and scraping and tearing away of the shoots, leaves, etc. If on the other hand the insects causing the injury are earhead bugs, leaf hoppers, or mealy bugs, the general external indication will be a gradual fading and drying up of the part or whole of a plant, stunted growth and a sickly appearance as a whole, but without the form of a plant being damaged in any way as in the former case. This is also the case when the pest attacks the plant from inside the shoot, stem or roots invisible from outside as in the case of the paddy stem-borer.

Life-history and habits.

All beetles, moths, butterflies and flies pass through four different stages in their lives, viz., the egg, the larva (which is called grub or maggot in the case of beetles and flies, and caterpillars in the case of butterflies and moths), the pupa and the adult ; these stages show a striking difference from one another in structure and in feeding habits. In the case of bugs and grasshoppers the life stages are not so marked and there is no pupa stage ; the young and the parent look more or less similar and have the same feeding habits. It must be noted that butterflies, moths and flies are directly injurious to plants only in their younger stages, while beetles, grasshoppers and bugs do damage to the plant in all their stages. A general knowledge therefore of the life-history and general habits of these insects will not only help one to recognize the different stages, but will also help him to find out the really vulnerable of the different stages at which the pest can be easily checked. Among paddy insects, though there are some which indiscriminately feed on paddy in all stages of growth, a good number of these attack the crop at certain stages only. Of the former class are the grasshoppers and some of the leaf-feeding caterpillars which can feed on young or old foliage as long as it is green. On the other hand the borers want half-grown to fully-formed stalk, the rice hispa, the case-worm and leaf-rollers, etc., feed on tender foliage, the sap-sucking bugs want milky grains, and the blister beetles and allied insects feed on the pollen grains. Thus different sets of insects appear at different stages in the life of the crop (see plates II and III).

Pests at different stages of paddy.

Control measures.

The choice of control measures for different pests of paddy depends chiefly on the kind of insect to be tackled, the local conditions and the cost. The possible measures in the case of each insect are indicated in the treatment of

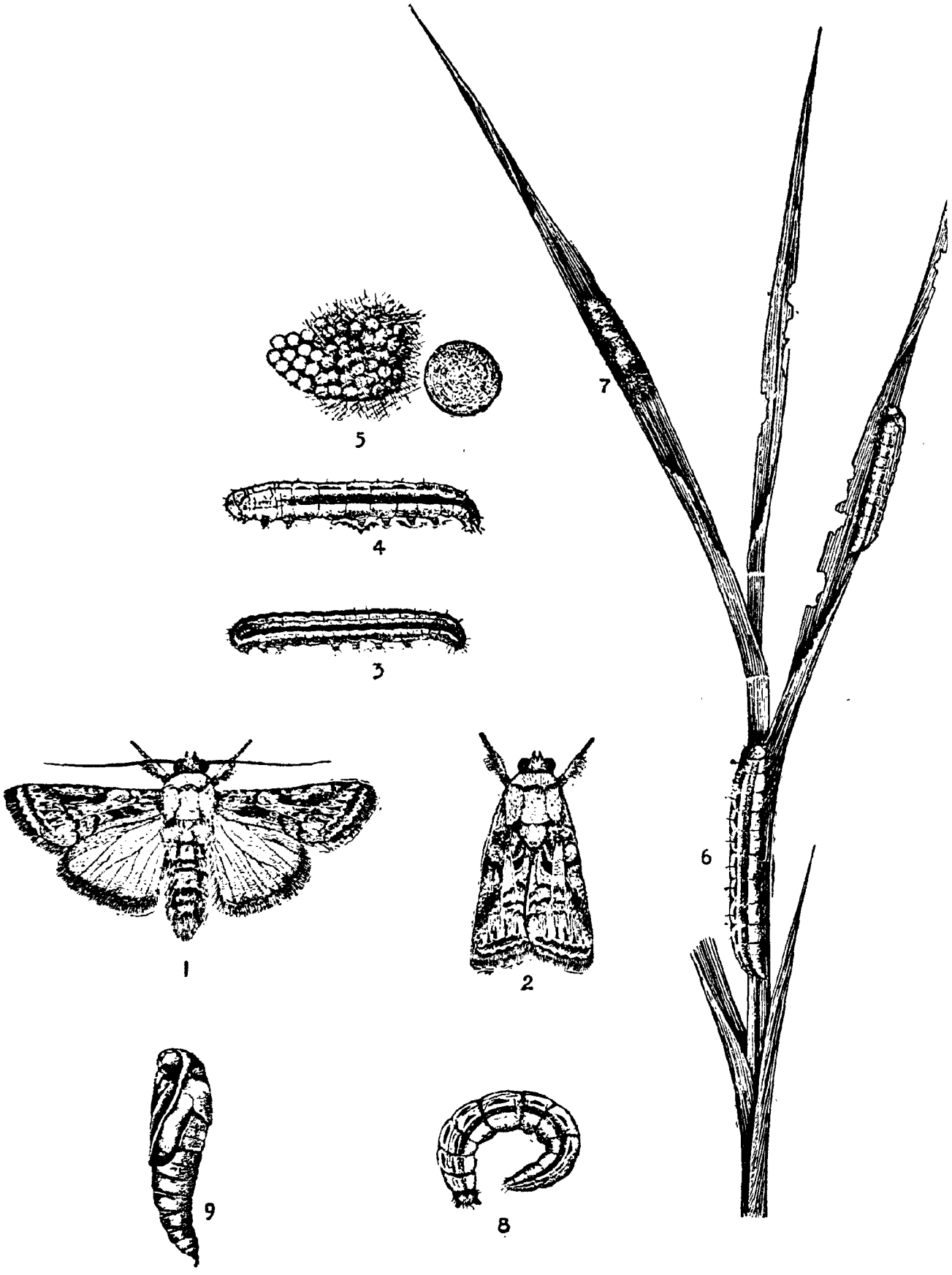

PLATE I.—PADDY SWARMING CATERPILLAR.

Fig. 1. Moth, wings spread.
„ 2. Do. do. closed.
Figs. 3–4. Caterpillars.
Fig. 5. Eggmass and one egg magnified.
„ 6. Paddy plant with caterpillars damaging the leaves.
„ 7. Eggmass on plant.
„ 8. Curled up caterpillar in ground.
„ 9. Pupa in ground.

each in the following pages. It might, however, be added that some of the important and serious pests often appear in the nurseries themselves ; hence the need for early investigation and prompt action. It is needless to add that in the matter of pest control co-operation between different farmers of a tract is very essential.

With these general observations of a very brief nature we proceed to deal with the different insects. No claim is made in the following account of the paddy insects for completeness in all matters, though almost all insects known so far are included in the following list. For any detailed information, other publications, reports and special leaflets on the subject should be consulted.

PADDY INSECTS OF SOUTH INDIA.

The following insects may be regarded as the more important or major pests of paddy in this Presidency :—

THE SWARMING CATERPILLAR (**Spodoptera mauritia, B**). [Plate I.]

MOTH—**Noctuidae.**

This insect occurs throughout the Oriental and Australian regions, and in South India it is found in all rice areas, especially along the West Coast and the delta tracts of the Northern Circars. The larva of the moth which is the most important of the paddy caterpillars often causes considerable damage to paddy in the younger stages, especially in the nurseries by feeding on the foliage and even the whole plant if it is a young seedling. The mother moth lays small spherical eggs in batches on various kinds of wild grasses and paddy and covers them with greyish hairs ; there may be two or three hundred in each batch. The young caterpillar that hatches out is green and escapes our notice, especially in the nurseries. Feeding on the green foliage it grows in size and in about twenty days it is full grown when it measures about an inch and-a-half in length. It is smooth and cylindrical and when full grown has a dark to pale green colour with dull dorsal and sub-dorsal stripes—there is found a great deal of variation in the colour. The full-grown caterpillar enters the soil and changes into the pupa in an earthen cocoon ; the pupa is dark-brown about $\frac{1}{2}$" long with two very slender spines at its narrow apex. In from ten to fifteen days the moth emerges from the pupa and in a day or two is ready for egg-laying. The moth is a stout-built dark-brown insect which usually hides during the day. The life-cycle is completed in from 30—40 days. The caterpillar often appears suddenly in swarms of thousands, completely eats up a whole field and moves to another ; this is why it is also called the " Army-worm." The caterpillars feed by night and hide during the day. In nurseries and small plots the area may be flooded if water is available ; this will bring up the hiding caterpillars and birds will easily destroy them. A herd of ducks which will destroy the caterpillars can be let into the field if available. Small plots can also be isolated and the progress of the caterpillar prevented by digging a trench around the infested field.

Life-history.

Control measures.

The mechanical method of sweeping the caterpillars by brooms into baskets or sweeping them into handnets and killing them is also effective if done thoroughly. The experienced farmer can also pick off eggmasses when found, and destroy the pupæ by ploughing, after harvest. These operations will prevent the future multiplication of the pest. Numerous natural enemies such as insectivorous birds, fly and wasp parasites also keep the pest under control in nature and as such these should be encouraged in every way. Since the insect is found on various grasses also besides paddy, attention may be paid to these before the pest affects growing paddy. Any of these methods to be effective should be adopted without any delay, since the pest is of such a nature that in one night a swarm might destroy a wide expanse of paddy fields.

THE STEM-BORER OF PADDY (**Schoenobius incertellus, W.**)

MOTH—**Pyralidae.** [Pl. II, figs. 1—4.]

This insect is also a caterpillar and is found in almost all tropical regions where paddy is grown ; in South India it is particularly common in the Northern Circars, Ceded Districts, Ramnad, Tanjore and Malabar. Unlike the army-worm this caterpillar is a borer feeding from inside the stem of the paddy plant, and the external symptom of the presence of the pest consists in the gradual fading and death of the whole central shoot in a young plant and the whole earhead in a mature one ; and if the stem is split open, the caterpillar, its pupa, or the signs of its work can be noted. Eggs are laid in small masses on the tender leaves and, as in the army-worm the eggmass is covered by a layer of buff hairs when laid. The young caterpillar that hatches out crawls along the leaf or hangs down by a silken string and reaches the stem where it bites a hole near a node and enters the stem ; inside the stem it grows feeding on the inner tissue. When full-fed the caterpillar has a pale yellowish white colour, is smooth and about an inch in length. It pupates inside the stem itself, often lower down the stem, within a transparent silken cocoon and after the pupation period emerges through a hole made in the stem by the caterpillar before pupating. The pest is not so destructive as the army-worm, but occasionally does appreciable damage in some tracts. No other foodplant on which this insect breeds has been found as yet. There are a few natural enemies affecting the eggs and the caterpillar, but these are not very effective as control agents.

Life-history.

Being a borer, preventive measures are preferable in the case of this pest. The presence of the pest should be made out in the nurseries. Eggmasses can be collected and destroyed. While transplanting, seedlings showing dead-hearts can be eliminated and destroyed. The female moth is commonly attracted to lights, and so, light traps may be tried. By top clipping the seedlings before transplanting the eggmasses which escape our notice will also be removed. Once the borer attacks a seedling or grown-up plant nothing can be done to save it. In localities where it is possible, the stubble may be ploughed up and destroyed, since the pest lingers as larva or pupa in these stubbles after harvest and then passes on to the next crop of paddy.

Control measures.

PLATE II.—THE PADDY STEM-BORER, ETC.

Fig.	1. Schœnobius incertellus, O... ...	Eggmass on paddy-leaf.
„	2. Do.	Larva (caterpillar) inside paddy-stem.
„	3. Do.	Pupa inside paddy-stem.
„	4. Do.	Moth.
„	5. Leptocorisa acuta	Eggs on paddy-leaf.
Figs.	6, 7. Do.	Young bugs.
Fig.	8. Do.	Adult bug.
„	9. Cicindela 6-punctata	A predaceous beetle which attacks the rice bug.
Figs.	10, 11. Cantharid beetles feeding on	Pollen of paddy-flowers.
Fig.	12. Cirphis unipuncta	Larva (caterpillar).
„	13. Do, ...	Moth.

RICE HISPA (**Hispa armigera, Ol.**)

BEETLE—**Chrysomelidae.** [Pl. III, figs. 14—16.]

This is a small bluish-black beetle covered with numerous short spines on its body ; it is found all over India and as a pest it occurs in the West Coast, Salem, along the Coromandel Coast, North Arcot and Northern Circars. It attacks the younger stages of the paddy plant and generally disappears when the plants have grown and the earheads are out. The damage consists in the beetle eating up the green matter of the leaves which makes the leaves fade and wither. The presence of characteristic parallel white lines on the leaf surface is an indication of attack by this beetle. When the insect appears in numbers on the nurseries and the just planted seedlings, the damage is serious showing most plants turning pale and gradually withering. All the stages of the insect are passed on the paddy plant itself. The eggs are laid into the tissue of the young leaf close to the tip ; the grub which hatches out burrows into the leaf tissue feeding on the green matter ; this produces the characteristic blister patches on infested leaf-tips (see figure 15). The pupa is found in the same burrow and after the pupation period, the adult beetle comes out. Two or three generations are passed through in one paddy season.

Life-history.

In nurseries the beetles can be collected in numbers with a hand-net ; if water is available, the seedlings can also be flooded when the beetles will float up and these can be collected and destroyed. The leaf-tips of seedlings may be clipped before transplantation and the clippings which contain the younger stages destroyed. In valuable experimental plots spraying or dusting with insecticides can also be done. Such operations will kill or drive the pest away from the fields.

Control measures.

THE RICE BUG (**Leptocorisa acuta, T.**). [Pl. II, figs. 5—9.]

BUG—**Coreidae.**

This active bug is found chiefly along the West Coast though occasionally reported from Ganjām, Tinnevelly and Coimbatore. It appears at a stage when the plants have flowered and the grains are in the milky stage. Both the adult and the young bugs feed on the plant by sucking up the juice from the milky grains which become chaff in consequence. In this way in a badly infested field the earheads show numerous grains sucked up empty and turned brown and dry ; on some of the plants the bugs will also be in evidence often emitting the characteristic buggy stink. Generally the pest disappears when the earheads begin to ripen and the grains become hard.

The insect breeds on different grasses besides paddy. The mother bug lays brownish seed-like eggs in rows of 10 to 20 on the leaf blade; in a week each egg hatches into an active slender greenish nymph which feeds by sucking the plant sap from the tender shoots and leaves ; in about a fortnight the nymph assumes the winged adult stage when it is able to fly about and move from plant to plant and feed on the milky ears. In the West Coast the pest breeds freely during the monsoon months and causes considerable damage to the paddy crop.

Life-history.

Control measures.

As a preventive measure the field bunds should be kept clean and properly weeded ; all grasses on which the pest will otherwise breed should be destroyed before the paddy comes up. When however, a field is badly infested, proper measures to destroy or deter the pest should be adopted. The most feasible and economic method is the mechanical one of collecting the bugs in handnets or bags and destroying them. The use of the handnet will be found very efficient ; if systematic sweeping is done with a net or bag for two or three mornings, the pest can be reduced considerably. Thus clean cultivation followed by the prompt use of the handnet will control the pest sufficiently well.

THE RICE GRASSHOPPER (**Hieroglyphus banian, F.**)

GRASSHOPPER—**Acridiidae.** [Pl. III, figs. 1—3.]

This is the chief grasshopper pest of paddy in South India and is found in almost all paddy areas, though it is specially bad in the West Coast along the Ghats and in the Ganjām and Vizagapatam districts. This is a well-known pest of paddy and both the young and adult insects do very serious damage to the crop.

Life-history.

Eggs are laid in masses of over 30 to 40 under the soil, especially at the sides of field bunds during the months October and November. These hatch into young grasshoppers soon after the first rains in the following June-July period. Though active they are wingless and grow by feeding on the grasses, etc., on the field bunds until the paddy comes up, by which time the young hoppers become winged adults and begin to damage growing paddy by feeding on the leaves and shoots and cutting off of the earheads. Thus there is only one generation during the year, the eggs remaining under the soil for several months. In Ganjām a closely allied species (*H. orizivorus*) is also found ; it has the same habits as *H. banian*.

Control measures.

Netting and bagging during the hopper stages of the pest when they are generally found on the field bunds will be found effective. Destroying the eggmasses by scraping the bunds and ploughing up the field during the early summer months, wherever possible, has also produced good results by egg destruction in some tracts like Ganjām and South Malabar. Insecticides can also be used, but is too early to suggest under Indian conditions.

RICE CASE-WORM (**Nymphula depunctalis, Gr.**)

MOTH—**Pyralidae.** [Pl. III, figs. 4—6.]

This is a leaf-eating caterpillar found on young paddy and generally in fields under swampy conditions. The slender greenish caterpillar, which is over ½″ when full grown, cuts the paddy blade into short lengths, remains inside these small leaf rolls (see figure 4) and feeds on the foliage. It is aquatic in habits and is able to breathe under water. In a badly infested field numbers of these leaf-cases could be seen attached to the plants. The insect passes all its stages on the plant itself. The tiny eggs are laid on the plant and the larva that hatches makes the leaf-fold and

Life-history.

PLATE III.—PADDY GRASSHOPPER, ETC.

Fig.	1.	Hieroglyphus banian ...	Adult grasshopper.
"	2.	Do. ...	Half-grown grasshopper.
"	3.	Do. ...	Young grasshopper.
"	4.	Nymphula depunctalis ...	Larva in case feeding on paddy-leaf.
"	5.	Do. ...	Larva removed from case.
"	6.	Do. ...	Moth.
"	7.	Melanitis ismene	Larva (caterpillar).
"	8.	Do.	Pupa.
"	9.	Do.	Butterfly.
"	10.	Spodoptera mauritia	Eggmass on paddy-leaf.
"	11.	Do.	Moth.
"	12, 13.	Do.	Larva (caterpillar).
Figs.			Beetle.
Fig.	14.	Hispa armigera	Early stages in tissue of leaf.
"	15.	Do.	Larva (magnified).
"	16.	Do.	Larva (caterpillar) in folded leaf.
"	17.	Parnara mathias	Pupa.
"	18.	Do.	Butterfly.
"	19.	Do.	

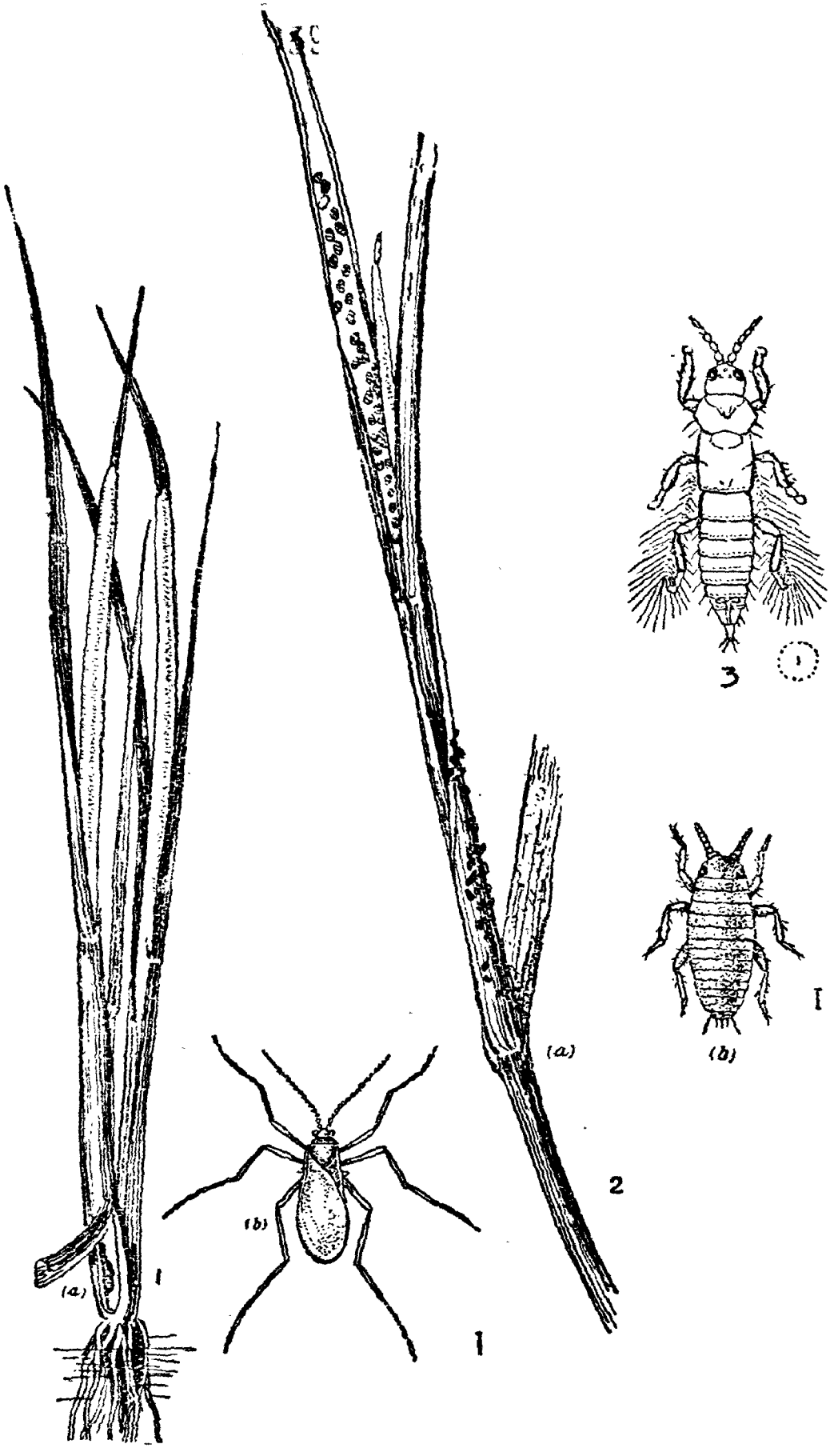

PLATE IV.—PADDY GALL-FLY OR SILVER SHOOTS, MEALY BUG AND THRIPS.

Fig. 1(*a*) Paddy galls on plant showing maggot (Pachydiplosis oryzae).
„ (*b*) The adult gall-fly magnified.
„ 2(*a*) Paddy showing mealy bugs on stem (Ripersia oryzae).
„ (*b*) Paddy mealy bug magnified.
„ 3. Paddy thrips (Thrips oryzae).

remaining inside it grows by feeding on the foliage; the pupa is found inside the larval case. The moth that comes out is a small delicate creature with the wings white, speckled with pale brown markings.

Control measures.

The best method is to dislodge these larval cases and destroy them. This is usually done by disturbing the plants by passing ropes or thorny branches of trees over them and then the water is drained off. The addition of a little kerosene to the water in the field before shaking the plants will help in killing the caterpillars that fall on the water.

THE PADDY GALL-FLY (**Pachydiplosis oryzae, W.**)

FLY—**Cecidomyiadae.** [Pl. IV, fig. I.]

This is a fly pest of paddy and the damage caused is known popularly as "*Silver shoots*", and in the vernacular *Anaikombu* (Tamil) and *Kòdu* (Telugu). This is found chiefly in the Northern Circars, Tanjore, Ramnad and South Kanara districts. The external symptom of the presence of the pest is the formation of the white or pale brown hollow outgrowths from the paddy stems without formation of earheads. This abnormal growth of the plant is caused by the irritation caused by the fly maggot inside the stem. This is often serious in the Northern Circars.

Life-history.

Eggs are laid on the plant and the maggot burrows inside the stem and produces the galls or outgrowths. The pupa also is found inside the same until the mosquito-like slender fly emerges out of it.

Control measures.

No effective control measures are known. But the damage can be reduced by keeping the bunds and banks of water ways clear of grasses on many of which also the pest breeds.

PADDY MEALY BUG (**Ripersia oryzae, Gr.**)

BUG—**Coccidae.** [Pl. IV, fig. II.]

This insect is the cause of the "*Soorai*" disease of paddy in the Tanjore delta, South Arcot, Trichinopoly, Salem and parts of Coimbatore. The insect is not generally visible outside; it is a reddish white soft wingless creature found in colonies attached to the paddy stem covered over by the outer sheathing leaves. It hardly moves about. The damage is caused by hundreds of these bugs attaching themselves to the succulent stem and sucking up the plant sap; this drainage affects the growth and makes the plants stunted and sickly; in many cases no earheads are put out. In an infested field the badly affected plants are found as patches of stunted and sickly ones. When the outer sheath of an infested stem is drawn apart, numerous bugs are seen attached to the stem in all stages.

Life-history.

Numerous eggs are laid on the stem by the mother bug. The pale yellowish white young ones crawl about the plant for a while and settle themselves on the plant stem and grow by feeding on the sap. The young and the adult have the same feeding habits and the adult females are wingless,

Control measures.

No effective control measures are known as yet, though as in the gall-fly, the multiplication of the pest can be considerably reduced by dealing with the various grasses on which this mealy bug is found to breed as alternate foodplants. If the infestation is found very early, the infested plants may be pulled out and destroyed preventing the multiplication of the pest.

RICE THRIPS (**Thrips oryzae, W.**)

THRIPS—**Thripidae.** [Pl. IV, fig. 3.]

These are minute insects found in very young paddy often when expected rains are not received. This pest has been noted in Chingleput, Malabar, Mysore and Coimbatore. The insects are small active creatures found in all stages inside the rolled up tips of the tender leaves; they lacerate the parts and suck up the plant sap and this causes rolling up and fading away of the leaf tips and in the case of very young seedlings the leaves wither and the plant is killed. The adult insects are small creatures with the wings having fringes along the sides. Their life-history is similar to bugs; eggs are laid in the leaf rolls and active young ones that hatch out feed exactly like the parent, and in course of time assume the adult winged condition. During certain unfavourable seasons *Thrips* cause appreciable damage to nurseries and transplanted seedlings.

Life-history.

Control measures.

A smart shower of rain is sufficient to remove thrips. In its absence the fields may be flooded with water wherever available. In valuable plots and nurseries the pest may be checked by spraying water mixed with some tobacco decoction.

PADDY LEAF-ROLLER (**Cnaphalocrocis medinalis, G.**)

MOTH—**Pyralidae.** [Pl. V, fig. 5.]

During certain seasons young paddy suffers to some extent from the attacks of this caterpillar which rolls up the leaf tips and feeds from inside the roll. It has been noted in Ganjām, Malabar and a few other places. The adult insect is a small moth with yellowish brown wings; the caterpillar is green a little over half-an-inch in length before pupation. The pupa is found inside the leaf-fold itself. Not being a regular pest sufficient studies have not been made of it to suggest any efficient control measures. In the early stages of the attack the infested leaf tips may be clipped and destroyed.

THE CLIMBING CUT-WORM (**Cirphis albistigma, M.**)

MOTH—**Noctuidae.** [Pl. V, fig. 2.]

This insect is in general features and habits very much similar to the swarming caterpillar (*Spodoptera*) and both belong to the same family. The climbing cut-worm, does not, however occur regularly as a pest as does the swarming caterpillar. It appears as a serious pest only during certain years. The insect has been noted in pest form chiefly in

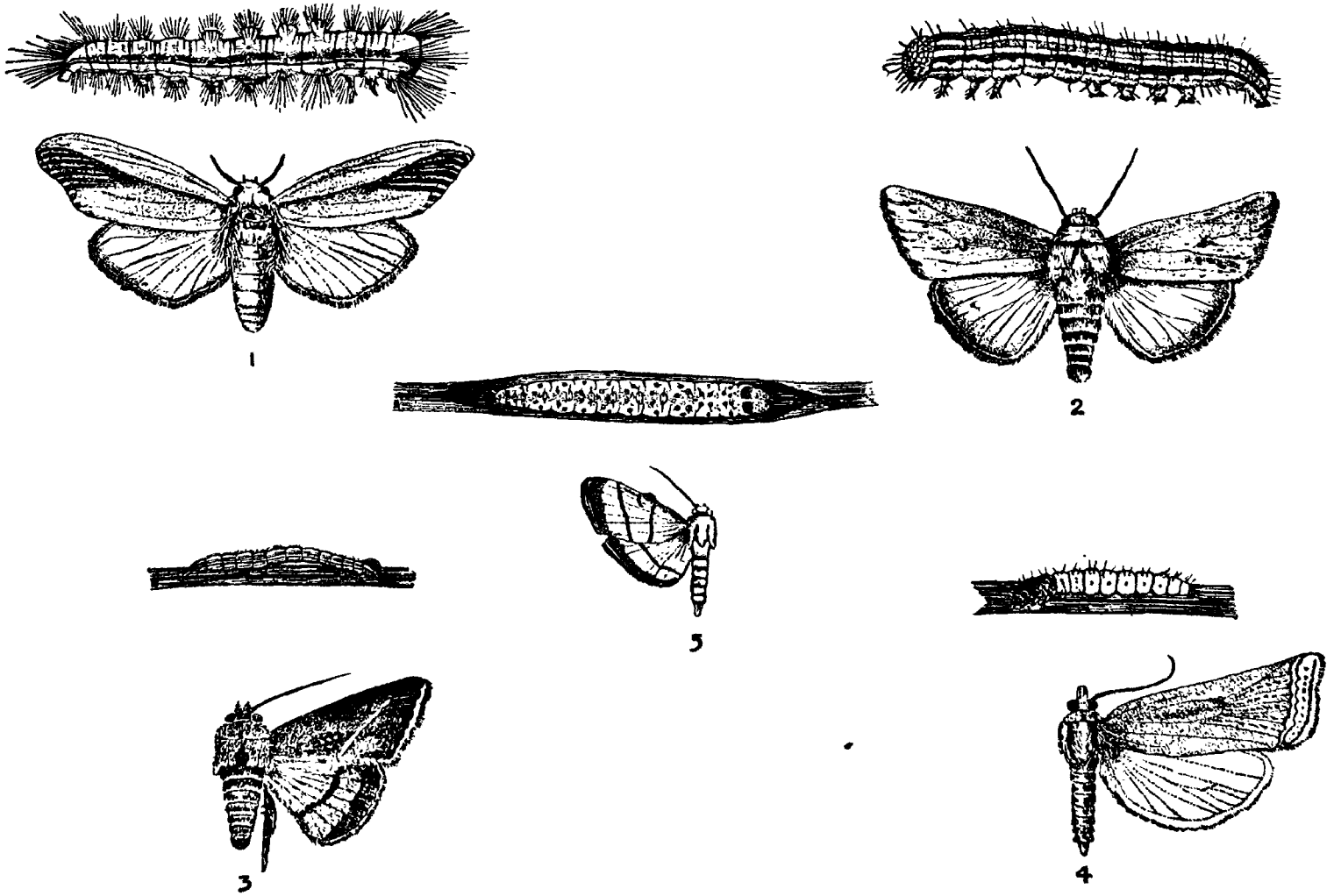

PLATE V.—SOME CATERPILLAR PESTS OF PADDY.

Fig. 1. The yellow hairy caterpillar and moth (Psalis securis).
„ 2. The climbing cut-worm and moth (Cirphis albistigma).
„ 3. The semi-looper of paddy and moth (Remigia Frugalis).
„ 4. The root stem-borer caterpillar and moth (Ancylolomia chrysographella).
„ 5. The paddy leaf-roller and moth (Cnaphalocrocis medinalis).

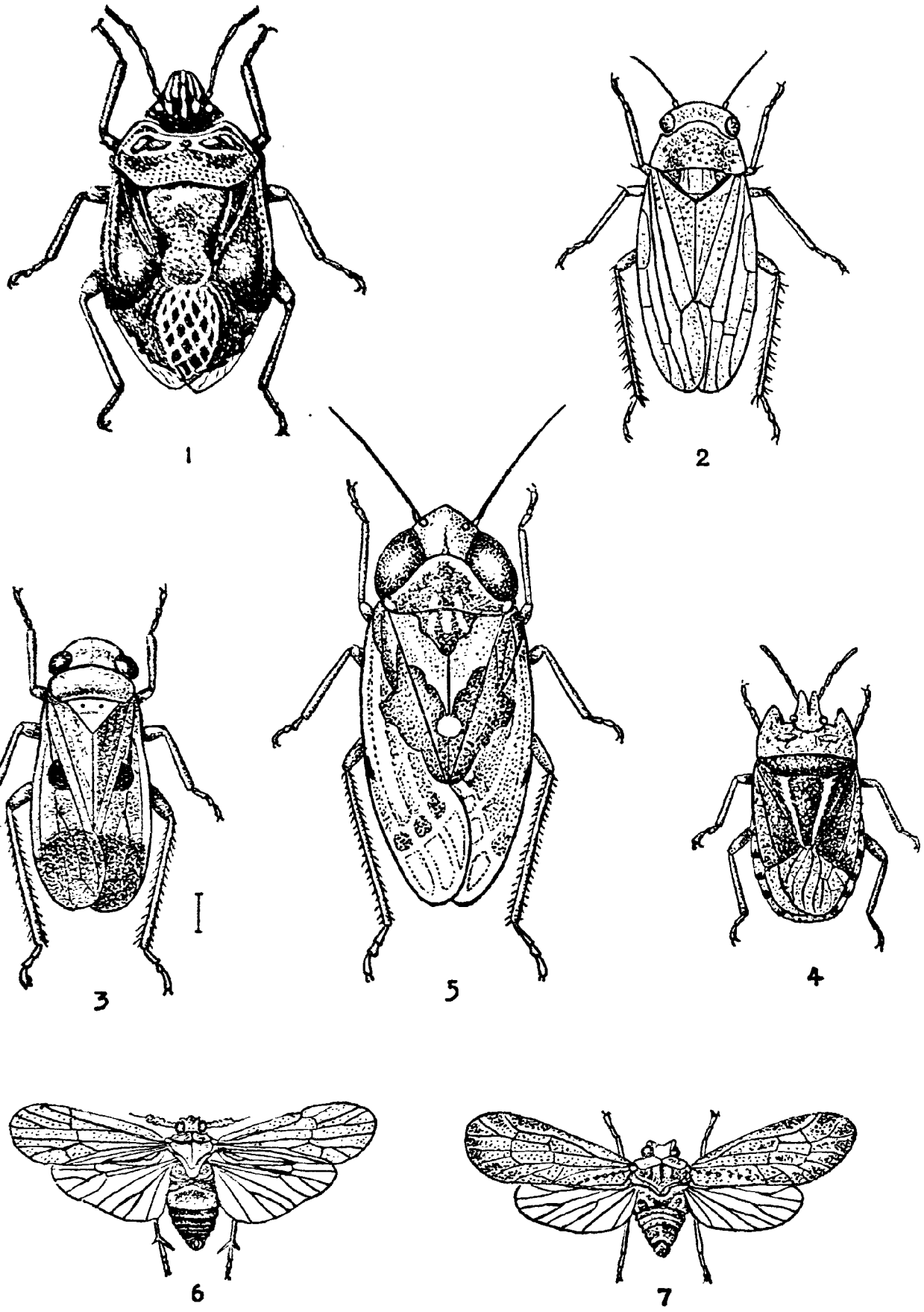

PLATE VI.—SOME BUGS OF PADDY.

Fig. 1. The earhead pentatomid (Menida histrio).
„ 2. Leaf jassid (Erythroneura subrufa).
„ 3. The spotted jassid (Nephotettix bipunctatus).
„ 4. The striped paddy bug (Tetroda histeroides).
„ 5. Leaf jassid of Krishna (Deltocephalus dorsalis).
„ 6. Leaf fulgorid (Nilaparvata sordescens).
„ 7. Do. (Nysia atrovenosa).

the Coromandel tracts on grown-up paddy during January–February in those years when the tract gets heavy rainfall and the fields are flooded. Life-history is similar to that of army-worm and the adult is a stout, dark-brown moth. The caterpillars which are smooth, cylindrical and stout appear in swarms, climb the plants and cut off the earheads. Though not absent in other tracts, it has not been noted as a pest so far. One or two species of *Cirphis* have also been noted occasionally with this pest, viz., *Cirphis loreyi* and *C. unipuncta.* No effective control measures known. Birds are found to do some beneficial work in such infestations by feeding on these larvæ.

THE STRIPED PADDY BUG (Tetroda histeroides, F.)

BUG—**Pentatomidae.** [Pl. VI, fig. 4.]

This bug has a dark-brown colour and is stouter and bigger than the rice bug (*Leptocorisa*). It can be easily recognized by the V-shaped white mark on the dark upper surface. This bug settles in numbers on young plants in patches and sucks up the sap from the tender plants. Infested fields present a yellowish-brown, dry appearance. This has been noted as a pest of some importance only in parts of Trichinopoly till now.

Life-history.

The cylindrical eggs are laid on the lower surface of leaves in batches of four or more in two rows. The eggs hatch within a week and the young nymphs grow by feeding on the plants like the parents. In about 40—50 days they reach maturity.

Control measures.

Handpicking and sweeping with nets will be very effective in the early stages ; the spraying of an insecticide like crude oil emulsion or fish-oil soap as a deterrent was found effective on one occasion.

Besides the abovementioned important insects numerous other insects have been noted to feed on the paddy plant and occasionally cause appreciable damage. The following are those noted in South India so far :—

LEAF CATERPILLARS.

1. The paddy skipper (*Parnara mathias*, F., Pl. III, figs. 17—19).—A smooth green caterpillar with distinct head. Pupa found on the leaf. The adult is a dark-brown butterfly found all over South India.

2. The paddy butterfly (*Melanitis ismene*, G., Pl. III, figs. 7—9). —An elongated green caterpillar with a rough body surface and with two red horn-like processes on the head. Pupation on the leaf. The adult has a dark-brown colour with large wings. Found all over the province.

3. The yellow hairy caterpillar (*Psalis securis*, Hb., Pl. V, fig. 1).—An yellowish-brown hairy caterpillar about 1½" long found on grasses and sometimes on paddy. Pupa inside a pale white cocoon of silk and frass attached to the leaf. The moth is a stout one with straw-coloured upper wings. Has a wide distribution in the province.

4. The paddy semi-looper (*Remigia frugalis*, Fb., Pl. V, fig. 3).—An elongated smooth greyish-yellow semi-looper caterpillar, pupates in a cocoon among leaves. The adult is a grey-brown moth with pale striæ on wings. Very rarely found doing any serious damage.

LEAF AND FLOWER BEETLES.

1. Paddy leptispa (*Leptispa pygmaea*, B., Fig. 2).—This is a small elongated smooth bluish beetle often found in company with rice hispa,

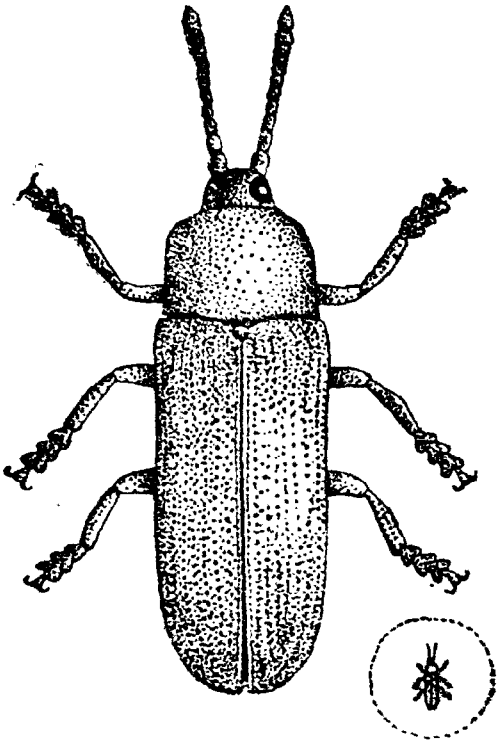

Fig. 2. Paddy Leptispa.

chiefly in Malabar. The occasional damage done to paddy and the life-history are more or less similar to those of hispa.

2. The spotted leaf beetle (*Oides affinis*, J., Pl. VII, fig. 5).—An ovoid reddish-brown beetle with a large dark blotch on each upper wing. An insect pest of very minor importance; found often in numbers but doing hardly any damage. Found in Malabar.

3. The leaf-weevil (*Athesapeuta oryzae*, M., Pl. VII, fig. 2).—A small dark-grey weevil; at times found in paddy fields in Coimbatore; status as a pest very doubtful.

4. The gregarious blue beetle (*Haltica cyanea*, Web., Pl. VII, fig. 3).—A medium-sized steel blue beetle bigger than "*Leptispa*" often found in hundreds on the paddy plant; this is often mistaken as a serious pest of paddy because it is found in numbers on the paddy plants; but it is harmless and is found breeding not on paddy, but on the common weed *Ammania* found in paddy lands.

5. Flower feeding blister beetles (*Gnathospastoides*, *Epicauta* and *Lytta*, Pl. II, figs. 10–11).—These are some of the kinds of blister beetles occasionally found visiting the plant during the flowering period and feeding on the pollen; they are, however, very rarely serious. Even when they appear the infestation lasts but two or three days at the most.

GRASSHOPPERS.

Besides the rice grasshopper (*Hieroglyphus*) noted above, a few other species also appear on the paddy plant generally as minor pests. These are (1) the Ganjām rice grasshopper (*H. orizivorus*, U.) which has the same habits as the rice grasshopper and found with it, (2) the small grasshopper of paddy (*Oxya velox*, Fb.); this is a very common insect found all over the plains of Southern India and is found occasionally in

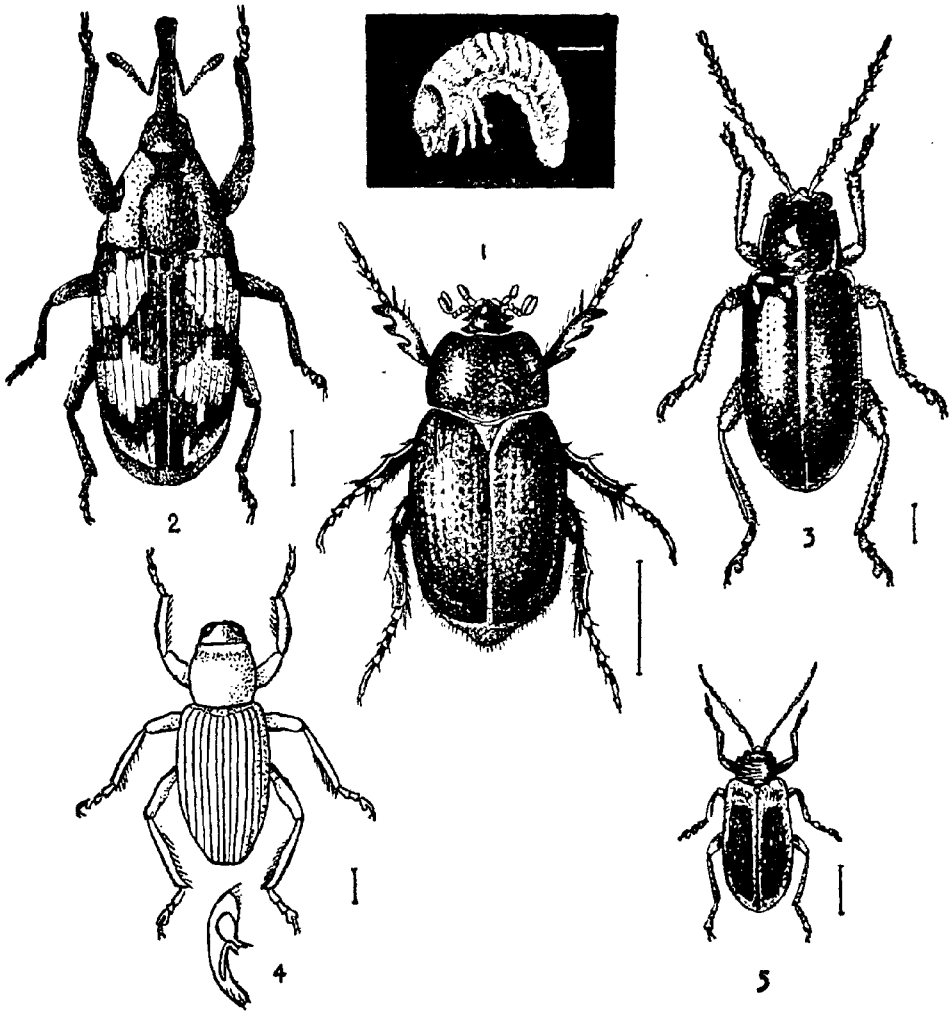

PLATE VII.—MINOR BEETLES ON PADDY.

Fig. 1. The rice cockchafer and grub (above) (Phyllognathus dionysius).
" 2. The rice leaf-weevil (Athesapeuta oryzae).
" 3. The gregarious blue beetle (Haltica cyanea).
" 4. The paddy root-weevil (Echinocnemus oryzae).
" 5. The spotted leaf beetle (Oides affinis).

company with the rice grasshopper, (3) when the paddy is in the nurseries just before transplantation numerous small grasshoppers do damage to the plants. These insects are called "*surface grasshoppers*" and include such common green and brown forms as *Acrotylus humbertiana*, S., *Heteropternis respondens*, W., *Aelopus affinis*, B., *Aelopus tamulus*, F., *Locusta danica*, L., and *Pyrgomorpha conica*, Gl.

The best and most economical measure against these is the use of the handnet or sweeping bag.

SAP-SUCKING BUGS.

Besides the rice bug and the striped *Tetroda*, numerous small bugs, chiefly of the jassid family, have been noted in different places appearing in numbers on paddy and occasionally causing damage. All of them suck up the juice from tender portions which fade if badly infested. They are of minor importance though sporadic sometimes. These include the following :—

(1) The spotted jassid (*Nephotettix bipunctatus*, Fb., Pl. VI, fig. 3).—This is a minute green insect found sometimes in thousands on paddy and grasses ; it is green in colour with two minute black dots conspicuous on the body of the male insect. It comes to light in numbers and is very rarely a pest. Common all over the country.

(2) The white jassid (*Tettigoniella spectra*, Dt.).—Somewhat bigger than the spotted jassid and having a uniform pale white colour, occasionally found in numbers and attracted to lights. Very common.

(3) Earhead pentatomid (*Menida histrio*, Fb., Pl. VI, fig. 1).—An ovoid stout-built reddish brown insect occasionally found feeding on the earheads ; a very minor pest. Noted in Malabar.

(4) *Deltocephalus dorsalis*, Mot—(Pl. VI, fig. 5) jassid.—Noted once in Kistna district, in some numbers.

(5) *Nilaparvata sordescens*, M. (Pl. VI, fig. 6) fulgorid.—Noted in Nellore and Kistna.

(6) *Erythroneura subrufa*, M. (Pl. VI, fig. 2) jassid.—In North Malabar.

(7) *Nysia atrovenosa*, L. (Pl. VI, fig. 7) fulgorid.—In Nellore.

ROOT-FEEDING INSECTS.

The following are those which have been noted to attack the roots or the lowest portions of the paddy stem, sometimes killing the shoots :—

1. The root caterpillar (*Ancylolomia chrysographella*, K., Pl. V, fig. 4).—This caterpillar, which is now and then noted as a pest in North Malabar, is slender, smooth and of a pale green colour ; it feeds at night on the stem and roots of the very tender paddy seedlings in the coastal sandy areas and pupates in silken tubular galleries. The moth is a medium-sized one and has straw-coloured wings. It often comes to lights.

2. The rice cockchafer (*Phyllognathus dionysius*, F., Pl. VII, fig. 1).—This is a dark-brown medium-sized cockchafer beetle ; its grub has the habit of attacking the roots of young paddy seedlings. Found occasionally in Kanara tract.

3. The root weevil (*Echinocnemus oryzae*, M., Pl. VII, fig. 4).—This is a small grey weevil, the grubs of which attack the paddy roots and cause some injury. Noted in Kistna and Guntūr districts.

LIST OF PADDY INSECTS ACCORDING TO THE DIFFERENT INSECT ORDERS TO WHICH THEY BELONG.

ORDER—**LEPIDOPTERA.**

FAMILY—Noctuidae.

Spodoptera mauritia, B.—(The swarming caterpillar).
Cirphis albistigma, M.—(The climbing cut-worm).
C. loreyi and C. unipuncta—(Cut-worms).
Remigia frugalis, F.—(The semi-looper caterpillar).

FAMILY—Pyralidae.

Schoenobius incertellus, W.—(The stem-borer).
Nymphula depunctalis, G.—(The case-worm).
Cnaphalocrocis medinalis, G.—(The leaf-roller).
Ancylolomia chrysographella, K.—(The root-feeding caterpillar).

FAMILY—Nymphalidae.

Melanitis ismene, Cr.—(The horned caterpillar).

FAMILY—Hesperiidae.

Parnara mathias, F.—(The rice skipper).

FAMILY—Lymantridae.

Psalis securis, H.—(The yellow hairy caterpillar).

ORDER—**ORTHOPTERA.**

FAMILY—Acridiidae.

Hieroglyphus banian, F.—(Rice grasshopper).
H. orizivorus, U.—(Rice grasshopper of Ganjām).
Oxya velox, F.—(Small grasshopper).

Acrotylus humbertiana, S.
Heteropternis respondens, W.
Aelopus affinis, B.
A. tamulus, F.
Locusta danica, L.
Pyrgomorpha conica, Gl.

} All these are small surface grasshoppers, green or brownish in colour, and usually infest nurseries in irrigated areas.

ORDER—**COLEOPTERA.**

FAMILY—Chrysomelidae (Leaf beetles).

Hispa armigera, Ol.—(The rice hispa).
Leptispa pygmæa, B.—(Paddy leptispa).
Haltica cyanea, W.—(The blue gregarious beetle).
Oides affinis, J.—(Spotted leaf beetle).

FAMILY—Scarabæidæ (Cockchafers).

Phyllognathus dionysius, F.—(The rice cockchafer).

FAMILY—Curculionidae (Weevils).

Echinocnemus oryzae, M. (The root-weevil).
Athesapeuta oryzae, M. (The leaf-weevil).

FAMILY—**Cantharidae** (Blister beetles) : on flowers.

Gnathospastoides rouxi, Cast.—(Yellow blister beetle). **Noted in** the Northern Circars.

Lytta tenuicollis, Pall.—(Green blister beetle). **Noted in Malabar** and Northern Circars.

Epicauta sp.—(Blue black blister beetle). **Noted in South Kanara.**

ORDER—RHYNCHOTA.

FAMILY—**Coreidae.**

Leptocorisa acuta, T.—(Rice bug).

FAMILY—**Pentatomidae.**

Tetroda histeroides, F.—(Striped bug).

Menido histrio, F. (Earhead pentatomid).

FAMILY—**Jassidae** (Leaf hopper bugs).

Nephotettix bipunctatus, F.—(Spotted Jassid).

Tettigoniella spectra, D.—(White Jassid).

Deltocephalus dorsalis, M.

Erythroneura subrufa, M.

FAMILY—**Fulgoridae** (Leaf hopper bugs).

Nilaparvata sordescens, M.

Nysia atrovenosa, L.

FAMILY—**Coccidae.**

Ripersia oryzae, G.—(Paddy mealy bug).

ORDER—DIPTERA.

FAMILY—**Cecidomyiidae** (Gall-flies).

Pachydiplosis oryzæ, W.—(Paddy gall-fly).

ORDER—THYSANOPTERA.

FAMILY—**Thripidae.**

Thrips oryzae, W.—(Rice thrips).

For any detailed information on the subject communications may be addressed to the author.

* INSECTS AFFECTING TOBACCO IN SOUTH INDIA.

The insects associated with the tobacco plant in South India are not many compared to those doing damage to some of our other crops such as paddy, cotton, etc. However, the crop is subject to the attacks of different kinds of insects from the time the plants are in the seed beds on to the stage when the dry tobacco reaches the manufacturer and consumer. In this province tobacco occupies an area of over 257,000 acres and is an important industrial crop second only to cotton in importance. In certain years insects of sorts levy a heavy toll in one or other of the tobacco areas and serious loss is thus sustained. The different pests of this plant noted all over South India are more or less similar everywhere and there are very few special insects confined to any particular tobacco tract. The important pests are found alike in the Gōdāvari lankas, in the Guntūr uplands, along the West Coast and in the southern tobacco tracts of South Arcot, Tanjore, Trichinopoly and Madura. The insects doing damage to the crop may be conveniently divided into two kinds, firstly, those that injure the crop by tearing or biting the leaves or by chewing the internal tissue of the stem or seed capsules, and secondly those which suck up the plant sap from the different regions of the plant, reduce its vigorous growth and make it fade. Under the former group are included the leaf-eating caterpillars, borers into the stem and seed-capsules, beetles and grasshoppers of sorts ; and among the latter category are the different kinds of sucking insects (bugs)—chiefly plant-lice. The two groups are known as biting and sucking insects respectively.

BITING INSECTS.

Leaf-eaters.

Tobacco Caterpillar (*Prodenia litura*, F.)—Two or three kinds of leaf-eating caterpillars are now and then found on tobacco, and of these the commonest one is that known popularly as the "Tobacco Caterpillar", called "*Laddipurugu*" in Gōdāvari, "*Kottiyam puchi*" in parts of Madura, and "*Arakkan*" in Coimbatore. Of all the insects affecting the tobacco plant this one is the most important and it often causes considerable damage to the crop in some tracts.

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* This is a revised edition of the author's leaflet No. II of 1918.

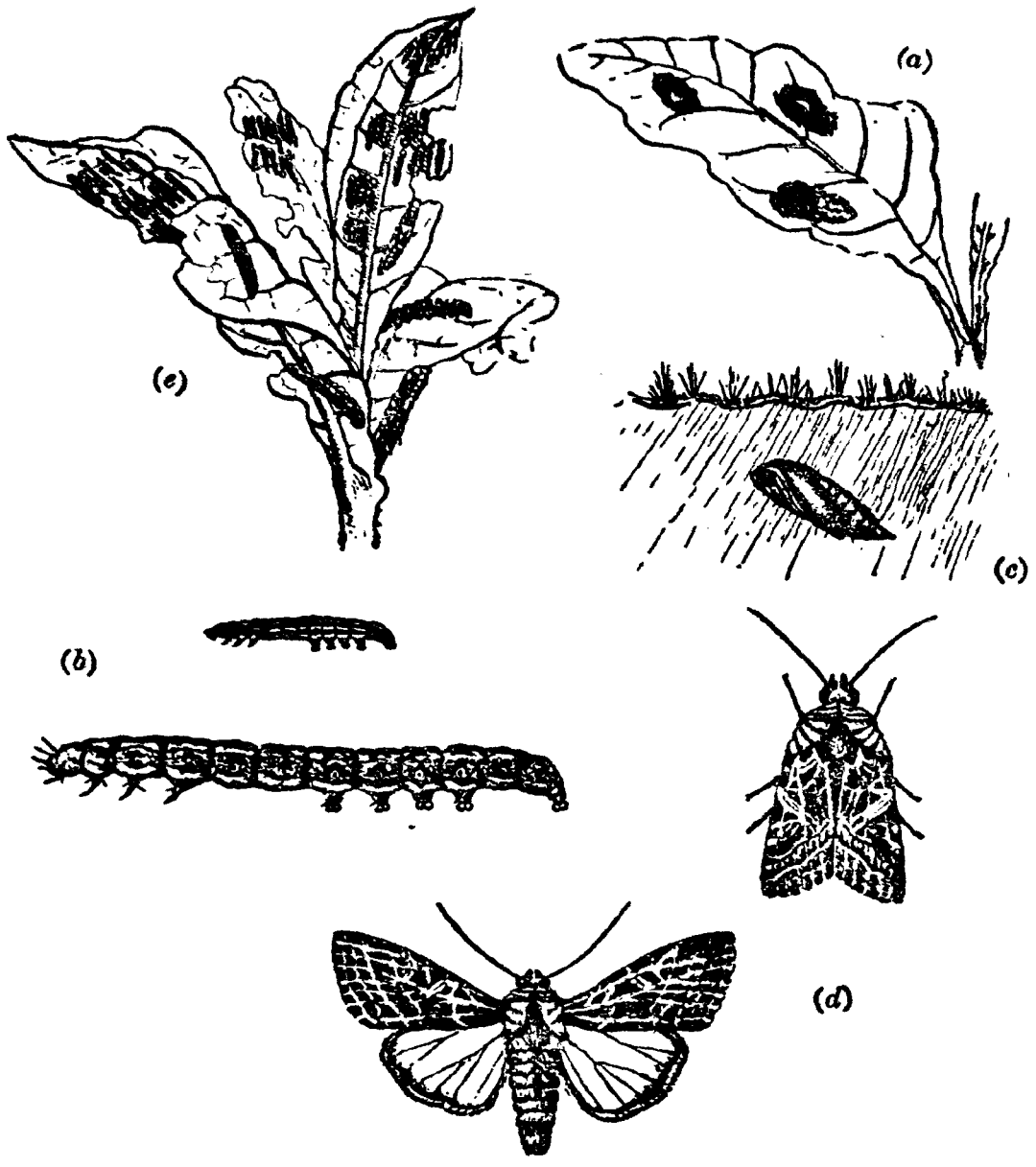

FIG. 1.—THE TOBACCO CATERPILLAR (*Prodenia litura*, F.).

(*a*) Egg masses on tobacco leaf.
(*b*) Young and full-grown larvae.
(*c*) Pupa under soil.
(*d*) Adult moth wings, closed and open.
(*e*) Young larvae feeding on tobacco in groups.

Life-history.—The caterpillar which causes the damage is the young one of a flying insect—a moth (*Prodenia litura*) [see fig. 1 (*d*)]. The parent moth deposits a number of eggs in a mass generally on the undersurface of the tobacco leaves and this mass is covered with a layer of soft pale brown hairs shed from the body of the moth [see fig. 1 (*a*)]. When this covering of hair is gently removed the shining yellowish green eggs are exposed. Each of these egg masses contains from 40 or 50 to 200 or more eggs. In about four or five days a minute dark caterpillar comes out of each of these eggs and these small caterpillars begin to feed on the soft upper layer of the leaf. Hundreds of these young caterpillars are generally found feeding together on one leaf [see fig. 1 (*e*)]. These caterpillars cast their skin four or five times before they reach their full growth. As they grow the body colour becomes pale green with dark markings and this gradually gives place to a dark brown with numerous transverse and longitudinal bands

of black, grey and yellow ; some also develop prominent rows of dark spots. There is a good deal of variation in the colouring of the caterpillar as it grows bigger and bigger. As the caterpillars grow the habit of feeding gregariously gradually disappears and they separate and then exhibit the characteristic habit of feeding on the plant by night and hiding during the day. In this way the caterpillar reaches its full-grown condition in about a fortnight. A full-grown caterpillar measures an inch and a half in length and is a stout, smooth, cylindrical creature [see fig. 1 (*b*)]. At this stage it stops feeding and goes into the soil where it encloses itself by means of a rough earthen case and then changes into the pupa stage. The pupa is a short reddish brown object see fig. 1 (*c*)] blunt towards the head end and pointed at the tail end. In this condition the creature remains underground for about twelve or thirteen days ; at the end of this period the winged moth emerges out of the pupa from the soil. The moth has dark brown wings with wavy white markings on the upper pair [see fig. 1 (*d*).] The life cycle of this insect from egg to the adult stage thus occupies about a month's time and the insect is therefore capable of passing through two generations during the earlier stages of the tobacco crop.

Habits.—The caterpillar is very voracious and if overlooked may defoliate a whole plot in a single night. The external indications of the presence of this pest in the field are :—

(1) The presence of egg-masses on the leaves especially during the earlier stages of the tobacco crop, even in the nurseries.

(2) The presence of leaves containing colonies of small caterpillars feeding on the leaf tissue and turning the leaf pale.

(3) The presence of leaves which are torn.

(4) The presence of excrement pellets on the leaves or on the ground around the infested plants.

In addition to tobacco this insect infests a number of other plants in South India, the chief of them being castor, plantain, tomato, colocasia and agathi. Having such alternate food plants, the insect is able to breed all through the year on one or other of these different hosts.

Control measures.—Though the insect is often a serious pest, with a knowledge of its habits and life-history and with some precautions the tobacco cultivator can check its ravages pretty well. The following methods may be adopted, according to the circumstances of each particular case :—

(1) Collection and destruction of the egg-masses —This is the most effective and economical method of dealing with this pest Any one who notices the egg-mass once can easily and readily detect it afterwards on the plant.

(2) The collection and destruction of leaves containing colonies of young caterpillars ; such leaves can be easily detected by their disfigured or eaten up edges and scraped surface.

These two measures are very easy and even juvenile coolies can be employed to carry out the work. These methods will be found very effective in checking the rapid multiplication of the pest and there will be no need for any further measures.

(3) The collection and destruction of the bigger caterpillar during the night or very early in the morning—Although a few can be got during the daytime by raking up the soil around the infested plants it will be easy to collect more during the night time when they are active. The control of the bigger caterpillar will not be found as easy as checking the younger larvae, and in bad cases other methods like baiting, trapping or insecticide applications may have to be resorted to.

(4) Application of insecticides.—The insecticides that can be used are arsenical poisons and have therefore to be used with great care, so that there will be no danger to human beings and domestic animals. It is therefore advisable to suggest this measure only to those cultivators who can be expected to exercise care in handling and using these substances and properly supervising the work. Most of our cultivators being illiterate it is rather unsafe to suggest this measure for some years to come. The insecticides that can be used are lead arsenate and calcium arsenate. A certain proportion of each of these is mixed with water and sprayed on the plants, which are either infested or are likely to be infested ; for this purpose spraying machines will be found necessary. These two substances can also be dusted in the powder form on the plants by means of small muslin bags. The substance is generally mixed with seven or eight times its bulk of ordinary slaked lime and the application made early in the morning when the plants are covered with dew and when there is no wind. Except in bad cases where the other methods have failed, there will be no necessity to resort to this somewhat expensive and risky measure. If done with care the insecticidal method will be found very effective against all leaf-eating insects.

(5) Cultural methods.—There are certain cultural methods which will also help the cultivator in keeping the pest under control wherever these measures can be easily adopted. Flooding the field will bring up the hiding caterpillars, and birds will easily destroy them. It is a common sight in some fields which are infested with caterpillars to see insectivorous birds such as the crow, the mynah, the woodpecker, etc., preying on these in numbers. As far as possible birds must be encouraged in this direction by affording them temporary perches in the fields and bunds. A badly infested field can also be isolated by digging a trench a foot or two in depth between this and other unaffected plots : the caterpillars in trying to cross over will fall into the pit and find it unable to come out. To ensure the death of the caterpillars falling in, some water mixed with kerosene may be kept standing in the trench.

Other Leaf Caterpillars.—Of the other leaf-eating caterpillars of tobacco one or two may be occasionally found, but these are not at all as important as the tobacco caterpillar. The green caterpillar (*Chloridea assulta*, G.) (see fig. 2) called the "*Pachapurugu*" in the lankas, is one of them. It has almost the same general structure, habits and life-history as the tobacco caterpillar except that the eggs are laid singly on the leaves, the caterpillar is green in colour and the moth has pale yellowish wings. The caterpillars generally bite holes on the top leaves and leave a lot of excrement pellets on these which show their presence.

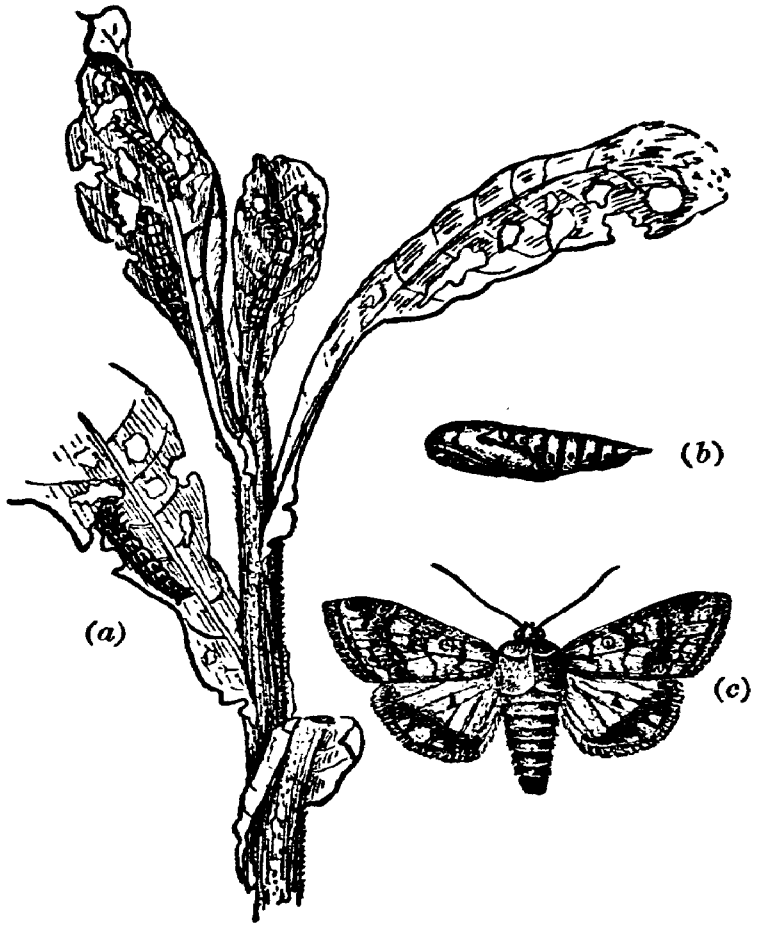

FIG. 2.—GREEN LEAF CATERPILLAR OF TOBACCO (*Chloridea assulta*, G.).

(*a*) Plants with leaves attacked by caterpillars.
(*b*) Pupa.
(*c*) The winged adult.

Another caterpillar occasionally found is the one in fig. 4 (*a*) and (*b*) (*Plusia signata*, F.). This caterpillar is called a semi-looper having fewer abdominal legs. It is generally found feeding on the leaves in the nurseries and rarely in the open fields. It has never been found as a serious pest and I have not seen it in the Gōdāvari lankas.

Grasshoppers.—Among other leaf-eating insects found on tobacco are one or two kinds of grasshoppers. Of these the one in fig. 3 (*a*) is the green form (*Atractomorpha crenulata*, F.), generally found on growing tobacco. Sometimes young plants are cut by small brownish grasshoppers which resemble the soil in colour—[see fig. 3 (*b*) (*Chrotogonus robertsoni*, B.).]

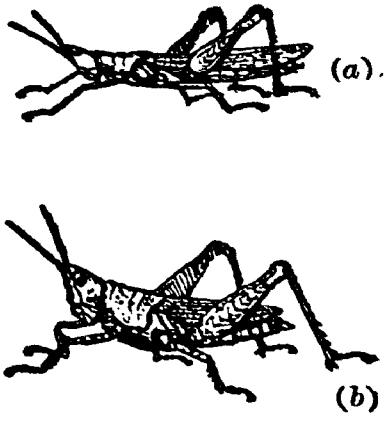

FIG. 3.—TOBACCO GRASSHOPPERS.

(*a*) Green Grasshopper (*Atractomorpha crenulata*, F.)
(*b*) Brown Ground Grasshopper (*Chrotogonus robertsoni*, B.).

BEETLES.—Occasionally small dark beetles are found nibbling tobacco seedlings; two of these (*Opatroides frater*, F., and *Seleron latipes*, G.)—ground beetles—have been noted in Guntūr area.

All these leaf-eating insects noted above can be checked both by the mechanical and insecticidal methods mentioned above; in the case of grasshoppers it will be found easier to collect and destroy them by means of handnets.

Borers.

The Stem-borer (*Phthorimoea heliopa*, L.).—In certain tracts the tobacco plant sometimes suffers from the attacks of a stem-boring

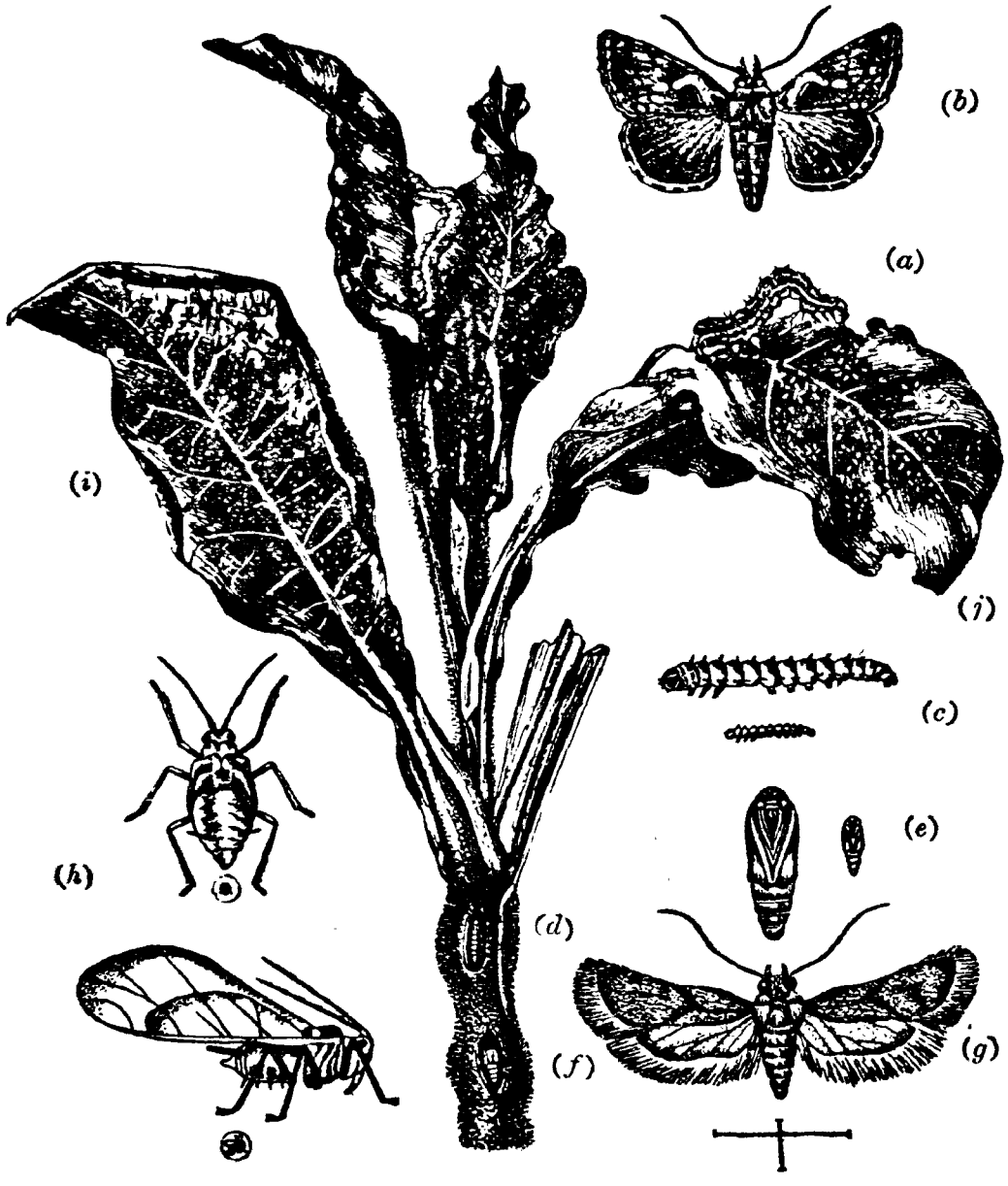

FIG. 4.—TOBACCO SEMI-LOOPER, STEM-BORER AND APHIS.

(*a*) Semi-looper Caterpillar (*Plusia signata*, F.).
(*b*) Moth of (*a*).
(*c*) Stem-borer (*Phthorimoea heliopa*, L.)
(*d*) Stem-borer in stem.
(*e*) Pupa of (*d*).
(*f*) Pupa in stem.
(*g*) Moth of borer.
(*h*) Plant lice, (*Myzus persicae*, S.) winged and wingless (natural and magnified).
(*i*) Leaves infested with plant lice.

caterpillar. This is a small reddish white worm about ½" in length when full-fed. The attacked plant stem becomes swollen here and there, and the presence of such gall-like swellings indicates the presence of the pest. The adult insect is a very small active moth [see fig. 4 (*g*)] with pale brown wings. Eggs are laid singly on the leaf stalks generally, and the young caterpillars when they hatch, burrow through the leaf-stalk into the stem in which they grow by feeding on the internal plant tissue and causing the swellings on the stem [see fig. 4 (*c*) and (*d*)]. Sometimes several caterpillars are found in the same stem. The small reddish brown pupa is also found in burrows inside the stem [see fig. 4 (*e*) and (*f*)], and from this emerges out the small moth after twenty or twenty-five days. One life cycle roughly takes about two months.

The stem-borer is not commonly found as a serious pest. In the Gōdāvari lankas it generally appears in the nurseries, and the cultivators who know the disease (*Thalabonda* in Telugu) carefully eliminate infested seedlings when they select them for transplanting. In some other tracts the pest is generally found attacking old plants, especially the stumps and stubble left over in the field after harvest.

The remedial measures against this pest are only preventive. The practice of eliminating infested plants in the seed beds is one of them ; the pulled out seedlings must not be carelessly thrown away in the field itself, but should be destroyed by burning or deep burial to prevent moths coming out from them and infesting healthy plants. In the fields all early attacked plants should be pruned or operated with a knife if possible, else destroyed to prevent other plants from getting affected. The stubble after harvest should be pulled out to prevent the breeding of the pest.

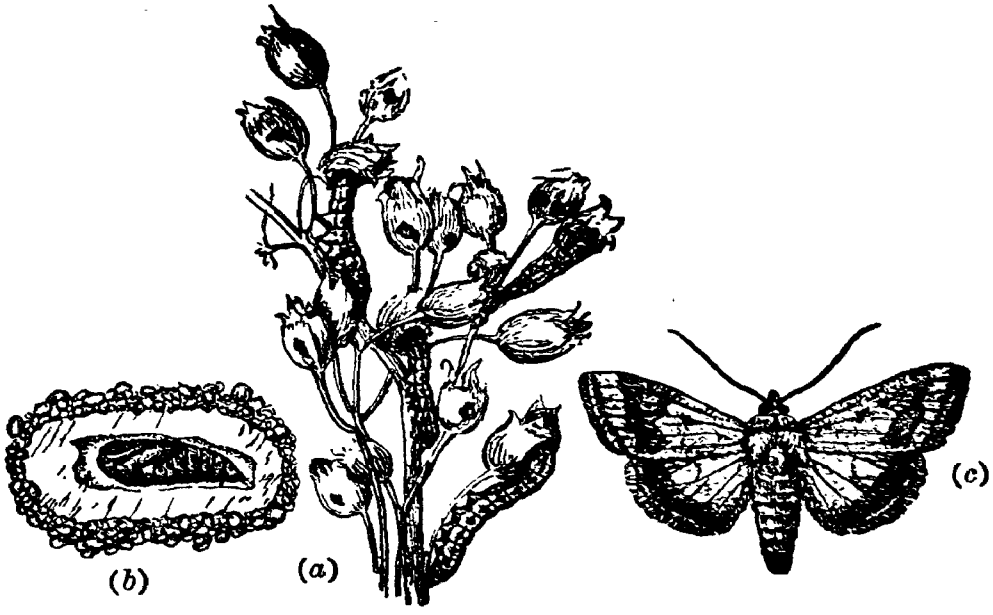

FIG. 5.—TOBACCO SEED CAPSULE BORER (*Heliothis obsoleta*, F.).

(*a*) Caterpillars on plant.
(*b*) Pupa under ground.
(*c*) The adult moth.

The Seed Capsule Borer (*Heliothis obsoleta*, F.).—Occasionally the flower heads and seed capsules of plants left for seed are found attacked by a caterpillar (see fig. 5). It is a green caterpillar and is similar in habits to the leaf caterpillar (*Pachapurugu*) mentioned above. It is generally not a pest of tobacco but is commonly found on bengal gram,

red gram, maize, etc. Handpicking of these worms in the early stages will be effective, or the flower heads can be covered over by a cloth bag over a bamboo prop and the moth prevented from reaching the flowers and buds to lay eggs. Powdered insecticides can also be sprinkled over the flower heads to prevent the attack or kill these caterpillars.

SUCKING INSECTS.

Plant-lice (*Myzus persicae*, S.).—Compared to the leaf-eating insects there are very few sucking insects which are serious pests of tobacco. The only ones worth mentioning are plant lice—"*Pènu*" in Telugu and Tamil. These are minute creatures [see fig. 4 (*h*)] found in colonies of thousands on the tender portions of the growing plant, sucking up the juice from the tender parts and arresting its vigorous growth. Badly infested plants appear sickly with the leaves curled up and fading; when the leaves of such plants are examined numerous colonies of these insects and their moulted skins can be found [see fig. 4 (*i*) and (*j*)]. These small creatures multiply enormously in a short period of time and whole fields become infested unless early measures are adopted. As a result of the attack of this pest the crop suffers both in outturn and quality of leaf. Plant-lice do considerable damage to tobacco in almost all the tracts and especially in South Kanara, Guntūr, Tanjore and Madura. Next to the tobacco caterpillar the tobacco cultivator dreads this pest. It has been frequently reported from most tobacco areas.

Remedial measures.—Plant-lice are insects which demand prompt action because of their remarkable powers of rapid multiplication. Badly infested and almost dying plants should be destroyed and the others may be treated with an application of a contact insecticide. Considering the nature of the crop, the only substance which might be used, with safety to the quality and aroma of the leaf, is found to be dry tobacco itself, made into a decoction. The decoction is made as follows:—A pound of dry tobacco (preferably the refuse stems and powder found in tobacco shops) is steeped in a gallon of water for 24 hours or boiled for ten minutes and then strained. To this four ounces of sliced soap of any ordinary kind may be added and this

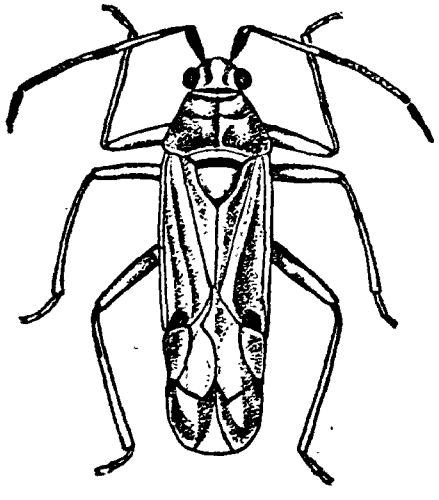

FIG. 6.—TOBACCO LEAF BUG (*Gallobelicus crassicornis*, D.) magnified.

diluted with six or seven times the volume of water is sprayed on the plants infested with plant-lice. The application to be economical and effective must be done by a good spraying machine.

Leaf Bug.—An active little greenish yellow bug (*Gallobelicus crassicornis*, D.) is also found sometimes swarming on the plants like mosquitoes, but this is never serious and tobacco decoction will be equally effective against this and other sucking insects also.

Root Bug.—In some tobacco areas of North Coimbatore a reddish brown flattish bug (*Stibaropus tabulatus*, S.) is sometimes noted attacking the roots and rootlets of tobacco plants below the soil and allowing plants so infested to gradually fade. Such plants appear stunted and gradually die. In badly infested fields patches of such fading and stunted plants could be seen. If a badly infested plant is pulled out numerous bugs in all sages of growth will be found clinging to the roots and rootlets. For this pest the irrigation water may be mixed with crude oil emulsion; this will kill the bugs and allow the plants to revive.

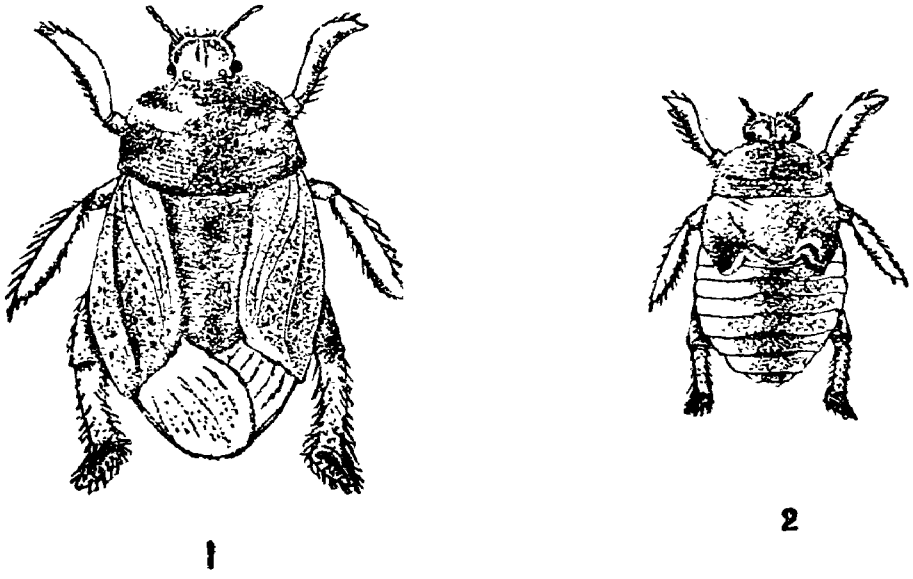

FIG. 7.—THE TOBACCO ROOT BUG (*Stibaropus tabulatus*, S.).

1. Adult bug. 2. Immature bug.

As far as we know the above are the only insects of importance noted as pests on tobacco in South India. Occasionally there may be other insects found visiting the plants casually, but they must not be regarded as pests without sufficient evidence.

The Cigar Beetle. (*Lasioderma serricorne*, F.).—The insects noted above are the pests of tobacco in the field. After harvest and when the dry produce reaches the manufacturer there is an important pest affecting tobacco. It is called the "cheroot or cigar beetle." The beetle which is a minute reddish brown creature and its small pale white fleshy grub bite holes into cigars and cigarettes and in that way reduce the quality and flavour of the manufactured tobacco. It is often very serious in the stores of tobacconists.

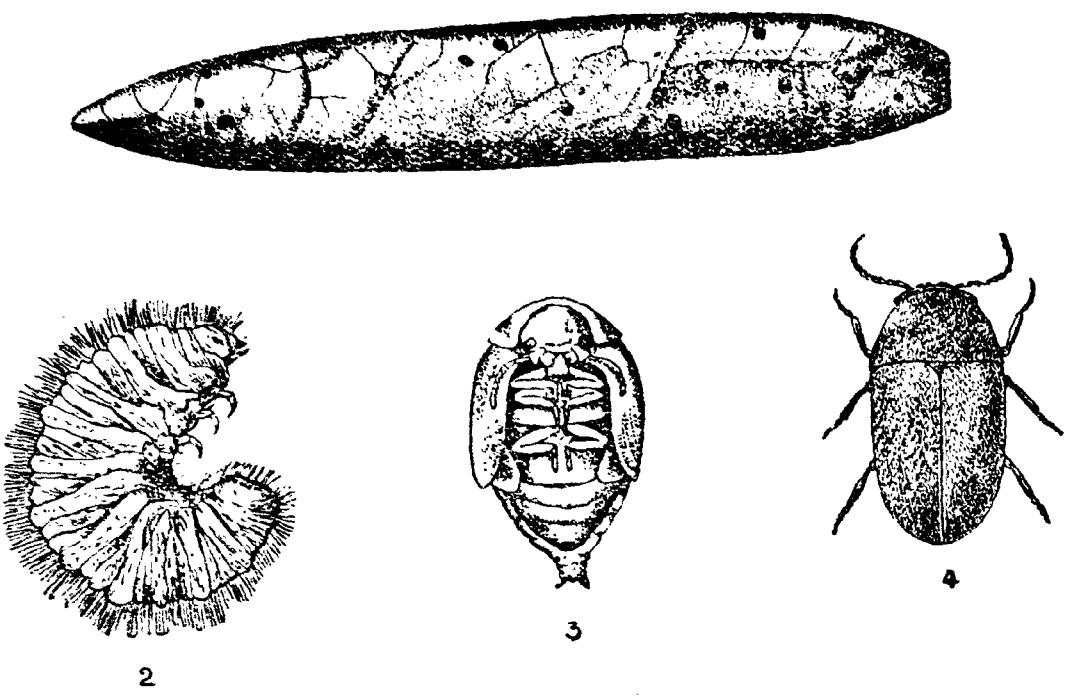

FIG. 8.—THE CIGAR BORER BEETLE (*Lasioderma serricorne*, F.).

1. Cigar damaged by the insect.
2. The larva.
3. Pupa.
4. Adult beetle.

(2—4 magnified highly).

The best remedy against this pest is to keep the godowns thoroughly clean and when the pest is found, to fumigate the tobacco with a chemical such as carbon bisulphide or potassium cyanide which will destroy all insects. The process of fumigation has to be done with great care since the chemicals generally used are poisonous or inflammable and as such only experienced men should attempt this measure.

TOBACCO INSECTS OF DIFFERENT GROUPS.

ORTHOPTERA (Grasshoppers).

Family—

Acridiidæ—1. *Atractomorpha crenulata*, F.—On leaf.
2. *Chrotogonus robertsoni*, B.—On seedlings.

COLEOPTERA (Beetles)

Family—

Tenebrionidæ—1. *Oxatroides frater*, F.—On roots and seedlings.
2. *Seleron latipes*, G.—On roots and seedlings.

Ptinidæ— 3. *Lasioderma serricorne*, F.—On dry stuff.

LEPIDOPTERA (Caterpillars)

Family—

Noctuidae—1. *Prodenia litura*, F.—On foliage.
2. *Chloridea assulta*, G.—On foliage.
3. *Plusia signata*, F.—On foliage in nurseries.
4. *Heliothis obsoleta*, F.—In seed capsules.

Gelechiadae 5. *Pthorimoea heliopa*, L.—Boring into stem.

RHYNCHOTA (Bugs).

Family—

Pentatomidae—1. *Stibaropus tabulatus*, S.—On roots.

Capsidæ— 2. *Gallobelicus crassicornis*, D.—On leaves and shoots.

Aphidiidae— 3. *Myzus persicae*, S.—On tender leaves and shoots.

Any further information on tobacco pests may be had from the author.

The Agricultural Department, Madras

Bulletin No. 27

ANNOTATED LIST

OF THE

INSECTS AFFECTING THE IMPORTANT CULTIVATED PLANTS IN SOUTH INDIA

BY

T. V. RAMAKRISHNA AYYAR, B.A., PH.D., F.Z.S.

(Madras Agricultural Department)

(This replaces Bulletin No. 86 of 1923)

MADRAS

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

1932

PREFACE TO THE SECOND EDITION.

There is no doubt that since the publication of the list in 1923 our knowledge of South Indian insects has considerably increased, and during these eight years several new forms have attracted our attention and numerous additional facts have been noted of many previously known forms. In this present edition an attempt is made to present the original list with some improvements in the way of some additions and alterations in the light of additional knowledge we have gained of South Indian insects. In doing so not only has the original list been revised by necessary additions and alterations, but the author has also ventured to add some additional information which might in his opinion enhance the usefulness of this bulletin for easy reference purposes. In addition to the revised list of crop-insects which forms the major part of the publication two important and useful things are added :—(1) A separate list of the insects arranged in their natural orders, and (2) Three illustrated crop-pest calendars referring to the Madras Presidency. As stated in the preface to the first edition, even this second edition cannot be said to be a complete list of the crop insects of South India or the last word on the subject; for, it is very likely that at any time in the future new pests might be discovered and new observations made on already known insects; no pains have, however, been spared to include in the list all forms worthy of being noted by gathering information from many scattered sources and make the same as up to date as possible. For detailed information on some of the important pests readers are referred to the different leaflets and bulletins issued by the Agricultural Department from time to time. For proper identification of some of the insects in the list the writer is indebted chiefly to the Imperial Institute of Entomology, London, and the Imperial Entomologist, Pusa. The writer is also indebted for some valuable information on some Mysore insects to the "Notes on some important Mysore crop-pests" contributed to the "Journal of the Agricultural and Experimental Union" by my brother T. V. Subrahmanya Ayyar, now Acting Entomologist in the Mysore State.

It is hoped that with all its inevitable defects this new edition may help those who are interested in the subject and perhaps contribute to encourage the study of Agricultural Entomology in South India.

September 1931. T. V. RAMAKRISHNA AYYAR.

PREFACE TO THE FIRST EDITION.

This pamphlet is prepared with the idea of supplying the educated agriculturists, district revenue and agricultural officers, agricultural students and all interested in South Indian Agriculture with a handy and up-to-date reference list of the more important insects injurious to different crops cultivated in South India, especially in the plains. It is believed that the list, with all its inevitable defects, will not only help such persons to get an idea of the chief pests of the particular crops they may grow, but will also aid them in identifying different insects which may now and then appear in their fields. This is not the first list of South Indian insect-pests, which has been issued; Mr. Fletcher issued a list in 1913. The present list however, besides being up to date, differs from the old one in two or three important points. Firstly, the arrangement is quite different, the insects being listed according to the crops they attack and not under their scientific orders and families; secondly, many of the forms in the former list which have been found to be of minor or no economic importance are omitted; and, thirdly, new forms noted since 1913 have been included. In addition, brief notes regarding the nature of injury to the crops, vernacular names where available, control measures wherever possible and references to illustrations are added in the list. It is hoped that the present list will be acceptable to our district officers and agriculturists as an up-to-date pocket reference list of insect-pests.

It may be added that this list is issued as a companion to the author's previous bulletin* on the "Entomologist's Crop-pest Calendar for the Madras Presidency." It is hoped that both these together may form an easy reference record of the important insect-pests of South India showing their distribution, their seasonal appearance, the nature of the damage they do, and other important facts that could possibly be brought within the compass of a small popular pamphlet. It is needless to add that only the more important pests of the different crops are listed, and greater attention is

* Bulletin No. 80, 1921.

paid to crops of the plains than to those of the hills, as our knowledge of the latter is very limited. The information attempted to be given under each insect consists of its popular name, its distribution as a pest, the nature of damage it does, its scientific name, possible control measures against it; and references to vernacular names, if any, and to illustrations of such of those insects in the list as are recorded in Fletcher's "Some South Indian Insects," the only book on South Indian insects published till now. The control measures suggested for each insect are only brief hints and suggestions that can be added within the small space allotted; so it is advisable to get further detailed information from books and specialists, especially in cases where insecticides are attempted to be used. Unimportant plants and plants on which no important insects have been noted till now have not been included; nor do insects of minor importance find a place here.

The list can by no means be said to be complete as new and important pests are frequently noted; but it is believed to be up to date as far as our knowledge of South Indian insects has advanced and might serve the purpose for which the author has prepared it.

October 1922. T. V. RAMAKRISHNA AYYAR.

BULLETIN No. 27.]

ANNOTATED LIST OF THE INSECTS AFFECTING THE IMPORTANT CULTIVATED PLANTS IN SOUTH INDIA.

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CHIEF REFERENCES CITED WITH THE ABBREVIATIONS USED IN THE LIST.

S.S.I. = Some South Indian Insects by T. B. Fletcher.

P.P.B. = Paddy Pests Bulletin by T. V. Ramakrishna Ayyar.

Cocc. Bull. = Bulletin on South Indian Coccidae by T. V. Ramakrishna Ayyar.

Tob. Bull. = Tobacco Insects Bulletin by T. V. Ramakrishna Ayyar.

Thy. Mem. = Memoir on Indian Thysanoptera by T. V. Ramakrishna Ayyar.

I.—INSECTS AFFECTING IMPORTANT CULTIVATED PLANTS IN SOUTH INDIA.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			CEREALS.		
			PADDY (*Oryza sativa*).*		
† Paddy swarming caterpillar.	West Coast tracts, Northern Circars, Tinnevelly, Chingleput, Mysore.	The caterpillar defoliates seedlings in the nurseries and young plants in the fields.	*Spodoptera mauritia*, B. (Noctuid—moth).	Flood the infested field and nurseries where water is available. Sweep with handnets in nurseries when the caterpillar is very young.	One of the worst pests of paddy in South India. (Colour Pl. XX, S.S.I.)
Paddy stem-borer.	Northern Circars, Ceded Districts, Ramnad, South Malabar, Mysore.	The caterpillar bores into the paddy stem and kills the shoot or causes white ears.	*Schoenobius incertellus*, W. (Pyralid—moth).	Collect eggmasses and destroy dead seedlings in nurseries before transplantation. Difficult to control in later stages.	Sometimes reported as a serious pest from Northern Circars. (Col. Pl. XXIX, S.S.I.)
† Rice hispa ...	West Coast, Salem, Chingleput, Northern Circars, North Arcot, Chittoor and South Arcot.	The grub mines into the leaf tissue and the beetle scrapes the green foliage.	*Hispa armigera*, Ol. (Chrysomelid—beetle).	Use the handnet and clip tips of seedlings, especially in the nurseries, where the pest starts.	This small bluish spiny black beetle is often found bad in South Kanara. (Col. Pl. IX, S.S.I.)
Rice leptispa ...	Malabar; very rarely in other rice tracts.	Grub and adult feed on foliage.	*Leptispa pygmoea*, B. (Chrysomelid—beetle).	Same as hispa	This is a smooth bluish black beetle. (Fig. 165, S.S.I.)
† Rice bug ...	West Coast, Coimbatore, Tinnevelly and rarely in the Northern Circars.	The adult and young ones suck the juice from the tender ears and shoots.	*Leptocorisa acuta*, Th. (Coreid—bug).	Use handnet or big sweeping bag. Remove from the bunds other grasses on which the bug breeds.	Bad in some years in the West Coast where it is called "*Chazhi*" in Malayalam; and *Bambuchu* in Kanarese; emits a bad smell. Found also on ragi, cumbu, and other grasses now and then. (P.P.B., Pl. 11-5-8).

* For fuller information on Paddy pests the writer's bulletin on Paddy insects (Madras Agrl. Dept. Bulletin No. 25, 1931) may be consulted. See also departmental leaflets Nos. 40, 41 and 42 on these three pests.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			CEREALS—*cont.*		
			PADDY (*Oryza sativa*)—cont.		
Rice grasshoppers.	West Coast, Mysore, Northern Circars, Tinnevelly, Chingleput and Coimbatore.	Feed on foliage and cut earheads.	*Hieroglyphus banian*, F. and *H. orizivorus*, U. (in Ganjām) (Acridiid grasshoppers).	Use handnets and bags on the field bunds soon after the early rains when eggs hatch out into hoppers; scrape bunds to destroy eggs in summer wherever possible.	Known as "*Pulpundu*" in South Malabar. (P.P.B., Pl. III-1-3.)
Small grasshopper.	Common all over the province and rarely as a pest.	Same habits as rice-grasshopper.	*Oxya velox*, F. (Acridiid—grasshopper).	Use handnets when found in numbers.	Fig. 426, S.S.I.
Rice case worm.	West Coast, Coimbatore, Mysore, Chingleput and Vizagapatam.	The caterpillars cut the leaves into pieces and make cases in which they live and feed on the paddy leaves.	*Nymphula depunctalis*, Gr. (Pyralid—moth).	Flood the field, shake the plants with a long pole to make the cases drop down. Drain the water or spray a thin film of kerosine oil on the water to kill the worms in the cases.	The injury done to paddy is known as *Kokku nonu* in Tamil. (Col. Pl. XXXII, S.S.I.)
Rice leaf-folder.	West Coast tracts and Ganjām.	Caterpillar rolls up leaf-tips and feeds on the green matter.	*Cnaphalocrocis medinalis*, Gr. (Pyralid—moth).	Clipping the leaf-rolls at the early stages.	Sometimes sporadic causing appreciable harm, (P.P.B., Pl. V-5.)
Paddy gall-fly.	N. Circars, Tanjore, Ramnad and West Coast.	The maggot bores into the stem, attacks bud of shoots and causes galls known as silver shoots. No ears are formed.	*Pachydiplosis oryzæ*, W. (Cecidomyiid—fly).	No effective remedy known yet; keep the field bunds clear of wild grasses in which this insect often breeds.	The disease is called "*Anaikombu*" in Tamil, "*Kodu*" in Telugu. (P.P.B., Pl. IV-1.)

Paddy mealy-bug.	South Arcot, Trichinopoly, Salem, Tanjore, Coimbatore, and rarely in Northern Circars.	Colonies of this minute insect infest the inside of the paddy leaf sheaths and suck up the plant sap.	*Ripersia oryzæ*, Gr. (Coccid—mealy bug).	No effective remedy known. As a preventive, the early attacked plants may be removed and burnt to prevent spread. Infested seedlings may be eliminated while transplanting.	The disease is known as "*soorai*" in Tamil and is sometimes bad in Trichinopoly, Tanjore and South Arcot. Affected fields show patches of plants with disease called "*Dumpa tegulu*" in Northern Circars. (P.P.B., Pl. IV-2.)
Rice thrips ...	Coimbatore, Tanjore, Malabar, Chingleput and Mysore.	Very small insects found in numbers on seedlings sucking up plant juice.	*Thrips oryzæ*, W. (Thripidæ—Thrips).	Easily checked by flooding if water is available. A rain will check the pest.	The insect appears when the seasonal rains are delayed. (P.P.B., Pl. IV-3.)
Paddy striped bug.	Cauvery valley areas in the Trichinopoly District.	Settles in numbers on young plants and sucks up juice.	*Tetroda histeroides*, F. (Pentatomid—bug), another dark pentatomid *Scotinophora lurida* B. is occasionally found with *Tetroda*.	Handpicking and bagging in early stages and spraying of a deterrent if necessary.	A brown bug with two whitish stripes. (P.P.B., Pl. VI-4.)
Climbing cutworm.	Coromandel area in January-February.	Defoliation and cutting of earheads.	*Cirphis albis tigma*, M. (Noctuid—moth).	No effective measures known. Handpicking in early stages may check multiplication.	Others noted now and then are *C. loreyi*, D. once noted in Tanjore. *Cirphis micaceae*, H in Cochin (1931). Another Noctuid found is *Borolea venalba*, M. (Tanjore, Chingleput). (P.P.B., Pl. V-2.)
Paddy root caterpillar.	North Malabar (in sandy coastal tracts).	Caterpillars cut the leaves and stems of young paddy and drag them below the soil; they live in tubular galleries below the plants.	*Ancylolomia chrysographella*, K. (Pyralid moth).	A smart rain or flooding will bring up the caterpillars and expose them to insect-feeding birds.	Occasionally serious to young broadcasted paddy in April-May. (P.P.B., Pl. V-4.)
Rice chafer ...	Kanara and Mysore.	Grubs attack roots of young plants.	*Phyllognathus dionysius*, F. (Dynastid—beetle).	Light traps may be kept early in the season to catch the adults. Irrigation water may be mixed with some crude oil emulsion.	Very rarely noted as injurious. (P.P.B., Pl. VII-1.)

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			CEREALS—*cont.*		
			PADDY (*Oryza sativa*)—cont.		
Root weevil ...	Kistna and Guntur.	Grubs attack roots of young plants under water.	*Echinocnemus oryzæ*, M. (Curculionid—beetle).	Irrigation water may be mixed with some crude oil emulsion or the water drained off.	A pest of very minor importance. (P.P.B., Pl. VII-4.)
Paddy semi-looper.	Coimbatore, Malabar, and other paddy areas.	Feeding on leaves ...	*Pelamia frugalis*, F. (Noctuid—moth).	Never noted as a pest ...	(P.P.B., Pl. V-3.)
Yellow hairy caterpillar.	Northern Circars and in all grass and paddy areas.	.....	*Psalis securis*, H. (Lymantrid—moth).	Do. ...	Often found breeding on grasses. (P.P.B., Pl. V-1.)
Rice skipper...	In all paddy tracts...	Feeding on leaves ...	*Parnara mathias*, F. (Hesperiid--butterfly).	Handpicking or netting of the caterpillars and butterflies.	A smooth green caterpillar with distinct head. Pl. XXVII, S.S.I.
Horned caterpillar.	Do. ...	Do. ...	*Melanitis ismene*, C. (Nymphalid—butterfly).	Do.	A smooth green caterpillar with a pair of red horn-like processes on head. (P.P.B., Pl. III-7-9.)
Paddy earhead bug.	Malabar, Kanara, Tinnevelly, and Anantapur.	Sucking tender ears ...	*Menida histrio*, F. (Pentatomid—bug).	Netting the bugs	A small reddish brown active insect. (P.P.B., Pl. VI-1.)
Green spotted jassid.	In all paddy areas ...	Sucking tender parts; often appearing in swarms and occasionally doing severe damage.	*Nephotettix bipunctatus*, F. (Jassid--bug).	Netting and light traps. Collecting with sticky winnows.	Noted as serious in parts o Bengal and Central Province, minute green insect. Recently reported from Madura and Ramnad. (P.P.B., Pl. VI-3.)
White jassid.	Do. ...	Do.	*Tettigoniella spectra*, D. (Jassid--bug).	Collecting with handnets or bags and use of sticky winnows.	A whitish insect slightly bigger than *Nephotettix*. Fig. 385, S.S.I.

Circars jassid.	Northern circars ...	Occasionally appearing in swarms; suck young plants and make them fade in patches in fields.	*Deltocephalus dorsalis*, M. (Jassid—bug).	Do.	Small-sized sporadic leaf-hopper pests in different tracts appearing in some years and causing some damage. For figures see P.P.B., Pl. VI.
Kistna leaf-hopper.	Nellore, Kistna, Malabar and Cochin.	Do.	*Nilaparvata sordescens*, M. (Delphacidæ—fulgorid bug).	Do.	
Leaf-hopper ...	Nellore	.....	*Nysia atrovenosa*. L. (Cixiidæ—fulgorid bug).	Do.	
North Malabar leaf-hopper.	North Malabar ...	Occasionally appearing in swarms; suck young plants and make them fade in patches in fields.	*Erythroneura subrufa*, M. (Fulgorid-bug).	Do.	
Paddy leaf-weevil.	Coimbatore ...	Feeding on paddy leaves.	*Athesapeuta oryzae*, M. (Curculionid—weevil).	Hardly a pest	Another grey weevil, *Myllocerus dentifer*, F. is occasionally seen in some places on paddy but rarely doing serious harm. (P.P.B., Pl. VII-2.)
Striped leaf-beetle.	Malabar	Do.	*Oides affinis*, F.* (Chrysomelid—beetle).	Hardly a pest, though found in numbers sometimes.	Reddish brown beetle with a black mark on each forewing. Fig. (P.P. B., Pl. VII-5.)
Yellow blister beetle. Green blister beetle.	In most tracts ...	Feed on the flower heads, chiefly pollen.	*Gnathospastoides rouxi*, C. *Lytta tenuicollis*, Pall *Epicauta sp.* (Cantharid—beetles).	Easily checked by netting or driven by smoke; beetle remains on plant only for a short time generally.	Figs. 147, 148, 154, S.S.I.
Blue black blister beetle.	South Kanara ...	Do.			
Paddy Eupterotid.	Agency tracts, Vizagapatam.	Caterpillars feeding on foliage.	*Nisaga simplex*, W. (Eupterotid—moth).	Rarely a pest	Stout brown moth.
Paddy surface grass-hoppers.	Coimbatore, Anantapur, etc.	Feeding on young plants and doing some appreciable damage especially in small areas and nurseries.	*Acrotylus humbertiana*, S. *Heteropternis respondens*, W., *Aelopus affinis*, B., *Locusta danica*, L., *Pyrgomorpha conica*, O. (Acridiidæ—grasshoppers).	Can be easily checked by netting, by poison baits or by poison dusting.	Chiefly found in nurseries. All are small grass-hoppers, greenish, greenish brown or yellowish brown in colour.

* The blue leaf beetle *Haltica cyanea*, J. is often found in numbers on paddy; it is not a pest of paddy but breeds on the plant *Ammania* in paddy fields.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
		CEREALS—*cont.*			
		PADDY (*Oryza sativa*)—cont.			
Rice stem fly...	Coimbatore	Larva boring in stem.	*Atherigona sp.* (Anthomyiid—fly).	Only preventive methods feasible in this case.	The insect is a minute fly noted only now and then in small numbers.
Rice flea beetle.	Gōdāvari	Causes dead-hearts in nurseries.	*Chaetocnema sp.* (Halticid—beetle).	Do.	Very minute active beetles; rarely serious.
		CHOLAM (*Andropogon sorghum*).			
Cholam stem-borer.	Northern Circars, Ceded districts, Coimbatore and Tinnevelly.	Caterpillars bore through stem killing young plants and damaging older stems.	*Chilo zonellus*, S. and *C. Sp.* (Pyralid—moths).	Collect and destroy dead-hearts and destroy stubble after harvest. Difficult to check on old plants.	More injurious to young plants; also found on maize, ragi, sugarcane, etc. Fig. 300, S.S.I.
Cholam earhead bug.	Ceded districts, Coimbatore, Tinnevelly and Northern Circars.	The active green insects suck up the sap from tender earheads.	*Calocoris angustatus*, L. (Capsid—bug). Another capsid, *Megacoelum syramineum*, W. is also found with this bug occasionally.	No effective remedy known. In young and short plants netting and sticky winnows may be tried to reduce damage.	Sometimes serious in Coimbatore and the Ceded Districts. Fig. 376, S.S.I. called "*Aggi purugu*" in Ceded District.
Red hairy caterpillar.	In all dry areas, especially in red soil tracts of South Arcot, Salem, Ceded Districts, Trichinopoly and Mysore.	Feeding on every part of the plant and skeletonising it.	*Amsacta albistriga*, W. (Arctiad—moth).	Light traps and handpicking moths soon after the early rains when they emerge; plough badly infested fields in summer to expose underground pupae.	Not so bad as on cumbu or groundnut. See Mysore bulletin on the "*Kambli hula*." Pl. XVII, S.S.I. A pest of many other plants.

Cholam fly ...	Coimbatore, Mysore and adjacent tracts.	Larva attacks young seedlings causing dead-hearts.	*Atherigona indica*, M. (Anthomyiidae—fly).	Dead seedlings to be pulled out and destroyed while the field is thinned; seed rate may be slightly increased in localities subject to infestation.	Generally attacks only seedlings. (Fig. 215, S.S.I.)
Cholam shoot bug.	Coimbatore, Ceded Districts and Northern Circars.	Colonies of this small insect infest tender leaves and suck the juice.	*Pundaluoya simplicia*, D. (Fulgorid—bug).	No effective remedy known; pull out first attacked plants to check spread; in valuable plots spraying may be done with a contact insecticide.	Badly infested plants appear as though scorched by fire. Ants are found visiting these insects. They are often found in company with plant-lice. (Fig. 382, S.S.I)
Shoot caterpillar.	Coimbatore	Feeding on foliage from inside leaf shoots.	*Cirphis unipuncta*, M. and rarely *C. loreyi*, D. (Noctuid—moths).	Handpicking or dusting shoots with arsenates if necessary.	Not a serious pest generally; a stout smooth caterpillar, one of the army or cutworms. Pl. XVIII, S.S.I.
Leaf-roller ...	In all dry tracts ...	Rolling leaf and feeding from inside roll.	*Marasmia trapezalis*, G. (Pyralid—moth).	Of minor importance ...	A yellowish brown moth with wavy marks on wings. Pl. XXXIII, S.S.I.
Leaf weevil ...	Coimbatore, Northern Circars and Ceded Districts.	Feeding on leaves ...	*Myllocerus discolor*; B. (Curculionid—beetle).	Do. ...	A greyish brown sp. fairly common everywhere; the grub is often found feeding on roots of cholam, ragi, etc.
Cholam aphid.	Coimbatore and Northern Circars.	Found in colonies inside tender shoots sucking up juice.	*Aphis maidis*, F. (Aphidae—bug).	Dust tobacco powder, if necessary.	Rarely a pest. Commonly kept in check by predatory insects.
Earhead caterpillar.	Tanjore	Feeding on the ripening grains.	*Eublemma silicula*, S. (Noctuid—moth).	Very rarely a pest	The adult insect is a small pale brown moth.
Earhead webber.	Ceded Districts and Coimbatore.	Caterpillars found webbing the grains in the earhead and feeding on the grains.	*Stenachroia elongella*, H. (Pyralid—moth).	Rarely a pest and only of local importance.	Fig. 296, S.S.I.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			CEREALS—*cont.*		
			CHOLAM (*Andropogan sorghum*)—cont.		
Plant bugs ...	Northern Circars, Tinnevelly, and many other parts.	Attacking tender parts, especially the ripening earheads and sucking the plant sap.	*Nezara viridula*, L., *Dolycoris indicus*, S., *Agonoscelis nubila*, F., *Piezodorus rubrofasciatus*, F. (Pentatomid—bugs).	Handpicking and netting ...	Figs. 352, 347 and 351, S.S.I. Found mostly confined to the earheads
Earhead chafers.	Ceded Districts and Coimbatore.	Feeding on the ears and pollen.	*Anatona stillata*, N., *Oxycetonia versicolor*, F., *Chiloloba acuta*, W. *Protaetia aurichalceae*, F. (Cetonidae—chafer beetles).	These beetles are conspicuous and can be easily checked by handpicking and netting, but they are pests very rarely.	Figs. 122, 123 and 124, S.S.I.
Earhead blister beetles.	Do.	Do.	*Gnathospastoides rouxi*, C., *Lytta tenuicollis*, P. (Cantharid—beetles).	As on Paddy	See under Paddy.
Surface grasshopper.	Do.	Attacking young plants and often cutting them down.	*Chrotogonus saussurei*, B. (Acridiid—grasshopper).	Netting and poison traps ...	Small active creatures often resembling the soil in colour.
Cholam gall-fly.	Coimbatore	Breeding inside the tender grains of cholam and making seeds empty.	*Contarinia andropogonis*, Felt. (Cecidomyid—fly).	No remedy known	Sometimes sporadic.
Cholam mite ...	In most cholam tracts.	The leaves are turned sickly red by colonies of the mite feeding on the leaf tissue.	*Paratetranychus indicus*, H. (Acari—mite).	Dusting of fine powdered sulphur.	An occasionally serious pest. Not an insect.

Ragi (*Eleusine coracana*).

Pink borer ...	Coimbatore, Ceded Districts and Northern Circars.	Caterpillar bores into stem and kills central shoot.	*Sesamia inferens*, W. (Noctuid—moth).	Same measures as suggested for cholam stem-borer above.	Also found on wheat maize, sugarcane and cholam. The caterpillar has a uniform pink colour. (Pl. XXI, S.S.I.)
White borer ...	Coimbatore and Ceded Districts.	Caterpillar bores into lower portions of the stem.	*Saluria inficita*, W. (Pyralid—moth).	Same as above; the moth comes to light and so light traps may be tried early in the nurseries to trap moths about to lay eggs.	The borer is cream white in colour. Noted on paddy in Mysore. (Fig. 304, S.S.I.)
Cholam stem-borer.	In all tracts ...	Bores into stem as in cholam.	*Chilo zonellus*, S. (Pyralid—moth).	As on cholam	See under cholam stem borer.
Black hairy caterpillar.	Coimbatore ...	Eats leaves and earheads.	*Estigmene lactinea*, Cr. (Arctiad—moth).	Collect the caterpillars in the early stages by jerking the infested leaf over a pan of water containing a little kerosene.	Known as the wooly bear caterpillar; found on cumbu also. (Fig. 230, S.S.I.)
Root lice ...	Coimbatore tract ...	The minute insects attack roots and suck up the juice.	*Tetraneura hirsuta*, B. (Aphidid—bug).	Irrigate with water mixed with a little of kerosene emulsion or Crude oil emulsion.	Small white insects found in numbers attached to the underground roots and rootlets. (Fig. 390, S.S.I.)
Earhead caterpillar.	Coimbatore and Mysore.	Caterpillar attacks earheads in stacks soon after harvest.	*Simplicia robustalis*, G. (Noctuid—moth).	Thrash the harvested crop soon after harvest.	Found as a pest of thatching material in Coimbatore.
Leaf Noctuid.	Coimbatore, Vizagapatam and many other places.	Sometimes bad in nurseries feeding on the young plants.	*Laphygma exigua*, Hb. (Noctuid—moth).	Netting or dusting arsenates.	Fig. 240, S.S.I.
Thrips ...	Coimbatore ...	Sometimes bad in nurseries; sucking up the plant juice from seedlings	*Heliothrips indicus*, B. (Thripidae—thrips).	Flood the nurseries or spray tobacco decoction.	Very minute insects. See Fig. 1, Thy. Mem.
Grasshoppers.	Coimbatore, Tinnevelly and Ramnad.	Feeding on foliage of the young plants.	Several different kinds noted such as spp. of *Oedaleus*, *Aeolopus*, *Chrotogonus*, *Acrotylus*, etc.	Use handnets or sweeping bags.	These do more harm when the crop is young when they can be easily checked.
Flea beetles.	Coimbatore ...	Biting holes in the tender foliage.	*Chaetocnema sp.*, a leaf-beetle. *Lema downsei*, B. is also found. (Hispid beetles).	Netting or dusting of arsenates.	Very minute and active beetles; occasionally doing some damage.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			CEREALS—*cont.*		
			CUMBU (*Pennisetum typhoideum*).		
Red hairy caterpillar.	Coimbatore, Tinnevelly, South Arcot, Salem and Ceded Districts.	Feeds on the leaf, earheads and stem.	*Amsacta albistriga*, W. (Arctiad—moth).	Same as the one noted above on cholam.	Sometimes a bad pest of cumbu and groundnut. (Pl. XVII, S.S.I.)
Green plant-bugs.	Tinnevelly, Ramnad and Coimbatore.	Suck the juice from the tender parts.	*Nezara viridula*, L. *Eusarcocoris guttiger*, Th. (Pentatomid—bugs).	Easily checked by hand-picking or by using hand-nets. The eggs and nymphs which are easily found cut can also be destroyed promptly.	Nezara known as "*Pachalai*" and "*Navai puchi*" in Tamil. Green and flattish with the buggy smell. The other bug is small brownish insect.
Black hairy caterpillar.	Coimbatore ...	Feeds on the leaf, earheads and stem.	*Estigmene lactinea*, Cr. (Arctiad—moth).	Same as noted above on ragi.	Not commonly found.
Deccan grasshopper.	Ceded Districts and Northern Mysore.	Feeding on all parts of the plant.	*Colemania sphenarioides*, B. (Acridiid—grasshopper).	Netting, bagging, etc. ...	A wingless grasshopper also found on cholam, tenai, etc. So far confined to Ceded Districts.
Tinnevelly wingless grasshopper.	Coimbatore and Kovilpatti.	Feeding on all parts of the plants.	*Othacris simulans*, Bol. (Acridiid—grasshopper).	Do. ...	A small wingless grasshopper.
Earhead beetles.	Coimbatore, Ceded Districts, Tinnevelly, South Arcot and Northern Circars.	Eat up the flower heads and ripening ears.	*Gnathospastoides rouxi*, C. *Lytta tenuicollis*, P. (Canthrid—beetles).	The beetles are sluggish and so can be handpicked or collected in handnets easily. They can also be smoked out of the fields.	These generally appear when the plants are in flower and disappear very soon. (Figs. 153, 148, 147, S.S.I.)
Seed bug ...	Kistna District ...	Sucks the grain soon after harvest.	*Aphanus sordidus*, F. (Lygaeid—bug).	Collect bugs with nets or cover harvested seeds.	See under groundnut.

Tenai (*Setaria italica*).

Deccan grass-hopper.	Bellary District and North Mysore.	Completely eats up the young and grown up plants.	*Colemania sphenarioides*, B. (Acridiid—grasshopper).	Netting, bagging, and poison traps.	Very serious during certain years in Bellary District; does more harm to this crop than others in this tract.
Tenai erotylid.	Coimbatore	Larva bores into stem ...	*Anadastus parvulus*, W. (Erotylid—beetle).	Destruction of first attacked shoots and collection and destruction of the beetles when found.	A blue and red beetle; not an important pest.
Leaf-weevils.	South Arcot, Coimbatore and Ceded Districts.	Eating the leaves ...	*Myllocerus dentifer*, F., and *M. transmarinus*, H. (Curculionid—weevils).	Handpicking and netting. The beetles could be jarred from the plants over a bucket of water and kerosene.	Though these are of minor importance they sometimes appear sporadically as pests of millets and defoliate the plants.

Maize (*Zea mays*).

Almost all insects found on cholam attack maize also; of these maize pests the chief are—

Pink borer ...	Coimbatore, Northern Circars and Ceded Districts.	Stem-borer	*Sesamia inferens*, W. (Noctuid—moth).	Same as ragi pink borer; same measures to be adopted.	See under ragi pink borer.
Cholam shoot bug.	Coimbatore, Ceded Districts and Northern Circars.	Sucks the juice from tender parts.	*Pundaluoya simplicia*, D. (Fulgorid—bug).	See under cholam	See under cholam.
Cholam stem-borer.	Do.	Do.	*Chilo zonellus*, S. (Pyralid—moth).	Do.	Do.
Leaf Noctuid.	Coimbatore, Northern Circars, Salem, etc.	Feeds on the foliage and sometimes serious.	*Laphygma exigua*, H. (Noctuid—moth).	Handpick or net caterpillars or dust arsenate on infested plants.	A sporadic local pest in some tracts.
Grasshopper ...	Coimbatore and Northern Circars.	Feeding on green parts ...	*Orthacris elegans*, Bol. (Acridiid—grasshopper).	Do.	Wingless grasshopper.

Millets (*Panicum spp.*).

Panivaragu flea beetle.	Coimbatore and Guntur.	Larva and adults feed on foliage and also cause dead-hearts in nurseries.	*Chaetocnema pusaensis*, M. (Haltiicid—beetle).	Netting or dusting of arsenates.	Very minute active beetles, occasionally found in numbers.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			CEREALS—*cont.*		
			WHEAT (*Triticum vulgare*).		
Stem-borer ...	Coimbatore and Bellary.	Caterpillar bores into stem and kills shoot.	*Sesamia inferens*, D. (Noctuid—moth).	This is the same as the ragi pink borer and the same measures will apply.	See under ragi pink borer.
Plant lice ..	Do.	The minute insects suck up the juice from tender parts.	*Toxoptera graminum*, R. (Aphid—bug).	If badly infested, the plants may be sprayed with crude oil emulsion if the crop is a valuable one, but generally the pest is checked by predators.	Minute insects found in colonies and visited by ants and predators like lady-bird, beetles, hover flies and chrysopa.
Termites ...	Do.	The ants eat up roots of growing plants.	*Microtermes obesis*, H. (Termitidae—white-ant).	Mix contact insecticide with irrigation water.	
			SUGARCANE (*Saccharum officinarum*).		
Cane stem-borers.	Northern Circars, Coimbatore, South Arcot, Chittoor and South Kanara.	Boring into stem, killing young shoots, and damaging growing canes.	Two or more species are found. Chief species are *Argyria sticticraspis*, H., and *Diatroea venosata*, W. (Pyralid—moths).	The injury is more serious in young plants. Pulling out and destroying dead-hearts will check the spread of the pest. Very little damage done to older plants.	The borers form the most important of cane pests in the province.
Cane white borer.	Coimbatore, South Arcot and Bellary.	The white caterpillar bores into the stem from the topshoot unlike other borers.	*Scirpophaga xanthogastrella*, W. (Pyralidae—moth).	Not so serious as the other borers. In early stages the attacked top shoots may be clipped. Egg-masses easily made out can be collected.	Figs. 302, 303, S.S.I. *S. nivella*, F., is also sometimes noted in Gōdāvari.

Termites ...	In almost all cane tracts.	Bore into the planted setts underground kill the tender shoots and buds.	*Odontotermes obesus*, R. (Termitidae—white-ant). The ant *Dorylus* is also found sometimes.	Fields should be cleared of white-ant nests before planting. Disease-free setts should be planted. Fields showing attack may be irrigated with water containing crude oil emulsion.	The pest is often serious in virgin fields and the setts and seedlings suffer much.
Cane fly ...	South Kanara, Coimbatore, Northern Circars, South Arcot and Gōdāvari.	Sucks up juice from tender portions.	*Pyrilla perpusilla*, W. (Fulgorid—bug).	Leaves containing egg-masses and nymphs can be clipped and the pest easily controlled if attended to in time.	A straw coloured active insect with the head drawn forwards. Serious only in rare cases and in small areas. (Fig. 381, S.S.I.)
Cane mealy-bug.	Coimbatore, South Arcot and Northern Circars.	Numbers of these small insect settle at the lower portions of the cane stem and suck the juice.	*Ripersia sacchari*, Gr. (Coccid—Mealy bug).	Nothing effective can be done except by using healthy seed and treating first attacked canes as a proventive.	Colonies of this insect are found attached to the lower nodes of the cane enclosed by old leaf-sheaths.
Cane scale insect.	Salem	Cover stem inside of leaf sheaths and suck the juice.	*Aclerda japonica*, N. (Coccid—scale insect).	Spraying with contact insecticide.	Rarely a pest.
Cane mealy wings.	Coimbatore, South Arcot and Gōdāvari.	Sucks up juice from leaves and makes the crop sickly and stunted.	*Aleurolobus barodensis*, Msk. *Neomaskellia bergii*, Sign. (Aleurodidae—Mealy wings).	Prune badly infested leaves and spray contact insecticide.	Fig. 394, S.S.I.
Cane hesperid.	Coimbatore, South Arcot and Northern Circars.	Caterpillar feeds on the leaves.	*Telicota augias*, L. (Hesperid—butterfly).	Handpick caterpillars and net butterflies.	Fig. 294, S.S.I.
Cane leaf-hopper.	Do.	Found in numbers on leaves. Leaf-sucking bugs.	*Assamia moesta*, W. (Fulgorid—bug).	Not a pest usually though found in numbers.	Small black fly-like insects. Fig. 390, S.S.I.
Cane hispid.	Coimbatore and Northern Circars.	Grubs and adults feeding on tender foliage.	*Phidodonta modesta*, W. (Hispid—beetle).	Hardly a pest	Insects similar to rice hispa. Plate IX, S.S.I.
Cane thrips ...	Coimbatore and South Arcot.	Sucking juice from tender leaf tips and making them curled and rolled up.	*Bregmatothrips ramakrishnae*, B. (Thripidæ—thrips).	Clipping the curled leaves. A very minor pest.	Minute small insects of a dark brown colour. See page 267, Thy. Mem.
Cane root lice.	Coimbatore	Attack roots	*Tetraneura ulmi, coimbatorensis*, G.	See under ragi root aphis.	Noted only in Coimbatore till now.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			PULSES.		
			RED-GRAM (*Cajanus indicus*).		
Gram caterpillar.	Throughout South India.	Eats leaves and bores into the seed pods eating up the seeds.	*Heliothis obsoleta*, Fb. (Noctuid—moth).	In early stages handpicking may be tried; difficult to check when too late and in large areas.	Also attacks groundnut and Bengal-gram. A stout cylindrical greenish caterpillar. (Fig. 235, S.S.I.)
Plume moth ...	Do.	The same damage as above.	*Exelastes atomosa*, W. (Pterophorid—moth).	Same as above	A small light green caterpillar covered with small spines and hairs. The moth has plumed wings. (Pl. XXXVIII, S.S.I.)
Red hairy caterpillar.	Mysore	Feeding on all green parts.	*Amsacta albistriga*, W. (Arctiid—moth).	See under cholam	Often bad on red-gram in Mysore.
Pod-fly ...	Do.	The small maggot bores into the seed pod and damages the seeds.	*Agromyza obtusa*, M. (Agromyzid—fly).	No effective remedy known.	The adult insect is a very small blnish blackfly like the housefly but much smaller. (Fig. 216, S.S.I.)
Bud weevil ...	Coimbatore and Northern Circars.	The grub and the adult feed on the flowers and buds and destroy them preventing pod formation.	*Ceuthorhynchus asperulus*, F. (Curculionid—weevil).	Shake the shoots and collect the weevils on infested flower buds, or dust with arsenate powder.	Small greenish brown weevil. (Fig. 194, S.S.I.)
Gram pod bug.	Coimbatore, Ceded Districts and Northern Circars.	The adult and young ones suck the juice from young seed pods.	*Clavigralla horrens*, D. Sometimes also *C. gibbosa*, S.	Collect with nets and destroy eggs on pods on leaves.	An active grey brown insect with sharp shoulder spines.
Leaf-weevil ...	Coimbatore, Ceded Districts and South Arcot.	Leaf-eater	*Episomus lacerta*, F., and *Myllocerus spp.* also sometimes found. (Curculionid—weevils).	Collect with handnets ...	Stout ashy grey weevil fairly common on most pulses.

Tussock hairy caterpillar.	Coimbatore and Northern Circars.	Caterpillar feeding on leaves and tender shoots.	*Euproctis fraterna*, M. (Lymantrid—moth).	Handpick leaves containing the larvæ feeding together in numbers and if necessary spray or dust arsenate.	A reddish hairy caterpillar, often found on castor and roses also.
Orange-banded blister beetle.	In all tracts ...	Feeding on flowers and tender shoots.	*Mylabris pustulata*, Th. (Cantharid—beetle).	Easily checked by handpicking or netting. The beetles are slow fliers.	The beetle is often found on different kinds of red and yellow flowers such as *Hibiscus*, prickly-pear, gogu, etc. (Fig. 149, S.S.I.)
Crab caterpillar.	Coimbatore, Malabar and Ganjām.	Caterpillar feeds on leaves and shoots.	*Stauropus alternus*, W. (Notodontidae—moth).	Generally not a serious pest. Can be handpicked. Often heavily parasitised.	A curiously looking greyish brown caterpillar. (Fig. 279, S.S.I.)
Leaf and shoot folder.	Coimbatore and Northern Circars.	Caterpillar webs together leaves and top shoots.	*Eucosma critica*, Mey. (Eucosmid—moth).	Handpick webbed leaves and shoots.	A minor pest. The caterpillar is a short pale yellowish creature. (Pl. XXXIX, S.S.I.)
Leaf roller ...	In all red-gram tracts.	Caterpillar rolls the leaf-tips.	*Gracillaria soyella*, D. (Gracillariad—moth).	Hardly a pest	.....
Blue butterfly.	In all tracts	The larva feeds on the pods and flowers.	*Polyommatus boeticus*, L. (Lycaenid—butterfly).	A minor pest. Butterflies can be netted.	Small bluish butterfly with short stout fleshy larva. (Fig. 288, S.S.I.)
Scale insects...	Coimbatore and Northern Circars.	Infest shoots and stem in colonies and suck juice.	*Ceroplastodes cajani*, M. and *Lecanium longulum*, D. (Coccid—Scale insects).	Prune badly infested shoots and spray others with contact insecticide.	See Fig. 400, S.S.I.
Leafcutter bee.	All over South India.	Cuts pieces of tender leaves and carries the pieces to the nest.	*Megachile anthracina*, Gm. (Apidae—bee).	May be caught by nets or the leaves can be dusted with arsenates.	This is also noted in plants like roses, cassia, etc., in gardens.
Bruchid ...	Coimbatore and Mysore.	Feeding and breeding on pods in fields.	*Bruchus theobromae*, L. (Bruchid—beetle).	Collect beetles with nets ...	One of the few pulse-beetles found in the field also.
Lab-lab bug ...	Coimbatore, Mysore and Northern Circars.	Sucking plant sap from tender parts.	*Coptosoma cribraria*, F. (Pentatomid—bug).	Collect bugs by nets ...	Small greenish bug found on lab-lab, pongamia in swarms, with a bad smell.
Verpuchi ...	South Arcot, Bellary and Coimbatore.	Grub of beetle bores into stem close to the roots.	*Sphenoptera perotteti*, G.L. (Buprestid—beetle).	Rarely a serious pest of red-gram, usually a pest of groundnuts; only preventives possible.	See under groundnut.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			PULSES—*cont.*		
			BENGAL-GRAM (*Cicer arietinum*).		
Gram caterpillar.	Coimbatore, Ceded Districts and Northern Circars.	Eating leaves and the seeds by boring into pods.	*Heliothis obsoleta*, Fb. (Noctuid—moth).	Same as the one on red-gram (see above). Same control measures.	It is a major pest of Bengal-gram in South India. The pest is sometimes checked by parasitic wasps and dies.
			BLACK AND GREEN GRAMS (*Phaseolus radiatus* and *P. mungo*).		
Pod borer ...	All over South India.	Caterpillar damaging seeds.	*Maruca testulalis*, G. (Pyralid—moth).	Only preventive method of plucking off first attacked pods practicable in the early stages.	Found also on other grams and sunnhemp. Not a serious pest. (Fig. 305, S.S.I.).
Sphinx caterpillar.	Northern Circars and Coimbatore.	Defoliating the crop ...	*Herse convolvuli*, L. (Sphingid—moth).	Eggs and caterpillars which are very conspicuous on the plants can be hand-picked and destroyed; the infested fields may be ploughed up after harvest to kill underground pupæ.	Stout big caterpillar. Sometimes causes serious damage. (Fig. 272, S.S.I.)
Green leaf-caterpillar.	All over the province.	Feeding on leaves ...	*Asazia rubrican*, B. (Noctuid—moth).	A minor pest. In bad cases arsenates may be used.	Fig. 254, S.S.I.
Pod weevil ...	Coimbatore and Mysore.	Feeding on leaves and breeding in pods.	*Apion amplum*, F. (Curculionid—beetle).	Collect the beetles or dust plant with arsenate if serious.	Very small ant-like black insects, often bad on black-gram in Mysore.
Plant lice ...	All over the province.	Crowding on tender shoots and sucking the sap.	*Aphis sp.* (Aphid—plant-louse).	May be sprayed with a contact poison in valuable plots. Commonly checked by predators.	Colonies of the minute insect often cause some appreciable damage.

Leaf weevils ...	Coimbatore, Coorg, Ceded Districts, Salem, Tinnevelly, etc.	Feeding on the leaves and shoots.	*Alcides collaris*, P, *A. fabricii*, F. (Curculionid—weevils).	Collect weevils by the hand.	Rarely serious. (Figs. 197 and 195, S.S.I.)
Green-gram weevil.	Ceded Districts ...	Damaging the seeds ...	*Pachytychius mungonis*, M. (Curculionid—weevil).	No effective remedy known except preventive method of picking of attacked pods.	Also attacks daincha pods in Coimbatore. (Fig. 194, S.S.I.)
		HORSE-GRAM (*Dolichos biflorus*).			
Pod-borer ...	All over South India.	Caterpillar damaging seeds.	*Etiella zinkenella*, Tr. (Pyralid—moth).	Only preventive method of plucking off first attacked pods practically in the early stages.	Found also on other grams and sunnhemp. Not a serious pest (Fig. 305, S.S I.)
Leaf caterpillars.	Coimbatore, Ceded Districts and Northern Circars.	Feeding on foliage ...	*Azazia rubricans*, B (Noctuid-moth), *Nacoleia* (*Lamprosema*) *indicata*, Fb. (Pyralid—moth).	Generally of minor importance. Spraying or dusting with arsenates in serious attacks.	Sometimes occur as sporadic pests. (Figs. 254 and 310, S.S.I.)
Hairy caterpillar.	Mysore	Do. ...	*Diacrisia obliqua*, W. (Arctiad—moth).	Handpicking of leaves containing the gregarious larvæ.	Noted sometimes serious in Mysore.
		COW PEA (*Vigna catiang*).			
Stem fly ...	Coimbatore and Tinnevelly.	Maggots bore into stem of plants.	*Agromyza phaseoli*, Coq. (Agromyzid—fly).	No effective remedy known.	Similar to the red-gram pod fly in general appearance and habits. (Fig. 217, S.S.I.)
Plant lice ...	In all tracts ...	Sucking up the juice ...	*Aphis sp.* (Aphididae—bug).	May be sprayed with a contact poison in valuable plots; commonly checked by predators.	Colonies of this minute insect often cause some appreciable damage.
Blister beetles.	Do. ...	Feeding on flowers ...	The common spp. noted on cereals and *Cantharis setaceae*.	Handnet beetles ...	The last one was once found bad in Gōdāvari in 1919.
Blue butterfly.	In most tracts ...	The caterpillars bore into the seed capsules.	*Euchrysops cneyus*, F., and *Polyommatus boeticus*, L. (Lycaenid—butterflies).	Only preventive method, plucking off early attacked pods. The caterpillars may also be handpicked in early stages. The butterflies can be netted.	The caterpillars are soft and fleshy and the butterflies small and bluish, found often flying in the fields. (Pl. XXVI, Fig. 288, S.S.I.)

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
		PULSES—*cont.*			
		Cow Pea (*Vigna catiang*)—cont.			
Leaf caterpillar.	In all tracts ...	Leaf feeding	*Azazia rubricans*, B. (Noctuid—moth).	Handpick caterpillars and spray stomach poison when needed.	A looper caterpillar occasionally found on most pulses. (Fig. 254, S.S.I.)
Pod bugs ...	Coimbatore and Malabar.	Sucking sap from pods and tender parts.	*Riptortus pedestris*, Fb., *R. linearis*, F., and *Anoplocnemis phasiana*, F. (Coreidae—bugs.)	Catch bugs with nets and destroy eggs laid on pods and leaves which can be easily seen.	Large-sized active bugs found on other pulses also. (Figs. 354 and 360, S.S.I.)
Stem-borer beetle.	Travancore ...	Larva boring into stem...	*Oberea sp.* (Cerambycid—beetle).	Destroy badly infested plants and beetles if found.	Minor pest.
		Field Bean (*Dolichos lablab*).			
Plant lice ...	In most tracts ...	Sucking up the juice ...	*Aphis medicagenis*, K. (Aphididae—bug).	Same remedy as in Cow pea plant-lice (see above).	The young shoots and vines are covered with these minute insects in bad attacks.
Do.	Do. ...	Do. ...	*Coptosoma cribraria*, F. (Pentatomid—bug).	The eggs and the adults can be easily collected and destroyed, the latter by handnets.	Small active greenish insects found in thousands on the tender vines, possess the usual buggy smell. (Fig. 345, S.S.I.)
Leaf weevil ...	Coimbatore, Ceded Districts and Northern Circars.	The insect defoliates the plant; sometimes seriously.	*Episomus lacerta*, F. (Curculionid—weevil).	Beetles to be collected by hand or by jerking over pan of water and kerosene.	A stout greyish weevil, sometimes numerous on the field bean crop (Fig. 184, S.S.I.)

Pod borer caterpillar.	Coimbatore and Northern Circars.	Caterpillar bores into the pod and eats the seeds.	*Adisura atkinsoni*, M. (Noctuid—moth).	Only preventive method feasible; first attacked pods to be plucked off.	A cylindrical greenish caterpillar found during the cold weather, sometimes checked by parasites; more or less like gram caterpillar in appearance.
Leaf-miner ...	Coimbatore, Malabar and South Kanara.	Minute caterpillar mines into leaf-tissue and feeds from inside.	*Cyphosticha coerulea*, Meyr. (Gracillariad-moth).	The blistered leaves to be picked off as a preventive.	The affected leaves show blistered white patches through which the small pink caterpillar is visible.
Sphinx caterpillar.	In all tracts ...	The long stout caterpillar eats the leaves.	*Acherontia styx* W. and *A. Lochesis* also sometimes. (Sphingid-moths).	The same measures as for green gram sphinx caterpillar (see above).	A stout built long, green caterpillar with a horn above the tail region with golden yellow bands at sides; found on gingelly and brinjal also. (Col. Pl. XXIV, S.S.I.)
Shoot borer ...	Coimbatore	The caterpillar bores into the young distal shoots.	*Laspeyresia torodelta*, Meyr. (Eucosmid—moth).	Clip first attacked shoots as a preventive.	A minor local pest.
Stem-weevil...	Coimbatore, Salem and North Arcot.	Larva causes galls in stems.	*Alcides pictus*, Boh (Curculionid—weevil).	Destroy first formed galls and the weevils seen on the plant.	Often a local pest in old vines.
Leaf hispid ...	Malabar and Tanjore	Leaf-feeding	*Platypria hystrix*, Fb. (Hispidae—beetle).	Collect beetles or dust arsenate on leaves.	A roundish small spiny insect like the hispa.
Stem boring chrysomelid.	Mysore and Coorg ...	Boring into stem and causing galls.	*Sagra nigrita*, Oliv. (Chrysomelid—beetle).	Remove first attacked vines as a preventive, or cut open the galls and destroy the grubs.	A shining green beetle with swollen hind legs. See Mysore Journal of the Agricultural Union, 1921, p. 16.
Thrips ...	Coimbatore and Northern Circars.	Swarming inside flowers and tender shoots.	*Taeniothrips distalis*, Ky. (Thripidae-thrips).	Spray with tobacco decoction.	The insect sometimes causes some harm; see p. 256, Thy. Mem.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			FIBRE CROPS.		
			COTTON (*Gossypium herbaceum*).*		
Spotted boll-worms.	In all cotton areas ...	The caterpillars bore into top shoots of young plants and into the bolls of older ones.	*Earias fabia*, S. and *Earias insulana*, B. (Noctuid—moths).	Preventive methods alone practicable. Clip off shoots when they are attacked and pick off early attacked bolls to prevent further multiplication.	These are bigger caterpillars than the pink boll-worm and of a greyish green spotted appearance; attack young plants and also bolls. (Col. Pl. XXIII, S.S.I.)
Pink boll-worm.	Do. ...	The caterpillar bores into the bolls and feeds on the seeds.	*Platyedra gossypiella*, S. (Gelechiad—moth).	Preventive measures alone are practicable. Selection of healthy seeds for sowing and picking off early attacked bolls to prevent multiplication are the chief. The caterpillars are generally parasitized by wasps. Act according to Pest Act.	The small pink-coloured caterpillar is a serious pest of cotton in many cotton-growing countries of the world. (Col. Pl. XLII, S.S.I.)
Stem weevil ...	Coimbatore, Madura and Ramnad.	The grubs bore into the stem and cause galls.	*Pempheres affinis*, F. (Curculionid—weevil).	Preventive method alone practicable. Remove first attacked plants.	The insect is a small weevil and an important pest especially of cambodia cotton in and around Coimbatore (Figs. 198 and 199, S.S.I.)
Plant-lice ...	Coimbatore, Tinnevelly and Ceded Districts.	Suck the juice from the tender portions.	*Aphis gossypii*, G. (Aphidid—bug).	May be sprayed with a contact poison-like crude oil emulsion or fish oil soap.	Minute insects. Often cause appreciable injury to young cotton crop; ants visit them.

Leaf-roller ...	All over the province.	Caterpillars feed inside rolls of cotton leaves.	*Sylepta derogata*, Fb. (Pyralid—moth).	The leaf-rolls containing the caterpillars are conspicuous and can be collected and destroyed easily.	The insect is a green long caterpillar living in rolls of cotton leaf; found also on other malvaceous plants. (Col. Pl. XXXV, S.S.I.)
Dusky bug ...	In all cotton tracts.	Sucks the juice from seeds and stains the lint.	*Oxycarenus lœtus*, K. (Lygaeid—bug).	Prematurely opening bolls should be collected early as they harbour the pest and all *kapas* containing the pest should be kept separate and fumigated.	Small dusky brown insect found crawling in numbers in open cotton bolls like ants. (Fig. 367, S.S.I.)
Red cotton bug.	All over the province.	Punctures the boll, sucks up the juice and stains the lint.	*Dysdercus cingulatus*, F. (Pyrrhocorid—bug).	Eggs and nymphs can be handpicked and the bugs shaken over a pan of water and kerosene.	A red and black insect found in numbers on isolated plants in all stages. (Col. Pl. XLVI, S.S.I.)
Semi-looper caterpillars.	In cotton tracts ...	Leaf-eaters	*Cosmophila indica*, G., *Tarache nitidula*, F., and *Acontia graellsi*, F. (Noctuid—moths).	Rarely serious. If bad, spray with arsenates.	Figs. 257, 243, 249, S.S.I.
Cotton bud-worm.	Coimbatore, Tinnevelly and Ceded Districts.	Feeds on the top shoot in a fold.	*Phycita infusella*, M. (Pyralid—moth).	The attacked top shoots which are easily seen to be clipped.	A small green caterpillar with black head, generally found on young plants. (Col. Pl. XXXI, S.S.I.)
Boll-boring noctuids.	Coimbatore	Boring into bolls ...	*Heliothis obsoleta*, F. and *Rabila frontalis*, W. (Noctuid—moths).	Very rarely found	The first is the notorious "American cotton boll-worm". Is chiefly a pest of pulses in India.
Stem-boring buprestid.	Ceded Districts ...	Larva boring into stem ...	*Sphenoptera gossypii*, K. (Buprestid—beetle).	Destroy first attacked stems.	Plate VIII, S.S.I.
Shoot weevil.	Coimbatore	Feeding and breeding on the shoots.	*Alcides affaber*, F. (Curculionid—weevil).	Handpick the beetles ...	Fig. 197, S.S.I.
Cotton blossom weevil.	Chingleput and Coimbatore.	Feeding inside the flowers.	*Amorphoidea arcuata*, M. (Curculionid—weevil).	Pick off and destroy badly infested flowers and destroy the weevils.	A very brown small weevil, not generally found as a pest. Closely allied to a very serious cotton pest in the Philippines. (*A. lata*, M.)

* Detailed information on cotton pests may be found in the author's bulletin on cotton insects in S. India. Agr. Deptt. Bull. No. 28.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			FIBRE CROPS—*cont.*		
			COTTON (*Gassypium herbaceum*)—cont.		
Scales and mealy bugs.	Coimbatore, Tinnevelly, Ceded Districts, and Northern Circars.	Infest shoots and leaves and suck up plant sap.	*Saissetia nigra*, N., *Cerococcus hibisci*, Gr., *Pseudococcus virgatus*, C., *Pseudococcus corymbatus*, Gr., *Pulvinaria maxima*, Gr. (Coccidae—scales and mealy bugs).	Prune infested shoots and spray with contact insecticides.	For Figs. see S.S.I. 403, 395 and Cocc. Bull. P.R. XXII and XIII.
Leaf-hopper ...	Coimbatore	Infest young plants in swarms and suck up plant sap causing leaf curls, bad on exotic cottons.	*Empoasca devastens*, D. (Jassid—bug).	Use the net and spray contact insecticide.	A small very active green leaf-hopper.
Surface weevil.	Tinnevelly and Ramnad.	Feeding on young plants and often causing some appreciable damage.	*Atactogaster finitimus*, F. (Curculionid—beetle)	Handpick weevils or dust arsenates on infested plants.	A stout greyish black weevil. (Fig. 191, S.S.I.)
Grasshoppers.	Coimbatore, Tinnevelly and Ramnad.	Feeding on tender plants and foliage.	*Cyrtacanthacris ranacea*, Gt., *Chrotogonus saussurei*, B., *Catantops annexus*, Bol., and *Aelopus tamulus*, F. (Acridiid—grasshoppers).	Trap with nets or poison baits.	Figs. 424, 422, S.S.I.
Hairy caterpillars.	Coimbatore and Tinnevelly.	Feed on the foliage ...	*Euproctis fraterna*, M. (Lymantrid—moth).	Same as the one on redgram and same control measures to be adopted.	See under red-gram. Rarely the red hairy caterpillar *Amsacta* and the black hairy caterpillar. *Pericallia ricini*, Fb., are also found on cotton.

Bud fly ...	Coimbatore and Mysore.	Larvæ inside buds ...	*Dasyneura gossypii*, Felt (Cecidomyid—fly).	Of very minor importance.	A closely allied fly is a pest in America ; rarely seen in South India.
Flea beetles ...	Coimbatore	Eat the very tender seedlings.	*Monolepta signata*, Ol. (Haltricidae—beetle).	Net the beetles or dust with arsenate.	A very small white spotted flea beetle. (Fig. 159, S.S.I.)
Thrips ...	Coimbatore and Bellary.	In shoots and flowers ...	*Thrips tabaci*, L. (Thripidae—thrips).	Very rarely seen as a pest.	Serious on "Onions" and "Garlic". See p. 265, Thys. Mem.
Cotton mites ...	Coimbatore and Ceded Districts.	Colonies of these minute creature attack plant and cause reddening of leaves, curling up, etc.	Red spider, *Eriophyes sp.*	Dust powdered sulphur ...	*Not insects.*

Gogu (*Hibiscus cannabinus*).*

Hairy caterpillar.	Coimbatore, South Arcot and Chingleput.	Feeds on the tender parts.	*Euproctis scintillans*, W. (Lymantrid—moth).	Same measures as against the Tussock caterpillar on red-gram and cotton.	The caterpillar is similar to the red-gram and cotton one but with a yellow stripe along the dorsal surface. (Fig. 268, S.S.I.)
Stem weevil ...	Coimbatore and South Arcot.	Grub tunnels into stem, causes galls and often kills young plant.	*Alcides affaber*, F. (Curculionid—weevil).	Only prevention by pulling out attacked plants.	See Fig. 197, S.S.I.
Flea beetle ...	Malabar, South Kanara and Trichinopoly.	Biting holes in tender leaves.	*Nisotra madurensis*, J. (Chrysomelid—beetle).	Collect with nets or dust with arsenates.	Fig. 160, S.S.I.
Leaf weevil ...	Coimbatore and Tinnevelly.	Feeding on leaves ...	*Dereodus mastos*, Hb. (Curculionid—weevil).	Handpick the beetles ...	The beetle is a fairly big creature and of minor importance.
Blister beetle.	All over the province.	Chiefly on flowers ...	*Mylabris pustulata*, Th. (Meloid—beetle).	Same insect noted above on red-gram, etc., and same measures to be adopted.	See under red-gram.

* *Note.*—The red and dusky bugs of cotton and a few cotton leaf caterpillars also attack Gogu.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			FIBRE CROPS—*cont.*		
			SUNNHEMP (*Crotalaria juncea*).		
Hairy caterpillars.	Northern Circars, Coimbatore, South Arcot and Tinnevelly.	Caterpillars feed on leaves and bore into seed capsules.	*Utetheisa pulchella*, L. (Arctiad-moth), *Argina cribraria*, C., and *A syringa*, C. (Hypsid—moths).	Moths which are day-flying may be netted. A badly infested and valuable crop, may be sprayed with lead arsenate. In the early stages the caterpillars may be collected in trays of water and kerosene.	The first which is the commonest is a hairy caterpillar with red and orange spots. Sometimes it is serious during early summer (Fig. 233, S.S.I.)
Pod-borer ...	Northern Circars and Coimbatore.	Caterpillar bores into pods.	*Etiella zinkenella*, Tr. (Pyralid—moth).	Remove first infested pods to check multiplication.	Fig. 305, S.S.I.
Stem-borer ...	Northern Circars ...	Caterpillar bores into stem and causes swelling at the nodes.	*Laspeyresia tricentra*, M. (Eucosmidae—moth).	Only preventive method of cutting off attacked shoots practicable.	Not a serious pest. (Col. Pl. XL, S.S.I.)
Capsid ...	Northern Circars, Coimbatore and Tinnevelly.	The small insects suck the juice from tender parts.	*Ragmus importunitas*, D. (Capsid—bug).	Use hand-nets in early stages.	Not a serious pest. Small active green insects. (Fig. 378, S.S.I.)
Flea beetle ...	Do.	Biting small holes in foliage.	*Longitarsus belgaumensis*, F. (Halticidae—beetle).	Net the beetles or spray deterrent insecticide.	A very minute active insect found often in numbers.
Leaf caterpillar.	Northern Circars, South Arcot and Coimbatore.	Leaf eater	*Amyna octo*, G. (Noctuid—moth).	Rarely a pest	A green semi-looper caterpillar.
Blue butterfly.	All over the province.	Feeding on and boring into the pods.	*Polyommatus boeticus*, L. (Lycaenid butterfly).	Collect butterfly and hand-pick the larvæ.	Very rarely serious.

OIL-SEED CROPS.

GINGELLY (*Sesamum indicum*).

Leaf and pod caterpillar.	Throughout South India.	Caterpillar feeds on the leaves and bores into the shoots and pods.	*Antigastra catalaunalis*, D. (Pyralid—moth).	No effective remedy known. In the early stages hand-picking will be found effective.	Often a bad pest of gingelly. (Col. Pl. XXXVII, S.S.I.)
Gingelly gall-fly.	Coimbatore and South Arcot.	The maggot injures the bud which forms a gall instead of a seed capsule.	*Aspondylia sesami*, F. (Cecidomyid—fly).	No effective remedy known.	The mal formed buds contain the pink maggots inside. (Figs. 224 and 225, S.S.I.)
Sphinx caterpillar.	Throughout South India.	Leaf and shoot eater ...	*Acherontia styx*, W. (Sphingid—moth).	Same as found on lab-lab...	See under lab-lab.
Gingelly bugs.	Ganjām and South Kanara.	Suck the juice from tender parts.	*Eusarcocoris ventralis*, W. (Pentatomid—bug). *Nysius inconspicuous*, D. (Lygaeid—bug).	Use of handnet will be very effective.	Small active bugs of two or three kinds found in swarms in the early summer months. (Fig. 349, S.S.I.)

CASTOR (*Ricinus communis*).

Semilooper caterpillar.	In all tracts; chiefly Ceded Districts.	Defoliates the plant ...	*Achoea janata*, L. (Noctuid—moth).	Handpicking of caterpillars. Spraying of lead arsenate if water is available and crop valuable. Dusting if no water available.	A major pest of castor. A smooth elongated greyish caterpillar moving in semiloops (Fig. 250, S.S.I.) called "Kondali hula" in parts of Mysore.
Tobacco caterpillar.	In all tracts ...	Do. ...	*Prodenia litura*, F. (Noctuid—moth).	Handpicking of eggmasses easy. Handpicking leaves containing hundreds of gregarious larvæ is also easy and effective.	A stout greyish brown caterpillar. It is a pest of tobacco and other plants. (Col. Pl. XIX, S.S.I.)
Seed capsule borer.	Do. ...	Caterpillar bores into seed capsules and leaf-stalks.	*Dichocrocis punctiferalis*, G. (Pyralid—moth).	Preventive method; first attacked shoots and top seed capsules to be clipped to prevent spread of pest.	Several seed capsules are found webbed together by the pest in an infested plant. (Col. Pl. XXXIV, S.S.I.)

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
		OIL-SEED CROPS—*cont.*			
		CASTOR (*Ricinus communi*)—cont.			
Hairy and tussock caterpillars.	Coimbatore, South Arcot, Northern Circars and Mysore.	Defoliate the plants ...	*Orgyia postica*, W., *Euproctis fraterna*, M., *Pericallia ricini*, F. *Olene mendosa*, H., *and Diacrisia obliqua*, W. (Lymantrid and Arctiad—moths).	Same remedy as for tussock caterpillar on red-gram and gogu.	One or more species often appear as sporadic pests in the cold weather. (Figs. 263 and 264, S.S.I.)
Castor slug caterpillars.	West Coast, Coimbatore, Northern Circars and Madras.	Do. ...	*Parasa lepida*, G., and *Altha nivea*, W. (Limacodid—moths).	Clipping of leaves on which larvæ are found gregariously. Destruction of cocoons generally found in masses on the plant stem.	The first is an apple green slug-like creature, spiny and irritating to the touch, also found on mango and palms. (Figs. 283, 284 and 285, S.S.I.); the second rarely found. Noted in Mysore.
Butterfly ...	All over South India.	Leaf-eating caterpillar ...	*Ergolis merione*, Cr. (Nymphalid—butterfly).	Clipping the leaves on which the larvæ feed gregariously.	Rarely a pest. A green spiny caterpillar.
Mealy wing ...	Do.	Colonies found on leaf surface sucking sap.	*Trialeurodes ricini*, M. (Aleurodidae—bug).	Clip badly infested leaves and spray if necessary with contact insecticide.	The adults are very minute moth-like creatures.
Leaf-hopper ...	Coimbatore	Sometimes appear in swarms and suck sap.	*Empoasca flavescens*, F. (Jassid—bug).	Collect with handnets ...	Minute green leaf hoppers. (Fig. 387, S.S.I.)
Flea beetle ..	Do.	Biting holes on foliage ...	*Hermacophaga ruficollis*, L. (Halticidae—beetle).	Collect with nets or spray deterrent.	A very minor pest. A minute beetle.
Shot-hole borer.	Mysore	Larvae and adults boring into stem.	*Xyleborus fornicatus*, E. (Scolytid—beetle).	Cut and burn badly infested shoots and stems.	Sometimes found on tea (Fig. 204, S.S.I.)
Green plant-bug	Ceded Districts and Coimbatore.	Sucking sap from tender parts.	*Nezara viridula*, L. (Pentatomid—bug).	Handpicking	Found on numerous other crops.

Hairy caterpillar.	Throughout the Central and Coromandel districts of the province.	Completely eating up all parts of the plant.	*Amsacta albistriga*, Moore (Arctiad—moth).	Same as found on red-gram or cholam and the same remedies.	A very serious pest of groundnuts in S. India.
Surul puchi ...	South Arcot, Salem, Trichinopoly, Tanjore, Chingleput, etc.	The small caterpillar feeds on the foliage and does injury.	*Stomopteryx nerteria*, M. (Gelechiad—moth).	No effective remedy known; moths come to light in numbers and light traps may be tried to minimize damage.	A small greenish caterpillar does considerable damage to the foliage, called "*Surul*" or "*Mudu*" *puchi*. (Fig. 333, S.S.I.)
Gram caterpillar.	South Arcot and Chingleput, etc.	Feeds on the foliage ...	*Heliothis obsoleta*, (Noctuid—moth).	Same insect found on bengal and red-gram.	See under red-gram.
Thrips... ...	Ceded Districts and South Arcot.	Tender shoots are sucked and dry up.	*Heliothrips indicus*, B. (Thripidae—thrips).	Spray with tobacco decoction or water with high pressure.	Often very bad causing "*Tamara novu*". (Thy. Mem. Fig. 1.)
Verpuchi ...	South Arcot, Chingleput and Tanjore.	The grub bores into the stem and kills the plant.	*Sphenoptera perotteti*, G. (Buprestid—beetle)	Preventive method alone practicable. Pull out attacked plants to prevent spread.	The white grub is found inside stem close to ground level. (Figs. 141 and 142, S.S.I.)
Leaf weevils ...	South Arcot and Coimbatore.	Feeding on leaves ...	*Myllocerus viridanus*, F. (Curculionid—weevil).	Collect with net	Generally a minor pest.
Semi-looper caterpillars.	South Arcot, Coimbatore and Guntūr.	Do. ...	*Plusia chalcytes*, F., *Plusia signata*, F. (Noctuid—moths).	Handpick or dust arsenates.	Rarely serious. (Fig. 259, S.S.I.)
Grasshopper ...	All over the province.	Feeding on and cutting young plants.	*Chrotogonus saussurei*, B. (Acridid—grasshopper).	Collect with nets or trap by baits.	Attack young plants generally.
Seed-sucking bug.	Ceded Districts, South Arcot and Kistna.	Sucking the freshly harvested pods in the threshing floor.	*Aphanus sordidus*, Fb. (Lygaeid—bug).	Collect with nets or cover harvested nuts to prevent attack.	Fig. 368, S.S.I.
Flower beetles.	Coimbatore and South Arcot.	Feeding on flowers and buds.	*Oxycetonia versicolor*, Fb. (Cetoniad—beetle), *Mylabris pustulata* and *Mylabris balteata* (Cantharid—beetles).	Handpick or net the beetles; they can also be driven by smoke.	Figs. 123, 149, S.S.I.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			OIL-SEED CROPS—*cont.*		
			SAFFLOWER (*Carathmus tinctorius*).		
Leaf caterpillar.	Coimbatore and Tinnevelly, etc.	Caterpillar feeds on the foliage.	*Perigoea capensis*, G. (Noctuid—moth). Occasionally the noctuid, *Heliothis peltigera*, Sch., is also found in Coimbatore.	The leaves containing the caterpillars may be hand-picked in the early stages. May be sprayed with lead arsenate.	Smooth stout green caterpillar appears sporadically as a pest. (Fig. 239, S.S.I.)
Lace-wing bug.	Coimbatore and Tinnevelly.	.....	*Monanthia globulifera*, W. (Tingidid—bug).	Rarely a pest	Fig. 371, S.S.I.
Plant lice ...	Do.	Suck up plant sap ...	*Macrosiphum solidaginis*, F. (Aphid—bug).	Spray with contact poison.	Sometimes bad.
			LINSEED (*Linum usitatissimum*).		
Leaf caterpillars.	Coimbatore	Caterpillars feed on the foliage.	*Grammodes stolida*, F., *Plusia orichalcea*, F. (Noctuid—moths).	Usually minor pests; spray when bad with arsenate solution.	Both are semi-loopers, the first is black and red spotted in colour. (Figs. 251, 260, S.S.I.)
			VEGETABLES.		
			BRINJAL (*Solanum melongena*).		
Fruit and shoot-borer.	In all tracts ...	Boring into the top shoots and fruits.	*Leucinodes orbonalis*, G. (Pyralid—moth).	Attacked fruits and shoots should be clipped as a preventive.	A common pest of brinjal fruits; pink caterpillar found inside fruits, attacks shoots of young plants. (Col. Pl. XXX, S.S.I.)

Stem-borer ...	Do. ...	Bores into the stem and often kills the plant.	*Euzophera perticella*, R. (Pyralid—moth).	Preventive only. Pull out and destroy first attacked plants.	Appears generally in old gardens where the plants have completed their yielding season. (Col. Pl. XXX, S S.I.)
Epilachna beetles.	Do. ...	The beetles and the grubs scrape the green matter from the leaves.	*Epilachna* 12 *punctata*, M., *E.* 28 *punctata*, Fb. (Coccinellid—beetles).	Handpicking all stages and spraying or dusting with arsenates when bad.	Round spherical spotted beetles scraping the leaf surface. Found in all stages, also found on Cucurbitaceae. (Pl. XXX, S S.I.)
Lace-wing bug.	All over South India.	Colonies of this small insect suck the juice from tender portions.	*Urentius echinus*, D. (Tingidid—bug).	Handpicking of leaves infested with colonies of the insect in the early stages and spraying with crude oil emulsion when badly infested.	Small insects with the wings patterned like lace found in colonies on the backs of leaves. (Fig. 370, S.S.I.)
Brinjal mealy bug.	Chingleput and Coimbatore.	Colonies appear and suck the juice.	*Phenacoccus insolitus*, G. (Coccid—mealy bug).	Removal of the attacked plants is the best in the early stages. May be sprayed as above if many plants are attacked.	Appears generally on old plants late in the season. A bad attack on a plant appears as though the plant is whitewashed. (Pl. XXI, fig. 3, Cocc. Bull.)
Leaf-folding caterpillars.	Madras, South Arcot and Chittoor.	Feed inside leaf folds ...	*Eublemma olivacea*, W. (Noctuid—moth). *Phycita clientella*, Z. (Pyralid—moth).	By handpicking of the folds in infested plants the pest can be easily checked.	Short stout purple brown caterpillar with yellow spots and hairs. (Fig. 241, S.S.I.)
Brinjal bud-worm.	Coimbatore and Chingleput.	The small caterpillar bores into the bud and destroys it.	*Phthorimoea blapsigona*, M (Gelechiad—moth).	Only preventive method practicable, picking off and destroying early dropping buds.	Sometimes the insect causes appreciable damage. It is often parasitized by a wasp. (Fig. 317, S.S.I.)
Leaf webber ...	Malabar and South Kanara.	Webbing the leaves and living gregariously inside webbed leaves feeding on the same.	*Psara bipunctalis*, Fb. (Pyralid—moth).	Clip leaves containing the larvae.	
Sphinx caterpillar.	In all tracts	Caterpillar defoliates the plants.	*Acherontia styx*, W. (Sphingid—moth).	Same as on lab-lab and gingelly.	See under lab-lab and gingelly.
Leaf noctuid.	Madras, Coimbatore, Travancore and Bellary.	Leaf eater	*Plotheia nephelotis*, Meyr. (Noctuid—moth).	Handpick caterpillars or dust arsenates.	(Fig. 246, S.S.I. often found feeding gregariously.)

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			VEGETABLES—*cont.*		
			BRINJAL (*Solanum melongena*)—*cont.*		
Grey weevil ...	All over the province.	Feeding on the foliage ...	*Myllocerus subfasciatus*, G. (Curculionid—weevil).	Handpick the beetles ...	Commonly found, but rarely as a pest.
Small pentatomid.	South Kanara and Malabar.	Found in numbers on tender shoots sucking the sap.	*Coptosoma nazirae*, A. (Pentatomid—bug).	Handpick or net the bugs.	A small dark species found on other vegetables also.
The pulse coreid.	All over the province.	Sucking sap from tender portions.	*Anoplocnemis phasiana*, F. (Coreid—bug).	Catch bugs by nets ...	A conspicuous dark brown bug with stout hind legs.
			LADY'S FINGER ("BHENDAI") (*Hibiscus esculentus*).		
			All insects found on cotton except pink bollworm attack this plant, the chief are—		
Fruit borer ...	All over the province.	Caterpillars bore into shoots and fruits.	*Earias fabia*, S. (Noctuid—moth).	See under cotton	See under cotton.
Stem weevil ...	Do.	The grub bores into stem and shoots.	*Alcides affaber*, F. (Curculionid—weevil).	Do.	Do.
Leaf-roller ...	Do.	The caterpillars fold the leaves into rolls.	*Sylepta derogata* (Pyralid—moth).	Do.	Do.
Semi-looper caterpillars.	In cotton tracts ...	.....	*Cosmophila indica*, G. *Acontia graellsi*, F. (Noctuid—moths).	Do.	Do.
Leaf weevils.	Everywhere ...	Feeding on foliage ...	*Myllocerus viridanus*, Fb. (Curculionid—weevil).	Net the weevils. Not a serious pest.	Found also on groundnut, castor, etc.—A small greenish weevil.

Cluster Beans (*Cyamopsis psoralioides*).

Leaf weevils ...	Coimbatore, Bellary, South Arcot, Madura and Chingleput.	Bores into top shoots and feeds on those portions.	*Alcides bubo*, F. *Blosyrus inacqualis*, B. (Curculionid-weevils).	Clipping off of top shoots of infested plants.	The first is a specific pest of Agathi (Fig. 196, S.S.I.). See under Agathi.
Lab-lab bug ...	Do.	Sucks up the juice from tender parts.	*Coptosoma cribraria*, F. sometimes also *C. nazirae*, At. (Pentatomid bugs).	Same as found on lab-lab ...	See under lab-lab above.

Sweet Potato (*Ipomoea batata*).

Sweet potato weevil.	All over South India.	The vines are bored by the grub and damaged badly.	*Cylas formicarius*, Fb. (Curculionid—weevil).	No effective remedy known; attacked vines and tubers to be destroyed to check spread, growing of deep-rooted varieties, and leaving the field fallow for a season or two.	An ant like blue and red weevil, a major pest of the crop, found both in the field and in the stored tubers. (Col. Pl. XII, S.S.I.)
Sphinx caterpillar.	Coimbatore and Northern Circars.	Leaf-eater	*Herse convolvuli*, L. (Sphingid—moth).	Same one noted above on green-gram.	See under green-gram.
Stem-borer ...	Do.	Caterpillar bores into the vines.	*Omphisa anastomosalis*, G. (Pyralid—moth).	Same remedies to be adopted as for the weevil (*Cylas*).	Found also on other Ipomoeaceous plants. (Fig. 316, S.S.I.)
Leaf-folder ...	Coimbatore	Caterpillar feeds on leaves which are rolled up.	*Brachmea effera*, Meyr. (Gelechiad—moth).	Clip folded leaves. A minor pest only.	A very slender dark caterpillar.
Leaf noctuid ...	Coimbatore, Tinnevelly.	Feeding on leaves and shoots.	*Catephia inquieta*, W. (Noctuid—moth).	Hand pick caterpillars ...	Rarely a pest.
Tortoise beetles.	Coimbatore, West Coast, Madura, Mysore, etc.	Leaf feeders. Some breed on the foliage.	*Aspidomorpha miliaris*, F., *Metriona circumdata*, H. (Cassidid—beetles).	Handpick or net the beetles.	Yellow and green tortoise beetles. (Figs. 168, 170, S.S.I.)
Leaf hispid ...	Coimbatore	Feeding on leaves ...	*Oncocephala tuberculata*, Ol. (Hispid—beetle).	Of very minor importance.	A small spiny beetle.
Leaf butterfly.	Coimbatore, Tinnevelly.	Do. ...	*Junonia orithyia*, L. (Numphalid—butterfly).	Catch butterfly with net and handpick larvae.	Rarely a pest.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			VEGETABLES—*cont.*		
			SWEET POTATO (*Ipomoea batatas*)—*cont.*		
Hairy caterpillar.	Malabar	Feeding on leaves; sometimes bad.	*Diacrisia obliqua*, Wlk. (Arctiad—moth).	Handpick leaves on which larvae feed in numbers.	Sometimes a sporadic pest.
Leaf syntomid.	Travancore	Larva feeding on leaves.	*Euchromia polymena*, *L.* (Syntomid—moth).	Handpick the larvae ...	Of very minor importance; a black moth with orange and red markings.
			POTATO (*Solanum tuberosum*).		
The tuber-borer.	Nilgiris, Mysore ...	The caterpillar burrows into the tuber and damages it badly in stored tubers.	*Phthorimoea operculella*, Z. (Gelechiad—moth).	It is more a pest of the stored tubers. Only prevention; fumigate or store the tubers in sand. In the case of plants pull out and destroy first attacked plants.	Found both in the field and in the stored tubers. A serious pest sometimes. (Col. Pl. XLIV, S.S.I.)
Leaf-caterpillar.	Shevaroys and Nilgiris.	Defoliates the plant and cuts seedlings.	*Euxoa segetum*, S. (Noctuid—moth).	Handpicking of caterpillars in early stages and trapping by poisoned baits when badly infested.	A stout dark brown caterpillar, generally found as a pest only in the hills and only serious at times. (Fig. 237, S.S.I.)
Epilachna beetle.	Mysore, Nilgiris and Coimbatore.	Defoliates the plants ...	*Epilachna* 12 *punctata*, *E.* 28 *punctata* (Coccinellid beetles).	See under brinjal	Brownish spotted beetles.
Green plant bug.	Shevaroys, Mysore ...	Sucks up sap from tender tissues.	*Nezara viridula*, *L.* (Pentatomid—bug).	Handpick the bugs, eggs and nymphs.	See under cumbu and castor.
Wire-worm ...	Nilgiris	Larva bores into the underground tubers.	*Drasterius sp.* (Elaterid—beetle).	Irrigate water mixed with contact insecticide.	Sometimes serious.

Ground beetles.	Nilgiris and Mysore,	Nibbling roots	*Gonocephalum hoffmanseggi*, St. also *Opatrum sp.* (Tenebrionid—beetles).	Collect beetles	(Fig. 143, S.S.I.)
Leaf-beetle ...	Nilgiris	Cutting holes in foliage.	*Chalaenosoma metallicum*, F. (Halticid—beetle).	Net beetles or dust the plants with arsenate.	Not a serious pest.

MORINGA (*Moringa pterygosperma*).

Hairy caterpillar.	Throughout South India.	Defoliates the plants ...	*Eupterote mollifera* Wlk. (Eupterotid—moth). *Pericallia ricini*, F. (Arctiad—moth).	Burning the swarms of caterpillars with a lighted torch or spray with arsenate.	The caterpillars of Eupterote are often found in thousands resting together on the plant stem; they are hairy and irritating. (Fig. 275, S.S.I.)
Leaf-caterpillar.	Coimbatore, Ceded Districts and Chingleput.	Folds the leaf and feeds from inside.	*Noorda blitealis*, W. (Pyralid—moth). *Actias selene*, H. is also sometimes found.	Handpicking the leaf folds is an easy method for this insect.	Not a very common pest; small greenish caterpillar of a blackish moth. (Fig. 318, S.S.I.)
Stem-borer ...	Coimbatore	Larva bores into stem ...	*Coptops asditicator*, F. (Cerambycid—beetle).	Cutting off first attacked stems and killing beetles when found; using borer solution if necessary.	Only occasionally found.

PUMPKINS, CUCUMBERS, GOURDS, ETC. (*Cucurbitaceae*).

(The insects affecting the different species of cucurbits are more or less the same.)

Pumpkin caterpillar.	Throughout South India.	Caterpillar feeds on the foliage.	*Margaronia indica*, S. (Pyralid—moth).	May be sprayed or dusted with a stomach poison in bad cases; otherwise handpicking of leaf-fold is easy and effective.	A bright green elongated caterpillar with a double white stripe on the body. (Fig. 312, S.S.I.)

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
		VEGETABLES—*cont.*			
		PUMPKINS, CUCUMBERS, GOURDS, ETC. (*Cucurbitaceae*)—cont.			
Pumpkin leaf-beetles.	Throughout South India.	Beetles feed on the foliage.	Aulacophora—three species, *A. foveicollis*, Red, *A. atripennis*, Blue, and *A. stevensi*, Grey (Chrysomelid—beetles).	Collecting by nets. Dusting the plants with a stomach poison in bad cases.	These are active insects and sometimes cause appreciable damage to leaves of gourds, melons and pumpkins. (Figs. 161, 162 and 163, S.S.I.)
Epilachna beetle.	Do.	Beetles and grubs feed on foliage.	*Epilachna* 12 *punctata*, and *E.* 28—*punctata* (Coccinellid-beetles).	Same as that found on brinjal.	See under brinjal above.
Fruit flies ...	Do.	Maggots bore into the fruit pulp and damage the same.	Important species found are *Chaetodacus caudata*, B., *C. cucurbitae*, Coq and *Dacus brevistylus*, *B.* (melon fly.) (Trypetidae—fruit flies).	Prevention. Destruction of badly infested fruits. Spraying of plants with a sweetened poison to kill the flies may also be tried in bad cases.	Often bad on bitter gourds and melons. Found also in mango and other fruits. (Col. Pl. XVI, S.S.I.)
Snake-gourd semi-looper.	Do.	Feed on leaves; young vines often suffer badly.	*Plusia peponis*, F. (Noctuid—moth).	The leaf folds containing the caterpillars and pupae are conspicuous and can be easily handpicked.	A pale green semi-looper caterpillar, more or less confined to the snake gourd plant, rarely found on other cucurbits.
Pumpkin stem-borer.	Northern Circars and Coimbatore.	Grub bores into vines of the plants.	*Apomecyna pertigera* Th. (Cerambycid—beetle).	Preventive method only. Destruction of first attacked vines; also the destruction of adult beetle when found in the field.	Chiefly noted in the Northern Circars on the cucurbit called "*Dondekaya*" in Telugu. (Col. Pl. XI, S.S.I.)
Plant lice ...	All over South India.	Colonies suck plant sap ...	*Aphis malvæ*, K. (Aphidid-bug.)	In bad cases spray contact poison.	Predators often check it.

Bottle gourd plume moth.	Throughout South India.	The slender spiny caterpillar is a leaf eater.	*Sphenarches caffer*, Z. (Pterophorid—moth).	Clipping off infested leaves is an effective method.	Not a serious pest generally, appearance similar to red-gram plume moth. (Fig. 320, S.S.I.)
Snake-gourd weevil.	Tanjore	Attacking shoots and leaves.	*Baris sp.* (Curculionid—beetle).	Collect beetles	Minute black insect, sometimes causing appreciable damage.
Melon gourd weevil.	Ceded Districts ...	Larva and adult found boring into fruits.	*Acythopius citrulli*, M. (Curculionid—beetle).	Destroy badly infested fruits and weevils when found.	A medium—sized black weevil.
Plant bugs ...	Throughout South India.	The active bugs suck the juice from tender portions; sometimes found in swarms.	*Aspongopus janus*, F. and *A. brunneus*, Th. (Pentatomid—bugs).	Collect bugs with net ...	A reddish or greyish brown active insect with a bad smell found on pumpkins generally.
Bitter gourd gall-fly.	Coimbatore	Larva causing elongated galls in tender vines.	*Lasioptera falcata*, Felt. (Cecidomyiad—fly).	Clip off badly galled vines.	Not a serious pest.
		AMARANTHUS (*Amaranthus spp.*).			
Amaranthus weevil.	All over South India.	The grub bores into the shoots, tender portions of the stem and often kills the shoot.	*Lixus brachyrhinus*, B. (Curculionid—beetle).	Being a borer only preventives possible. Cutting off of attacked shoots and killing of the beetle when found on the plants.	Found on wild varieties of amaranthus also. (Fig. 189, S.S.I.)
Leaf caterpillar.	Do.	Caterpillar feeds on foliage.	*Hymenia fascialis*, C. (Pyralid—moth).	Handpicking of early attacked leaves. Netting and destruction of moth which is found in the fields.	Not a bad pest generally. Very common on grasses and other low—growing shrubs. (Fig. 507, S.S.I.)
		CHILLIES (*Capsicum spp.*).			
Chillies thrips.	All over South India, especially in the Guntūr district.	These minute insects suck the juice from shoots and make the tender leaves curl and fade.	*Scirtothrips dorsalis*, Hood (Thripidae—thrips).	Spraying with tobacco washes and dust with tobacco even in the nurseries to prevent multiplication.	Often a serious pest and found in company with plant—lice—a virus disease? (Thys. Mem. p. 251.)

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			VEGETABLES—*cont.*		
			CHILLIES (*Capsicum spp.*)—cont.		
Leaf caterpillar.	Northern Circars and Coimbatore.	Feeds on the leaves ...	*Laphygma exigua*, H. (Noctuid—moth).	Net the caterpillars if in numbers; dust arsenates if serious.	Occasional pest.
Chafer beetle.	Guntūr	Larvae attack roots of young plants.	*Cockchafer* (Melolonthid—beetle), not named.	Flood soil with insecticide mixed with water.	A local pest.
Stem-borer ...	Coimbatore and Northern Circars.	Caterpillar bores into stem.	*Euzophera perticella*, R. (Pyralid—moth).	See under brinjal	Not very common on chillies.
			ELEPHANT-FOOT YAM (*Typhonium sp.*).		
Leaf beetle ...	Malabar and Gōdāvari.	Larvae and adults feed on the leaves, the former gregariously.	*Galerucida bicolor*, H. (Chrysomelid—beetle).	Collect leaves containing larvae and net beetles.	Local pest; at times serious.
Sphinx caterpillar.	Coimbatore	Feeding on foliage ...	*Hippotion celerio*, L. (Sphingid—moth).	The stout caterpillars can be easily handpicked.	Found on grape vine also.
			COLOCASIA (*Colocasia spp.*).		
White spotted beetle.	Coimbatore and Northern Circars.	The beetle bites holes on the foliage and feeds on the same.	*Monolepta signata*, Ol. (Chrysomelid—beetle).	Netting the beetles will be found effective.	Fig. 159, S.S.I.
Tobacco caterpillar.	Tanjore, Coimbatore and Malabar.	Feeds on the leaves ...	*Prodenia litura*, F. (Noctuid—moth).	Same one found on castor...	See under castor, tobacco, etc.
Striped wing thrips.	Northern Circars and Tanjore.	Numerous adults and larvae suck up sap from foliage.	*Heliothrips indicus*, B. (Thripidae—thrips).	In bad cases spray with tobacco decoction.	A minor pest only; some one found on groundnuts.
Sphinx caterpillar.	Coimbatore, Malabar, Tinnévelly and Tanjore.	Feeding on leaves ...	*Hippotion oldenlandiæ*, F. (Sphingid—moth).	Caterpillars can be easily handpicked.	The adult is a stout greyish brown moth.

Curry-leaf Plant (*Murrayia koenigi*).

Citrus butterfly.	All over South India.	Caterpillar feeds on leaves.	*Papilio demoleus*, L. (Papilionid—butterfly).	Eggs, caterpillars and pupae which are conspicuous on the plants can be collected and destroyed. The butterfly which is easily recognized can also be netted.	See under citrus plants on which the insect is a serious pest sometimes.
Shoot bug ...	Coimbatore and Malabar.	Minute insects infest tender shoots and leaves and suck the juice.	*Diaphorina citri*, Kuw (Psyllid—bug).	Clipping of attacked shoots and spraying of tobacco decoction.	Very small insects; sometimes do appreciable damage.

Onions and Garlic.

Thrips ...	Coimbatore, Mysore, Ceded Districts, and South Arcot.	Covering foliage and making the plants blighted; often serious.	*Thrips tabaci*, L., *Heliothrips indicus*, B. (Thripidae—thrips).	Spray with tobacco washes in the early stages.	*Thrips tabaci* is a minute yellowish insect found in thousands in bad attacks; the other is not so commonly found. (Thys. Mem., p. 265.)
Leaf caterpillar.	Coimbatore, Ceded Districts, and Northern Circars.	Feeding on the foliage ...	*Laphygma exigua*, H. (Noctuid—moth).	See under chillies	Occasionally serious.

Tomato (*Lycopersicum esculentum*).

Tobacco caterpillar.	All over the province.	Caterpillar feeds on leaves and bores into fruits.	*Prodenia litura*, F. (Noctuid—moth).	Same as on castor. Attacked fruits to be plucked and the worms hand-picked. (See under castor).	Sometimes found together with the gram caterpillar (*Heliothis*) boring into tomato fruits.
Epilachna beetles.	Do.	Grubs and beetles feed on the foliage.	*Epilachna* 12 *punctata*, M., *E.* 28 *punctata*, F. (Coccinellid—beetles).	Same as on brinjal	Sometimes bad on tomato.
Mealy bugs ...	Do.	Millions of these small creatures cover the plants and suck the juice.	*Pseudococcus virgatus*, F. (Coccid—mealy bug).	Removal of first attacked plants or spraying with crude oil or fish oil emulsion.	Whole plants are often covered with colonies of these white cottony insects. (Cocc. Bull. Pl. XXI-2.)
Eel worms ...	Coimbatore	Attacking roots and killing plants.	*Heterodera radicicola* (Nematode—Eel worms).	Destroy first attacked plants and try strong manures.	*Not insect.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
		VEGETABLES—*cont.*			
		CABBAGE, CAULIFLOWER, RADISH, MUSTARD, ETC. (*Cruciferae*).			
		(The insects affecting these Cruciferae are more or less similar.)			
Cabbage borer.	On the hills, Coimbatore, and Mysore.	Caterpillar bores into the cabbage and also into the stem.	*Hellula undalis*, Fb. (Pyralid—moth).	Being a borer preventive methods more effective. Destroying or plucking off early attacked plants.	A greyish brown caterpillar. (Fig. 314, S.S.I.)
Mustard leaf-webber.	Coimbatore, Mysore, Ceded Districts, and Gōdāvari.	Caterpillar feeds on leaf and webs together the foliage.	*Crocidolomia binotalis*, Z. (Pyralid—moth).	Prevention by handpicking or destroying first attacked plants in early stages or use naphthalene emulsion.	Elongated greenish caterpillar found often bad on mustard and radish. (Fig. 313, S.S.I.)
Diamond back moth.	On the hills and elevated places generally.	The slender caterpillar feeds on cabbage, cauliflower, etc.	*Plutella maculipennis*, C. (Plutellid—moth).	Handpicking and destruction of attacked plants in early stages. Naphthalene emulsion may be employed in bad cases.	The caterpillar is a very slender pale green one and the moth has a diamond mark on its wings; hence the name. (Fig. 340, S.S.I.)
Flea beetle ...	Coimbatore	Cuts holes on the foliage.	*Phyllotreta downsei*, B. (Halticid—beetle).	Net the beetles or dust powdered tobacco on plants.	Minute bluish black beetle.
Mustard saw-fly.	On the hills, Gōdāvari delta, Mysore, Bellary, and Coimbatore during the cold weather.	The black worm like grub is a defoliator on all Cruciferae.	*Athalia proxima*, Kl. (Tenthredinidae—saw-fly.)	Same remedy as for the diamond-back moth, but handpicking is easier in this case.	This is the only wasp pest of any cultivated crop in South India. (Pl. II, Figs. 12 and 13, S.S.I.)

Cutworms ...	Hills, Mysore ...	Feeding on foliage ...	*Euxoa segetum*, Sch., Other cutworms such as *Agrotis C-nigrum*, L., are also found (Noctuid—moths).	Trap them with baits ...	Sometimes bad on the hills.
Cabbage bugs.	Throughout the province.	Suck up nutrition from tender parts of plants.	*Bagrada picta*, F. (Pentatomid—bug).	By handpicking and netting this pest can be easily checked.	Flattish red and black-spotted bug. (Col. Pl. II, Fig. 10, S.S.I.)
Thrips... ...	Ceded Districts and Coimbatore.	In colonies; sucks up the juice affects the growth of the plant badly.	*Thrips tabaci*, L. (Thripidae—thrips).	See under onion	Not so serious as on onions.

FRUIT PLANTS.

MANGO (*Mangifera indica*).

Mango hopper.	Northern Circars, Salem, Mysore, Chittoor, etc.	The insects suck up the juice from the flower heads and make them drop.	*Idiocerus niveosparsus*, L., is the commonest; other two sometimes found are *I. clypealis*, L., and *I. atkinsoni*, L. (Jassid—bugs).	Spraying infested trees with Fish oil soap or crude oil emulsion three or four times at intervals of a week or ten days during the flowering season.	Number of these small active insects attack mango flower shoots during the cold weather and do considerable damage in certain years; called "*Honey dew*" disease of mango. (Fig. 384, S.S.I.)
Mango stem-borer.	All over South India.	The stout grub bores into the stem and often kills branches and stem.	*Batocera rubus*, L. (Cerambycid—beetle). Sometimes *Arbela tetronis*, M. (Zeuzerid—moth) also attacks mango stem.	Remove the grubs with a hooked wire; if impossible syringe into the bore a mixture of chloroform and creosote; this will kill the borer inside and will not affect the tree.	The beetle and grub are large-sized creatures, the former has long feelers and a hard body. (Fig. 179, S.S.I.)
Fruit flies ...	Do.	The white wriggling maggots burrow into the fruit pulp and spoil the fruits.	*Chaetodacus incisus*, W. and *C. ferrugineus*, Fb., appear to be the commonest of the species found in S. India.	Destroy infested and fallen fruits and spray foliage with sweetened poison to kill flies.	A serious pest of mango fruits almost every year. (Pl. XVI, S.S.I.)

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
		FRUIT PLANTS—*cont.*			
		MANGO (*Mangifera indica*)—cont.			
Leaf caterpillars.	In different parts of the province.	Feeding on leaves exposed, rolling leaves from inside of webbing of leaves and shoots or by mining into leaf tissue and shoots.	Numerous species have been noted; the following are the chief:—Slug caterpillar, *Parasa lepida*, C. (Limacodid—moth). Tussock caterpillar, *Euproctis scintillans*, W. (Lymantrid—moth), Shoot webber, *Orthaga exvinacea*, M. (Noctuid—moth), Shoot webber and borer, *Chlumetia transversa* (Pyralid—moth), Leaf eater, *Bombotelia jocosatrix*, G. (Noctuid—moth), Leaf miner, *Acrocercops syngramma*, M. (Gracillarid—moth), Leaf eater, *Euthalia garuda*, M. (Nymphalid—butterfly).	Caterpillars may be hand-picked, the webbings and bored shoots clipped and in bad cases a stomach insecticide may be used.	Some of these only occasionally become serious and can be easily checked.
Leaf weevils...	Northern Circars, Chittoor, Chingleput, South Kanara, etc.	Different kinds feeding on the foliage either openly or in folds or the grubs of some mine into leaves.	*Apoderus tranquebaricus*, F. (leaf-twister), *Eugnamptus marginatus* (leaf-tip cutter), *Rhynchaenus mangiferae* (leaf-miner) (all Curculionid beetles).	Same remedy as for leaf caterpillars. The beetles may be jerked and destroyed over a pan of water and kerosene or leaf folds collected and destroyed.	Harmful to tender foliage. They are rarely serious. (Figs. 193, 186 and 192, S.S.I.)
Nut weevil ...	Salem, Coimbatore, Bangalore and Chittoor.	The weevil developing inside the nuts and sometimes damaging pulp.	*Cryptorhynchus mangiferae*, Fb. (Curculionid—beetle).	Destruction of beetles when found and proper disposal of mango nuts after use of fruit.	Affects some special varieties of fruits badly. (Fig. 200, S.S.I.)
Mango jewel beetle.	Vizagapatam and Coorg.	Larva sometimes bores into stem.	*Belinota prasina*, Th. (Buprestid-beetle).	Same as for the other stem-borer on mango. (See above).	A shining bluish black beetle. Not commonly seen.

Scales and mealy bugs.	Coimbatore, Vizagapatam, Bangalore, Salem and Chittoor.	Colonies of these cover shoots, leaves and fruits and suck up sap.	Many species are found, the following being important.—*Chionaspis vitis*, Gr. *Phenacoccus mangiferae*, *P. iceryoides*, Gr. *Pulvinaria psidii*, M., *Lecanium adersi*, N. (Coccid-scales and mealy bugs).	Prune badly infested branches and spray with contact insecticides.	The mealy bugs sometimes cause serious damage. In many cases of injury by these insects ants are found visiting the infested leaves. For figures see Cocc. Bull. Pl. VI (1), Pl. XXIV, Pl. XXV and Pl. XII (1).
Shoot bugs ...	South Kanara and Malabar.	Numbers settle on tender shoots and suck up sap.	*Coptosoma nazirae*, A. (Pentatomid-bug).	Collect the bugs by hand or nets.	A minor pest on very young plants.
Red ant ...	West Coast tracts chiefly.	Builds nests on mango and other fruit trees and prevents men going up the trees.	*Oecophylla smaragdina* Fb. (Formicoid-ant).	Burn nests with torches ...	Fig. 114, S.S.I.
			CITRUS (*Oranges, Lemons, Pomelos, etc.*)		
Citrus butterfly.	All over South India.	The caterpillar defoliates the plants often seriously.	*Papilio demoleus*, L. Another closely allied species, *P. polytes*, L. is also found with this butterfly.	Eggs, larvae and pupae are very conspicious on plants and can be easily hand-picked; in bad cases infested plants may be sprayed with stomach poison. The butterfly can also be netted.	See under "Curry-leaf plant" above. (Col. Pl. XXV, S.S.I.)
The fruit moth.	Northern and Circars Ceded Districts.	The moth pierces the fruits and makes them rot and drop down.	*Ophideres fullonica*, L. Allied species noted as a similar pest is *O. materna*, L. (Noctuid—moths).	Moths may be caught by sugary traps. Valuable fruits may be protected by cloth or wicker covering to keep off moths. Deterrents may also be sprayed to keep off moths from fruits.	Only example of the adult insect doing damage among the Lepidoptera; often a very serious pest.
Shoot and stem-borer.	Ceded Districts and Northern Circars.	Caterpillar bores into top shoots and stems showing galleries outside.	*Arbela tetraonis*, M. (Arbelid—moth).	Clipping attacked shoots and syringing as in mango stem-borer above.	Found as a bark or shoot-borer on different trees; the tubular gallery is seen outside on the tree stem.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			FRUIT PLANTS—*cont.*		
			CITRUS (*Oranges, Lemons, Pomelos, etc.*)—cont.		
Fruit flies ...	Nilgiris	Larvæ breed inside fruits.	*Chaetodacus spp.* (Trypetid—fly).	Trap flies by bait and destroy first attacked fruits.	Fruit flies on citrus are rare in South India so far.
Stem borer beetle.	Coorg, Mysore and Salem.	The beetle grub has the same habit as the mango stem borer.	*Chloridolum alcmene*, T. Sometimes also another very similar beetle. *Chelidonium cinctum*, G. (Cerambycid-beetles).	Same remedies to be employed as in the case of the mango stem-borer above.	The beetles are shining blue in colour, with long feelers. (Fig. 177, S.S.I.)
Citrus leaf miner.	All over South India.	The small caterpillar mines into the leaf-tissue and makes the leaf curl and fade.	*Phyllocnistis citrella*, S. (Lyonetiad—moth).	Picking off early attacked leaves; difficult to check when badly infested.	Sometimes all the leaves of the plant are found mined and curled up. (Fig. 341, S.S.I.)
Psyllid ...	Coimbatore	Swarm on the tender shoots and suck sap.	*Diaphorina citri*, K. (Psyllid—bug).	Collect adults and spray with contact insecticide.	Feeds also on Murrayia plant.
Plant lice ...	Coimbatore and Northern Circars.	Colonies of these dark insects cover young shoots and suck the juice.	*Aphis tavaresi*, D.G. (Aphidid—bug).	Clipping badly infested shoots and spraying with Crude oil emulsion or fish oil soap.	Sometimes a bad pest found covering all the tender shoots of a plant.
Shoot cricket.	Mysore	Cutting tender shoots ...	*Brachytrypes portentosus*, L. (Gryllid—cricket).	Trap them with baits and catch when seen.	(Fig. 430, S.S.I.) Known to injure Casuarina seedlings in Nellore.
Shoot butterfly.	Northern Circars and Coimbatore.	Small caterpillar found on tender shoots and leaves.	*Chilades laius*, C. (Lycænid—butterfly).	Clip infested leaves and collect butterflies with net.	A minor pest.

Orange thrips.	**Mysore and Nilgiris.**	On one occasion found covering and discoloring leaves and fruits badly in Mysore.	*Thrips sp.* One sp. found in small numbers in orange flowers on the Nilgiris is described by the author in his memoir as *Thrips nilgiriensis*, R.	Spray tobacco decoction early in the season.	The writer has not seen this insect noted from Mysore.
Leaf folder ...	In all tracts	Caterpillar folds the tender leaves.	*Tonica zizyphi*, St. (Oecophorid—moth).	Clip the folds	A minor pest. (Fig. 335 S.S.I.)
Mealy wings...	Nellore, Northern Circars and Coimbatore.	All stages of the insect infest tender parts and suck sap.	*Aleurocanthus spiniferus*, Qt. *Dialeurodes citri*, A., is also found occasionally) (Aleurodid-bugs).	Clip badly infested parts and spray contact insecticide.	Occasionally serious.
Shoot and fruit-sucking bugs.	Kurnool, Northern Circars and on the hills.	Sucking sap from tender shoots and fruits; the latter sometimes badly damaged.	*Vitellus orientalis*, D. *Cappœa taprobanensis*, D. (Pentatomid-bugs) and *Dasynus antennatus*, Vb. (Corcid-bug).	Collect bugs by hand or nets.	Local minor pests.
Citrus mite ...	Northern Circars and Coimbatore.	Covering leaves and sucking sap.	*Tetranychus hindustanicus*, H.	Spray or dust sulphur ...	*Not an insect.*
Scales, and mealy bugs.	Coimbatore, Northern Circars, Nilgiris, etc.	Colonies cover the tender parts and suck sap.	Scales include chiefly : *Icerya purchasi*, M., *Lepidosaphes becki*, N. *Lecanium viridis*, G. *Pulvinara psidii*, G. *Saissetia hemisphæricum*, T. *Pseudococcus corymbatus*, Gr. and *Parlatoriazizyphus*, L. (Coccid—bugs).	On the Nilgiris. Everywhere especially on the hills.	Prune badly infected shoots and spray contact insecticides. Some of these cause serious damage at times. For fig. see Coco. Bull. Pl. XXXI, XVII, XII and XXII.

GUAVA (*Psidium Guava*).

Mealy scale ...	**All over South India.**	Colonies of the bug cover the leaves, suck the juice, and cover leaves with a sickly mould.	*Pulvinaria psidii*, Gr. (Coccid—mealy bug).	Clip badly infested leaves and spray Crude oil or Fish oil emulsion.	See also under mango and citrus for this insect. See Coco. Bull. Pl. XII.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			FRUIT PLANTS—*cont.*		
			GUAVA (*Psidium Guava*)—*cont.*		
Fruit fly ...	All over South India.	Maggots bore into and damage fruits.	Two or three species chiefly *Chaetodacus incisus*, W. (Trypetid—fly).	As under mango.	
Fruit moth ...	Northern Circars ...	Moths suck the fruits ...	*Ophideres fullonica*, L. (Noctuid—moth).	As under citrus	See under citrus.
Scales... ...	Coimbatore and Malabar.	Cover tender parts and fruits.	*Saissetia hemisphaerica*, T., *Lecanium viride*, Gr. (Coccid—scales).	As for mealy scale	Coce. Bull. Fig. 5, and Pl. XVII, Fig. 2.
			POMEGRANATE (*Punica granatum*).		
Fruit borer butterfly.	All over South India.	The caterpillar bores into the fruits and damages them.	*Virachola isocrates*, F. (Lycaenid—butterfly).	Damaged fruits to be picked off and good-fruits covered with loose muslin or paper bags to prevent attack by the butterfly. The butterfly can also be netted.	The caterpillar is a short dirty brown creature. Attacked fruits show small holes. (Fig. 289, S.S.I.)
Castor seed borer.	Coimbatore	Caterpillar bores into fruit.	*Dichocrocis punctiferalis*, G. (Pyralid—moth).	See under castor	Very rarely found serious.
Leaf caterpillars.	Northern Circars, Coimbatore, etc.	Feed on the foliage ...	*Parasa lepida*, Cr. (Limacodid—moth), *Euproctis fraterna*, M. (Lymantrid—moth), *Achoea janata*, L. (Noctuid—moth).	Handpicking in early stages and spraying with stomach poison in bad attacks.	See under castor for information regarding these insects.
Fruit bug ...	Kurnool	Sucking fruits	*Jurtina indica*, D. (Pentatomid—bug).	Collect bugs by nets ...	A minor pest.

Mealy wing ...	Coimbatore and Mysore.	All stages suck sap from tender parts.	*Siphonimus finitimus*, Silv. (Aleurodid—bug).	Spray with contact insecticide when bad.	Do.
Mealy bug ...	Coimbatore	Covering fruits in numbers and sucking it.	*Pseudococcus lilacinus*, Cock. (Coccid—mealy bug).	Do.	Sometimes bad (Pl. XXIII, Fig. 1—Cocc. Bull.)
Scale	Do.	On stem and shoots ...	*Aspidoproctus cinereus*, G.	Handpick scales and spray contact insecticide.	The insect is a stout giant scale and easily seen. (Cocc. Bull. Pl. XXIX, fig. 2.)
		GRAPE (*Vitis vinifera*).			
Flea beetle ...	Mysore, Salem, Coimbatore and Northern Circars.	The small beetle bites holes into tender leaves; often the foliage is badly eaten up.	*Scelodonta strigicollis*, M. (Chrysomelid—beetle).	Collecting beetles by hand-net and spraying or dusting infested plants with a stomach poison.	A small copper brown active beetle. (Fig. 158, S.S.I.)
Chafer beetles.	Coimbatore, Madras, Mysore and South Kanara.	The beetles come out at night and defoliate the vines often seriously.	Two species chiefly noted are—*Adoretus lasiopygus*, B., and *A. bengalensis*, B. (Rutelid—beetles).	Set up light traps and spray or dust with stomach poison as above.	These small brown beetles often come to light at dusk. (Fig. 127, S.S.I.)
Leaf sphingid.	Coimbatore and Mysore.	Feeding on leaves ...	*Hippotion celerio*, L. (Sphingid-moth).	Handpicking of caterpillars and eggs easy.	Rarely serious.
Leaf roller ...	Coimbatore, Mysore and South Kanara.	Rolls leaves and feeds on the same.	*Sylepta lunalis*, G. (Pyralid—moth).	Handpicking of rolls ...	Occasionally bad.
Leaf miner ...	Coimbatore, Madras, Mysore and South Kanara.	Mines in the leaf... ...	*Phyllocnistis toparcha*, M. (Lyonetiad—moth).	Clip badly infested leaves...	Do.
Grape thrips...	Coimbatore, Madura, Travancore, Mysore, Northern Circars, and Nilgiris.	All stages cover tender foliage and suck sap; sometimes serious.	*Rhipiphorothrips cruentatus*, H. (Thripid—thrips).	Clip badly infested leaves and spray tobacco decoction.	Found on roses also (Fig. 16, Thy. Mem.)
Scales ...	Coimbatore, Mysore, and Salem.	Colonies found sucking juice from shoots and leaves.	*Aspidiotus lataniae*, Sign, *Aspidiotus cydoniae*, C., *Lecanium longulum*, D., *Pulvinaria maxima*, Gr. (Coccid—bugs).	Do.	The leaves and vines are sometimes badly covered with one or more of these scales. (Cocc. Bull. Pl. VIII, fig. 1 and Pl. XIII.)
Vine girdler ...	Mysore and Coimbatore.	Rings the stems and often kills them.	*Sthenias grisator*, Fb. (Cerambycid—beetle).	Not easy to check. Catch beetles when found.	(Fig. 182, S.S.I.)

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
		FRUIT PLANTS—*cont.*			
		GRAPE (*Vitis vinifera*)—cont.			
Ground beetle.	Mysore and Coimbatore.	Found on tender plants.	*Gonocephalum depressum*, Th. (Tenebrionid—beetle).	See under potato ...	See under potato.
Termites ...	Do.	Found on roots and plant cuttings.	*Odontotermes obesus*, R. ? (Termitid—white ant).	See under sugarcane ...	Sometimes serious.
		MELONS.			
		(Chief insects affecting melons are those found on other cucurbitaceae.)			
		FIG. (*Ficus spp.* INCLUDING BANYAN, PEEPUL, ETC.).			
Stem-borer beetle.	Northern Circars and Coimbatore.	The grub burrows into the stem and often kills the shoot.	*Olenecamptus biolobus*, F. (Cerambycid—beetle).	Same remedy as in the case of the mango stem borer beetle.	The beetle is a slender pale white insect with very long feelers.
Leaf caterpillars.	Coimbatore, Bangalore and Trichinopoly.	Feeding on leaves often defoliating whole plant.	*Ocinara varians*, W. (Bombycid—moth) *Perina nuda*, Fb. (Lymantrid—moth) *Hypsa ficus*, Fb. (Hypsid—moth), *Phycodes radiata*, O. (Glyphipterygid—moth), *Margaronia stolalis*, G. (Pyralid-moths) and Glyphodes 2 or 3 spp. and *Plotheia celtis*, M. (Noctuid—moth).	Spray with arsenates in bad attacks of these larvae.	Occasionally serious. A very minor pest.

Scale insects and mealy bugs.	Northern Circars, and Coimbatore, Mysore.	Colonies sometimes cover shoots and fruits and suck up the juice.	*Saissetia oleae*, B., *Aspidiotus cydoniae*, Comst. *Pseudococcus lilacinus*, and *Lecanium ramakrishnæ*, G. Cock. (Coccid—scales and mealy bugs).	Spraying with a contact poison when serious.	See bulletin on Coccidae, Pl. XIV. (3), (Pl. VIII, Fig. 1), Pl. XXIII (1), and Pl. XVI (1).
Thrips ...	Northern Circars and Malabar.	Colonies crowd on tender parts and make leaves, curl.	*Gigantothrips elegans*, Z. (Phloeothripid—thrips).	Clip badly infested shoots and leaves.	A large-sized species of Thrips found on most spp. of ficus. (Fig. 11, Thys. Mem.)

PLANTAIN (*Musa sapientum*).

Stem-borer beetle.	Malabar and Ganjām.	The grub bores into the stem of the plant lower down and often kills the plant.	*Cosmopolites sordidus*, G. (Curculionid—weevil).	Only preventive; completely remove infested banana stump, don't leave stumps after the plantain bunches are cut. Collect beetles when found and destroy.	The insect is a medium sized dark beetle with a prominent snout and the grub pale white. (Fig. 201, S.S.I.)
Tobacco caterpillar.	Malabar, Tanjore and Gōdāvari.	Feeding on leaves ...	*Prodenia litura*, F. (Noctuid—moth).	Cutting off infested leaves will alone be quite effective.	
Other caterpillars.	Northern Circars, Malabar and South Kanara.	Do. ...	*Parasa lepida*, Fb. Slug, (Limacodid—moth) *Pericallia ricini*, F. (Arctiad—moth).	Do.	See Fig. 232 "*Pericallia*" is a black hairy caterpillar.
Lace wing bug.	Northern Circars and Malabar.	Sucking tender foliage ...	*Stephanitis* (*Cadamastus*) *typicus*, D. (Tingidid—bug).	Rarely serious	Minute bugs with lace like wings.
Scale insects.	Nilgiris (Walayar), Gōdāvari, and Tinnevelly.	Sucking tender tissues ...	*Aspidiotus destructor*, Sign, *A. cyanophylli*, S. and *Lecanium descrepans*, Gr. (Coccid—bugs).	Not serious pests generally found on fruits.	See Coco. Bull. Pl. VII, Fig. and Pl. VII, fig. 3.
Spittle insect.	South Kanara, Coorg and Malabar.	Do. ...	*Phymatostetha deschampsi*, L. (Cercopid—bug).	Collect by nets	A black and red insect; rarely a pest though often found in numbers.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			FRUIT PLANTS—*cont.*		
			JAK (*Artocarpus integrifolia*).		
Shoot borer caterpillar.	Gōdāvari, Malabar and South Kanara.	The caterpillar bores into tender shoots and buds.	*Margaronia caesalis*, W. (Pyralid—moth).	Preventive. Clip off and destroy all infested and rotten tender shoots to check spread.	When serious several buds drop. (Fig. 311, S.S.I.)
Jak bud weevil.	Mysore and Malabar.	Grub bores into the tissue of young fruits.	*Ochyromera artocarpi*, M. (Curculionid-weevil).	Same remedy as above; badly infested tender fallen fruits to be collected and destroyed to check spread.	A small grey brown weevil. Not found so far outside the Mysore uplands and West Coast.
Jak aphid ...	Do.	Colonies suck sap from shoots.	*Greenidea artocarpe*, W. (Aphidid-bug.)	Cut badly infested shoots.	
Mealy bugs ...	Nilgiris foothills and Malabar.	Covering soft parts and sucking juice.	*Icerya aegyptiaca*, D. *Pseudococcus corymbatus*, Gr. (Coccid—mealy bug).	Sometimes serious and attended by swarms of ants. Spraying with a contact insecticide.	Pl. I, fig. 4. Cocc. Bull.
Jak spittle insects.	Coorg and Mysore hill tracts.	Sometimes found in numbers and doing appreciable damage.	*Cosmoscrata relata*, Dt. (Cercopid—bug).	One or two other species. *Ptyelus sp.* and *Clovia, lineaticollis* are also found on jak in Malabar.	A minor pest only.
Jak scale ...	Mysore	Covering leaves and twigs in swarms and sucking sap.	*Aspidiotus triglandulosus*, Gr. (Coccid-bug).	Sometimes serious and attended by swarms of ants. Syraying with a contact insecticide.	Minute ashy black scales. Generally clustering along the leaf ribs. (Pl. X, fig. 1, Cocc. Bull).
			BREAD FRUIT TREE (*Artocarpus incisa*).		
Mealy bugs ...	West Coast	Covering tender shoots and sucking sap.	*Icerya aegyptiaca*, D. (Coccid—bug).	Sometimes serious and attended by swarms of ants. Spraying with a contact insecticide.	Sometimes bad covering shoots in white masses. Pl. I, fig. 4 Cocc. Bull.

Tamarind (*Tamarindus indicus*).

Scale insects...	Coimbatore, South Arcot, Tinnevelly and Mysore.	Colonies cover fruits and leaves and suck up sap; fruits suffer badly.	*Aspidiotus orientalis*, N. *A. tamarindi*, G. (Coccid—scales).	Prune heavily infested parts and spray with contact insecticide.	*A. tamarindi* has been noted chiefly in Coimbatore, see Pl. VIII (2). Coco. Bull.
Mealy bugs ...	Coimbatore	White masses cover fruits and leaves.	*Pseudococcus lilacinus*, C. (Coccid—mealy bug).	Do.	(See Pl. XXIII, fig. 1, Coco. Bull).
Crab caterpillar.	Do.	Feeding on shoots and leaves.	*Stauropus alternus*, W. (Notodontid—moth).	Handpick the caterpillars.	Occasionally bad. See under redgram.
Bag worms ...	Do.	Do.	Not named (Psychid—moth).	Pick off the bags containing the larvæ or poison leaves with arsenate.	Sometimes sporadic.

Wood-apple (*Feronia elephantum*).

Slug caterpillar.	Coimbatore, Mysore and South Arcot.	Feeding on leaves ...	*Parasa lepida*. Cr. (Limacodid-moth).	See under castor	Occasionally serious.
Fruit borer ...	Coimbatore	Larvae bore into fruit and feed on contents.	*Euzophera plumbei fasciella*, H. (Pyralid—moth).	Destroy first attacked fruits.	Rarely serious.

Nelli (*Phyllanthus emblica*) Gooseberry?

Fruit bug ...	Northern Circars ...	Sucking fruits	*Scutellera nobilis*, F. (Pentatomid—bug).	Handpick or net the bugs and nymphs.	Noted as a local pest only.
Mealy bug ...	Madras and South Arcot.	Covering shoots and leaves in white masses.	*Pseudococcus sp.* (Coccid—mealy bug).	Prune badly infested parts and spray contact insecticide.	Sometimes a mealy-wing is also seen on the leaves.
Leaf roller ...	Madras and Malabar.	The small caterpillar feeding inside leaf rolls.	Not named. (Microlepidoptera).	Clip rolled leaves	A minor pest.

Eugenia (*Eugenia jambulana*).

Leaf caterpillar.	Mysore and Coimbatore.	Feeding on foliage ...	*Carea subtilis*, W. (Noctuid—moth).	Collect caterpillars by hand.	Rarely serious. Caterpillar has the anterior part of the body conspicuously swollen.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			FRUIT PLANTS—*cont.*		
			EUGENIA (*Eugenia jambulana*)—cont.		
Fruit-fly ...	Ceded Districts, Northen Circars and Coimbatore.	Maggots burrow into fruit pulp.	*Bactrocera correctus* in Godavari. (Trypaenid—fly).	Destroy badly infested fruits.	Sometimes bad.
Mealy wings...	Northern Circars, Coimbatore and Mysore.	Colonies cover shoots and tender leaves and suck sap.	*Dialeurodes eugeniae*, M. (Aleurodid—bug). Sometimes a Psyllid (*Trioza sp.*) is also noted on Eugenia.	Clip badly infested shoots and if necessary spray with contact insecticide.	A minor pest.
			JUJUB (*Zizyphus jujuba*).		
Fruit borer ...	Ceded Districts, Coimbatore and Mysore.	The reddish caterpillar bores into the fruit pulp.	*Meridarchis scyrodes*, M. (Carposinid—moth).	Same remedy as for fruit flies on mango, pumpkin. etc., see above.	The fruit fly maggot and this reddish caterpillar are often found together.
Fruit-fly ...	Do.	The maggot burrows into the pulp of the fruit.	*Carpomyia vesuviana*, B. (Trypetid—fly).	Same remedy as for the fruit borer above.	This fruit fly is different from all others noted before. It is confined to this plant in Southern India. It is smaller in size also.
Hairy caterpillar.	Coimbatore	Swarms of caterpillars feed on the foliage.	*Thiacidas postica*, W. (Lymantrid—moth.)	Prune badly infested branches and spray arsenate.	Sometimes bad.
Leaf butterfly.	All over Southern India.	The small fleshy larva feeds on the foliage.	*Tarucus theophrastus*, F. (Lycaenid—butterfly).	Rarely bad	Ants visit these caterpillars.
Leaf weevil ...	Coimbatore	Feeding on foliage ...	*Myllocerus transmarinus*, Hb (Curculionid—weevil).	Shake the branches when the beetles will drop and then collect and destroy them.	Fairly large beetle.

Leaf hispid ...	Do. ...	Larvae and adults feed on the foliage.	*Platypria andrewesi*, W. (Hispid—beetle).	Shake the branches when the beetles will drop and collect leaves containing the larvæ.	Small spiny beetle.
Scale insects...	Bellary and Coimbatore.	Colonies cover leaves and shoots and suck sap.	*Ceroplastodes cajani*, M. *Pulvinaria maxima*, Gr. (Coccid—scale insects).	Prune badly infested shoots and spray contact insecticide.	Sometimes bad for (figures Pl. XV-2 and Pl. XIII, Coco. Bull).

CUSTARD APPLE (*Anona squamosa*).

Mealy bug ...	Coimbatore, South Arcot, Malabar and Anantapur.	Colonies cover the tender portion and suck sap.	*Pseudococcus virgatus*, C., *P. lilacinus*, C. (Coccid—mealy bugs).	Spray with contact insecticides after pruning the badly infested parts.	Sometimes very serious covering whole fruits and stalks.
Fruit borer ...	All over Southern India.	Caterpillar bores into the fruits.	*Heterographis bengalella*, R. (Pyralid—moth).	Destroy first attacked fruits.	A minor pest.
Fruit-fly ...	Coimbatore and Anantapur.	Maggots bore into fruits.	*Bactrocera persicae*, B. (Trypetid—fruit-fly).	Do.	Sometimes bad.

COUNTRY ALMOND (*Terminalia catoppa*).

Leaf beetle ...	Throughout Southern India.	The leaves are twisted by the creature into knots and the larvae develop in these.	*Apoderus tranquebaricus*, F. (Curculionid—beetle).	Clip off the knotted and twisted leaves and kill beetles when found.	Occasionally numerous, but easily checked.
Scales ...	Coimbatore, Mysore and South Arcot.	Colonies of young and adult cover tender parts and suck plant sap.	*Saissetia nigra*, N., and *S. hemisphaerica*, T. (Coccid—scales).	Prune badly infested parts and spray contact insecticide.	Sometimes bad.
Thrips ...	Coimbatore and Malabar.	Colonies cover tender parts and suck up sap.	*Rhipiphorothrips cruentatus*, H. (Thripidae—thrips).	Prune badly infested leaves.	A minor pest found on grape and rose also. Thy. Mem. p. 252 and fig. 16.

CASHEW (*Anacardium occidentale*).

Thrips ...	Malabar	Cover foliage and shoots and blighten the surface.	*Selenothrips rubrocinctus*, G. Thripidae—thrips).	Clip badly infested parts and spray with tobacco decoction.	Sometimes a serious pest. Attacks cacao.
Leaf caterpillar.	Do.	Feeding on foliage ...	*Cricula trifenestrata*, H. (Saturnid—moth).	Spray with arsenate if bad.	A big brown moth found on pepper leaf also.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			FRUIT PLANTS—*cont.*		
			CASHEW (*Anacardium occidentale*)—*cont.*		
Leaf capsid ...	Cochin, Malabar ...	Sucking sap from tender parts.	*Helopeltid antonii*, S. (Capsid—bug).	Net bugs when found ...	Attacks tea.
Shoot weevil...	South Kanara, Mysore.	Feeding on shoots and buds.	*Apion amplum*, F. (Curculionid—weevil).	May be easily handpicked and netted.	Small dark insect.
Scale insects ...	Do.	Covering tender parts and sucking sap.	*Ceroplastes floridensis*, C. (Coccid—bug).	Clip leaves with the scales.	Waxy oval scales easily seen. Coco. Bull., p. 40.
			SAPOTA (*Achras sapota*).		
Leaf hoppers.	Northern Circars ...	As on mango	*Idiocerus niveosparsus*, and allied spp. (Jassid—bugs).	See under mango	Not so serious as on mango.
Mealy bugs ...	Do. ...	Covering shoots and stalks and sucking sap.	*Phenacoccus iceryoides*, Gr., *Pseudococcus lilacinus*, F. (Coccid—bugs).	Prune badly infested shoots and spray with contact insecticides.	Occasionally serious. Cocc Bull., Pl. XXV and XXIII.
			PINE APPLE (*Ananas sativus*).		
Mealy bug ...	North Malabar ...	Colonies of small white reddish insects suck the juice from the fruits.	*Pseudococcus bromeliae*, B. (Coccid—mealy bug).	Destroy badly infested apples.	Rather new to India.
			MULBERRY (*Morus sp.*).		
Stem girdler.	Coimbatore	Beetle rings the stem and often kills it.	*Sthenias grisator*, F. (Cerambycid—beetle).	Destroy infested stems and Kill beetles when found.	See under grape.

Bael or Bilwa (*Aegle marmelos*).

Leaf beetle ...	Coimbatore and Malabar.	Grubs and beetles defoliate plants often badly.	*Clitea indica*, J. (Chrysomelid—beetle).	Clip leaves containing gregariously feeding grubs and if necessary dust or spray arsenate.	A small dark shining beetle with orange-yellow grubs.
Scale insects.	Do.	Colonies cover leaves and suck up sap.	*Lecanium viride*, Gr. (Coccid—scale).	Prune badly infested shoots and spray contact poison if necessary.	See under citrus, coffee (Plate XVII, Fig. 2, Coccid bulletin.)

Apples, Pears and allied fruits (*Pyrus spp.*).

Wooly blight.	Nilgiris, Shevaroys and Mysore.	Colonies of these small insects attack the roots and stem and cause galls.	*Eriosoma lanigera*, H. (Aphidid—bug).	Remove and destroy badly infested parts and spray the plants.	An introduced pest found only on the hills so far; very bad sometimes. (Fig. 389, S.S.I.).
Plant-lice ...	Nilgiris and Shevaroys.	Colonies cover shoots and suck plant sap.	*Dilachnus krishni*, G. (Aphidid—bug).	Spray contact insecticide.	Sometimes bad.
Leaf weevil ...	Mysore	Feeding on foliage ...	*Myllocerus subfasciatus*, G. (Curculionid—beetle).	Handpick or net beetles ...	Not very serious generally.
Scales ...	Do.	Colonies suck sap ...	*Aspidiotus cydoniae*, C. (Coccid—scales).	Prune badly infested shoots and spray contact insecticide.	Also found on Fig. (Plate VIII (1), Cocc. Bull.)

Peach, Plum (*Prunus spp.*).

Fruit flies ...	Nilgiris	Maggots bore into fruits.	Chiefly the species—*Chaetodacus ferrugineus*, F. (Trypaenid—fly).	Destroy first attacked fruits and trap flies by poisoned syrup spray.	Bad on the Nilgiris fruit farms. See under mango, guava, etc.

DYES, DRUGS, SPICES, NARCOTICS, Etc.

Indigo (*Indigofera arrecta*).

Leaf weevil ...	Ceded Districts, Tinnevelly, South Arcot, Coimbatore.	The weevil and grubs feed and breed on the tender shoots.	*Alcides bubo*, F. (Curculionid—beetle).	Beetles may be collected and infested shoots pruned.	Attacks agathi and cluster beans.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
DYES, DRUGS, SPICES, NARCOTICS, ETC.—*cont.*					
INDIGO (*Indigofera arrecta*)—*cont.*					
Indigo psylla.	Ceded Districts, Tinnevelly, South Arcot, Coimbatore.	The small insects suck the juice in numbers and make the shoots and leaves curl and fade.	*Arytaina punctipennis*, Cr. = (*P. isitis*, B.) (Psyllid—bug).	Spray contact insecticide when bad.	Pl. XLVII, S.S.I.
Leaf caterpillars.	Do. ...	Feed on the leaves ...	More than one species noted; chief are—*Laphygma exigua*, H., *Plusia orichalcea*, F. (Noctuid—moths) *Dichomeres ianthes*, M. (Gelechiad—moth).	Handpick caterpillars or spray arsenate if pest is bad.	These are not commonly serious in South India.
NUNA (*Morinda tinctoria*).					
Scales ...	Coimbatore	Cover leaves and cause blight.	*Aspidiotus orientalis*, N., *Lecanium viride*, S. *Pulvinaria psidii*, M. (Coccid—bugs).	Cut badly infested branches and spray contact insecticide.	Sometimes the scales do severe damage. Coco. Bull., Pl. XII (1).
Shoot beetle...	Do.	Larvae bore into shoots and kill them.	*Hypothenemus plumeriae*, N. (Scolytid—beetle).	Prune infested shoots ...	During certain seasons numerous shoots are found dry and drooping due to the attack of this insect.
Sphinx caterpillars.	Do.	Feed on the leaves ...	*Macroglossa vialis*, B. and other *spp.*; also *Rhopalopsyche bifasciata*, B. (Sphingid—moths).	Handpick larvae which are stout and conspicuous.	Pretty and active moths.

Turmeric (*Curcuma longa*) and Arrow-root.

Shoot borer ...	All over South India.	The caterpillar bores into the growing shoot and often kills it.	*Dichocrocis punctiferalis*, G. (*Pyralid*—moth).	Only prevention. Destruction of attacked shoots. Same as the insect attacking castor seed capsules.	See under "castor" above.
Turmeric butterfly.	Do. ...	The caterpillar feeds on the leaves often inside folds.	*Udaspes folus*, Cr. (Hesperiad—butterfly).	Handpicking of the caterpillars and pupae inside leaf folds very easy and effective. The butterflies can also be netted and destroyed.	A stout greenish caterpillar with dark head; butterfly is white and black spotted. (Fig. 295, S.S.I.)
Scale	Salem	Colonies of the scale cover the underground haulms and makes them fade.	*Aspidiotus hartii*, C. (Coccid—scale).	Mix irrigation water with contact insecticide; use insect-free seeds.	Sometimes serious.
Lace-wing bug.	All over South India.	Colonies of these small insects suck the juice from the leaves.	*Stephanitis typicus*, D. (Tingidid—bug).	Handpicking of leaves containing colonies, or in bad attacks spray leaves with a very dilute solution of crude oil emulsion.	Very small insects found in colonies on the back of the infested leaves. Same kind of insects as brinjal lace-wing bug noted under brinjal. (Fig. 369, S.S.I.)
Thrips ...	Chittoor, Malabar, Cuddapah and Travancore.	Swarm on tender parts and suck sap.	*Panchaetothrips indicus*, B. (Thripid—thrips).	Net the creatures and spray with tobacco washes if necessary.	Active little insects sometimes found in numbers. Fig. 23. Thys. Mem.

Ginger (*Zingiber officinalis*).

Shoot borer ...	Malabar	Larva bores into shoot and often kills it.	*Dichocrocis punctiferalis* G. (Pyralid—moth)	As in turmeric	See under turmeric and castor.
Fly	Do.	Maggot found in rotting ginger.	Two species are noted: *Calobata sp.* (Micropesid—fly), *Formosina flavipes*, M. (Chloropid.—fly).	Destroy first attacked plants with the maggots.	Found also on turmeric; status doubtful.

Cummins, Coriander, Aniseed, etc.

Leaf caterpillar.	Coimbatore and Northern Circars.	Feeding on leaves and tender buds.	*Laphygma exigua*, H. (Noctuid—moth).	Same as noted on onion ...	See under "onion" above.
Flower-head bug.	Northern Circars ...	Sucking the juice from flower buds.	*Agonoscelis nubila*, F. (Pentatomid—bug).	Checked easily by netting the insects.	Not serious generally. (Fig. 351, S.S.I.)

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
DYES, DRUGS, SPICES, NARCOTICS, ETC.—*cont.*					
PEPPER (*Piper nigrum*).					
Flea beetle ...	Malabar	The small grub of the beetle bores into the green pepper berry.	*Longitarsus nigripennis*, M. (Chrysomelid—beetle).	Spraying of some deterrent which will keep away the beetle.	A small red and black insect found scraping leaves and berries of pepper.
Scales ...	Malabar and Travancore.	Scales suck the juice from the vine and shoots and are found in thousands on the vines.	*Lepidosaphes piperis*, G., *Pinnaspis aspidistroe*, S. (Coccid—Scales).	Removal of badly infested vines and in bad cases spray with a strong contact poison like "resin compound".	Colonies of these small boat-shaped scales sometimes completely cover the pepper vines and leaves killing them in some cases. (Fig. 1, Cocc. Bull.)
Mealy bug ...	Malabar	White masses of these insects sometimes cover leaves and shoots.	*Pseudococcus virgatus*, C. (Coccid—mealy bug).	Prune and spray with contact washes.	See under tomato, custard apples, etc. Pl. XXI (2). Cocc. Bull.
Leaf caterpillar.	Do.	Feeding on foliage; does not damage pepper as it does the standard on which pepper twines.	*Cricula trifenestrata*, H. (Saturnid—moth).	See under cashew	Often heavily parasitised.
BETEL VINE (*Piper betel*).					
Betel-vine bug.	South Kanara, Bellary and Kurnool.	The bugs suck the juice from tender leaves which curl up and fade.	*Disphinctus politus*, W. (Capsid—bug).	No effective remedy known; in the early stages the first attacked leaves which may contain eggs may be clipped off to prevent spread; if possible the bugs found flying may be netted or caught by sticky boards.	Belongs to the same group as the cholam ear-head bug but is reddish brown in colour. (Fig. 375, S.S.I.)

Cardamom (*Elettaria cardamomum*).

Stem borer ...	Hill tracts along the Western Ghats.	Larva boring into stem and often killing it.	*Dichocrocis punctiferalis*, G. (Pyralid—moth).	See under turmeric and ginger.	A minor pest.
Capsule borer.	Coorg	Beetle boring and destroying capsules.	Scolytid beetle ...	Collection and destruction of first attacked capsules. No other method known so far.	A minute dark brown beetle (Fig. 203, S.S.I.)

Cinnamon (*Cinnamomum zeylanicum*).

Leaf psyllid ...	South Kanara ...	Larvae and adults causing galls in shoots and leaves and sucking sap.	*Pauropsylla depressa*, C. (Psyllid—bug).	Clip galled leaves and shoots.	Commonly noted.

Coffee (*Coffea arabica*).

White borer ...	Nilgiris, Coorg, Mysore, South Kanara.	The white grub bores into the stem and kills it often.	*Xylotrechus quadripes*, Ch. (Cerambycid—beetle).	Pruning of dead and dying shoots and scrubbing the bushes to remove loose bark to prevent egglaying.	A black and white-spotted beetle with long feelers. (Fig. 178, S.S.I.) A serious pest of coffee.
Red borer ...	In different parts of the South Indian hill districts.	Red caterpillar bores into the shoot and stem.	*Zeuzera coffeae*, N. (Zeuzerid—moth).	The branches containing the borer may be lopped off as they are easily located.	Not a common pest of coffee. (Fig. 323, S.S.I.)
Mealy bug ...	Do.	Colonies of these attack the roots of the coffee seedlings.	*Pseudococcus citri*, R. (Coccid—mealy bug).	The soil may be irrigated with water mixed with crude oil emulsion.	(Pl. XX, Fig. 2, Coccid Bulletin.)
Green bug ...	Throughout South Indian hills.	Colonies of this scale insect cover the leaves and suck the juice.	*Lecanium viride*, G. (Coccid—scale).	Cut and burn badly infested shoots and spray with fish-oil soap. Destroy ants' nests in the vicinity.	Sometimes bad on coffee in some plantations, the scale is killed in numbers during the rainy season by a fungus. Cocc. Bull. Pl. XVII (2).
Brown bug ...	Do.	Do.	*Saissetia hemisphaerica*, T. (Coccid—scale). Other scales sometimes noted on coffee are *Pulvinaria psidii*, M., and *Saissetia nigra*, N.	Do.	Fig. 5, Cocc. Bull.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			DYES, DRUGS, SPICES, NARCOTICS, ETC.—*cont.*		
			COFFEE (*Coffea arabica*)—cont.		
Leaf caterpillars.	Along the Western Ghat.	Feeding on leaves and often seedlings.	*Euxoa segetum*, Sch. (Noctuid—moth). Other caterpillars occasionally noted are *Belippa laleana*, M. (Slug—Limacodid), *Olene mendosa*, H. (Hairy caterpillar—Lymantrid) and *Homona coffearia*, N. (Flush-worm—Tortricid—moth).	See under potato, redgram, castor, and tea.	Euxoa is a cutworm and attacks numerous plants on the hills. (Fig. 237, S.S.I.) For *Olene* and *Homona* see Figs. 264 and 330, S.S.I.
Coffee shoot and berry bug.	Nilgiris and Shevaroys.	Sucks shoots and berries.	*Antestia cruciata*, F. (Pentatomid—bug).	Collect or net the bugs ...	(Fig. 350, S.S.I.) Found on jesmine also.
Cockchafer ...	Coorg, Mysore and Travancore.	The grub attacks the seedlings and adults attack foliage.	*Holotrichia conferta*, S. (Coorg and Mysore). *Serica pruinosa*, B. (Travancore) (Melolonthid—beetles).	Put up light traps for adults and irrigate seedlings with poisoned water.	These are occasionally bad.
Leaf beetles ...	Coorg, Shevaroys, Nilgiris.	Feed on foliage	*Sympiezomias frater*, M. (Curculionid—beetle). *Corynodes sp.* (Chrysomelid—beetle).	Jar the weevils from the plants and destroy them.	Though found in numbers are minor pests only. *Corynodes* is a shining bluish-green beetle.
Coffee shoot borers.	Coorg, Malabar ...	Bore and breed in shoots and twigs of growing and dead stems.	The species noted are—*Xyleborus compactus*, E, *X. fornicatus*, E. and *X. morstatti*, E. (Scolytid—beetles).	Prune badly infested branches and burn them with insects.	*X. fornicatus* is found on castor also. (Fig. 204, S.S.I.)

Coffee leaf hopper.	Nilgiris	Larvae and adults sucking sap from tender parts; sometimes found in numbers.	*Ricania bicolorata*, D. (Fulgorid—bug).	Net the bugs and spray the plants with deterrent insecticide when necessary.	An active black insect found in numbers during summer in the Nilgiri slopes.
Coffee berry beetle.	Western Ghats, Mysore.	Beetle bores into pulp of berries; also found in stored berries.	*Araecerus fasciculatus*, Dg. (Anthribid—beetle), the Scolytid. *Stephanoderes hampeii* has not yet been definitely noted on Indian-grown coffee.	Destroy infested berries and fumigate stored coffee.	Found attacking arecanuts also.
Coffee grasshopper.	Do.	Feeding on foliage; occasionally found in some numbers.	*Aularches miliaris*, D. (Acridiid—grasshopper).	Net the grasshoppers ...	Rarely a pest. (Fig. 418, S.S.I.)

TEA (*Camellia theifera*).

Tea mosquito.	All along Western Ghats and Nilgiris.	Sucking up sap from tender parts and leaves and making them fade; often serious.	*Helopeltis antonii*, S. Occasionally another common hill Capsid. *Disphinctus humeralis*, W., is also seen.	Netting the bugs and spraying deterrent washes.	(Fig. 374, S.S.I.) often a very bad pest in all the tea districts.
Leaf caterpillars.	In different tea districts of South India.	Caterpillars found feeding on foliage in different ways as open feeders, feeding in folds of leaf, etc.	Chief of the species noted in South India are—*Heterusia virescens*, B., *Buzura suppressaria*, G., *Homona coffearia*, N., *Laspeyresia leucostoma*, M., *Contheyla rotunda*, R., *Dasychira horsfieldi*, S., *Thosea cervina*, M.	Zygaenid—moth. Geometrid ,, Tortricid ,, Eucosmid ,, Limacodid ,, Lymantrid ,, Limacodid ,, } Different methods for different species; hand-picking, pruning, scraping stems containing cocoons, etc.	For Heterusia and Buzura. See Figs. 326 and 281, S.S.I.
Shot-hole borer.	Travancore and Malabar.	Bore holes into twigs and shoots.	*Xyleborus fornicatus*, E., *X. semigranosus* (Malabar) (Scolytid—beetles).	Prune badly infested shoots.	See under coffee.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
			DYES, DRUGS, SPICES, NARCOTICS, ETC.—*cont.*		
			TEA (*Camellia theifera*)—*cont.*		
Stem-borers ...	In the tea districts...	Larvæ bore into stem ...	*Zeuzera coffeae*, N. (Zeuzerid—moth). *Indrabala theeivora*, H. (Small dark brown—moth). *Phassus malabaricus*, M. (Hepialid—moth).	Same as under coffee ...	Only occasionally serious. For *Phassus* see Fig. 344, S.S.I.
Scale insects ...	Do. ...	Cover shoots and leaves in colonies.	Chief species are—*Aspidiotus camelliae*, Sign, *Saissetia hemisphaerica*, T. (Coccid—bugs).	Prune badly infested branches and spray contact insecticide, if necessary.	*Camelliæ* is sometimes bad. Coco. Bull. Pl. VII (2).
Thrips ...	Nilgiris	Attacking tender parts... P.C.	*Dendrothrips bispinosus*, B. (Thripid—thrips).	Of very minor importance.	Noted once on the Nilgiris. Thya. Memr., p. 252.
Tea mites ...	In all tea districts ...	Cover the plants in colonies and juice.	Two species—*Phytopus carinatus* and *Tetranychus bioculatus* (mites).	Dusting with flowers of sulphur effective.	The purple and red mites of tea. (Figs. 440 and 439, S.S.I.) *Not insects.*
			CACAO (*Theobroma cacao*).		
			(In South India it is grown only in Government Gardens, Kallar.)		
Mealy bug	Nilgiri slopes ...	Covering shoots and pods.	*Pseudococcus citri*, R. (Coccid—mealy bug).	Prune badly infested branches and spray contact insecticide, if necessary.	(Pl. XX, Fig. 2, Cocc. Bull.)

Tobacco (*Nicotiana tabacum*).*

Tobacco caterpillar.	Northern Circars, Coimbatore, Tanjore and Madura.	Feeding on the foliage either in the nurseries or planted areas.	*Prodenia—litura*; F. (Noctuid—moth); other species occasionally found are *Chloridea assulta*, G. and *Plusia signata*, F.	The first is the same as the one on castor, agathi, tomato, etc. Egg clusters and leaves containing numerous caterpillars may be collected and destroyed. In bad cases spraying with a stomach poison.	*Prodenia* is often serious and found on various other plants. (Figs. 1 and 2, Tob. Bull.)
Stem-borer ...	Northern Circars, Ceded Districts, Coimbatore and South Arcot.	The small caterpillar bores into the stem and produces galls on the stem.	*Pthorimoea heliopa*, L. (Gelechiad-moth).	Only preventive being a borer; cut out the larvæ in first attacked plants. Destroy attacked seedlings before transplantation from nursery.	Both the caterpillar and moth are small. Attacked plants can be easily made out from the swelling at the stem. (Col. Pl. XLIII, S.S.I. Fig. 4 (*c—g*), Tob. Bull.)
Gram caterpillar.	All over South India.	Caterpillar boring into seed capsules.	*Heliothis obsoleta*, F. (Noctuid—moth).	See under red-gram; cover the flower heads with muslin to prevent attack.	Occasionally serious. (Fig. 5, Tob. Bull.)
Plant-lice ...	In all tobacco tracts.	Colonies of these infest the leaves, suck the juice and affect their vigour.	*Myzus persicæ*, S. (Aphidid—bug).	In bad infestation spray with tobacco decoction which is very effective.	A pest often reported from South Kanara, Guntūr, Tanjore and Coimbatore districts. (Fig. 4 Tob Bull.)
Capsid ...	Do.	Swarms settle on tender parts and suck sap.	*Gallobelicus crassicornis*, D. (Capsid—bug).	Net the bugs and if necessary, spray tobacco decoction as deterrant.	Fig. 6 (i), Tob. Bull.
Grasshoppers.	Do.	Feed on the seedlings in the nursery and on the foliage in the fields.	*Atracto morpha crenulata*, Fb., *Chrotogonus robertsoni*, B. (Acridiid—grasshoppers).	Net and trap them with poison baits.	Fig 3, Tob. Bull.

* For detailed information on tobacco pests see author's bulletin on tobacco insects in South India. (Agr. Deptt. Bull. No. 26.)

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestions for control, if any.	Remarks.
DYES, DRUGS, SPICES, NARCOTICS, ETC.—*cont.*					
TOBACCO (*Nicotiana tabacum*)—*cont.*					
Root-sucking bug.	Coimbatore ...	Young and adults attach themselves to roots and rootlets and suck sap; this causes fading and even death of affected plants.	*Stibaraopus tabulatus, Fb.* (Pentatomid—bug).	Irrigate the plants infested with contact insecticide and water.	Fig. 7, Tob. Bull.
Ground beetles.	Guntūr	Nibbling roots and shoots of seedlings.	*Opatroides frater*, F. and *Seleron latipes*, G. (Tenebrionid—beetles).	Rake up soil and poison irrigation water with contact insecticide.	See under potato.
GANJA (*Cannabis sativa*).					
Gram caterpillar.	Ganja areas in the Presidency (North Arcot, Guntūr, etc.)	Feeds on the foliage ...	*Heliothis obsoleta, F.* (Noctuid—moth).	See under gram	Worst caterpillar pest of ganja.
Leaf caterpillar.	Do.	Feeding on the leaves ...	Those often found are the following *spp.* *Amyna octo*, *G. Laphygma exigua* *Prodenia litura* (Noctuid—moths).	Handpick caterpillars early in the season. Not advisable to spray arsenates on the leaves.	One or other of these at times become serious.
White ant ...	Do.	Workers attacking growing plants.	*Microtermes obesus*, R. (Termitidæ—white-ant).	Irrigate water mixed with insecticide.	Sometimes bad.
Thrips ...	Do.	Swarm on tender shoots and suck sap.	*Heliothrips indica, B.* (Thripid—thrips).	Dust with fine tobacco powder.	See under groundnut and Onion. Thys. Mem. fig. 1.
Ganja mite ...	Do.	Do.	*Tetranychus telarius*, L. (Acari—mite).	No effective remedies known.	This pest is often bad in Upper India also. *Not an insect.*

Cinchona (*Cinchona ledgeriana*).

Chafer beetles.	Nilgiris	Grubs attack the roots ...	The chief of the species noted are—*Holotrichia repetita*, S., *Rhizotrogus rufus*, A., *Serica nilgiriensis*, S., *Popillia chlorion*, N., (Rutelid and Cetoniad—beetles).	Light traps may be put up to catch adults. Plants may be irrigated with insecticide mixed with water and grubs collected.	Sometimes very bad on the Nilgiris.
Leaf and shoot capsid.	Anamalais	Sucks up juice from young plants.	*Disphinctus humeralis*, W. (Capsid-bug).	Net the bugs	Occasional pest. See under "Tea."
Leaf weevils...	Nilgiris	Feeds on foliage ...	*Sympiezomias decipiens*, M. (Curculionid—beetle).	Jar beetles and dust plants with arsenate.	A minor and often sporadic pest.

PALMS.

Coconut (*Cocos nucifera*).

Rhinoceros beetle.	All over South India, chiefly along the West Coast.	The beetle burrows into the growing shoot and cuts the same often killing it.	*Oryctes rhinoceros*, L. (Dynastid—beetle).	Preventive measures are the most effective. Prevent insect breeding in manure pits. Cut open and dry dead and rotting trees to check the pest breeding in them. The beetle can also be pulled out by a hooked wire from infested crowns.	The beetle is black and has a horn on the face like the rhinoceros. It is a bad pest of coconuts all over South India. Col. Pl. III, S.S.I.
Red weevil ...	Do.	The grubs burrow into the soft portions and do damage.	*Rhynchophorus ferrugineus*, F. (Curculionid—beetle).	Scars and wounds on the tree crown should be tarred to prevent the weevil laying eggs. If the rhinoceros beetle is checked the weevil will also be automatically checked since the latter often follows the former.	A red cylindrical insect with a long curved pointed snout. All the stages are found in infested trees. Pl. XLV, S.S.I.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestion for control, if any.	Remarks.
			PALMS—*cont.*		
			COCONUT (*Cocos nucifera*)—*cont.*		
Black-headed caterpillar.	West Coast, Northern Circars, and parts of Coromandel coast.	The caterpillar feeds on the leaf, remaining between the folds of the leaf.	*Nephantis serinopa*, M. (Xyloryctid—moth).	Cutting off attacked fronds and burning them. Only preventive method practicable. Encourage parasites	Often a serious pest along the West Coast. Fig. 336, S.S.I.
Slug caterpillars.	Do.	Caterpillars feed on the foliage.	*Parasa lepida*, G. (all over South India), *Contheyla rotunda*, H. (found only in the West Coast till now), *Natada nararia*, M. (once noted bad in Gōdāvari), (Limacodid—moths).	Cutting off infested fronds and destruction of cocoons on the stems.	For *Parasa* see under "Castor" and "Mango."
Skippers ...	All over South India.	The caterpillars cut young leaves and feed inside the folds.	*Gangara thyrsis*, M. (on young coconut trees chiefly), *Suastus gremius*, F. (More on palmyra), (Hesperid—butterflies).	The leaf-folds containing caterpillars can be easily handpicked.	The pest is bad only on young trees. The caterpillars are covered with white powdery wax. Figs. 290, 291, S.S.I.
Scale insects ...	West Coast, Coimbatore, Tinnevelly and Anantapur.	Colonies of these small insects cover the foliage and suck juice.	*Aspidiotus destructor*, S., this is the chief of those found and often destructive; others noted are *Aspidiotus ficus*, A., *Ceroplastes actiniformis*, G., *Vinsonia stellifera*, W., *Lecanium hesperidum* (Coccid—scales).	Cutting off and burning the badly infested fronds is the best and effective remedy.	The first is an oval transparent insect found often in colonies on the foliage; See Coco. Bull., Pl. VII (1), Pl. XII (2), and Pl. XIV(1).

Mealy bug ...	West Coast and Coimbatore.	Colonies of these small insect cover the foliage and suck juice. Tender shoots suffer much.	*Pseudococcus longispinus*, T. (Coccid—mealy bug).	Cut off badly infested parts and if necessary spray contact insecticide.	Fig. 1, Pl. XXI of Coccid bulletin.
Stem weevil ...	West Coast tracts ...	Numbers found breeding in stem. Status as pest doubtful.	*Calandra stigmaticollis*, G. (Curculionid—weevil).	Collect beetles and destroy.	Very probably the insect comes after some disease; small brownish weevils.

PALMYRA (*Borassus flabellifer*).

(The first four insects under coconut are pests also of palmyra in South India.)

DATE (*Phoenix sylvestris*).

(The rhinoceros beetle and the red weevil are the chief pests of this palm also.)

ARECA (*Areca catechu*).

Scale insects...	West Coast, Mysore, Coimbatore and Nilgiris.	Colonies suck the juice ...	Chief species concerned are—*Chionaspis dilatata*, G. and *Pinnaspis aspidistrae*, S. (Coccid—scales).	Prune badly infested parts and spray contact insecticide.	For the first see Fig. 2, Pl. VI of Cocoid bulletin.
Nut beetle ...	West Coast	Bores into nuts	*Aroecerus fasciculatus*, D. (Anthribid—beetle).	Destroy badly infested nuts.	See under coffee.

FLOWER AND ORNAMENTAL GARDEN PLANTS.

ROSE (*Rosa centifolia*).

Leaf caterpillars.	Coimbatore, Madras, Malabar, and Northern Circars.	Feeding on the foliage ...	*Euproctis fraterna*, M. (Lymantrid-moth) *Parasa lepida*, Cr. (Limacodid-moth), *Achoea janata*, L. (Noctuid—moth).	See under castor for all these insects.	The first two caterpillars are hairy, spiny and irritating to the touch. The last noted in Northern Circars.
Grape thrips...	Coimbatore, and Northern Circars.	Swarming on tender parts and sucking sap. The tissue gets blighted.	*Rhipiphorothrips cruentatus*, H. (Thripidae—thrips).	See under grape-vine ...	Often very serious in Coimbatore. Fig. 16, Thys., Mem.

I.—Insects affecting important cultivated plants in South India—*cont.*

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestion for control, if any.	Remarks.
FLOWER AND ORNAMENTAL GARDEN PLANTS)—*cont.*					
Rose (*Rosa centifolia*—*cont.*					
Red scale ...	Malabar, and Northern Circars.	Colonies are found on twigs and leaves sucking the juice.	*Aspidiotus aurantii*, M. (Coccid—bug).	Cut and burn badly infested shoots and spray with crude oil emulsion.	Sometimes whole plants are killed by this scale. It is a well-known pest of oranges elsewhere but not noted on oranges as yet in South India. Fig. 1, Pl. IX, Coccid bulletin.
*Chafer beetles.	Nilgiri Hills, and Coimbatore.	Adult beetles feeding on flowers.	*Oxycetonia versicolor*, F., and other Cetoniad—beetles.	Net or handpick the beetles. Light traps may also be put up.	See under "Cholam".
Leaf cutter bees.	Coimbatore, Nilgiris and Malabar.	Bees cutting tender leaves and removing the cut pieces to their hive.	*Megachile anthracina*, S. is the chief *sp.* noted; other *spp.* of *Megachile* have also this habit of cutting leaves of different plants.	Catch the bees or dust arsenate on leaves.	These are not the honey bees but bigger forms of the same family.
Jasmine (*Jasminum sambac*).					
Red scale ...	Northern Circars ...	Covering leaves and sucking sap; often very serious.	*Aspidiotus aurantii*, M. (Coccid—scale).	Prune badly infested parts and spray contact insecticide.	See under "Rose". Fig. 1, Pl. IX, Cocc. Bull.
Jasmine bug...	Ceded Districts ...	Sucking up juice from buds and flowers; sometimes serious	*Antestia cruciata*, F. (Pentatomid—bug).	Bugs may be collected or killed by fumigation.	See under "Coffee". A tingid also occurs sometimes
Mealy bug ...	Coimbatore and Salem.	Colonies appear on tender parts and suck sap.	*Phenacoccus ornatus*, Gr. (Coccid—bug).	Clip badly infested parts and spray contact insecticide.	A beautiful delicately built white insect found sometimes in numbers on the foliage.

Thrips ...	Coimbatore and Mysore.	Colonies appear on tender parts and suck sap; flowers are often badly damaged.	*Isoneurothrips orientalis*, B. (Thripid—thrips).	May be treated in the same way as for jasmine bug.	Minute blackish active insects found inside flowers. Thys. Mem., p. 261.
Mealy wing ...	Do.	Do.	*Dialeurodes vulgaris* ?, K. (Aleyrodid—bug).	Clipping badly infested leaves and spraying with dilute crude oil emulsion.	Infested leaves appear pale yellowish and show numerous oval pupae on the under surface; these are the nymphal cases of the insect.
Leaf caterpillar.	Coimbatore and Tanjore.	Feeding on foliage ...	*Glyphodes unionalis*, F. (Pyralid—moth).	Handpick caterpillars or dust with arsenates.	Moth with transparent white wings.
CHRYSANTHEMUM.					
Caterpillar ...	Madura	Feeds on foliage and flowers and causes severe damage sometimes.	*Lamprosema indicata*, F. (Pyralid—moth).	Spray or dust with arsenate.	Figs. 309 and 310, S.S.I Insect is found also on pulses in different parts of India.
OLEANDER (*Nerium oleander*).					
The oleander sphinx.	All over South India.	The stout big caterpillar defoliates the plants.	*Deilephila nerii*, L. (Sphingid—moth).	Handpicking of eggs and caterpillars very easy and effective.	The caterpillar is a very stout and long one with a spine over the tail end. Figs. 273 and 274, S.S.I.
The nymphalid butterfly.	Do.	Feeding on leaves ...	*Euploea core*, C. (Nymphalid—butterfly).	The caterpillars and pupae can be easily handpicked and the butterflies can be netted.	A common butterfly, with dark wings with white spots. The pupa is a shining gold coloured chrysalid hanging from the leaf.
LILIES.					
Lily caterpillar.	Coimbatore, Madras and Malabar.	The pretty caterpillar bores into the fleshy leaves and leaf stalk in numbers.	*Polytela gloriosa* (Noctuid—moth).	The leaves containing these caterpillars feeding gregariously could be clipped and destroyed with the larvae; the pupae under the soil may also be dug up.	The caterpillar is a cylindrical red and white spotted insect. Fig. 238, S.S.I.; attacks all liliaceous plants.

* Grubs of chafer beetles such as *Anomala Adoretus*, *Holotrichia*, etc., damage the roots of many garden plants.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestion for control, if any.	Remarks.
			LILIES—*cont.*		
			MAKUTUM (*Mimusops elengi*).		
Leaf thrips ...	Coimbatore, Tanjore and Trichinopoly.	Larvae and adults attack leaves and cause galls.	*Arrhenothrips ramakrishnae*, H. (Phloeothripid—thrips).	Clip badly galled parts and spray tobacco decoction.	A dark ant-like insect found inside the leaf galls and folds. Fig. 25, Thys. Mem.
			TULSI (*Ocimum sanctum*).		
Lace-wing bug.	All over South India.	Small dark insects infest leaves in numbers and suck the juice.	*Monanthia globulifera*, W. (Tingidid—bug).	Spray tobacco decoction ...	Fig. 371, S.S.I.; Minute creatures found in colonies.
Scale insect ...	Do.	Colonies of these waxy insects cluster on the shoots and suck the juice.	*Ceroplastodes cajanii*, M. (Coccid—scale).	Same as above for lace-wing bug but with a stronger solution of emulsion.	See under "Red-gram." Cocc. Bull., Pl. XV (2).
			GARDEN CROTONS.		
Scales ...	All over South India.	Cover shoots and stems and suck sap.	Chief species found are *Saissetia nigra*, N., *Lecanium depressum*, C., *Lepidosaphes* sp.? (Coccid—Scales).	Prune badly infested parts and spray with strong contact insecticide.	See under "Cotton."
Mealy bugs ...	Do.	Do.	*Pseudococcus virgatus*, C., *Icerya aegyptiaca*, D., *Monophlebus phyllanthi*, G. (Coccid—mealy bugs).	Do.	Sometimes one or other of these completely cover the shoots and tender leaves allowing swarms of ants to visit them.

Thrips ...	Bangalore and Coimbatore.	Do.	*Heliothrips haemorrhoidalis*, B., *and Ayyaria choetophora*, K.	Do.	The first a well-known insect affecting many hothouse plants in different parts of the world.
Stem ringing beetle.	Coimbatore	The beetle cuts the stem; sometimes kills the plants.	*Sthenias grisator* F. (Cerambycid—beetle).	See under "Mulberry" ...	Sometimes serious.

HOLLY-HOCK AND SHOE-FLOWER (*Hibiscus rosasinensis*).

(Many of the insects affecting cotton are found on different kinds of shoe—flower and holly-hock such as the species of spotted bollworms, leaf-roller, bugs, caterpillars on leaf and scales).

SUN-FLOWER (*Helianthus annuus*).

Gram caterpillar.	Coimbatore, and Mysore.	Caterpillar feeds on leaves and seeds.	*Heliothis obsoleta*, F. (Noctuid—moth).	See under "gram" ...	Occasionally found in numbers.

PARIJATH (*Nyctanthes arbortristis*).

Leaf caterpillar.	Madras and Coimbatore.	Big caterpillar feeding on leaves.	*Metanastria hyrtaca*, C. (Lasiocampid—moth).	Pick off the caterpillars.	Of minor importance; also found on country almond.

TABERNIMONTANA.

Leaf caterpillar.	Cochin, and Malabar.	Feeding on leaves ...	*Glyphodes glauculalis*, G. (Pyralid—moth).	Handpick caterpillars or dust arsenate.	A light blue moth with a yellowish streak along front margin of forewing.

GRASSES, FODDER AND GREEN MANURE PLANTS.

LUCERNE (*Medicago sativa*).

Caterpillar ...	Coimbatore and Godavari.	Feeding on the foliage and tender shoots.	*Laphygma exigua*, H., is the chief species (Noctuid—moth).	Netting the caterpillars. It is not safe to use arsenates which will of course kill the pest.	See under "Onions," etc.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestion for control, if any.	Remarks.
GRASSES, FODDER AND GREEN MANURE PLANTS—*cont.*					
LUCERNE (*Medicago sativa*)—*cont.*					
Leaf beetles ...	Coimbatore and Godāvari.	Biting small holes on the leaves; often found in numbers and doing substantial damage.	Chief species noted is the pumpkin beetle *Aulacophora abdominalis*, F. Other small flea beetles are also found occasionally.	Collect beetles with hand-net.	See under "Cucurbitaceæ."
GUINEA GRASS (*Panicum jumentorum*) AND OTHER GRASSES.					
Hairy caterpillar.	Coimbatore and South Arcot.	Feeding on the foliage ...	*Psalis securis*, H. (Lymantrid—moth).	See under "Paddy" ...	Rarely serious.
Swarming caterpillars.	Coimbatore, Hosur and Chingleput.	Feeding on the grass plots in fodder areas; sometimes cause serious damage.	More important of the species concerned are—*Spodoptera mauritia*, B., *Cirphis albistigma*, M., *C. loreyi* and *Pelamia frugalis* (Noctuid—moths), *Psara phacopteralis*, G. (Pyralid—moth).	Netting of caterpillars; deep ploughing; baiting with traps, etc. No satisfactory method known yet.	Some of these are pests of paddy.
Rice bug ...	Malabar, Ganjam and Kistna.	Feeding on the flower heads of grasses.	*Leptocorisa acuta*, Th. Probably another spp. of this genus also.	See under "Paddy" ...	Not serious generally.
BAMBOO (*Bambusa, Dendrocalanus, Ochlandra, etc.*).					
Plant lice ...	Coimbatore	Colonies swarm on leaves and suck sap.	*Oregma bambusae*, B. (Apidid—bug).	Clip badly infested parts and spray contact poison.	Fig. 392, S.S.I.

Scales	Coimbatore and Malabar.	Do.	*Chionaspis elongata*, Gr., *Asterlecanium longum*, Gr. and other spp. (Coccid—scales).	Do.	Sometimes these scales very badly cover the foliage and blighten them.
Mealy bug ...	Malabar	Cover shoots in white masses.	*Pseudococcus detorquens*, Gr. (MS.).	Do.	Noted once in Walayar.
Stem bug ...	Coimbatore	Adults and nymphs settle in numbers and suck sap.	*Purohita nigripes*, D. (Fulgorid—bug).	Collect adults and egg-masses.	Eggs and nymphs are seen in white woolly masses attached to the bamboo stem inside the sheathing.
Stem-borer ...	Bellary	Larva bores into bamboo stem.	*Stromatium barbatum*, F. (Cerambycid—beetle).	Destroy first attacked stems.	Fig. 392, S.S.I.
Shoot borer chalcid.	Malabar Forests ...	Numerous grubs found inside drying shoots.	*Eurytoma chrysothrix*, W. (Chalcidid—Wasp).	Cut off badly infested branches.	In habits this insect appears to be similar to the daincha pod wasp *Bruchophagus*.

AGATHI AND DAINCHA (*Sesbania grandiflora*, *S. aculeata and S. ægyptiaca*).

Stem-borer ...	All over South India.	The stout whitish caterpillar bores into the stem and often kills the plant.	*Azygophleps scalaris*, Fb. (Zeuzeridæ—moth).	Preventive only being a borer. Cut out first attacked stems and destroy larvæ and pupæ. Egg clusters may also be collected and destroyed.	A fairly serious pest, sometimes in betelvine gardens where the caterpillar is called "*Chandana puchi*" in Tamil, Fig. 324, S.S.I.
Tobacco caterpillar.	Coimbatore, South Arcot and Madura.	The caterpillar feeds on the leaves.	*Prodenia litura*, F. (Noctuid—moth).	Same as on castor. In betelvine gardens the infested areas are sometimes flooded in Agathi nurseries.	See under castor, tobacco, tomato, etc. Sometimes bad in Agathi nurseries in betelvine gardens.
Agathi weevil	Do. Arcot and Madura.	The weevil and the grub feed and breed on the tender shoots.	*Alcides bubo*, F. *A. fabricii*, F., is also found occasionally. (Curculionid—beetles).	Same as on cluster bean and indigo; clipping attacked top shoots in young plants.	Not bad on grown-up plants.
Shoot bugs ...	Do.	Attach themselves in numbers to tender parts and suck sap.	*Coptosoma cribraria*, F. *Brachyplatis vahlii*, F. (Pentatomid—bugs).	Net the bugs; this is quite easy.	See under "Lab-lab."

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestion for control, if any.	Remarks.
GRASSES, FODDER AND GREEN MANURE PLANTS—*cont.*					
AGATHI AND DAINCHA (*Sesbania grandiflora, S. aculeata and S. ægyptiaca*)—cont.					
Moth caterpillars.	All over South India.	Feed on the foliage and sometimes cause severe damage especially on a young crop.	*Laphygma exigua*, Hb. *Pericyma glaucinans*, G. (Noctuid—moths).	Can be sprayed with arsenates when not used for fodder.	For *Pericyma* see Fig. 255, S.S.I.
Butterfly caterpillars.	Do.	Do.	*Terias hecabe*, L. *Catopsilia pyranthe*, L. (Pierid—butterflies).	Collect the butterflies with net and spray if necessary if crop is not for fodder.	Figs. 287 and 286, S.S.I.
Seed wasp ...	Coimbatore	Grub develops inside seed capsule; sometimes does serious damage.	*Bruchophagus mellipes*, G. (Chalcidid—wasp).	First attacked seeds to be destroyed.	A small shining black wasp, one of the very few plant pests among the hymenoptera in South India.
(KOLINGI) WILD INDIGO (*Tephrosia purpurea*).					
Seed pod caterpillar.	Tanjore and Tinnevelly.	Caterpillar bores into seed pods and buds and causes swollen galls.	*Dactylethra candida*, St., (Gelechiad—moth).	Destroy first appearing galls and spray arsenates if necessary.	Seed formation is prevented by the caterpillar.
MURUKKAM (DADAP) (*Erythrina indica*).					
Shoot borer ...	Malabar, South Kanara, Bellary, Madras, and South Arcot.	Caterpillar bores into shoots and tender capsules.	*Terastia meticulosalis*, G. (Pyralid—moth).	Destroy first attacked shoots and pods.	Fig. 315, S.S.I.

Leaf caterpillar.	South Arcot and Coimbatore.	Feeds on leaves	*Agathodes ostentalis*, H. (Pyralid—moth).	Collect leaves with the larvae.	A minor pest; beautifully coloured moth.
Plant bug ...	Malabar and South Kanara.	The dark bug sometimes covers tender parts in thousands and sucks sap.	*Cyclopelta siccifolia*, W. (Pentatomid—bug).	Net the bugs; this is very easy.	Fig. 357, S.S.I.
Leaf beetle ...	South Kanara and Nilgiris.	Small spiny beetles feeding on foliage; the larva is also found in the same situation.	*Platypria echidna*, G. (Hispid—beetle).	The spiny beetles can be easily netted.	Minor pest.
Pod bug ...	Do.	The stout dark bug sucks up juice from the pods and tender shoots.	*Anoplocnemis phasiana*, F. (Coreid—bug).	Collect the bugs by hand or net.	See under Cowpea.
Stem girdler...	Coorg	The beetle rings the branches of the plant.	*Sthenias grisator*, F. (Cerambycid—beetle).	See under "Mulberry" ...	Sometimes bad.

CALOTROPIS (*Calotropis gigantea*).

Weevil ...	All over South India.	Larva bores into shoots and rind.	*Paramecops farinosa*, W. (Curculionid—weevil).	Destroy first attacked parts.	Of minor importance. Fig. 190, S.S.I.
Stem borer ...	Do.	Larva bores into the stem.	*Monohammus nivosus*, W. (Cerambycid—beetle).	Do.	Of minor importance.
Leaf caterpillars.	Do.	Feeding on foliage ...	*Danias chrysippus*, L. (Nymphalid—butterfly).	The butterflies can be netted and caterpillars handpicked.	Rarely found as a pest though common.
Fruit-fly ...	Do.	Maggots bore into seed-capsules.	*Dacus longistylus*, W. (Trypaenid—fruit-fly).	Destroy first infested capsules.	Almost exclusively found on this plant.
Grasshopper...	Do.	Feeding on foliage ...	*Poecilocerus pictus*, F. (Acridiid—grasshopper).	Collect the grasshoppers; it is very easy.	A pretty grasshopper. Fig. 419. S.S.I. Very commonly found.
Plant lice ...	Do.	Fringe backside of leaves in colonies and suck sap.	*Aphis nerii*, B. (Aphid—bug).	Destroy badly infested leaves.	Minute yellowish insects.
Leaf hopper bug.	Do.	Suck juice from tender parts.	*Eurybrachis tomentosa*, F. (Fulgorid—bug).	Bugs can be easily collected.	An active green and red bug.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestion for control, if any.	Remarks.
SOME USEFUL TREES OF THE PLAINS.					
NIM (*Azadarichta indica*).					
Nim scale ...	Coimbatore, Bellary and Kistna.	Colonies cover the whole tree and cause severe blight.	*Pulvinaria maxima*, Gr. Other scales noted are *Lepidosaphes meliae*, Gr., and *Parlatoria camelliae*, C. (Coccid—scales).	Prune badly infested branches and spray contact insecticide.	This *Pulvinaria* is a specific pest of this tree; also found to a small extent on Cotton and Jatropa. Pl. II and XIII, Coccid bulletin.
Shoot bug ...	Coimbatore	Suck the sap from shoots which dry up often.	*Helopeltis antonii*, S. (Capsid—bug).	Collect the bugs with net if possible.	The frequent drying up of nim shoots is believed to be due to the damage by this bug. This has to be definitely confirmed in the writer's opinion. See under "Tea."
BABUL (*Acacia arabica*).					
Babul scale ...	Coimbatore	Colonies cover tender shoots and stem and suck sap.	*Anomalococcus indicus*, Gr. (Coccid—scales.)	Prune badly infested branches; often checked effectively by a predator moth (*Eublemma*).	Very common in and around Coimbatore and visited by the common black ant. Pl. XIX, Coccid bulletin.
Hairy caterpillar.	Coimbatore and Ceded Districts.	Feeding on the foliage and bark.	The chief species found are—*Taragama siva*, Lef. (Lasiocampid—moth), *Euproctis lunata*, W. (Lymantrid—moth).	Prune badly affected branches containing numerous caterpillars and spray arsenate if necessary.	*Taragama* has a stout elongated caterpillar with the colour of the bark and fully clothed with irritating hairs. *Euproctis* appears as a very serious pest in certain years and completely defoliates babul trees in many places.
		The bag worm *Clania crameri*, W. also is sometimes found.			

Pungam (*Pongamia glabra*).

Plant bugs ...	Mysore, Malabar and Coimbatore.	Swarms of the bug settle on tender shoots and suck sap.	*Coptosoma cribraria and Cyclopelta siccifolia.* (Pentatomid—bugs).	Same remedies as when the insect is found on lab-lab.	See under "Lab-lab" and "Eythrina" above. Sometimes whole trees are covered by millions of this bug.
Fruit gallfly ...	Coimbatore, Mysore and Ceded Districts.	The fruit pods are bored and turned into round galls.	*Aspondylia pongamiae*, F. (Cecidomiyiad—fly).	Collecting and destroying the early galls is the only practicable remedy that can be employed.	.....
Leaf caterpillars.	Malabar and Coimbatore.	Feeding on the leaf exposed in folds or mining into leaf tissue.	*Parata alexis*, F. (Hesperid—butterfly). A leaf miner is also found.	The leaf folds containing caterpillars could be easily collected with the caterpillars in them.	Not common pests. The leaf miner is often bad in Malabar.
Pod caterpillar.	Madras	Boring into pods ...	*Lamoria* sp. (Pyralid—moth.)	First attached fruit pods may be destroyed.	Found once only in Madras.

Portia (*Thespesia populnea*).

Black scale ...	All over South India.	Cover the tender shoots and leaves and suck juice.	*Saissetia nigra*, N. (Coccid-scale.)	Same remedy as for the black scale on garden plants.	Avenue trees very often suffer badly from the "black scale."

Teak (*Tectona grandis*).

Leaf roller ...	All over South India, chiefly West Coast.	Feeding on leaves inside rolls.	*Hybloea puera*, C. (Noctuid—moth).	Control sometimes difficult in bad cases. Caterpillars may be handpicked and the foliage sprayed with lead arsenate.	Fig. 258, S.S.I. The insect is sometimes found on *Millingtonia* and *Bignonia* plants also.
Teak defoliator.	All over South India, chiefly West Coast.	Defoliating the plants ...	*Pyrausta n ac haeralis*, W. (Pyralid—moth).	Control sometimes difficult in bad attacks. Caterpillars may be handpicked and the foliage sprayed with lead arsenate.	Fig. 319, S.S.I. A yellowish brown moth.
Teak gall ...	Tinnevelly	Producing ball-like galls on the branches.	Unidentified *cynipid?* (wasp).	Collect and destroy early forming galls.	So far found only in Tinnevelly forests.
Teak borer ...	Malabar	Grub boring into the stems.	*Psiloptera fastuosa*, F. (Buprestid—beetle).	Infested branches may be cut and the beetles may be caught easily.	Shining green and blue jewel beetle. Fig. 140, S.S.I.
Mealy bug ...	Do.	Covering shoots	*Phenacoccus hirsutus*, G.	Clip badly infested shoots.	Coco. Bull. Pl. XXV., 2.

Insect.	Distribution (in pest form in case of important insects).	Nature of injury done to plant.	Scientific name and classification.	Suggestion for control, if any.	Remarks.
SOME USEFUL TREES OF THE PLAINS—*cont.*					
CASUARINA (*Casuarina equisetifolia*).					
Bark caterpillar.	Ganjām, Gōdāvari and Kistna.	Caterpillar girdling bark and often causing severe damage.	*Arbela tetraonis*, M. (Arbelid—moth).	See under "Citrus" ...	This insect attacks many trees.
Stem borers ...	All along Coromandel coast.	Grubs bore into the stem and often kill the young plants.	*Caelosterna scabrator*, F., also *C. spinator*, F., and *Heresium simplex*, G. (Cerambycid—beetles).	Sometimes the first is a bad pest and difficult to deal with. Same remedies as for mango and citrus stem borer beetles.	Reported now and then from Coromandel tracts. Fig. 181, S.S.I.
Ground cricket.	Nellore	Damaging seedlings ...	*Brachytrypes portentosus*, L. (Gryllid—cricket).	Collect the cricket; hoe the soil well to kill these underground pests and if necessary irrigate with poisoned water.	Fig. 430, S.S.I.
RUBBER.					
Stem borer ...	Anamalais and Western Ghats.	Grub bores into stem ...	*Batocera rubus*, L. (Cerambycid—beetle).	Reported once attacking rubber stump in the Western Ghats. Probably a minor pest.	See under "Mango".
Bark beetles...	Western Ghats ...	The small beetles and grubs bore into bark and interfere with latax flow.	*Xyleborus biporus*, S., and allied species (Scolytid—beetles).	Prune badly infested branches and scrape loose bark.	Minute dark brown beetles. Status doubtful.

RAIN TREE (*Pithecolobium saman*).

Mealy bug ...	Coimbatore	Cover the shoots with mealy masses.	*Phenacoccus iceryoides*, G. (Coccid—mealy bug).	Prune badly infested branches and spray contact insecticide.	Pl. XXV, Fig. 1, Coccid bulletin.
Scales... ...	Do.	Cover shoots and stem and suck juice.	*Aspidiotus spp.* and *Aspidoproctus xyliae*, Gr. (Coccid—scale insects).	Do.	Pl. XXX, Coccid bulletin.

BANYAN TREE.

(See under Fig. Most of the pests are same for all Ficus *spp.*)

ASOKA, POINCIANA, ETC. (*Avenue trees*).

Stem borer ...	Coimbatore, Chingleput, etc.	Boring into the stem or between stem and bark in galleries of wood dust.	*Arbela tetraonis*, M. (Arbelid—moth).	The tree bark to be thoroughly scraped and the same treatment to be adopted as when the insect is found on fruit trees.	See under "Citrus" above, sometimes very bad on avenue trees of different kinds.

PALAS (*Butea frondosa*).

The leaf miner beetle.	Mysore, Malabar and Coimbatore.	The grub mines into leaf and causes blister spots on leaves; occasionally serious.	*Trachys bicolor*, K. (Buprestid—beetle).	Cut and burn badly infested leaves.	A small bluish black beetle.
Leaf bug ...	Coimbatore	Hundreds swarm on tender leaves, suck juice, and turn them pale.	*Coptosoma ostensum*, Dt. (Pentatomid—bug).	Clip badly infested leaves.	A lady-bird beetle is found as predator on this.

* II.—PESTS ARRANGED ACCORDING TO THE NATURAL ORDERS WITH THEIR IMPORTANT FOOD PLANTS.

Order—ORTHOPTERA.

	Chief host plants.
Family—*Acridiidae*—	
Hieroglyphus banian, Fb.	Paddy.
Hieroglyphus orizivorus, U.	Do.
Colemania sphenarioides, B.	Cholam, tenai, cumbu.
Atractomorpha crenulata, Fb. ...	Tobacco.
Oxya velox, F.	Paddy.
Chrotogonus saussurei, B.	Cholam, cotton.
Acrotylus humbertiana, S.	Paddy nurseries.
Heteropternis respondens, W. ...	
Locusta danica, L.	
Pyrgomorpha conica, O.	
Aelopus affinis, B.	
Orthacris simulans, B.	Ragi.
Cyrtacanthacris ranacea, S.	Cotton.
Orthacris elegans, B.	Maize.
Oedaleus sp.	Ragi.
Catantops annexus, B.	Cotton.
Aelopus tamulus, F.	Do.
Poecilocerus pictus, F.	Calotropis.
Aularches miliaris, L.	Coffee.
Chrotogonus robertsoni, B.	Tobacco.
Family—*Gryllidae*—	
Brachytrypes portentosus, L.... ...	Casuarina seedlings.

Order—NEUROPTERA.

Family—*Termitidae*—	
Microtermes obesi, Hol.	Wheat.
Odontotermes obesus, Rau	Sugarcane.

Order—HYMENOPTERA.

Family—*Tenthredinidae*—	
Athalia proxima, K.	Cruciferous plants.
Family—*Chalcididae*—	
Bruchophagus mellipes, G.	Sesbania *spp.*
Eurytoma chrysothrix, W.	Bamboo shoots.
Family—*Apidae*—	
Megachile anthracina, S.	Rose and other garden shrubs.
Family—*Formicidae*—	
Dorylus orientalis, W.	Sugarcane.
Selenopsis geminata, F.	Brinjal.
Oecophylla smaragdina, F.	Mango and other trees.

* Non-insect pests noted in Section I are not included in this list.

Order—COLEOPTERA.

	Chief host plants.
Family—*Melolonthidae*—	
Serica nilgiriensis, S.	Cinchona
Serica pruinosa, S.	Coffee.
Holotrichia conferta, S.	Do.
Holotrichia repetita, S.	Cinchona.
Rhizotrogus rufus, A.	Do.
Family—*Rutelidae*—	
Popillia chlorion, N.	Cinchona.
Adoretus bengalensis, B.	Grape-vine.
Adoretus lasiopygus, B.	Do.
Anomala varians, O.	Garden plants.
Family—*Cetoniadae*—	
Anatona stillata, N.	Cholam.
Oxycetonia versicolor, F.	Do.
Protoetia aurichalcea, F.	Do.
Chiloloba acuta, W.	Cholam and cumbu.
Family—*Dynastidae*—	
Oryctes rhinoceros, L.	Palms.
Phyllognathus dionysius, F.	Paddy.
Family—*Erotylidae*—	
Anadastus parvulus, W.	Tenai.
Family—*Coccinellidae*—	
Epilachna 12-punctata, M.	Brinjal, cucurbitaceæ, Potato.
Epilachna 28-punctata, F.	Do.
Family—*Tenebrionidae*—	
Gonocephalum hoffmanseggi, S. and Opatrum *sp.* ...	Grape-vine, potato.
Gonocephalum, depressum, F. ...	Do.
Opatroides frater, F.	Tobacco.
Seleron latipes, G.	Do.
Family—*Meloidae*—	
Mylabris pustulata, Th.	Flowers of various plants.
Mylabris balteata, B.	Groundnut, grasses, etc.
Gnathospastoides rouxi, C.	Earheads of paddy and other cereals.
Lytta ruficollis, O.	Do. do.
Lytta (Cylindrothorax) tenuicollis, P.	Do. do.
Epicauta *sp.*	Paddy ears.
Cantharis setacea	Cowpea.
Family—*Buprestidae*—	
Sphenoptera gossypii, K.	Cotton.
Sphenoptera perotteti, G.	Groundnut.
Psiloptera fastuosa, F.	Teak.
Belinota prasina, Th.	Mango.
Trachys bicolor, K.	Butea.

Order—COLEOPTERA—*cont.*

	Chief host plants.
Family—*Elateridae*—	
Drasterius *sp.*	Potato.
Family—*Cerambycidae*—	
Batocera rubus, L.	Mango, rubber, fig, etc.
Chloridolum alcmene, T.	Citrus varieties.
Chelidonium cinctum, G.	Do.
Xylotrechus quadripes, Ch.	Coffee.
Apomecyna pertigera, Th.	Cucurbitaceae.
A. perotteti, F.	Do.
Sthenias grisator, F.	Garden plants, mulberry, etc.
Stromatium barbatum, F.	Bamboo.
Coelosterna scabrator, F.	Casuarina.
Coelosterna spinator, F.	Do.
Heresium simplex	Do.
Olenecamptus bilobus, F.	Ficus *spp.*
Monohammus nivosus, W.	Calotropis.
Oberea *sp.*	Cow-pea.
Coptops asditicator, F.	Moringa.
Family—*Chrysomelidae*—	
Sagra nigrita, Ol.	Dolichos lab-lab.
Scelodonta strigicollis, Mots	Grape-vine.
Oides affinis, Ja.	Paddy.
Aulacophora stevensi, B.	Cucurbitaceae, Lucerne.
Aulacophora abdominalis, F.	
Aulacophora atripennis, F.	
Galerucida bicolor, H....	Elephant-foot yam.
Nisotra madurensis, J.	Gogu.
Monolepta signata, O....	Cotton, Colocasia.
Chalaenosoma metallicum, J.	Potato.
Clitea indica, J.	Bael.
Chaetocnema *sp.*	Ragi.
Lema downsei, B.	Do.
Chaetocnema pusaensis, M.	Millets.
Longitarsus nigripennis, M.	Pepper.
Longitarsus belgaumensis, F.	Sunnhemp.
Hermacophaga ruficollis, L.	Castor.
Phyllotreta downsei, B.	Cruciferae.
Haltica cyanea, J.	Paddy, Ammania.
Aspidomorpha miliaris, F.	Sweet potato.
Metriona circumdata, H.	Do.
Leptispa pygmoea, B.	Paddy.
Oncocephala tuberculata, Ol.	Sweet potato.
Platypria andrewsi, W.	Zizyphus jujuba.
Platypria echidna, G.	Erythrina.
Platypria hystrix, F.	Sesbania, Erythrina.
Hispa arimigera, O.	Paddy.

Order—COLEOPTERA—*cont.*

	Chief host plants.
Family—*Chrysomelidae*—cont.	
Phidodonta modesta, W.	Sugarcane.
Corynodes *sp.*	Coffee.
Family—*Bruchidae*—	
Bruchus theobromae, L.	Red-gram.
Family—*Anthribidae*—	
Araecerus fasciculatus, de. G.	Areca, coffee.
Family—*Curculionidae*—	
Blosyrus inaequalis, B....	Cluster beans.
Sympiezomias frater, M.	Coffee.
Sympiezomias decipiens, M.	Orange, cinchona.
Dereodus mastos, H.	Gogu.
Episomus lacerta, F.	Pulses.
Myllocerus discolor, F.	Cholam.
Myllocerus transmarinus, H.	Tenai.
Myllocerus dentifer, F.	Paddy.
Myllocerus viridanus	Groundnut, bhendai.
Myllocerus subfasciatus, G.	Brinjal.
Atactogaster finitimus, F.	Cotton.
Lixus brachyrrhinus, B.	Amaranthus.
Paramecops farinosus, W.	Calotropis.
Apoderus tranque baricus, F. ...	Mango, terminalia.
Cylas formicarius, F.	Sweet potato.
Eugnamptus marginatus, P.	Mango.
Apion amplum, F.	Green-gram, cashew.
Alcides pictus, B.	Lab-lab.
Alcides bubo, Fb.	Agathi, indigo.
Alcides collaris, P.	On pulses.
Alcides affaber, F.	Gogu.
Alcides fabricii, F.	Pulses and agathi.
Pachytychius mungonis, M.	Green-gram.
Ceuthorhynchus asperulus, F.... ...	Red-gram.
Rhynchaenus mangiferae, M.	Mango.
Cryptorrhynchus mangiferae, F. ...	Do.
Pempheres affinis, F.	Cotton.
Baris *sp.*	Snake-gourd.
Acythopius citrulli, M.	Melon.
Rhynchophorus ferrugineus, F. ...	Palms.
Amorphoides arcuata, M.	Cotton.
Cosmopolites sordidus, G.	Plantain.
Calandra stigmaticollis, G.	Coconut.
Ochyromera artocarpi, M.	Jak.
Athesapeuta oryzae, M.	Paddy.
Echinocnemus oryzae, M.	Do.
Family—*Scolytidae*—	
Xyleborus compactus, E.	Coffee.
Xyleborus fornicatus, E.	Castor, coffee and tea.
Xyleborus morstatti, E.	Coffee.

Order—COLEOPTERA—*cont.*

	Chief host plants.
Family—*Scolytidae*—cont.	
Hypothenemus plumeriae, N.	Morinda.
Xyleborus biporus, S.	Rubber.
Xyleborus semigranosus	Tea.

Order—LEPIDOPTERA.

Family—*Arctiadae*—	
Amsacta albistriga, W.	Groundnut, cumbu, cholam, etc.
Pericallia ricini, F.	Castor, plantain, etc.
Utetheisa pulchella, L.	Sunnhemp.
Estigmene lactinea, C....	Cumbu, ragi, etc.
Diacrisia obliqua, W.	Castor, sweet potato, groundnut.
Family—*Noctuidae*—	
Spodoptera mauritia, B.	Paddy, grasses.
Heliothis obsoleta, F.	Pulses, ganja, tobacco.
Heliothis peltigera, S....	Safflower.
Heliothis assulta, C.	Tobacco.
Agrotis C-nigrum, L.	Cruciferae.
Euxoa segetum, S.	Potatoes and other garden crops on the hills.
Rabilia frontalis, W.	Cotton.
Adisura atkinsoni, M.	Lab-lab and other legumes.
Sesamia inferens, W.	Ragi, wheat, cane, etc.
Cirphis albistigma, M....	Paddy, grasses.
Cirphis unipuncta, H.	Cholam.
Cirphis loreyi, D.	Cholam, paddy.
Cirphis micacea, H.	Paddy.
Borolia venalba, M.	Do.
Prodenia litura, F.	Tobacco, plantain, castor, etc.
Laphygma exigua, Hb.	Maize, lucerne, onions, chillies, etc.
Polytela gloriosae, F.	Garden lilies.
Perigoea capensis, G.	Safflower.
Amyna octo, G.	Sunnhemp, pulses, ganja.
Eublemma silicula, S.	Cholam.
Eublemma olivacea, W.	Brinjal.
Bombotelia jocosatrix, G.	Mango.
Orthaga exvinacea, M....	Do.
Chlumetia transversa, W.	Do.
Plotheia nephelotis, W.	Brinjal.
Plotheia celtis	Ficus *spp.*
Earias fabia, S.	Cotton and other malvaceae.

Order—LEPIDOPTERA—*cont.*

	Chief host plants.
Family—*Noctuidae*—cont.	
Earias insulana. B.	Do.
Tarache nitidula, F.	Cotton and calotropis.
Carea subtilis, W.	Eugenia.
Acontia graellsi, F.	Cotton and Hibiscus esculentus.
Cosmophila indica, G....	Do.
Catephia inquieta, W.	Sweet potato.
Achoea janata, L.	Castor.
Grammodes stolida, F.	Linseed.
Azazia rubricans, B.	Pulses.
Pelamia frugalis, F.	Paddy and grasses.
Pericyma glaucinans, G.	Sesbania.
Plusia chalcytes, F.	Groundnut.
Plusia signata, F.	Do.
Plusia peponis, F.	Snake-gourd.
Plusia orichalcea, F.	Indigo.
Ophideres fullonica, L. and O. materna, L	Citrus plants.
Simplicia robustalis, G.	Ragi and thatching stacks.
Hybloea puera, Cr.	Teak, millingtonia and bignonia.
Family—*Syntomidae*—	
Euchromia polymena	Sweet potato.
Family—*Lymantridae*—	
Dasychira horsefieldi, S.	Tea.
Euproctis fraterna, M.	Castor, cotton, red-grams pomegranate and rose.
Euproctis lunata, W.	Babul trees.
Euproctis scintillans, W.	Gogu, mango, etc.
Psalis securis, H.	Paddy and grasses.
Thiacidas postica, W.	Zizyphus.
Orgyia postica, W.	Castor.
Perina nuda, Fb.	Ficus.
Olene mendosa, H.	Castor.
Family—*Hypsidae*—	
Hypsa ficus, F.	Ficus species.
Argina syringa, G.	Sunnhemp.
Argina cribraria, C.	Do.
Family—*Sphingidae*—	
Acherontia: styx, W. and A. lachesis also sometimes.	Lab-lab, gingelly and brinjal.
Deilephila nerii, L.	Garden oleander.
Hippotion oldenlandiae, F.	Colocasia.
Hippotion celerio, L.	Grape-vine.
Herse convolvuli, L.	Sweet potato and green-gram.

ORDER—LEPIDOPTERA—*cont.*

	Chief host plants.
Family—*Sphingidae*—cont.	
Macroglossa vialis, B.	Morinda.
Rhopalopsyche bifasciata, B.	Do.
Family—*Eupterotidae*—	
Eupterote mollifera, W.	Moringa.
Nisaga simplex, W.	Paddy, grasses.
Family—*Bombycidae*—	
Ocinara varians, W.	Ficus *spp.*
Family—*Saturnidae*—	
Cricula trifenestrata, H.	Mango, cashew and pepper.
Actias selene, Hb.	Moringa and odina.
Family—*Notodontidae*—	
Stauropus alternus, W.	Red-gram and tamarind.
Family—*Limacodidae*—	
Parasa lepida, Cr.	Castor, palms and mango.
Altha nivea, W.	Castor.
Contheyla rotunda, H.	Coconut.
Natada nararia, M.	Pithecolobium dulce.
Belippa laleana, M.	Coffee.
Thosea cervina	Tea.
Family—*Geometridae*—	
Buzura (Biston) suppressaria, G.	Tea.
Family—*Lasiocampidae*—	
Metanastria hyrtaca, Cr.	Acacia and other trees.
Taragama siva, L.	Acacia.
Family—*Pyralidae*—	
Ancylolomia chrysographella, K. ...	Paddy.
Schoenobius incertellus, W.	Do.
Scirpophaga xanthogastrella, W. ...	Sugarcane.
Scirpophaga nivella, F.	Do.
Argyria sticticraspis, H.	Do.
Diatroea venosata, W....	Do.
Chilo zonellus, S.	Cholam and ragi.
Stenachroia elongella, H.	Cholam.
Saluria inficita, W.	Ragi.
Euzophera perticella, R.	Brinjal and chillies.
Euzophera plumbeifasciella, H. ...	Wood-apple.
Phycita infusella, M.	Cotton.
Phycita clientella, Z.	Brinjal.
Psara bipunctalis	Do.
Heterographis bengalella, Rag. ...	Custard apple.
Nymphula depunctalis, G.	Paddy.
Etiella zinckenella, T....	Sunnhemp.
Hymenia fascialis, C.	Amaranthus and grasses.
Marasmia trapezalis, G.	Cholam, maize, etc.

Order—LEPIDOPTERA—*cont.*

	Chief host plants.
Family—*Pyralidae*—cont.	
Cnaphalocrocis medinalis, G.	Paddy.
Sylepta derogata, Fb....	Cotton and other malvaceous plants.
Dichocrocis punctiferalis, G.	Castor, turmeric, arrowroot and ginger.
Lamprosema indicata, F.	Garden chrysanthemums and pulses.
Lamoria *sp.*	Boring into pungam pods.
Sylepta lunalis, G.	Grape-vine.
Crocidolomia binotalis, Z.	Cruciferous plants.
Leucinodes orbonalis, G.	Brinjal.
Margaronia stolalis, G.	Ficus *spp.*
Margaronia indica, S.	Cucurbitaceous plants.
Margaronia caesalis, W.	Jak.
Maruca testulalis, G.	Pulses.
Omphisa anastomosalis, D.	Sweet potato.
Hellula undalis, Fb.	Cabbage.
Glyphodes glauculalis, G.	Tabernimontana.
Psara pheopteralis, G....	Grasses.
Glyphodes unionalis, H.	Jasmine.
Antigastra catalaunalis, D.	Gingelly.
Terastia meticulosalis, C.	Erythrina.
Agathodes ostentosus, H.	Do.
Noorda blitealis, W.	Moringa.
Pyrausta machoeralis, W.	Teak.
Family—*Psychidae*—	
Clania crameri. W.	Acacia.
Family—*Zygaenidae*—	
Heterusia virescens, B.	Tea.
Family—*Zeuzeridae*—	
Azygophleps scalaris, F.	Agathi and daincha.
Zeuzera coffeae, N.	Coffee.
Family—*Arbelidae*—	
Arbela tetraonis, M.	Citrus, mango and other trees.
Family—*Pterophoridae*—	
Exelastes atomosa, W.	Red-gram.
Sphenarches caffer, Z....	Bottle gourd.
Family—*Tortricidae*—	
Homona coffearia, N.	Coffee.
Family—*Carposinidae*—	
Meridarches scyrodes, M.	Zizyphus.

Order—LEPIDOPTERA—*cont.*

	Chief host plants.
Family—*Eucosmidae*—	
Eucosma critica, M.	Red-gram.
Laspeyresia leucostoma, M.	Tea.
Laspeyresia tricentra, M.	Sunnhemp.
Laspeyresia torodelta, M.	Lab-lab.
Family—*Gelechiadae*—	
Stomopteryx nerteria, M.	Groundnut.
Platyedra gossypiella, S.	Cotton.
Pthorimoea operculella, Z.	Potato.
Pthorimoea blapsigona, M.	Brinjal.
Pthorimoea heliopa, L.	Tobacco.
Brachmia effera, M.	Sweet potato.
Dichomeres ianthes, M.	Indigo.
Dactylethra candida, S.	Wild indigo.
Family—*Oecophoridae*—	
Tonica zizyphi, St.	Citrus plants.
Family—*Xyloryctidae*—	
Nephantis serinopa, M.	Coconut and other palms.
Family—*Glyhyipterygidae*—	
Phycodes radiata, O.	Ficus *spp.*
Family—*Plutellidae*—	
Plutella maculipennis, C.	Cruciferous plants.
Family—*Gracillariadae*—	
Acrocercops syngramma, Meyr. ...	Mango.
Cyphostycha coerulea, M.	Lab-lab.
Gracillaria soyella, V. D.	Red-gram.
Family—*Lyonetiadae*—	
Phyllocnistis citrella, St.	Citrus plants.
Phyllocnistis toparcha, M.	Grape-vine.
Family—*Hepialidae*—	
Phassus malabaricus, M.	Tea.
Indrabala theivora, H.	Do.
Family—*Nymphalidae*—	
Euploea core, C.	Oleander.
Melanitis ismene, C.	Paddy.
Euthalia garuda, M.	Mango.
Danais chrysippus, L.	Calotropis.
Junonia orithyia, L.	Sweet potato.
Ergolis merione, Cr.	Castor.
Family—*Papilionidae*—	
Papilio demoleus, L.	Citrus and Murrayia.
Papilio polytes, L.	Do.

Order—LEPIDOPTERA—*cont.*

	Chief host plants.
Family—*Pieridae*—	
Catopsilia pyranthe, L.	Sesbania.
Terias hecabe, L.	Do.
Family—*Lycaenidae*—	
Chilades laius, C.	Citrus plants.
Polyommatus boeticus, L.	Pulses.
Euchrysops cnejus, Fb.	Do.
Virachola isocrates, F.	Pomegranate.
Tarucus theophrastus, F.	Zizyphus.
Family—*Hesperiadae*—	
Parata alexis, F.	Pongamia.
Gangara thyrsis, M.	Coconut.
Udaspes folus, Cr.	Turmeric.
Telicota augias, L.	Sugarcane.
Parnara mathias, F.	Paddy.
Suastus gremius, F.	Coconut.

Order—DIPTERA.

Family—*Cecidomyidae*—	
Pachydiplosis oryzae, M.	Paddy.
Aspondylia sesami, F.	Gingelly.
Aspondylia pongamiae, F.	Pungam.
Dasyneura gossypii, F.	Cotton.
Contarinia andropogonis, F.	Cholam.
Lasioptera falcata, F.	Bitter gourd.
Family—*Agromyzidae*—	
Agromyza obtusa, W.?	Red-gram.
Agromyza phaseoli, C.?	Cowpea.
Family—*Micropezidae*—	
Calobata, *sp.*	Turmeric and ginger.
Family—*Trypaenidae*—	
Dacus longistylus, W.	Calotropis.
Dacus brevistylus, B.	Melons.
Chaetodacus ferrugienus, F.	Guava, mango.
Chaetodacus incisus, W.	Do.
Bactrocera persicae, B.	Custard apple.
Bactrocera correctus, B.	Eugenia, mango.
Chaetodacus cucurbita, C.	Cucurbitaceae.
Chaetodacus caudatus, F.	Snake-gourd.
Carpomyia vesuviana, B.	Zizyphus.
Family—*Chloropidae*—	
Formosina flavipes, M.	Ginger.
Family—*Anthomyiidae*—	
Atherigona *sp.*	Paddy.
Atherigona indica, M.	Cholam.

Ordre—RHYNCHOTA.

	Chief host plants.
Family—*Pentatomidae*—	
Bagrada picta, F.	Cruciferous plants.
Coptosoma cribraria, Fb.	Pulses, pongamia, agathi, etc.
Coptosoma ostensum, D.	Palas, butea.
Coptosoma nazirae, At.	Cluster beans, mango, etc.
Stibaraopus tabulatus. F.	Tobacco.
Brachyplatys vahlii, F.	Agathi.
Vitellus orientalis, D.	Citrus plants.
Jurtina indica, D.	Pomegranate.
Tetroda histeroides, Fb.	Paddy.
Scotinophara lurida, B.	Do.
Cappaea taprobanensis, D.	Citrus plants on the hills.
Scutellara nobilis, F.	Phyllanthus.
Dolycoris indicus, S.	Cholam, red-gram, etc.
Menida histrio, Fb.	Paddy.
Eusarococoris guttiger, Th.	Cumbu.
Eusarococoris ventralis, W.	Gingelly.
Antestia cruciata, F.	Coffee, jasmine.
Agonoscelis nubila, F.	Cholam, ani-seed.
Nezara viridula, L.	Cumbu, castor, potato, etc.
Cyclopelta siccifolia, W.	Erythrina, pongamia.
Piezodorus rubrofasciatus, F. ...	Cholam.
Aspongopus janus, F.	Cucurbitaceae.
Aspongopus brunneus, N.	Do.
Family—*Coreidae*—	
Anoplocnemis phasiana, F.	Cowpea, brinjal, etc.
Leptocorisa acuta, Th.	Paddy.
Clavigralla horrens, D.	Pulses.
Clavigralla gibbosa, S.	Do.
Riptortus pedestris, F.	Do.
Riptortus linearis, F.	Do.
Dasynus antennatus, K.	Orange.
Family—*Lygaeidae*—	
Nysius inconspicuous, D.	Gingelly.
Oxycarenus loetus, K.	Cotton, gogu.
Aphanus sordidus, F.	Groundnut, cumbu.
Family—*Pyrrhocoridae*—	
Dysdercus cingulatus, Fb.	Cotton, gogu, etc.
Family—*Tingididae*—	
Urentius echinus, D.	Brinjal.
Stephanitis typicus, D.	Turmeric, plantain.
Monanthia globulifera, W.	Tulsi (*ocimum*) and saf-flower.
Jasmine Tingid	Jasmine.

Order—RHYNCHOTA—*cont.*

	Chief host plants.
Family—*Capsidae*—	
Calocoris angustatus, L.	Cholam, maize.
Megacoelum stramineum, W.	Cholam.
Helopeltis antonii, Sign.	Tea, cashew.
Disphinctus politus, W.	Betel-vine.
Disphinctus humeralis, W.	Tea, cinchona.
Gallobelicus crassicornis, D.	Tobacco.
Ragmus importunitas, D.	Sunnhemp.
Family—*Fulgoridae*—	
Eurybrachys tomentosa, F.	Calotropis.
Pyrilla perpusilla, W.	Sugarcane.
Ricania bicolorata, D.	Coffee.
Pundaluoya simplicia, Dt.	Cholam, maize.
Nysia atrovenosa, L.	Paddy.
Erythroneura subrufa, M.	Do.
Nilaparvata sordescens, M.	Do.
Purohita nigripes, D.	Bamboo.
Assamia moesta, W.	Sugarcane.
Family—*Cercopidae*—	
Cosmoscarta relata, D.	Jak.
Phymatostetha deschampsi, L. ...	Plantain.
Clovia lineaticollis, D.	Jak.
Ptyelus *sp.*	Do.
Family—*Jassidae*—	
Idiocerus niveosparsus, L.	Mango, sapota.
I. clypealis, L.	Do.
I. atkinsoni, L.	Do.
Tettigoniella spectra, D.	Paddy.
Nephotettix bipunctatus, F.	Do.
Empoasca flavescens, F.	Castor, tea.
Empoasca devastens, D.	Cotton.
Deltocephalus dorsalis, M.	Paddy.
Family—*Psyllidae*—	
Arytaina punctipennis, S.	Indigo.
Diaphorina citri, K.	Murrayia (curry-leaf plant) and citrus.
Trioza *sp.*	Eugenia.
Pauropsylla depressa, Cr.	Cinnamon, ficus.
Family—*Aleyrodidae*—	
Aleurolobus barodensis, W.	Sugarcane.
Aleurocanthus spiniferus, Q.	Citrus.
Dialeurodes vulgaris, K.	Jasmine.
Dialeurodes eugeniae, M.	Eugenia.
D. citri, A.	Citrus.
Neomaskellia bergi, S.	Sugarcane.

Order—RHYNCHOTA—*cont.*

	Chief host plants.
Family—*Aleyrodidae*—cont.	
Trialeurodes ricini, M.	Castor.
Siphonimus finitimus, S.	Pomegranate.
Family—*Aphididae*—	
Aphis maidis, F.	Cholam.
Macrosiphum solidaginis, F.	Safflower.
M. rosaeformis, D.	Rose.
Toxoptera graminum, R.	Wheat.
Tetraneura hirsuta, B.	Ragi.
Myzus persicae, S.	Tobacco and cruciferae.
Tetraneura ulmi, K. coimbatorensis, G.	Sugarcane.
Aphis gossypii, G.	Cotton.
Greenidea artocarpe, W.	Jak.
Aphis medicagenis, K.	Lab-lab.
Dilachnus krishni, G.	Pear.
Eriosoma lanigera, H.	Apples, pears, etc.
Aphis tavaresi, D.	Citrus plants.
Aphis odinae, V. D.	Mango.
Oregma bambusae, B.	Bamboo.
Aphis malvae, K.	Cucurbits.
Aphis nerii, B.	Calotropis.
Family—*Coccidae*—	
Icerya purchasi, M.	Citrus and wattles on Nilgiris.
Icerya aegyptiaca, D.	Garden crotons, jak ficus.
Aspidoproctus cinerea, Gr.	Pomegranate.
Aspidoproctus xyliae, Gr.	Rain tree.
Monophlebus phyllanthi, Gr.	Garden crotons.
Ripersia oryzae, Gr.	Paddy.
Ripersia sacchari, Gr.	Sugarcane.
Phenacoccus hirsutus, Gr.	Teak shoots, ficus.
Phenacoccus ornatus, Gr.	Jasmine.
Phenacoccus iceryoides, Gr.	Citrus, cotton, rain tree, etc.
Phenacoccus mangiferae, Gr. ...	Mango.
Phenacoccus insolitus, Gr.	Brinjal.
Pseudococcus bromeliae, B.	Pine-apple.
Pseudococcus lilacinus, C.	Pomegranate, tamarind.
Pseudococcus corymbatus, Gr. ...	Jak, citrus, Gr.
Pseudococcus virgatus, C.	Crotons, tomato, cotton, etc.
Pseudococcus longispinus, T.	Coconut.
Pseudococcus citri, R.	Cacao, coffee.
Pseudococcus detorquens, G.	Bamboo.
Asterolecanium longum, G.	Do.
Cerococcus hibisci, G.	Cotton, garden hibiscus, tephrosia.
Anomalococcus indicus, G.	Acacia.

Order—RHYNCHOTA—*cont.*

	Chief host plants.
Family—*Coccidae*—cont.	
Aclerda japonica, N.	Sugarcane.
Lecanium discrepans, G.	Mango, banana.
Lecanium viride, Gr.	Coffee, citrus, bael, etc.
Lacanium adersi, N.	Mango.
Lecanium ramakrishnae, Gr.	Ficus.
Lecanium depressum, C.	Crotons.
Lecanium longulum, D.	Red-gram, grape.
Lecanium hesperidum, L.	Citrus, coconut.
Saisesetia oelae, B.	Tamarind, erythrina, fig.
Saissetia hemisphaericum, T. ...	Coffee, guava, ferns, tea, etc.
Saissetia nigra, N.	Cotton, thespesia, hibiscus *sp.*, croton, etc.
Ceroplastodes cajani, M.	Red-gram, tulsi, zizyphus.
Ceroplastes floridensis, C.	Cashew.
Ceroplastes actiniformis, Gr.	Coconut, calophyllum.
Vinsonia stellifera, W.	Do.
Pulvinaria maxima, Gr.	Nim, cotton.
Pulvinaria psidii, M.	Guava, citrus, mango, etc.
Parlatoria zizyphus, L.	Citrus.
Parlatoria camelliae, C.	Nim.
Lepidosaphes meliae, Gr.	Do.
Lepidosaphes becki, Newst	Orange on the Nilgiris.
Lepidosaphes piperis, Gr.	Pepper.
Aspidiotus hartii, C.	Turmeric, yam.
Aspidiotus triglandulosus, Gr. ...	Jak.
Aspidiotus ficus, A.	Citrus, coconut.
Aspidiotus aurantii, M.	Rose, jasmine.
Aspidiotus tamarindii, Gr.	Tamarind.
Aspidiotus cydoniae, C.	Grape.
Aspidiotus camelliae, S.	Tea.
Aspidiotus lataniae, S.	Grape.
Aspidiotus orientalis, N.	Tamarind.
Aspidiotus cyanophylli, S.	Plantain.
Aspidiotus destructor, S.	Coconut, plantain.
Pinnaspis aspidistroe, S.	Pepper, areca.
Chionaspis vitis, Gr.	Mango.
Chionaspis dilatata, Gr.	Areca, ferns.
Chionaspis elongata, G.	Bamboo.

Order—THYSANOPTERA.

Family—*Thripidae*—	
Selenothrips rubrocinctus, G. ...	Cashew.
Dendrothrips bispinosus, B.	Tea.

ORDER THYSANOPTERA—*cont.*

	Chief host plants.
Family—*Thripidae—cont.*	
Scirtothrips dorsalis, H.	Chillies.
Rhipiphorothrips cruentatus, H. ...	Grape-vine, rose, etc.
Heliothrips haemorrhoidalis, B. ...	Garden crotons.
Ayyaria chaetophora, K.	Do.
Heliothrips indicus, B.	Groundnut, onions, etc.
Taeniothrips distalis, Ky.	Lab-lab and other pulses.
Isoneurothrips orientalis, B	Jasmine, morinda.
Thrips oryzae, W.	Paddy.
Thrips nilgiriensis, R.	Citrus.
Thrips tabaci, L.	Onions, garlic, cotton.
Bregmatothrips ramakrishnae, B. ...	Sugarcane.
Panchaetothrips indicus, B. ...	Turmeric, arrowroot.
Family—*Phloeothripidae*—	
Arrhenothrips ramakrishnae, H. ...	Mimusops.
Gigantothrips elegans, Z.	Ficus *spp.*

III.—CROP PEST CALENDARS FOR THE MADRAS PRESIDENCY.

The matter in this section which was prepared by the author in 1921 appeared as a departmental bulletin (No. 80). It is now believed that the same might be found very useful for reference purposes if issued as a supplement to this revised bulletin on crop pests.

In almost every agricultural tract one often comes across intelligent farmers who are able to tell us with a certain amount of confidence and precision, something about the important insect pests that appear on the various crops grown by ryots in their tract season after season. In certain localities we often meet with landholders who not only possess this knowledge but are also able to pronounce rough predictions regarding the approximate time of appearance of some of the important pests every year. This is, of course, due to previous experience, and in spite of the fact that there may be mistakes in such forecasts they are not found altogether valueless. In the same way that the farmer of one particular area is enabled to predict such a thing in his tract, the Agricultural Department, with its experience of several years in the past, is now in a position to roughly indicate the time of appearance of important crop pests during any normal year in all the different agricultural tracts of the Madras Presidency with perhaps a little more definiteness based on scientific knowledge. This information collected together and properly arranged may be called the "Entomolgist's Crop Pests Calendar for the Madras Presidency."

It must be emphasized, however, that the information attempted to be given in these calendars is based purely on a limited experience

of a few years and does not in any way pretend to be comprehensive or very accurate. In spite of the inevitable defects which such calendars are bound to possess, it is believed that the same might still serve some useful purpose to those interested in scientific agriculture and natural science. To the farmer who is anxious to reduce the annual toll levied by insects on his crops, a correct knowledge of the probable time of appearance of important insect-pests during the year will be a very valuable help. For, in most cases of insect attacks, especially on field crops grown over extensive areas, preventive and precautionary methods go a great way in saving the situation. Therefore, it is apparent that such a knowledge will serve as a sort of warning to the farmer to be on the look-out for the pests and be prepared beforehand to take prompt measures the moment the pest makes its appearance or even just before it is expected to appear. To the Agricultural Entomologist this knowledge is much more; it gives him, in addition, a clue to the seasonal habits of the different crop insects, their life cycles during the year, and a number of other interesting items in the biology of the various organisms. It helps the official Entomologist of any province not only to proceed to the different localities at the proper time to carry out investigations, but also to organize his campaigns against various pests sufficiently early and not be compelled to rush at the eleventh hour all unprepared when the pest has already appeared and done some appreciable mischief. He may find it difficult to pre-arrange the work of his staff which might often be insufficient and not available in time, if some sort of a time-table is not chalked out for them corresponding to the periods of appearance of the different crop pests. A calendar of this sort is not without its use to the outsider. The district Revenue and Agricultural officer who has to be in touch with the agricultural population of his tract may also find in the calendar some useful information; and he, being in a better position than many others to come into contact with cultivators, might easily impart the information in the calendar which many an illiterate and poor ryot might find helpful. To an outside Entomologist who wishes to study particular pests of the province, a calendar might indicate to him the approximate time of the year when he could arrange to visit the locality with advantage. And as to its utility to an insect expert coming fresh into the country with absolutely no experience of the local conditions, no one, I think, will have any doubts.

To facilitate the proper arrangement of the information to be given in such an insect calendar all the important injurious insects of any province may be divided into three convenient groups. The first includes the major pests which occur regularly during certain seasons year after year and cause more or less damage to crops; the second includes certain insects which are generally of minor importance and are occasionally found in small numbers, but which during certain years, become serious sporadic local pests; and under the third are included the remaining injurious insects, which do not exhibit any special seasons for appearance, but which are

found all through the year on their food plants. Of the three divisions the insects of the last group do not apparently demand any calendar at all as their activities are not restricted to any particular period of the year. It is therefore the insects of the first two groups that have to find a place in the calendar.

It must be stated that in some respects a pest calendar is quite different from an ordinary weather almanac or astronomical chart. The information contained in the latter is often applicable to a whole set of countries or even a continent or two. But in the case of the former the time of appearance and exit of the same and different crop pests differ remarkably in the various agricultural tracts of a single province. This is because the agricultural conditions are varied in the different regions of the province and the outbreaks of crop pests and diseases depend a good deal on the weather and agricultural conditions of each tract. In this Presidency we have several distinct agricultural areas each possessing climatic and physical features of its own, and naturally the crop seasons vary a good deal in the different tracts, the same crop having its own appropriate time in the year in the different regions. We have the West Coast area with its unfailing heavy rains, chiefly during the south-west monsoon season; there are the delta tracts which are irrigated by the big rivers Gōdāvari, Kistna and the Cauveri ; next the East Coast which shares a part of the south-west monsoon in the Circars and gets the full benefit of the north-east monsoon rains along the Coromandel tracts ; and then we have the central plateau and the southern undulating plains with a scanty and capricious rainfall. (See Map.) This being the case, even the same insect affecting a particular crop often appears in the different areas in different seasons.

All these aspects have been kept in view, as far as possible, in bringing together the necessary information. The calendar itself is made up of a few diagrams designed chiefly to indicate at a glance all the salient facts regarding the periodicity and geographical distribution of the important insect pests of different crops in the Presidency.

For insects of the first group two diagrams are designed : (Nos. I and II).

Diagram No. I.—This is a circular one and devoted solely to indicate the calendar of the important pests of paddy alone in the Madras Presidency. Ten insects affecting this crop are selected as being the most important and each is allotted a sort of orbit, the design thus showing ten concentric circles. These circles are divided into twelve portions to indicate the months of the year. On this ground plan the seasonal occurrence of each pest is marked in shading with the name or names of the district where the pest appears at that time. In addition, the figure of each pest is added at the sides of the circular diagram and is indicated in the diagram by reference numbers. The addition of the figures will help non-scientific men to make out clearly which are the pests that are referred to inside the diagram. The paddy pests included are (1) the swarming caterpillar, (2) stem-borer, (3) hispa, (4) leptispa, (5)

bug, (6) caseworm, (7) grasshopper, (8) gallfly, (9) mealybug, and (10) thrips.

Diagram No. II.— This is a tabular diagram and shows in the same manner the geographical distribution and seasonal occurrence of the chief pests of some important crops other than paddy. Here the insects selected are (1) the red hairy caterpillar, (2) the castor semi-looper, (3) the mango hopper, (4) the tobacco aphis, (5) the tobacco caterpillar, (6) the cotton aphis, (7) the cotton stem-weevil, (8) the cotton bollworms, (9) the cholam earhead bug, (10) the gingelly leafroller, (11) the castor-slug, (12) the gram caterpillar, (13) the caneborers, (14) the sunnhemp hairy caterpillar, and (15) the groundnut leaf miner. These are fifteen of the important pests of different crops other than paddy.

Diagram No. III.—For insects of the second group the arrangement is shown in the next diagram. This is also a tabular one and is designed to represent particulars of insects which are not regular pests during normal years, but which assume pest conditions, in certain years when conditions appear favourable to them. So far, the following ten insects might be taken as important examples of the group :— (1) The climbing cut worm of the Coromandel tracts which does considerable damage to ripening paddy earheads during the cold weather in certain years; (2) the black hairy caterpillar on ragi, cumbu, etc.; (3) the Deccan grasshopper of the Ceded Districts; (4) the surface weevil of cotton; (5) the green-gram sphinx; (6) the tussock caterpillar of castor; (7) cotton grasshopper; (8) surface grasshopper of paddy seedlings and ragi; (9) blister beetles on cereal earheads; (10) the green plant bug of cumbu and castor.

All the three diagrams contain information regarding seasonal and geographical distribution of the insects noted in each.

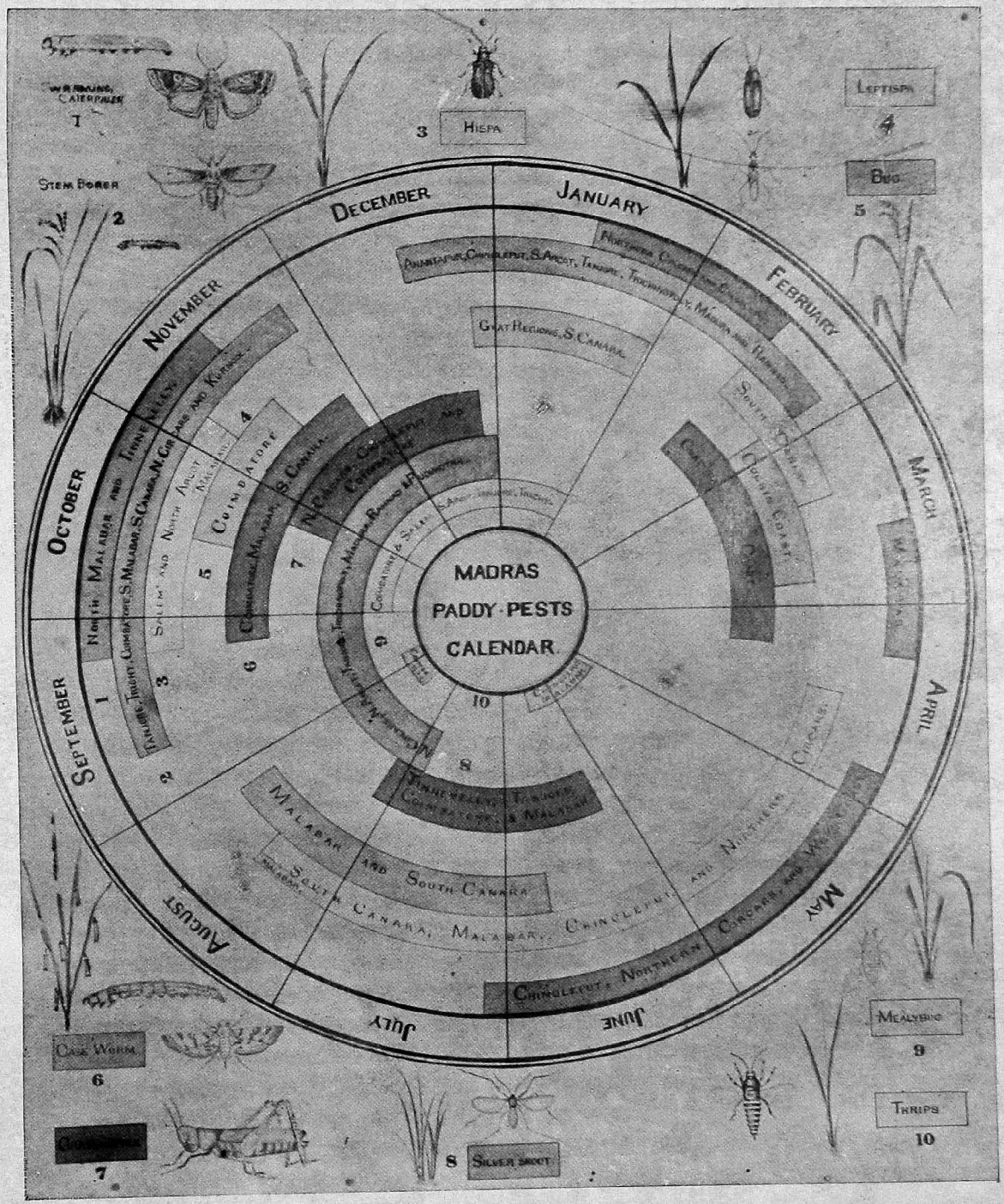
A map of the Madras Presidency is also added for reference purpose.

With regard to the information contained in this calendar two points have to be remembered; (1) that the insects referred to in the diagrams are not exclusively restricted in distribution to those districts which are noted therein; many or all of them have a wider distribution and are found on their respective food plants in many localities though not in pest form; (2) that the insects referred to in the diagrams are not the only injurious ones of the two groups referred to above in this province, but there are also others. but that, the ones in the diagrams are taken as the more important ones as far as our present knowledge has advanced.

As stated at the outset these calendars are based on the knowledge and experience gained till now. In course of time, as our experience and knowledge of the different insects of the province increase, it might be found necessary and possible to correct the information contained in this pamphlet in the light of fresh knowledge. Till then it is believed they may be of some use to farmers and others interested in the progress of agriculture in this province.

25 JUL 1939
MADRAS

Calendar No. 1.



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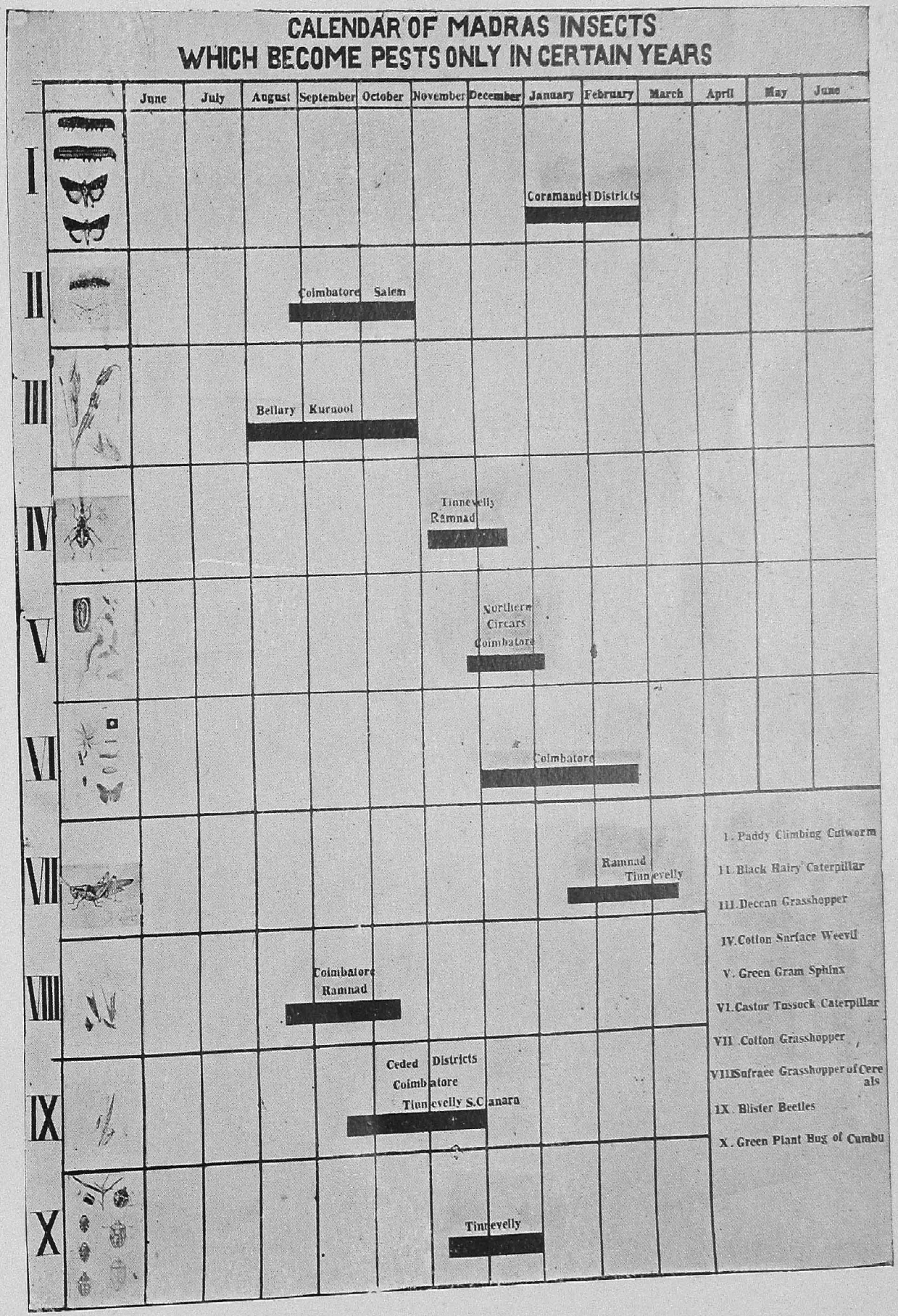
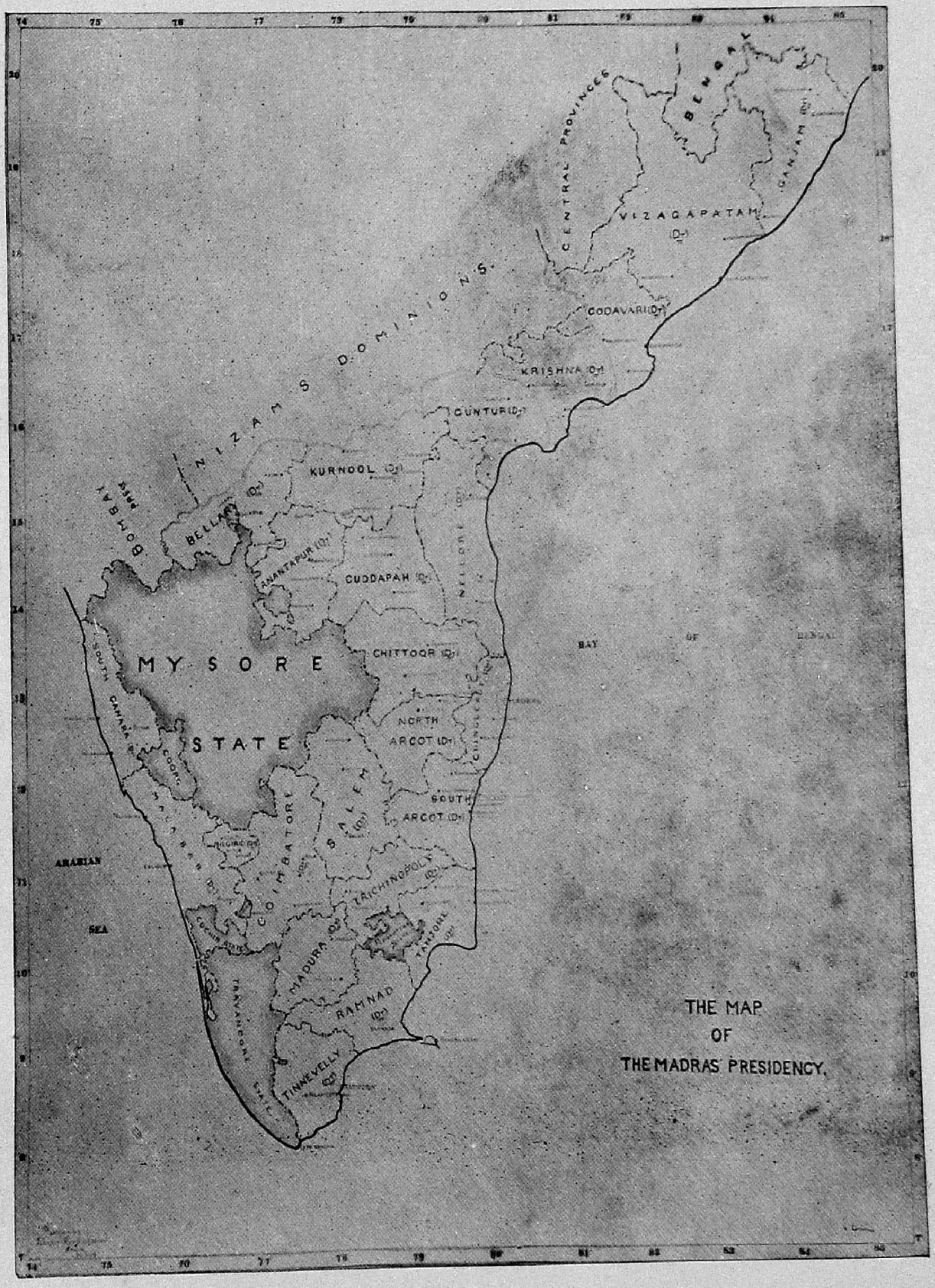
Calendar No. II.

CALENDAR OF IMPORTANT PESTS OF CHIEF CROPS OTHER THAN PADDY

INSECT PESTS	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	Nº
	South Arcot, Salem, North Arcot, Trichinopoly, & Bellary.													I
				Anantapur, Bellary, Kurnool, Chingleput, Trichinopoly, Salem, & Coimbatore.										II
								Chittoor, Salem, Bangalore, & Vizagapatam.						III
							Guntur, Coimbatore, Madura, Tanjore, S. Arcot, & S. Canara.							IV
							N. Circars, Madura, Ramnad and Coimbatore.							V
							Tinnevelly & Coimbatore.							VI
								Coimbatore, Madura, Ramnad, Tinnevelly, and Trichinopoly.						VII
						Spotted	Coimbatore, Tinnevelly, and Ceded Districts.			Spotted & Pink			Pink	VIII
	Coimbatore Tract				Tinnevelly, Coimbatore, & Ceded Districts									IX
								N. Circars, S. Arcot, N. Arcot, S. Canara						X
				Coimbatore, West Coast, Northern Circars, & N. Arcot.										XI
							Coimbatore & Ceded Districts							XII
											N. Circars, Coimbatore.			XIII
						Northern Circars								XIV
				S. Arcot, N. Arcot, Trichinopoly & Tanjore.							South Arcot			XV

I. Red Hairy caterpillar.
II. Castor semilooper.
III. Mango hopper.
IV. Tobacco aphis.
V. Tobacco caterpillar.
VI. Cotton aphis.
VII. Cotton stem weevil.
VIII. Cotton boll worms.
IX. Cholam earhead bug.
X. Gingelly caterpillar.
XI. Castor slug.
XII. Green caterpillar.
XIII. Cane borer.
XIV. Sun hemp caterpillar.
XV. Groundnut 'Bured'


CALENDAR OF MADRAS INSECTS
WHICH BECOME PESTS ONLY IN CERTAIN YEARS
June
July
August
September
October
November
December
January
February
March
April
May
June
I
II
III
IV
V
VI
VII
VIII
IX
X
Coramandel Districts
Coimbatore
Salem
Bellary
Kurnool
Tinnevelly
Ramnad
Northern
Circars
Coimbatore
Coimbatore
Ramnad
Tinnevelly
Coimbatore
Ramnad
Ceded Districts
Coimbatore
Tinnevelly S.C anara
Tinnevelly
I. Paddy Climbing Cutworm
II. Black Hairy Caterpillar
III. Deccan Grasshopper
IV. Cotton Surface Weevil
V. Green Gram Sphinx
VI. Castor Tussock Caterpillar
VII. Cotton Grasshopper
VIII. Sufraee Grasshopper of Cereals
IX. Blister Beetles
X. Green Plant Bug of Cumbu


NIZAM'S DOMINIONS
CENTRAL PROVINCES
BERAR
GANJAM
VIZAGAPATAM (D.)
GODAVARI (D.)
KRISHNA (D.)
GUNTUR (D.)
KURNOOL (D.)
BELLARY (D.)
BOMBAY PRESD.
ANANTAPUR (D.)
CUDDAPAH (D.)
NELLORE (D.)
MYSORE
STATE
CHITTOOR (D.)
SOUTH CANARA (D.)
COORG
NORTH ARCOT (D.)
SOUTH ARCOT (D.)
SALEM (D.)
COIMBATORE
TRICHINOPOLY (D.)
MADURA (D.)
TANJORE
RAMNAD (D.)
TINNEVELLY (D.)
TRAVANCORE
COCHIN
ARABIAN SEA
BAY OF BENGAL
THE MAP
OF
THE MADRAS PRESIDENCY.

Department of Agriculture, Madras.

INSECTS AFFECTING THE COTTON PLANT IN SOUTH INDIA.

INTRODUCTION.

In the Madras Presidency cotton forms the most important of the industrial crops and occupies a very conspicuous and high position among the principal crops grown in the province. However, as in other cotton areas of the world the cotton grower in South India has to contend against noxious insects of different kinds which cause damage to the crop season after season. Though we possess no accurate statistics as to the total amount of annual loss sustained by the country due to the ravages of insect pests on this important crop, it cannot be denied that a good percentage of the expected outturn is removed as toll by injurious insects year after year.

In South India a number of insects have been noted on the cotton plant. Fletcher* notes as many as 34 different kinds and compared to the number recorded on other cultivated crops cotton stands second only to cholam in the number of insect visitors. In spite of the fact that so many insects visit this plant, the number of those that actually cause any serious or appreciable damage is not, however, so numerous as we might be led to believe; for, of these many insects, several are quite harmless while a good many are only casual visitors. In the following pages an attempt is made to present a connected account of the more important insects injurious to cotton so far known in South India with brief notes on the general form, habits, life-history, the nature of damage caused to the plant and possible control measures that might be adopted in each case. The main idea of this pamphlet is to give a general idea of the more important insects affecting cotton in South India so that the cotton grower might recognize and become familiar with them and whenever possible, take advantage of the control measures suggested herein under each.

DIFFERENT CATEGORIES OF COTTON INSECTS.

All the important insect enemies of cotton may be brought together under two important and convenient groups according to the method of feeding of each insect. All those that damage the plant by biting, tearing and chewing up the vegetable tissue from different parts of it are grouped together as "Biting insects." These are provided with mouth parts adopted for biting and masticating purposes. This group includes the leaf eaters, and borers of shoot, stem and boll. Such are the green and hairy caterpillars, grasshoppers and beetles affecting the leaves and seedlings and the boll, stem and shoot-borers. The boring and leaf-eating pests of cotton are mostly caterpillars and

* Some South Indian Insects, 1914.

grubs, the former being young ones of moths and the latter those of beetles. The adult insects, except in the case of a few grasshoppers and beetles, are not directly responsible for any damage to the plant; they are only culpable as parents of the caterpillars and grubs that actually affect the plant. In most of these insects the life-history exhibits what is called a metamorphosis showing four different stages—the egg, the caterpillar or grub, the pupa and the adult insect. Of the different stages it is commonly the caterpillar or grub which is the real pest stage and which the cultivator happens to come across.

Under the second group we have all those insects which suck up the plant sap and which are unable to tear or bite vegetable tissue. The feeding apparatus in this case is a tube which enables the insect to suck up vegetable sap from the tender portions of the plant. The various kinds of insects called bugs such as plant lice, red bug, dusky bug, leaf hoppers, scale insects, mealy bugs, etc., come under this group. In the life-history of these insects we do not find such a metamorphosis as in beetles and caterpillars. The young ones of bugs are more or less similar to the mother in appearance and feed in the same manner and there is no resting or pupa stage in their life-history.

Considered from this aspect of the feeding habits and the nature of damage to the crop the important insects affecting the cotton plant in South India may be arranged as below :—

I.—Biting Insects.

(*a*) *Borers*—

The spotted boll-worms ...	*Earias fabia*, S. and *E. insulana*, B.
The pink boll-worm ...	*Platyedra gossypiella*, S.
Stout boll-worms ...	*Heliothis obsoleta*, F. and *Rabila frontalis*, W.
The stem weevil	*Pempheres affinis*, F.
Stem borer buprestid ...	*Sphenoptera gossypii*, K.
Shoot weevil	*Alcides affaber*, B.

(*b*) *Leaf, bud, shoot and flower feeders*—

Leaf-roller	*Sylepta derogata*, F.
Bud worm	*Phycita infusella*, M.
Hairy caterpillars ...	*Euproctis fraterna*, M., *Amsacta albistriga*, W. and *Pericallia ricini*, F.
Semi-looper leaf caterpillars.	*Cosmophila erosa*, H., *Acontia graellsi*, F. *and Tarache nitidula*, F.
Leaf grasshoppers ...	*Cyrtacanthacris ranacea*, S. and *Catantops annexus*, B.
Flower weevil	*Amorphoidea arcuata*, M.
Orange banded blister beetle.	*Mylabris pustulata*, Th.

(*c*) *Surface insects affecting seedlings*—

Surface grasshoppers ...	*Chrotogonus saussurei*, B. *and Aelopus tamulus*, F.
Surface weevil	*Atactogaster finitimus*, F.

II.—Sucking Insects.

(*a*) Plant lice	*Aphis gossypii*, G.
(*b*) Plant bugs...	*Dysdercus cingulatus*, F. and *Oxycaraenus loetus*, K.
(*c*) Leafhopper	*Empoasca devastens*, D.
(*d*) Scales and mealy bugs ...	*Saissetia nigra*, N., *Pulvinaria maxima*, G. and *Cerococcus hibisci*, G.
	Pseudococcus virgatus, C. and *P. corymbatus*, G.

In the following pages brief notes are added on these insects especially dealing with the general form, life habits, damage done by each and suggestions for control in different cases.

I.—BITING INSECTS.

(*a*) *The Borers.*

The Spotted Boll-worms (*Earias fabia*, S. and *E. insulana*, B. (Pl. I.)

General form and distribution.—There are two species of these insects found in South India (*Earias fabia*, S. and *E. insulana*, B.). In the caterpillar stage the two forms look so similar that they cannot be easily distinguished. In the adult stage they can be distinguished from each other by the colour of the upper wings. In *E. fabia* the upper wing is pale white with a broad greenish band. In *E. insulana* the upper wing is completely green without any white interspace. The life-history, habits, etc., of both are, however, similar. The commonest of the two on cotton is the species *E. fabia*. (Pl. I, figs. 6 and 7.) This insect is found as an important pest in all the important cotton tracts—Tinnevelly, Coimbatore and Ceded Districts.

Habits and life-history.—This boll-worm is one of the most serious of cotton pests in the plains of India. The caterpillar which is of a pale greenish brown colour injures the plants both when they are young and when they put out bolls. In the former case the top shoots of young plants are bored through by the caterpillar and killed. The faded and drooping top shoots in a field of young cotton indicate the presence of the pest; when such a top shoot is split open, either the caterpillar or the effect of its attack could be made out. When the attack is on mature plants which have put out bolls these latter are bored into by the caterpillar and all affected bolls show small pale brown holes. When split open the worm may be found inside feeding on the inner contents. Of the two kinds of boll-worms injuring cotton in South India, viz., the spotted and the pink, the spotted one is generally found more numerous and doing greater damage during the earlier stages of the cotton plant and the amount of damage to the bolls during the latter stages is to a great extent caused by the pink boll-worm. The mother moth of the spotted boll-worm deposits small shining bluish eggs singly on the tender parts of the plants such as the shoots, buds, flowers, young bolls, etc. About 100—300 are laid by each moth and from these eggs small dark brown caterpillars hatch out. If it is on a young plant the creature bores down the top shoot and if the plant is

in bolls the caterpillar bites a hole through the tender boll and enters it. Inside the shoot or boll the worm feeds upon the plant tissue and

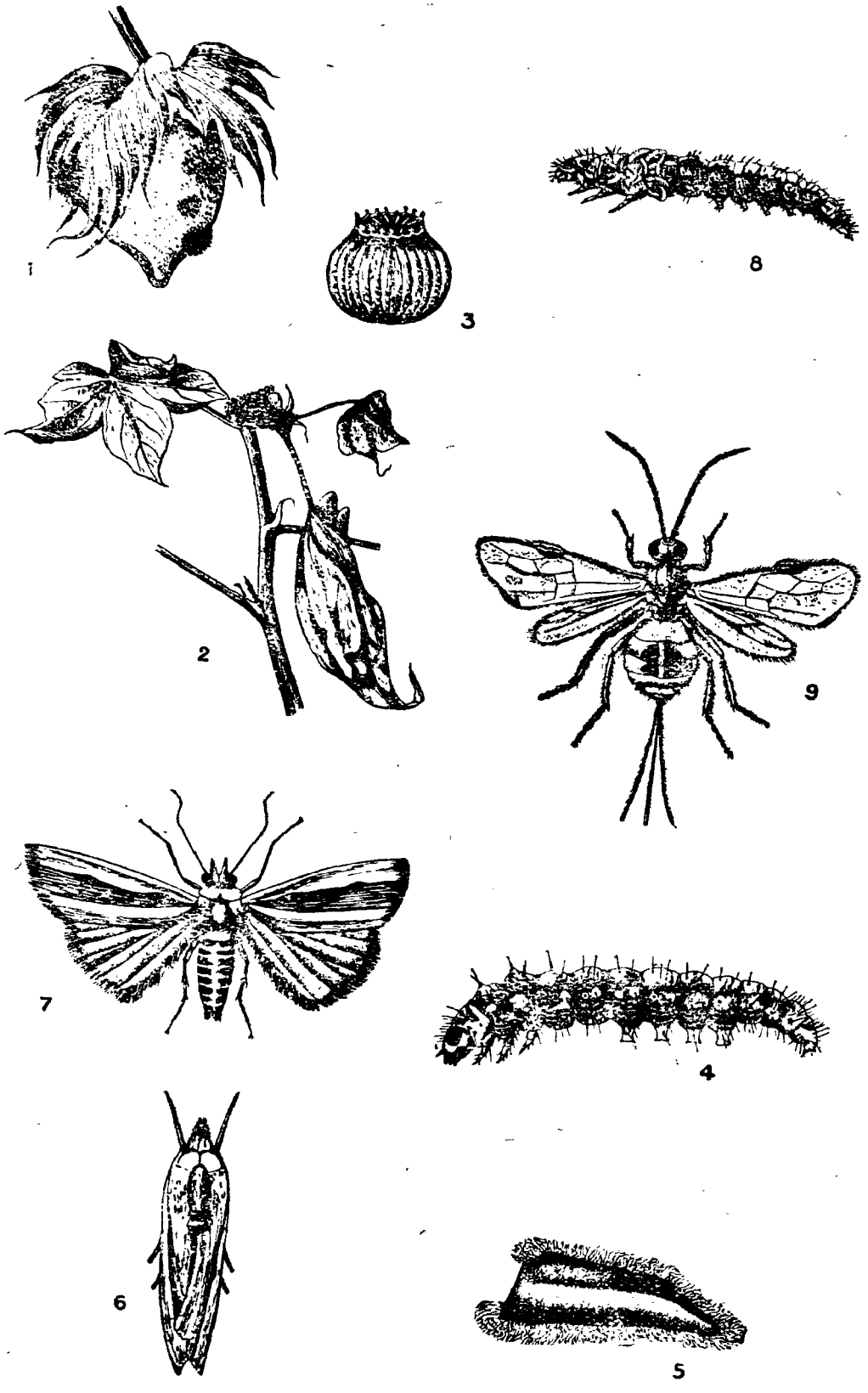


PLATE I.—Spotted Boll-worm of Cotton (*Earias Fabia*, S.).

1. Boll showing worm hole.
2. Shoot attacked by the boll-worm.
3. Egg of the insect (magnified).
4. Caterpillar (the boll-worm).
5. The cocoon enclosing the pupa.
6. Moth with closed wings.
7. Moth with wings spread out.
8. Boll-worm with parasitic grubs on.
9. The parasitic wasp (*Microbracon*).

grows in size reaching about two-thirds of an inch in length when full-fed (Pl. I, fig. 4). At this stage it comes out and selecting a suitable spot prepares a boat-shaped cocoon (fig. 5) of tough dirty brown silk and changes into the pupa inside this cocoon. The cocoon is generally found on the surface of bolls, bracts, etc., or sometimes in cracks in the soil below the plant. The pupation peroid lasts about eight or nine days at the end of which the adult moth comes out. One life-cycle from egg to adult occupies about 25 days ; egg 3—4 days, larva 10—12 days and pupa 8—10 days. This boll-worm is often found attacked by grubs of parasitic wasps, which kill them in large number in certain seasons (Pl. I, figs. 8 and 9).

Besides cotton the spotted boll-worm is found breeding on Bhendai (*Hibiscus esculentus*), Hollyhock, and a few allied malvaceous shrubs.

Control measures.—Being a borer or internal feeder, only preventive methods will be of any good in the case of this insect. These methods should chiefly aim at the destruction of the first attacked shoots and bolls and thus prevent the multiplication of the insect. Generally one brood appears when the plants are young and the insect is a top shoot borer at this stage. If at this stage these attacked top shoots are systematically pruned and destroyed, there will be a considerable reduction in the number of the pest when the plants grow up and put out bolls.

In cotton areas it is advisable not to grow Bhendai plant (*Hibiscus esculentus*) at times when there is no cotton in the field. Due to the presence of Bhendai and other host plants growing at times when no cotton is in the field, the insect is able to breed and multiply all through the year ; this must be avoided as far as possible. All malvaceous shrubs on which this insect breeds must be examined and destroyed wherever possible. Parasites if found to exist may be encouraged by use of parasite boxes, in which infested shoots and bolls are kept to rear parasites. These are generally small wooden boxes enclosed with wire gauze the meshes of which do not allow the moths of the boll-worm to fly through but allow the parasites to escape through and attack the boll-worms in the field.

The Pink Boll-worm (*Platyedra*) *gossypiella*, S. (Fig. 1.)

General form and distribution.—This worm which is also a caterpillar is easily distinguished from the spotted boll-worm by its uniform pale or deep pink colour. The adult insect is a dark brown moth with a wing expanse of not more than $\frac{2}{3}$" (fig. 1 (*b*)). The insect is found all over the province and has a very wide distribution all over the world having been noted in most of the important cotton growing areas of the world.

Habits and life-history.—This borer is found often in company with the spotted boll-worm inside ripening bolls of cotton, but it is not found in the younger stages of the cotton plant. The external indication and the nature of damage done to the crop are also similar to that caused by the other boll-worm, viz., feeding on the tender ripening boll and on the oily seeds inside it. If young buds or bolls are attacked they drop down, and if riper bolls suffer part of the contents is eaten up and there is loss in lint formation. Small flattish eggs are laid by parent moth on the tender portions of the plant such as leaves, bolls, etc. These hatch into small pale whitish caterpillars which gradually find their way into the boll. When full-fed, which generally takes about three weeks, the worm (fig. 1 (*c*)) has a uniform

bright pink colour and is a little over half an inch in length. The pupation generally takes place inside the boll, often inside the portion of a seed hollowed out by the larva and the pupa is enclosed in a light cocoon of silk (fig. 1 (*d*)). Pupal period ranges from 8—10 days and the adult insect, which is less than half an inch in length, is a small blackish brown moth not easily distinguishable from many of the small commoner moths ; it is nocturnal in habits and under favourable conditions continues alive for about a month. One life-cycle approximately occupies 25—35 days ; 5—6 for egg, larva 12—20 days and pupa 8—10 days. The moths also come to lights occasionally. It has not so far been found breeding on any of the common cultivated or wild plants in South India other than cotton, though it was once wrongly believed to breed on Bhendai (*Hibiscus esculentus*) ; nor has the moth been noted to hibernate in the larval or pupal stage inside cotton seeds in South India. What happens to the insect when there is no cotton in the field is therefore a problem not yet solved.

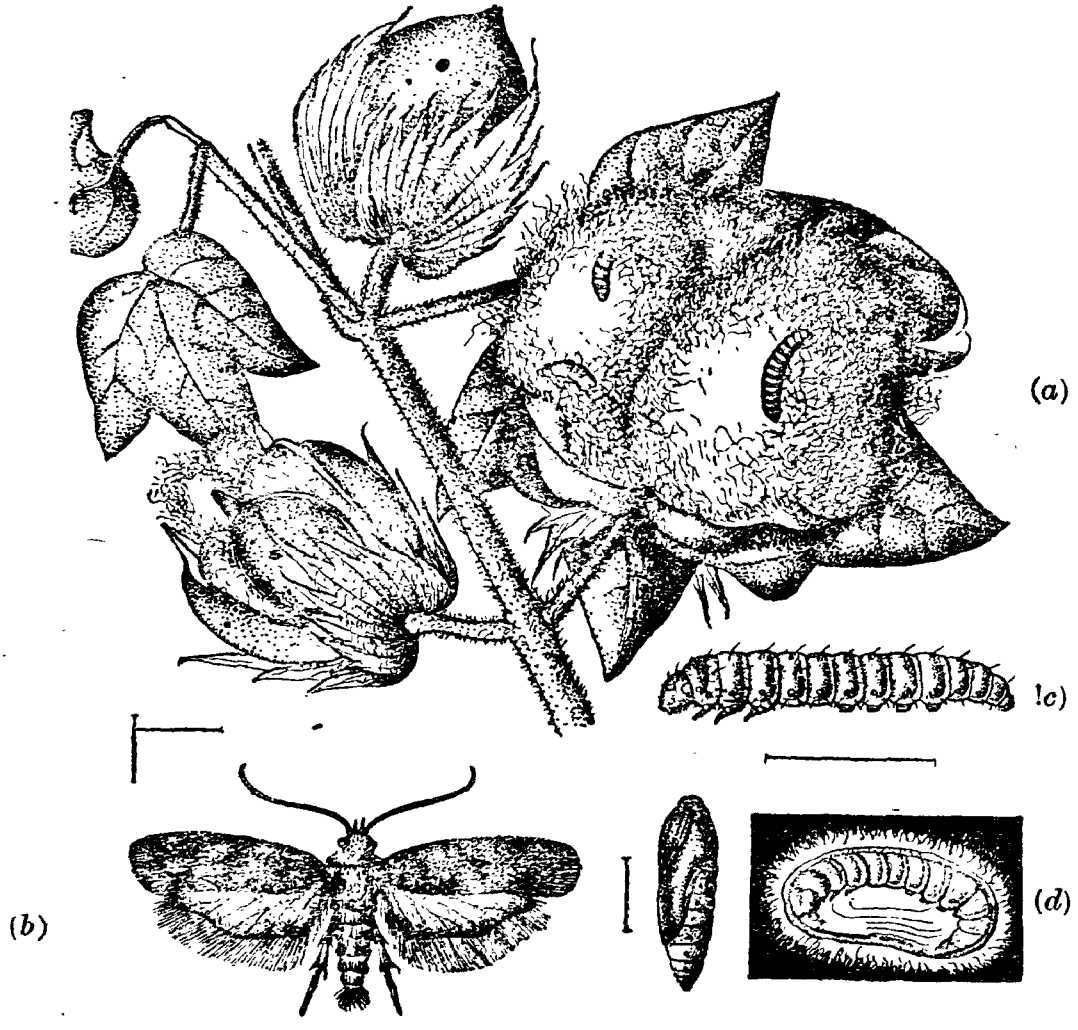


FIG. 1.—Pink Boll-worm (*Platyedra gossypiella*, S.)
(*a*) Infested cotton bolls. (*b*) Adult moth. (*c*) The caterpillar.
(*d*) Pupa separately and the larva inside seed.

Control measures.—The remedies against this pest which is also a borer are entirely of a preventive nature. Good seeds should be used and it is safer to fumigate all such seeds before sowing. Early attacked bolls should be picked and disposed off to prevent multiplication of the pest. It is safe to fumigate all seed imported from places outside the country before sowing, to be sure that the seeds are pest-free.

To help the control of the three important pests of cotton in South India, viz., the spotted boll-worm, the pink boll-worm and the stem weevil, Government have passed a Legislative enactment called the Cotton Pest Act to be in force in some definite areas of South India where Cambodia and allied varieties of cotton which are more subject to these pests are grown. This act stipulates that all cotton plants (especially the Cambodia and American varieties) should be uprooted from the fields by a certain fixed date in the year. The idea is to create as long an interval as possible between one cotton season and the other so that these three pests may be starved out and considerably reduced in numbers before the next cotton season. In former years ryots used to allow the cotton plants to remain in the fields for two or three years continuously and thus allow the insect pests to multiply abnormally and the aim of the act was to stop this system to check pests. Though at the beginning cotton growers looked upon this Act as unnecessary Government interference, they have gradually begun to realize the good effects of the Act in getting these cotton pests comparatively reduced and enabling them to get better outturns both in quantity and quality in recent years.

Other Boll-worms. (Fig. 2.)

Heliothis obsoleta, F. and *Rabila frontalis*, W.—Occasionally these two noctuid caterpillars have been found boring into cotton bolls especially on the Coimbatore farm. They have not, however, been found to be as important as the boll-worms noted above.

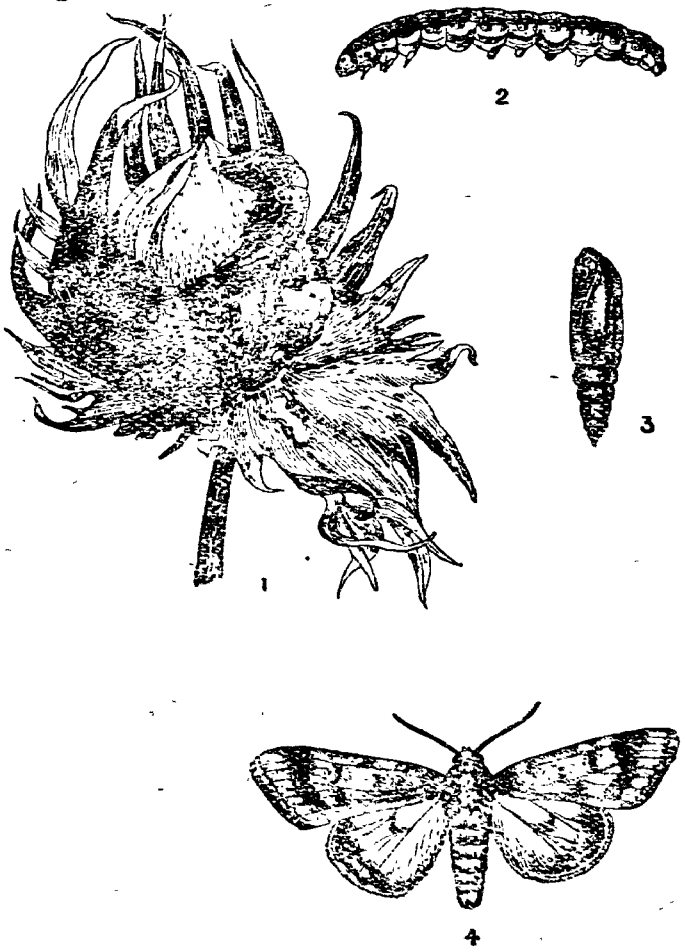


FIG. 2.—Gram Caterpillar boring into Cotton Boll. (*Heliothis obsoleta*, F.)

(1) Boll attacked by caterpillar.
(2) The caterpillar.
(3) The pupa.
(4) The adult moth.

Heliothis obsoleta, F. (fig. 2) is the well-known gram caterpillar and is normally a pest of pulses all over South India. It is, however, a well-known pest of cotton in America and is known there as the cotton boll-worm. In this province it has not as yet been noted as a serious pest of cotton. Though rare, when it does appear the caterpillar bores into the bolls and causes more substantial damage than the spotted or pink boll-worm.

Rabila frontalis, W., which has been noted on cotton in Coimbatore is a stout built yellowish brown moth and its larva a thickest caterpillar having a light pinkish colour. This stout caterpillar bores into the boll and consumes a good part of it; pupation takes place in the soil. The same measures adopted for the commoner boll-worms can be applied in these two cases also.

THE COTTON STEM WEEVIL *Pempheres affinis*, F. (Pl. II.)

General form and distribution.—Next to the two important boll-worms, this insect ranks as a very important and serious pest of cotton in South India. It is a small dirty brown beetle about $\frac{1}{8}''$ in length with the curved snout very conspicuous (see Pl. II, fig. 2). The insect has been noted in all the important cotton areas of South India and in Malabar also. It has also been noted in Pusa, Bihar.

Habits and life-history.—As in the case of the boll-worms it is the larva of the weevil that is injurious to the cotton plant. The injury to the plant consists in the young ones of the beetle burrowing into the stem, especially between the bark and the stem. Plants that are attacked in this way show the characteristic nodular swellings on the stem surface, generally at the lower portions of it just above the ground. When very young plants of a month or forty days are attacked the pest often kills the plant but in the case of older plants many survive the attack, though they suffer in vigour. The external indication is generally visible on the plant only when the pest has almost completely done its work. During strong winds badly infested plants lodge and often break at or near the region of the stem where the nodular swellings are present. (Pl. II, fig. 1).

The life-history of the insect so far known is as follows: The parent weevil deposits small shining whitish eggs singly just under the skin of the stem of the growing plant. It is very difficult to find eggs in a field. The small pale whitish yellow grub that hatches out of the egg bites through into the region between the bark and the main stem and here makes irregular galleries, and this causes the abnormal growth of the plant resulting in the formation of those swellings on the stem. Several grubs are found in the same stem. The pupa is also found inside the burrow. One generation in the life of the insect occupies roughly two months, the period of the different stages generally occupying 9—11 days in egg, 30—45 days as grub and 10—12 days as pupa. Weevils have been kept alive in captivity for a month though it is not known how long they are able to continue alive in nature. Besides cotton the other plants on which the insect has been noted to breed to a very small extent are Gogu (*Hibiscus cannabinus*), Bhendai (*H. esculentus*) and Thespesia seedlings; but on none of these has this been found on any large scale. In Northern India it has been noted on *Triumfetta sp.* The pest can easily pass through several generations in the year if the host plants are kept on growing for months and years together as was the case with Cambodia

25 JUL 1939

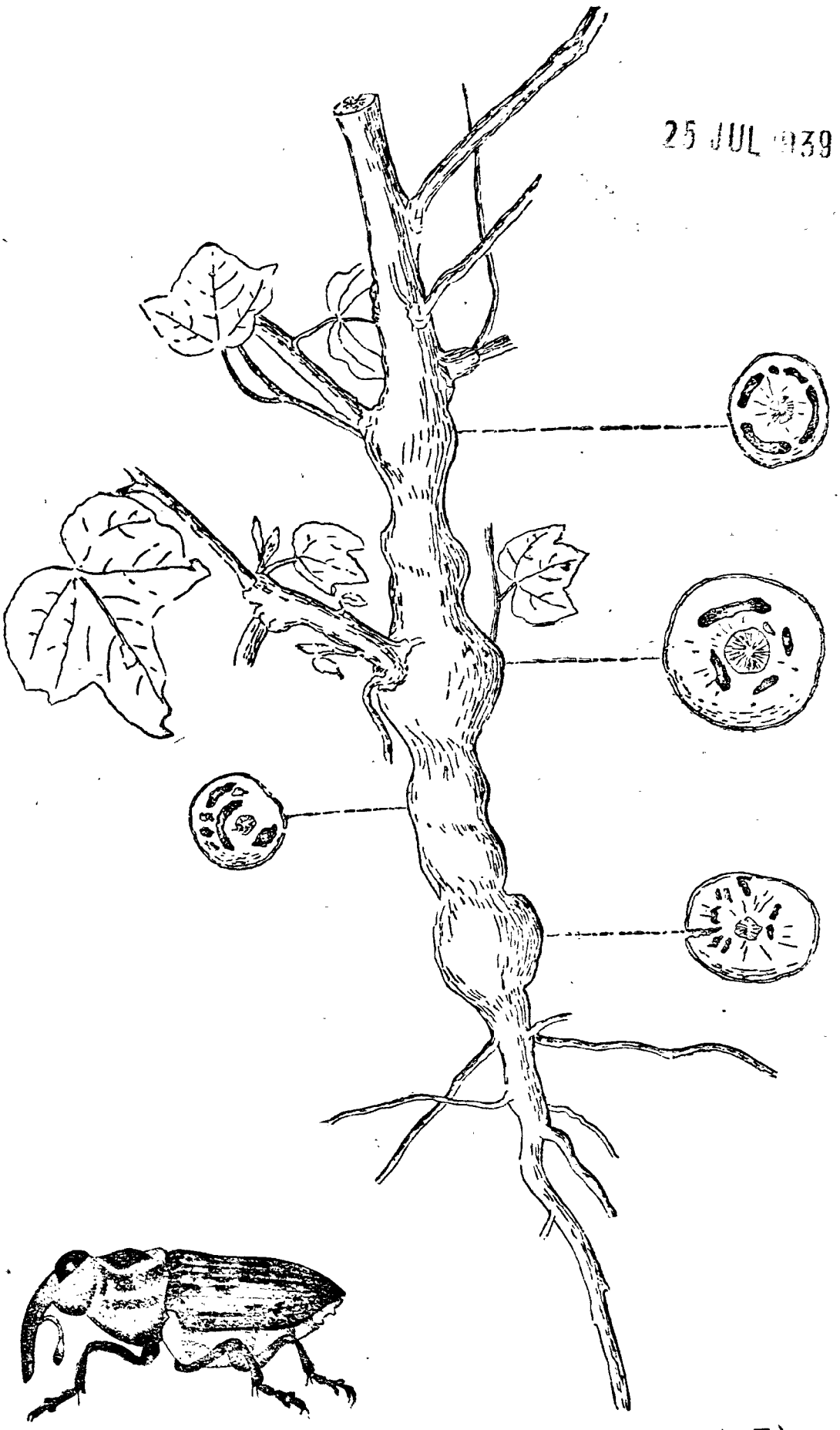


PLATE II.--Cotton Stem Weevil (*Pempheres affinis*, F.).

1. Infested cotton stem showing galls caused by the borer grub.
2. The adult weevil magnified.

cotton plants before the advent of the PestAct. No effective parasite has been found on this pest till now.

Control measures.—As to control measures none but those directed to prevent the beetle from multiplying and infesting fresh plants are possible. Once a plant is badly attacked nothing can be done to save it from death or loss of vigour. But the systematic prevention by destroying first attacked plants will greatly reduce the numbers of the pest and thus minimize the damage. All cotton plants should be pulled out at the end of the cotton season so that there may not be any cotton on the ground for the pest to breed and pass on to the next cotton season. All cotton plants thus pulled out should be thoroughly dried in the sun so as to kill the grubs and pupæ inside them which would otherwise remain there for some time and emerge later to infest fresh plants. It is not easy to catch the adult as it is very small in size and not commonly seen in the fields, unless very carefully searched for. The recent introduction of the Pest Act in some of the cotton areas of the province for the boll-worms and this insect has considerably reduced the incidence of this pest in recent years.

THE STEM-BORER BUPRESTID (*Sphenoptera gossypii*, K.). (Fig. 3.)

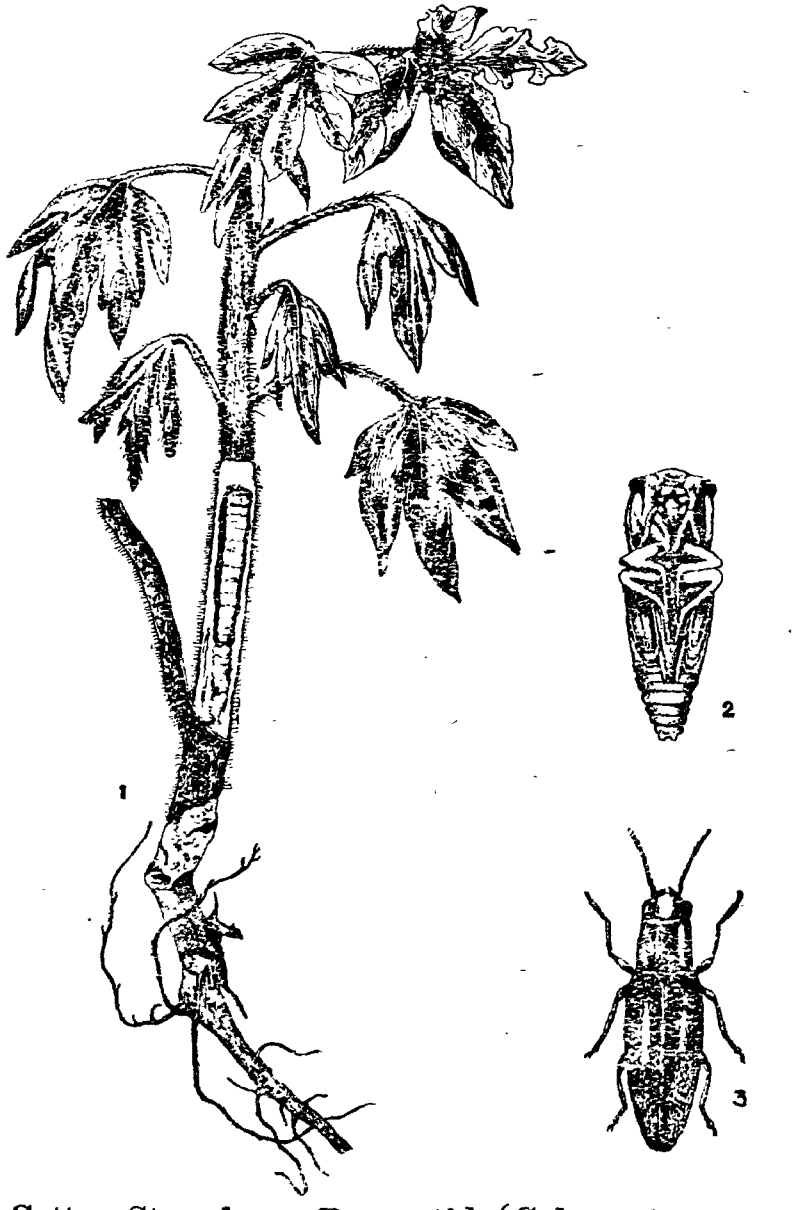


FIG. 3.—Cotton Stem-borer Buprestid (*Sphenoptera gossypii*, K.)
1. Plant showing the stem with borer *in situ*. 2. Pupa. 3. Beetle.

General form and distribution.—This is a shining coppery brown beetle of about $\frac{1}{3}''$ in length belonging to the group of jewel beetles. In this province this insect has been noted only in the Bellary tract and chiefly on American cottons, though it has a wider distribution in the different parts of Northern India.

Habits and life-history.—The damage done to cotton is by the grub of this beetle which bores into the stem and in many cases kills the whole plant. The parent beetle lays single eggs on the bark of the tender stem ; these hatch into grubs which burrow into the stem and tunnel through the same. The grub is of a pale whitish colour, elongated and with a flattish head. When full-fed it pupates in the gallery and after the pupation period the beetle emerges through a hole previously prepared by the grub. The grub is often parasitised by small wasps.

Control measures.—Destruction of first attacked plants and the collection of beetles when found in the fields.

THE SHOOT WEEVIL (*Alcides affaber*, B.). (Fig. 4.)

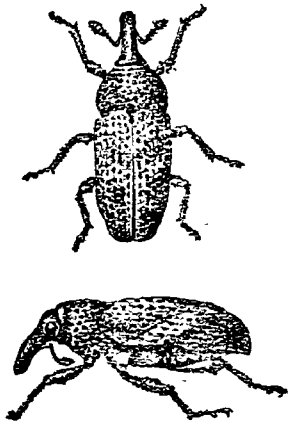


FIG. 4.—Shoot Weevil (*Alcides affaber*, B.).

General form and distribution.—This insect is a dark greyish brown insect with a prominent curved beak as in the stem weevil, and with pale cross bands on the upper wings. It is, however, much bigger in size than the latter. It is fairly common all over South India. Being very common on gogu it is known as the gogu stem weevil.

Habits and life-history.—This pest is also a boring weevil grub, but compared to the stem weevil (*Pempheres affinis*), it is not at all a serious pest. The damage to the plant consist in the grub of this weevil boring into the top shoots and leaf stalks. The weevil inserts shining smooth yellowish eggs singly into the plant stem. The grub is thick and pale yellowish $\frac{2}{3}''$ in length. The pupa which is pale white is also found inside the gallery made by the grub. This weevil attacks Bhendai (*Hibiscus esculentus*) and Gogu (*H. cannabinus*) commonly. The insect has not been noted till now as a serious pest of cotton on a large scale anywhere. On gogu it is often found doing appreciable damage. Isolated cotton plants often show a number of these weevils feeding on the top shoots and boring into leaf stalks and portions of the branches.

Control measures.—The pest can be easily controlled and prevented from multiplying by pruning the bored top shoots and collecting and destroying the adult weevils which can be easily found out. This weevil is closely allied to a similar one (*Alcides leopardus*) found to a small extent on cotton in North India.

(*b*) *Leaf, Bud, Shoot and Flower Feeders.*

The Cotton Leaf-roller (*Sylepta derogata*, F.). (Pl. III.)

General form and distribution.—The adult insect is a medium sized moth having yellowish wings with brown wavy markings (see Pl. III, fig. 5). It is the caterpillar of this creature that rolls the leaves and feeds on the green matter. It is found all over South India.

Habits and life-history.—The dark green caterpillar which is elongated and slender has the habit of living inside peculiar rolls made of the cotton leaves and feeding on the green matter. Infested plants can be very easily made out by the presence of such numerous rolls on the plant. When such a roll is opened out, the caterpillar or the pupa can be found inside. In bad cases these caterpillars completely defoliate the plant. The mother moth lays smooth flattish pale white eggs singly on the tender leaves usually on the under surface. The small greenish yellow caterpillar which emerges from each egg, within a week after hatching, begin to roll the leaves and live inside the rolls feeding on the leaf tissue. When full grown the larva is a little more than an inch in length and has a glistening green colour with head and prothorax dark. Th larva pupates in the roll itself and from the reddish brown pupa the adult moth emerges. The different periods of life-cycle roughly occupy 2—3 days for the egg 15—18 days for the larva and 7—8 days for the pupa and for one generation a moth's time approximately.

This insect feeds on different varieties of malvaceous plants especially on Bhendai (*Hibiscus esculentus*).

Control measures.—The control of this pest is not so difficult a matter as in the case of the some of those noted above. The leaf rolls in affected plants are easily recognized and the only thing to do is to collect these rolls and throw them into a bucket or tray containing some water and kerosene. The caterpillars are at once killed. If these rolls are not observed early and the pest has increased the plants can be sprayed with a stomach poison like lead arsenate which will be an effective remedy. However, the former method, if resorted to in time, is a very easy and economic one.

The Cotton Bud-worm (*Phycita infusella* M.). (Pl. IV.)

General form and distribution.—This is a small dark grey moth with a distinct whitish cross bar on each upper wing. It is the caterpillar of this creature that feeds on the buds and folded leaves on the top of a young cotton plant. The insect is commonly found in all cotton areas.

Habits and life-history.—The full grown caterpillar which is about ½″ in length is a smooth pale greenish creature with the head and prothorax black. This caterpillar brings together the tender top leaves around the bud and feeds on these portions; these leaves fade and often drop down if the growing portion is affected. The whole life-history is spent inside the fold. The greenish brown pupa which is enclosed in a flimsy silken cocoon is also found in the leaf fold. This

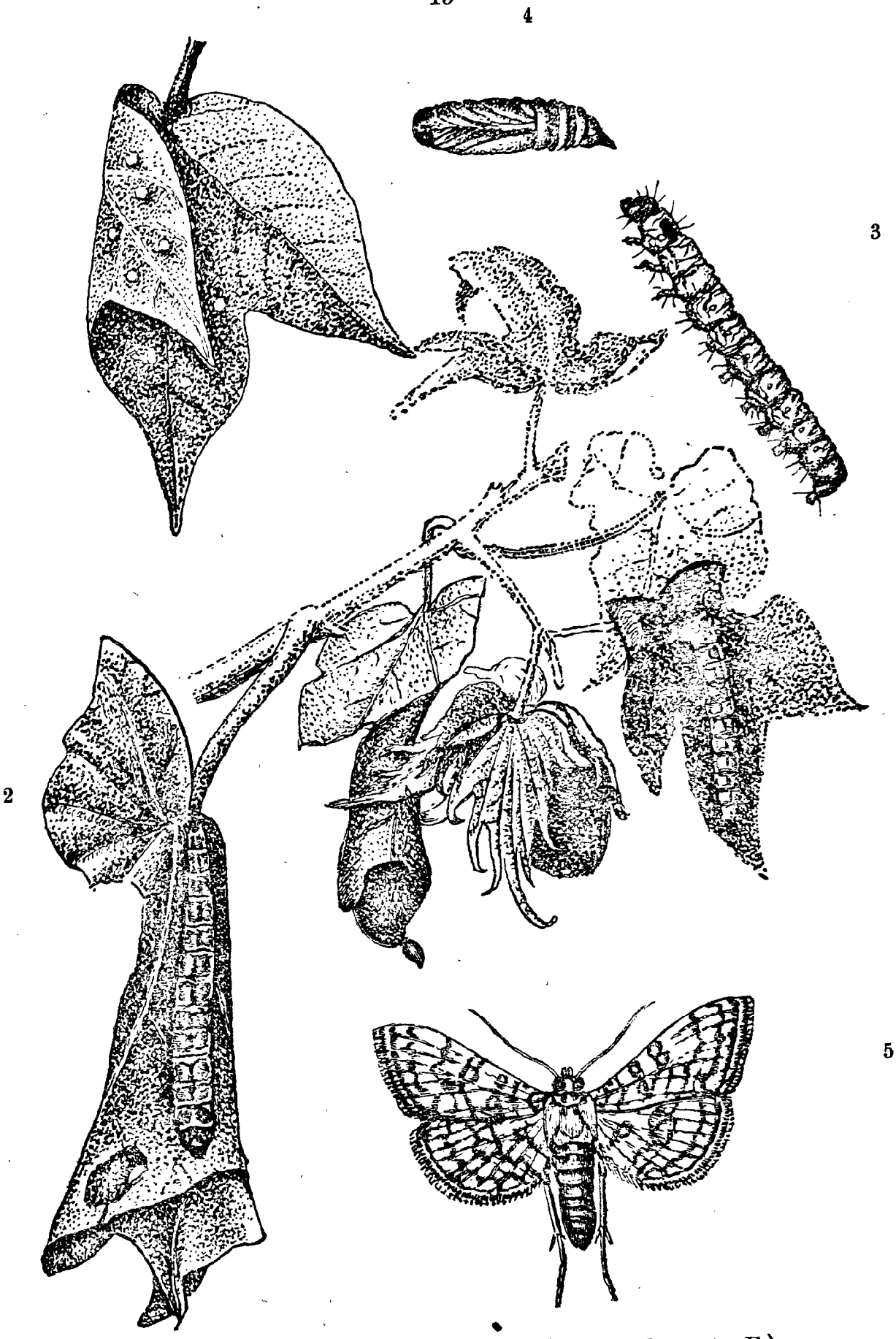


PLATE III.--The Cotton Leaf Roller (*Sylepta derogata*, F.).

1. Eggs of the insect on cotton leaf.
2. Cotton shoot showing leaf rolls made by the caterpillar and the latter.
3. Caterpillar taken separately.
4. Pupa.
5. Moth with wings spread out.

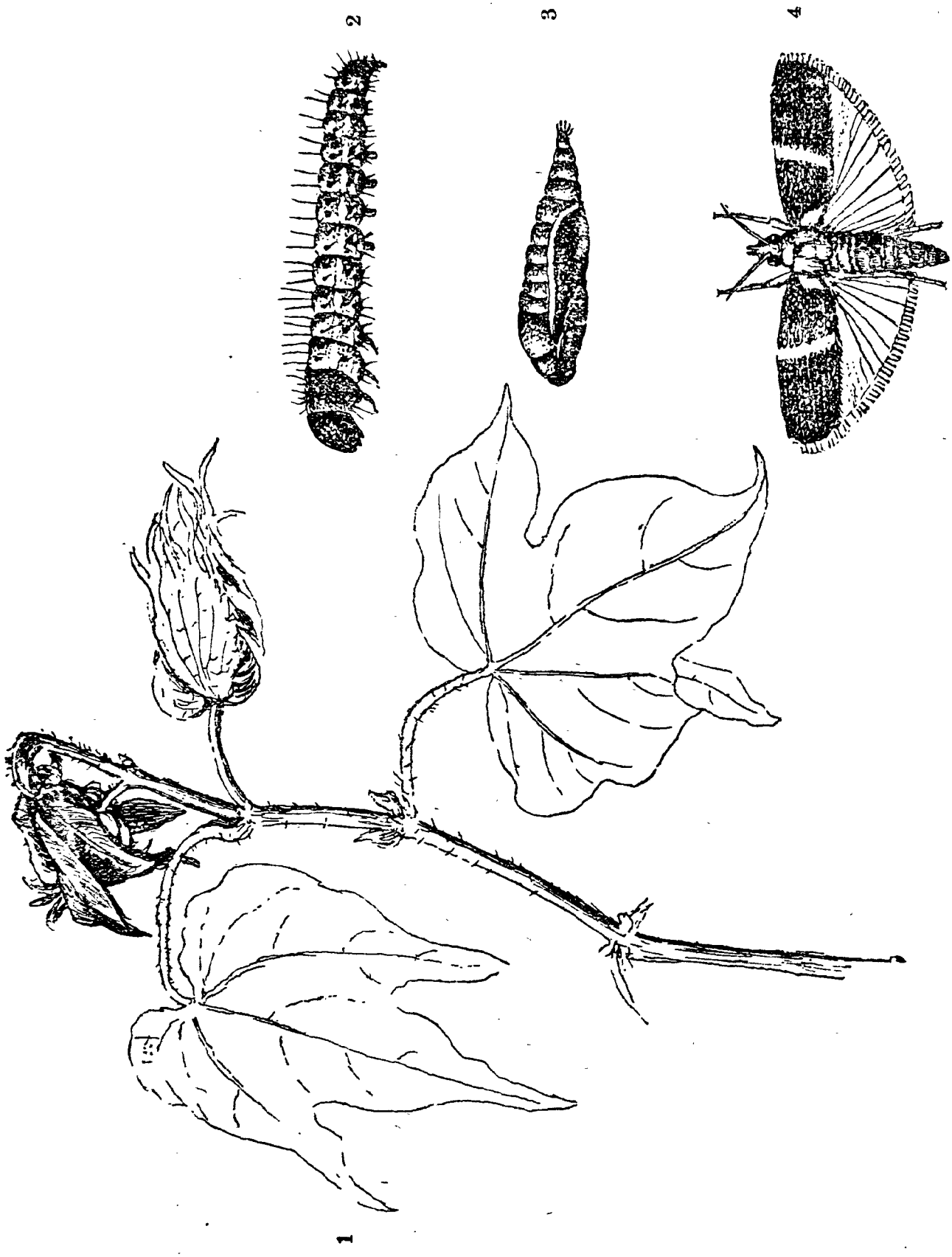


PLATE IV.—The Cotton Bud-worm (*Phycita infusella*, M.).

1. Plant showing bud-worm attack.
2. Caterpillar.
3. Pupa.
4. Moth with wings spread out.

creature is generally noted only when the cotton plants are a month or two old and disappears when they begin to blossom. It is often found in company with the spotted boll-worm in the role of a shoot borer.

Control measures.—The insect is very rarely found serious. The presence of the pest in a field is easily made out by the characteristic folded and fading condition of the top portions and at the early stage these shoots can be clipped and the multiplication of the pest easily checked.

HAIRY CATERPILLARS (*Euproctis fraterna*, M., *Amsacta albistriga*, W. and *Pericallia ricini*, F.). (Fig. 5.)

General form and distribution—Three species of hairy caterpillars (*Kamblipuchis*) are now and then found on cotton. These are the

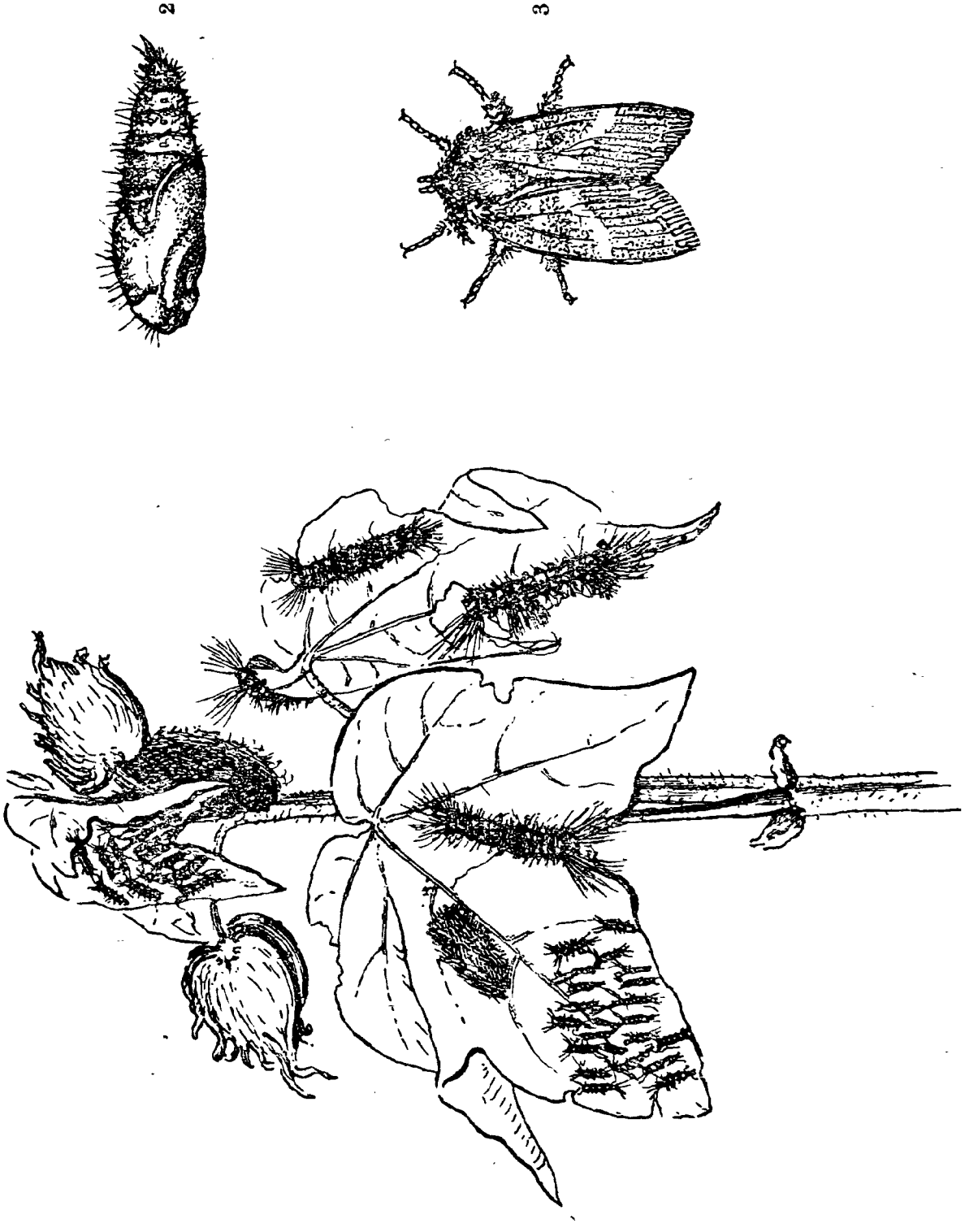


FIG. 5.—The Tussock Hairy Caterpillar (*Euproctis fraterna*, M.)
1. Plant showing caterpillars. 2. Pupa. 3. Moth.

tussock caterpillar *Euproctis fraterna*, M., the red hairy caterpillar *Amsacta albistriga*, W. and the black hairy caterpillar *Pericallia ricini*, F. These hairy caterpillars are found in all cotton areas in South India. These are commonly found more on castor, cholam and other plants than on cotton. On cotton these are only occasionally noted. The tussock caterpillar is reddish and has the characteristic long hairy tufts (see fig.). The moth has a bright yellow colour.

Habits and life-history.—So far only one of these species of hairy caterpillars—the tussock caterpillar has been more commonly noted on the cotton plant. This is a dark reddish brown insect covered with tufts of irritating pairs, saddle-like erect tufts and long brush-like tufts of hair in different regions of the body. The eggs are laid by the parent moth in masses of hundred or more protected above by a buff coloured hairy covering. The young caterpillars are gregarious and can be found feeding together on the leaf tissue in groups of fifty or more. The full-fed larva is elongated and stout having a reddish brown colour, with the head and prothorax of light orange red. The pupation takes place between leaf folds and the pupa which is reddish brown is enclosed in a coarse cocoon made up of hairs and silk.

Control measures.—The control of these hairy caterpillar pests is a a comparatively easy affair. The eggmasses which are easily identified can be picked and destroyed early in the season. The gregarious habits of the young larva also make it very easy to pluck and destroy the infested leaves, with a number of the caterpillars *in situ*. In worst cases the plants may also be sprayed or dusted with arsenates.

SEMI-LOOPER CATERPILLARS (*Cosmophila erosa*, H., *Acontia graellsi*, F., and *Tarache nitidula*, F). (Fig. 6.)

General form, etc.—Semi-looper caterpillars are larvae of moths but do not possess all the ten abdominal prolegs well developed and

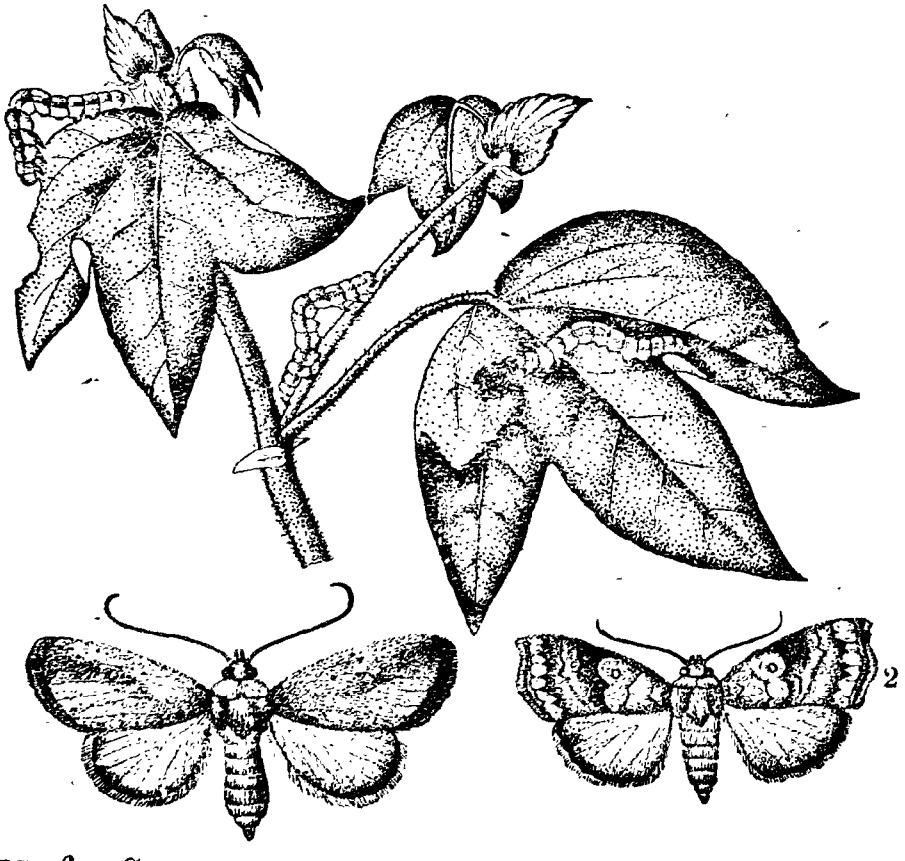


FIG. 6.—Semi-looper Caterpillar (*Cosmophila erosa*, H.).
1. Plant showing caterpillars.
2. Moths (male and female).

as such they move about by making partial loops ; hence they are called semi-loopers. Some of these caterpillars occasionally attack cotton as leaf eaters though not as serious pests. Among these the three noted above have been seen in all cotton tracts of South India. The caterpillars of *Cosmophila* and *Acontia* are bright leaf green in colour while that of *Tarache* has a dark brown colour. The moth *Cosmophila* has reddish brown wings, *Acontia* has bright lemon yellow upper wings and *Tarache* bright white wings with dark markings.

Control measures.—The caterpillars of all these can be easily handpicked in the early stages and if at any time they appear in numbers the plants may be sprayed or dusted with arsenates.

LEAF GRASSHOPPERS (*Cyrtacanthacris ranacea*, S. and *Catantops annexus*, B.). (Fig. 7.)

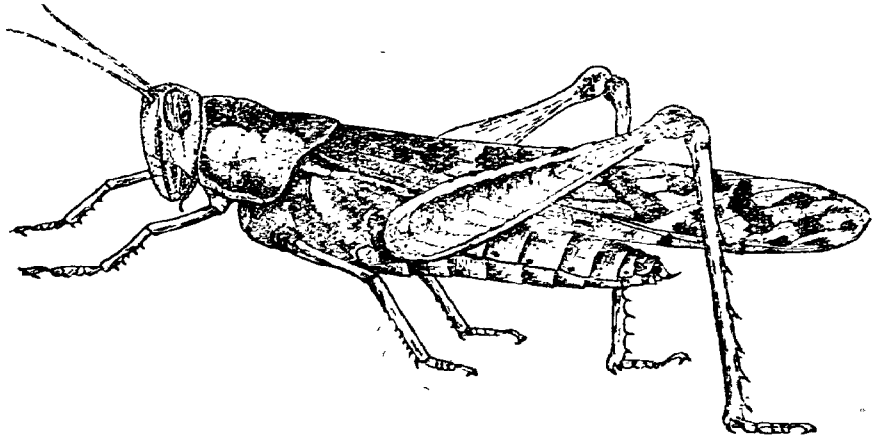


FIG. 7.—Cotton Grasshopper (*Cyrtacanthacris ranacea*, S.).

These two species are occasionally found to be minor pests. *Cyrtacanthacris ranacea*, S., is a stout big grasshopper found in small numbers in cotton fields everywhere, but it has never been reported as a pest. The other *Catantops annexus*, B., which is a smaller form was once reported to do some damage to cotton plants in the Ramnad district, as a sporadic local pest. In such cases the grasshoppers can be collected by nets or traps and if necessary the plants can also be sprayed with stomach insecticides.

ORANGE-BANDED BLISTER BEETLE (*Mylabris pustulata*, Th.). (Fig. 8.)

This common blister beetle is occasionally found feeding on cotton flowers but is rarely a serious pest. It is generally found all over South India on various flowers such as those of Prickly-pear, Red-gram, Gogu, etc. The beetles which are generally sluggish can be easily collected with a net and destroyed.

FIG. 8.—Orange-banded Blister Beetle (*Mylabris pustulata*, T.).

Flower Weevil (*Amorphoidea arcuata*, M.).

This is a minute smooth reddish brown weevil somewhat bigger than the rice weevil and found occasionally breeding inside cotton flowers. It has been noted in Coimbatore and Saidapet. Though not a pest in South India it is very closely allied to a serious cotton pest in the Philippines, viz., *Amorphoidea lata*, M. The local insect therefore deserves some watching as to its future.

(*c*) *Surface Insects affecting Seedlings.*

The Surface Grasshopper (*Chrotogonus saussurei*, B.). (Fig. 9.)

During the very early stages of the plant after the seedlings have just come out of the seeds cotton plants sometimes suffer from insects of different kinds which cut the seedlings and often do serious harm. Of these this grasshopper is a common one. These are short and stout active creatures often having the colour of the soil on which they are found. There are many species of this grasshopper found in different parts of the country doing the same kind of damage on other plants also of which *Aelopus tamulus* is one.

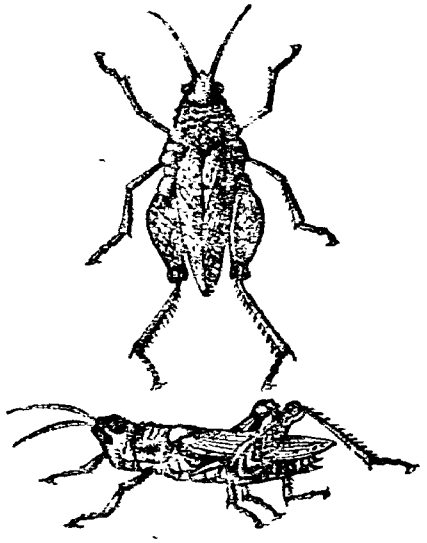


Fig. 9.—Surface Grasshopper (*Chrotogonus saussurei*, B.).

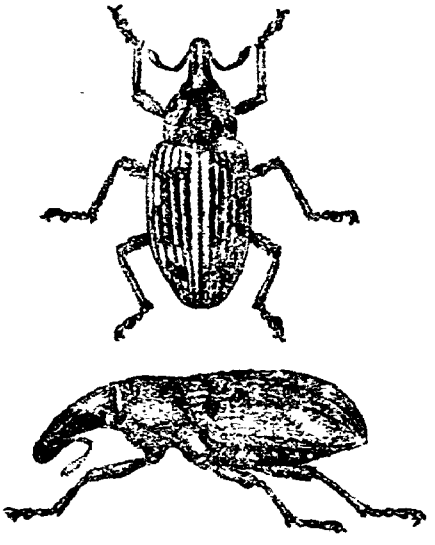


Fig. 10.—Surface Weevil (*Atactogaster finitimus*, F.).

The Surface Weevil (*Atactogaster finitimus*, F.). (Fig. 10.)

This insect which is a blackish grey weevil of $\frac{1}{3}''$ in length has the same habits as the grasshopper noted above. Though it is found in many tracts in South India, it has only been found as an occasional pest on young cotton in the black soil area of Tinnevelly. It is generally found in October-November. Young plants are often badly damaged when the pest occurs in numbers.

In all these cases of surface pests the insects can be collected by mechanical methods such as netting, sweeping, etc. The young plants can also be given a top dressing with some arsenate powder to check the pest attacking them.

II. SUCKING INSECTS.

We now come to those insects affecting cotton which suck up liquid nutrition from the plant tissues. Unlike the boring and leaf-eating caterpillars, grubs, grasshoppers and weevils, these insects have no biting mouth parts to cut or disfigure the plant tissue or to chew

up the same. They are all bugs and are provided with a sucking tube called the "Proboscis" with which they pump up liquid nutrition from the different tender portions of the plant tissue. The effect of such a process on the plant is the gradual drainage of the plant sap and this brings on weakness and in serious cases fading and death also of whole or parts of a plant. The following are the commonest of these bugs noted on cotton in South India :—

(*a*) *Plant-lice* (*Aphis gossypii*, G.). (Fig. 11.)

General form and distribution.—This is a small soft greenish brown insect hardly more than $\frac{1}{10}$ or $\frac{1}{8}''$ in length and is found in colonies

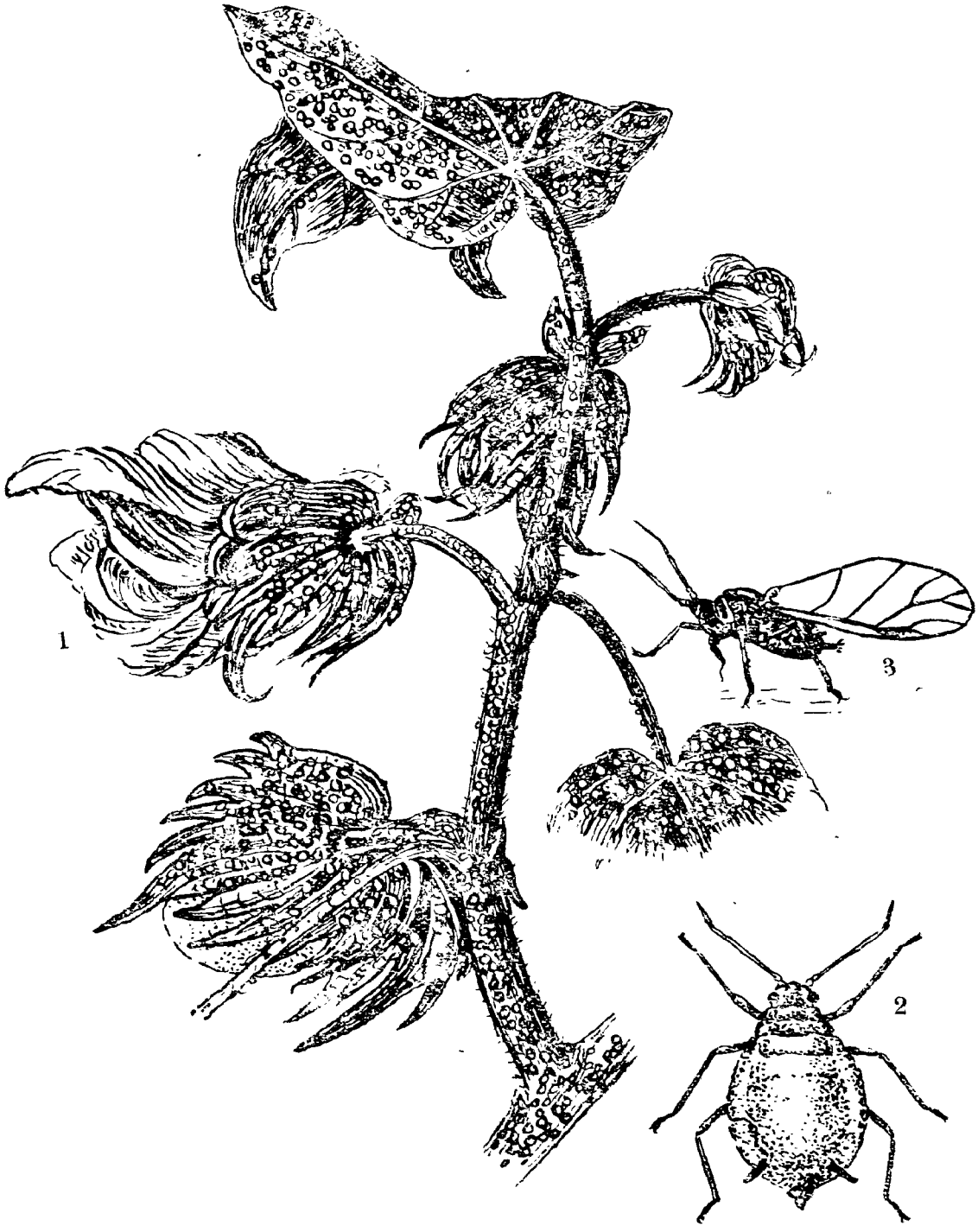


FIG. 11.—Cotton Aphis (*Aphis gossypii*, G.).

1. Cotton shoot infested with plant lice.
2. A wingless plant louse showing honey tubes (magnified).
3. A winged form (magnified).

of hundreds on the tender portions of the plant. In a colony the majority are usually wingless and slow moving. Plant lice could be easily made out by the possession of a pair of honey tubes (cornicles) attached to the posterior end of the abdomen. This is very characteristic of these insects. They have the legs and the sucking proboscis well developed. The cotton aphis has a very wide distribution and is found in all cotton areas.

Habits and life-history.—These minute creatures infest the tender portions of the plant in colonies and suck up the plant sap. The drainage caused on the plant by thousands of these creatures produces a very unhealthy effect; the leaves become curled up, the tender portions fade gradually and the whole plant becomes more or less blighted in a bad attack. Cambodia cotton suffers much more than the indigenous varieties. Plant lice multiply remarkably especially during cloudy weather. Very often they are able to multiply parthenogenetically, viz., the female insects giving rise to young ones without the previous connexion with the male, and commonly the creatures are viviparous also.

Control measures.—When a plant is badly infested and plenty of honey dew is thrown out by the plant lice, numerous bees, wasps and flies visit the plant for the liquid; in addition a black mould supervenes and the leaves get a black blighted appearance, and the leaves become sticky to the touch in this condition. In certain seasons, especially during cloudy weather, the plant lice multiply remarkably and cause considerable damage to the crop. The lower surface of the leaves of badly infested plants is found covered with thousands of the small insects. Plant lice, wherever they are found, are also accompanied by their natural enemies to a smaller or greater extent; the latter often do good work as a sort of natural check. The chief of these enemies are the following insects:—

Lady-bird beetles—small spherical spotted beetles which actively move on plants infested with plant lice and feed on them.

The hover fly.

The lace-wing fly.

All these insects, and especially their young ones, feed voraciously on plant lice and as far as possible the cultivator will do well to encourage these; at any rate not take them for pests and kill them.

With regard to control, in the early stages infested shoots may be pruned and burnt to prevent multiplication. In bad cases, where it is too late to do so, the application of a contact insecticide like fish-oil soap, kerosene emulsion or tobacco decoction by means of a spraying machine will kill them effectively. The spraying should be thorough and applied twice or thrice at intervals of a fortnight or twenty days. The spray should reach the under surface of infested leaves where the colonies are mostly confined.

(*b*) *The Cotton Plant Bugs.*

The Red Cotton Bug (*Dysdercus cingulatus*, F.). (Fig. 12.)

General form and distribution.—As the name indicates this insect is a medium sized (about 1″ in length) active bug of blood-red colour with blackish markings on the upper wings and thorax. The legs

and the sucking proboscis are well developed. It is found throughout South India and feeds mainly on malvaceous plants.

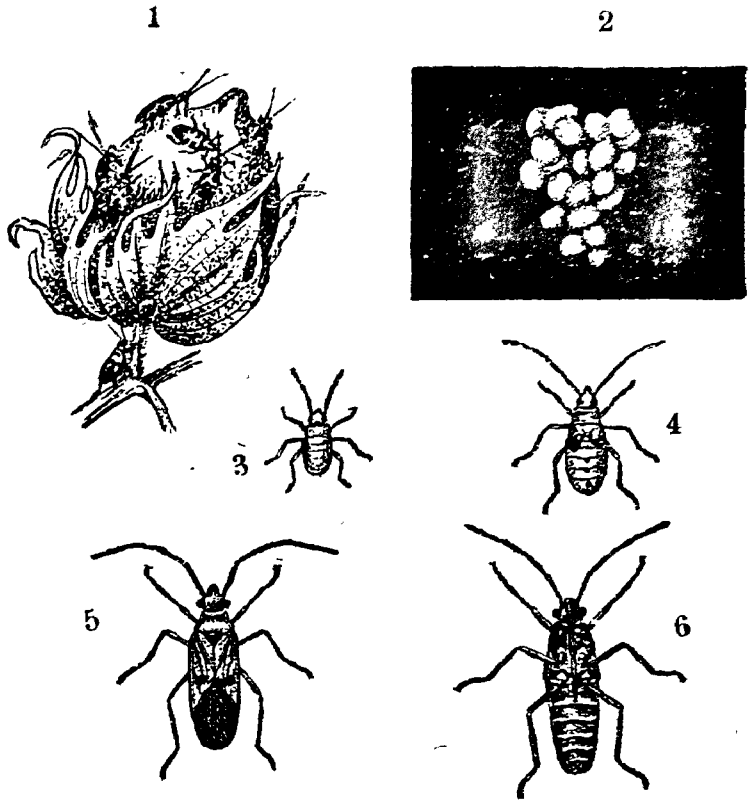


FIG. 12.—Red Cotton Bug (*Dysdercus cingulatus*, F.).

1. Cotton boll infested with bugs.
2. Eggs of the bug.
3 and 4. Young and later larvæ.
5. Adult bug, dorsal view.
6. Do. ventral view showing sucking tube.

Habits and life-history.—Both the adult bug and its young ones cause damage to the plant by sucking up plant sap from the tender portions and especially from the tender ripening bolls. In bad cases numerous bugs and nymphs cluster over a single boll and cause appreciable damage. The damage caused not only affects the formation of lint and the consequent loss in outturn, but the lint is discoloured by the bugs staining the same with their excretions.

The orange yellow eggs are laid loose in the soil generally in cracks around the cotton plant. These give rise to active young ones which more or less resemble the adult except in size, colour and absence of wings. They moult several times and assume the adult condition. All the stages are found together. The insect emits a characteristic bug smell. One generation from the egg to the adult bug generally occupies about two months. (Eggs hatch in a week and the nymphs take about a month or more to reach the adult stage.) Compared to the boll-worms and the stem weevil the damage done by this insect is insignificant. The bug is commonly found on Bhendai and Gogu also.

Control measures.—This insect generally exhibits the habit of congregating in numbers on isolated plants and is also sluggish in habits; as such numbers of the bug can be easily collected either by hand, by a net or by a winnow smeared with some sticky material. Egg clusters which are easily seen can also be collected and destroyed. The Bhendai plant may also be tried as a trap crop for this pest.

The Dusky Cotton Bug (*Oxycaraenus loetus*, K.) (Fig. 13.)

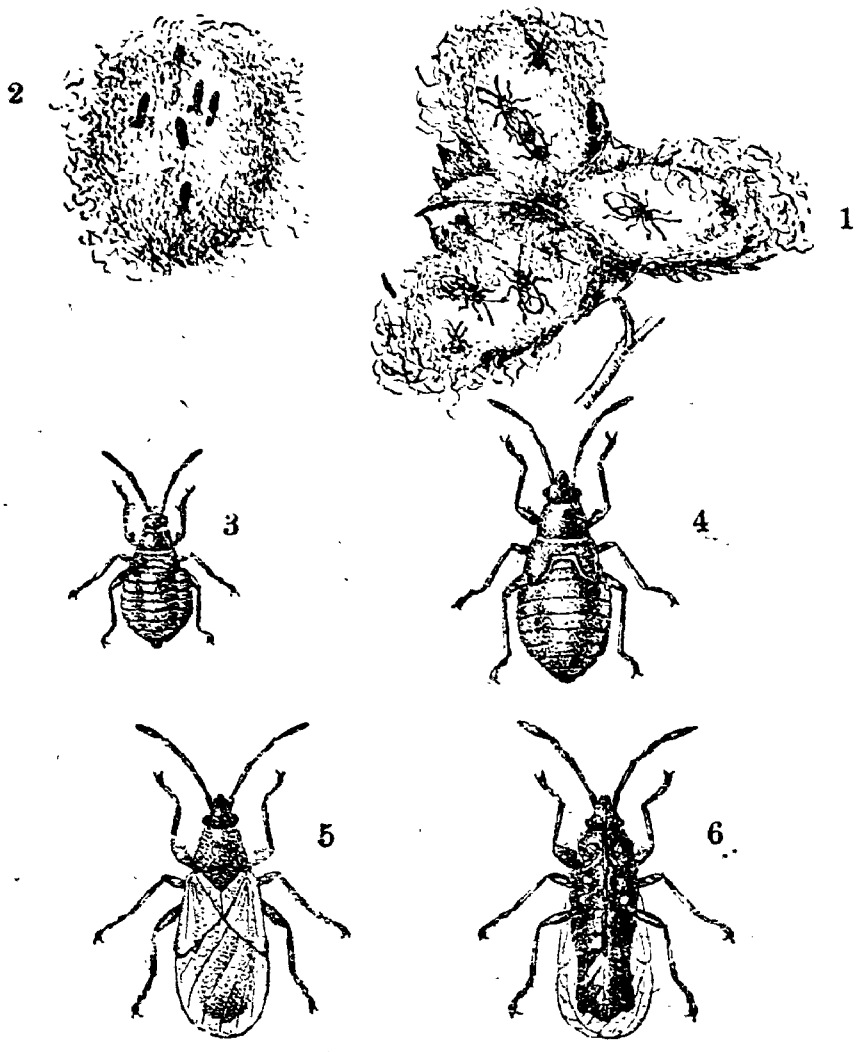


Fig. 13.—Dusky Cotton Bug (*Oxycaraenus loetus*, K.).

1. Bug infested lint.
2. Eggs in lint.
3 and 4. Young and old larvæ.
5. Adult bug, dorsal view.
6. Do ventral view.

General form and distribution.—Compared to the red bug this is a much smaller creature being only about $\frac{1}{6}''$ in length. It has a uniform dusky greyish brown colour. It is found in all the cotton areas of the province. The damage done to the bolls is the same as in the case of the red bug.

Habits and life-history.—The insect first appears in early opening bolls which are mostly malformed or boll-worm infested. The adults and nymphs are all found together on the infested bolls. Cigar-shaped eggs of a pale yellowish colour are laid in groups inside open bolls or on the other portions of the cotton shoot. These hatch into pale nymphs and reach maternity after feeding on the boll contents. In a bad infestation this bug and its nymphs crowd and even crawl over the bodies of coolies during the picking season.

Control measures.—The same remedies suggested for the red bug can be adopted in this case also. All malformed and prematurely open bolls must be collected and put into bags which will check the pest from spreading and increasing.

(c) *Cotton Leafhopper.*

THE COTTON LEAFHOPPER (*Empoasca devastens*, D.). (Fig. 14).

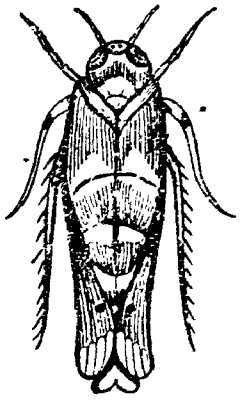


FIG. 14.—Cotton Leafhopper (*Emposca devastens*, D.).

This is a very small active green bug. When infested plants are approached, thousands of these hop and fly about like mosquitoes. These are also called green flies. In habits they are like plant lice and do the same kind of damage to the plants ; but they are very active and not found in colonies on the plant. Nor is the insect so common or so serious a pest of cotton. Occasionally young plants become infested and suffer in vigour ; the result of a bad attack is that the leaves become badly punctured, curl up and wither. When closely examined the insect is a very small triangular shaped creature having the head truncated and the hind legs well supplied with spines. Though common everywhere it has been found to do some appreciable damage, so far, only to exotic varieties of cotton. In badly infested and valuable plots the pest can be easily controlled by the use of the handnet or a sticky winnow ; or in worse cases contact insecticide can be sprayed.

(d) *Scale Insects and Mealy Bugs.*

Scales.—Among the bug pests of cotton, scales and mealy bugs often play a very important part. Scale insects are bugs, but unlike the ones dealt with above most of them are stationary and fixed to the plant surface in their adult condition. They have no clear limbs nor can the parts of the body be well made out ; it is covered over by a scale secreted by the insect itself. In this position the insects fix their sucking tube into the plant tissue and pump up the plant sap. Under the scale of the mature female hundreds of eggs develop which later hatch into minute actively moving larvæ : these wander about the plant for some time and fix themselves with their sucking tubes and secrete the scale. Among scale insects the following are found on cotton in South India.

THE BLACK SCALE (*Saissetia nigra*, N.). (Fig. 15.)

This is the well-known black scale found on many plants and shrubs in South India. The adult insect has a hard scaly covering and is of a deep reddish brown or darkish colour and is oval or roundish in shape. Cambodia cotton in the Coimbatore farm has been found to suffer from

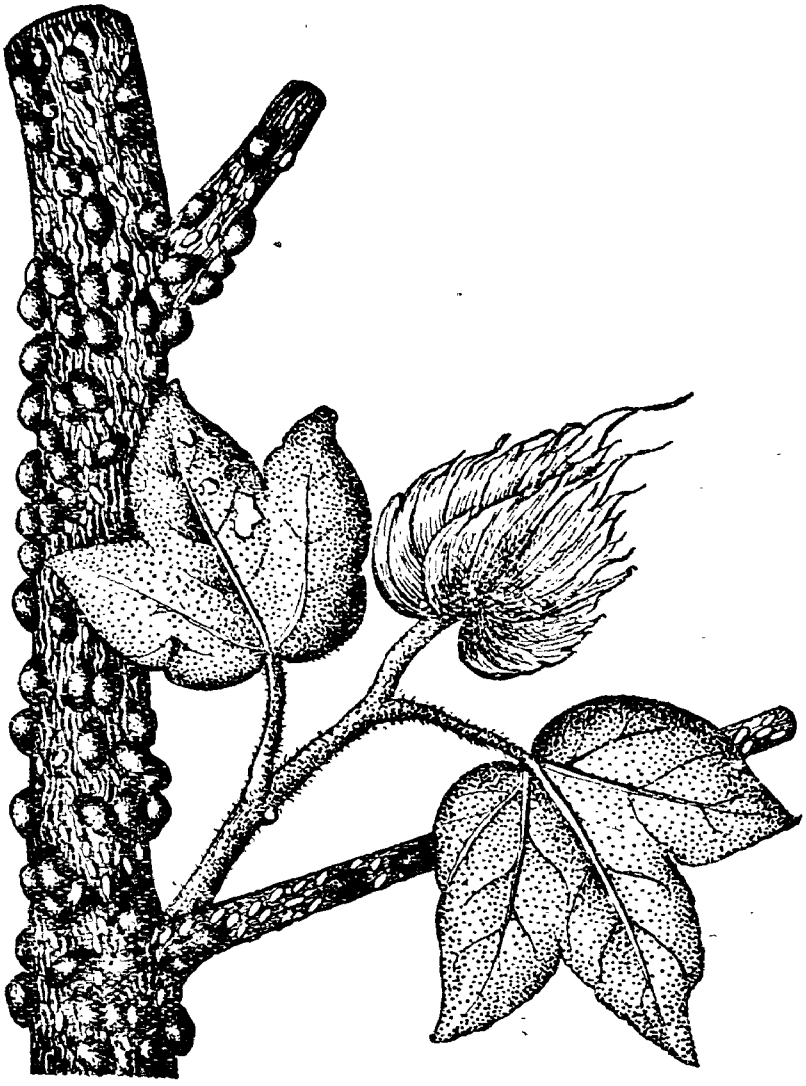


FIG. 15.—Cotton stem infested with Black scale (*Saissetia nigra*, N.).

this pest occasionally. The usual phenomenon is to find isolated plants in the field badly infested. The scale covers every portion of the plant, especially the tender stem and shoots. Each female scale gives birth to hundreds of pinkish eggs which hatch as minute active larvae and crawl about the infested plant and later on settle on the shoots and stems and suck up the plant sap. It is a very bad pest on the "Portia" tree (*thespesia*) and is also found on bhendai, coffee, tea and many garden shrubs.

THE NIM MEALY SCALE (*Pulvinaria maxima*, G.). (Fig. 16.)

This is another scale insect which, though not so common as the black scale on cotton, has been found occasionally attacking isolated plants in cotton areas in Coimbatore and Bellary. In this case the adult insect is leathery and oval and when about to breed the female insect deposits a long whitish egg sac covered with meal or white waxy matter (see fig. 16). The presence of this insect can be easily made out by the presence of these white mealy egg sacs. The damage done to the plant is similar to that caused by the black scale.

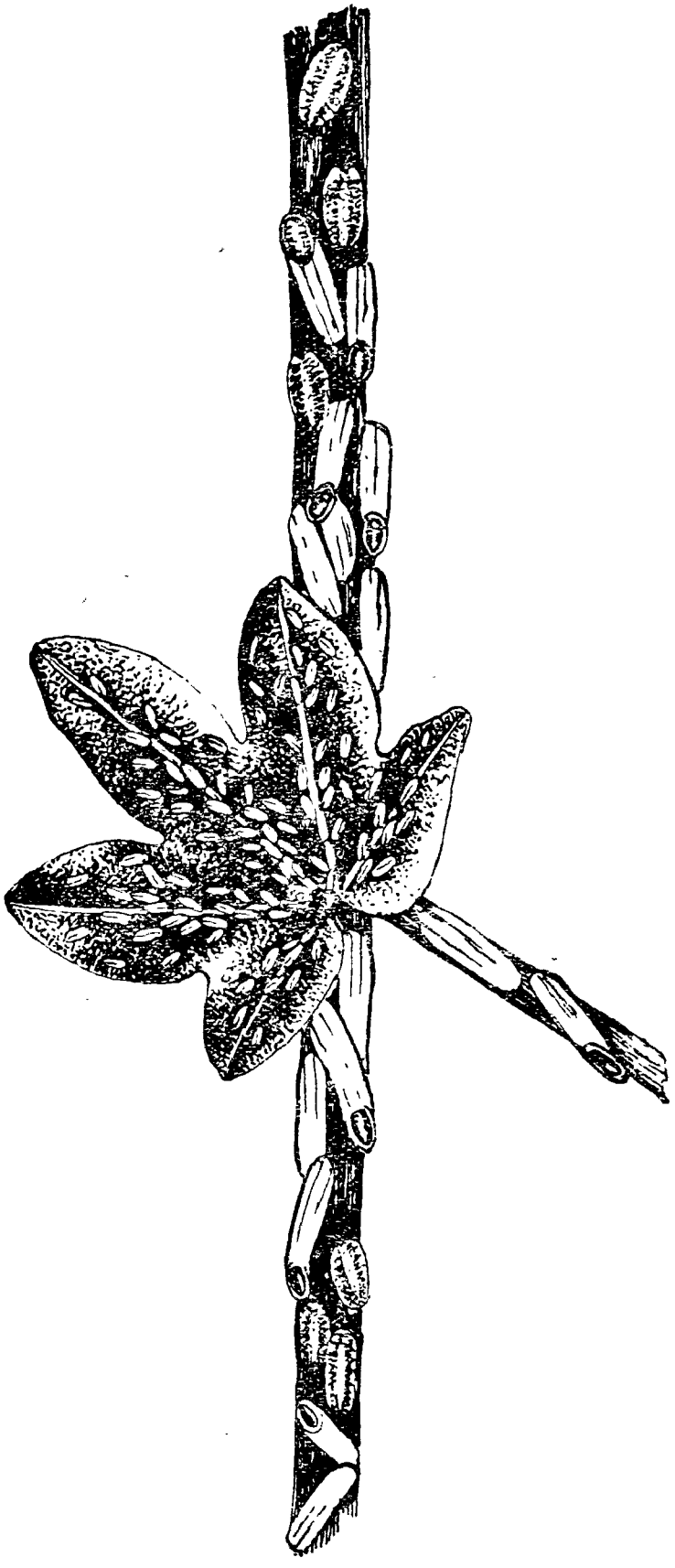


FIG. 16.—Cotton stem with Mealy scale (*Pulvinaria maxima*, G.).

THE COTTON YELLOW SCALE (*Cerococcus hibisci*, G.). (Fig. 17.)

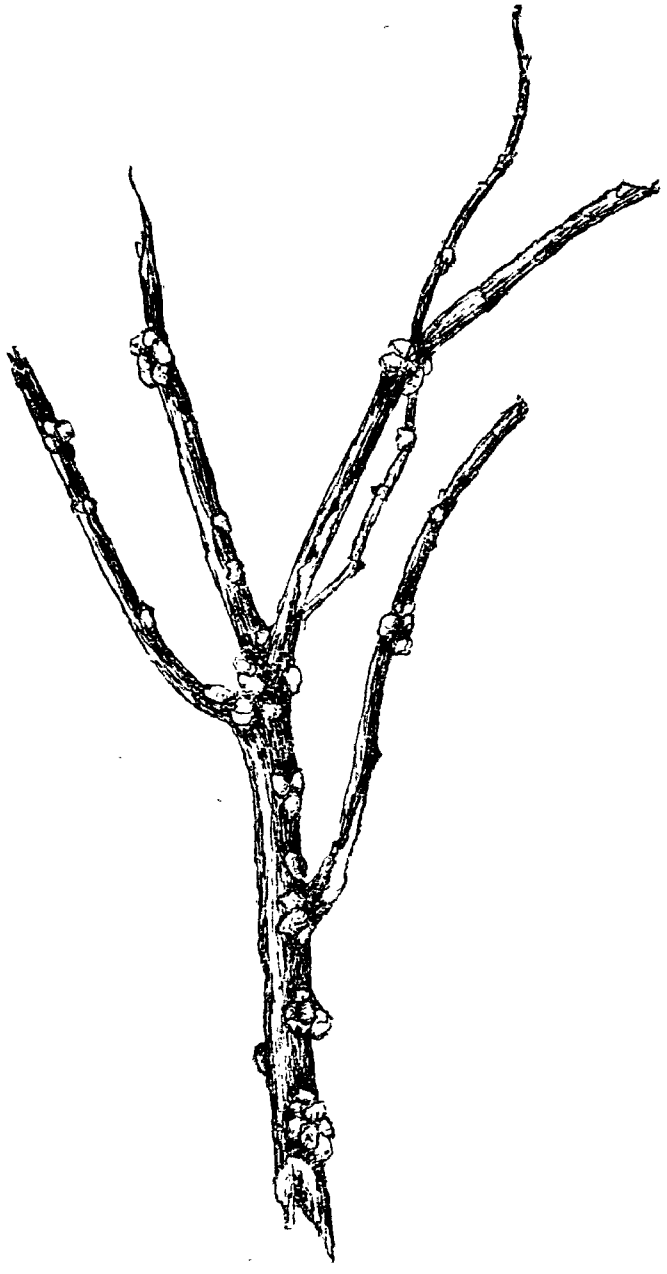


FIG. 17.—Cotton shoot infested with Yellow Scale (*Cerococcus hibisci*, G.).

This insect is occasionally found on cotton in Tinnevelly, North Arcot and Coimbatore. The mature insects are protected by a fairly hard scale of golden yellow colour and hundreds of these cover the infested plants in patches: this feature makes it easily recognized. The harm done to the plant is similar to that caused by the previously mentioned scales.

Mealy Bugs.—These insects belong to the same group as scales and have the same habits and life-history; but they are characterized by their bodies being covered over by white cottony or mealy secretion, and some of the adult mealy bugs are able to move about slowly. These bugs generally cover up the tender shoots and stems of the plants and check the vigorous growth. Of these the two noted below have been found on cotton till now.

Pseudococcus virgatus, C.

The adult of this insect is a soft white small creature of about ¼" with numerous white filaments on the sides and two conspicuous tail-like threads at the tail end. Very often this insect completely covers the leaves and shoots of the cotton plants which when looked from a distance appear as though whitewashed with lime. It is common in Coimbatore not only on cotton, but on many other plants like agathi, to-mato, etc.

Pseudococcus corymbatus, G.

This is a mealy bug similar to *P. virgatus* having the same general characters and habits, but in detailed structure the adult differs in certain features. The damage done to plants is similar also. Found in Coimbatore. Isolated plants often suffer from the attacks of the insect which often covers the shoots in white mealy masses.

Remedial measures for Scales and Mealy Bugs.—The treatment for scales and mealy bugs is the same. All badly infested plants should be thoroughly pruned and all the prunings burnt. Those that are partially attacked may be sprayed, if necessary, with a contact poison like, fish-oil soap, tobacco decoction or crude oil emulsion. In the case of the "black scale" which has a pretty hard body "rosin wash" may be used for the spray. In the case of mealy bugs and some scales, ants are found to play the part of distributing agents. So the remedial measures may be directed both against ants and mealy bugs. For the former, poisoned traps will be found useful ; a mixture of molasses and some poison like lead arsenate or paris green may be used as a bait. Whenever parasites are evident pruned branches may be kept in parasite boxes to allow the parasites to emerge and attack the scales in the fields.

As stated at the beginning, the idea of this pamphlet is merely to give some very general and brief information on the more familiar insects affecting cotton in South India so that the cotton-grower can get some hints to recognize them and take advantage of the different control measures suggested. As such all minute details with regard to the habits, life-history and other factors are omitted. For any further information readers can communicate with the author.

CLASSIFICATION OF COTTON INSECTS ACCORDING TO INSECT ORDERS.

ORDER—LEPIDOPTERA.

Family—Noctuidæ—

Earias fabia, S. ...	...	The spotted boll-worms.
Earias insulana, B. ...	...	
Heliothis obsoleta, F. ...	...	The stout boll-worms (not common).
Rabila frontalis, W. ...	...	
Cosmophila erosa, H....	...	Semi-looper leaf caterpillars.
Acontia grællsi, F. ...	...	
Tarache nitidula, F. ...	...	

Family—Pyralidæ—

Sylepta derogata, F. ...	...	The leaf roller caterpillar.
Phycita infusella, M.	...	The bud-worm.

Family—Lymantridæ—

Euproctis fraterna, M. .. The tussock caterpillar.

Family—Arctiadæ—

Pericallia ricini, F. ... ... The black hairy caterpillar.

Family—Gelechiadæ—

Platyedra gossypiella, S. ... The pink boll-worm.

ORDER—COLEOPTERA.

Family—Curculionidæ—

Pempheres affinis, F. ... ... The stem weevil.
Alcides affaber, B. ... ... The shoot weevil.
Amorphoidea arcuata, M. ... The flower weevil (not common
Atactogaster finitimus, F. ... The surface weevil.

Family—Buprestidæ—

Sphenoptera gossypii, K. ... Stem-boring buprestid.

Family—Cantharidæ—

Mylabris pustulata. Th. ... The flower blister beetle.

ORDER—ORTHOPTERA.

Family—Acridiidæ—

Chrotogonus saussurei, B. ... } Surface grasshoppers.
Aelopus tamulus, F. ... ... }
Cyrtacanthacris xanacea, S. } Leaf grasshoppers.
Catantops annexus, B. ... }

ORDER—RHYNCHOTA.

Family—Pyrrhocoridæ—

Dysdercus cingulatus, F. ... Red cotton bug.

Family—Lygaeidæ—

Oxycarenus loetus, K. ... The dusky cotton bug.

Family—Jassidæ—

Empoasca devastens, D. ... Leafhopper.

Family—Aphididæ—

Aphis gossypii, G. ... ... Plant lice.

Family—Coccidæ—

Saissetia nigra, N. ... ... The black scale
Cerococcus hibisci, G. .. The yellow scale.
Pulvinaria maxima, G. ... The nim mealy scale.
Pseudococcus virgatus, C. ... } Mealy bugs.
Do. corymbatus, G.... }

Department of Agriculture, Madras

Bulletin No. 29

TAMIL SAYINGS AND PROVERBS ON AGRICULTURE

MADRAS
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

1933

TAMIL SAYINGS AND PROVERBS ON AGRICULTURE.

As a general introduction to this collection, a number of couplets from the Kural of Tiruvalluvar, Pope's translation, are given. Of these, the first six are of general reference, and epitomise much that is again and again alluded to in other sayings given further on. No. 7 alludes to the great benefits of thorough tillage, and No. 8 to other necessary details of cultivation. In No. 9 is found a saying, often repeated, illustrating the necessity for personal direction to agriculture, if success is to be attained, and lastly one comes to tell how, so long as unoccupied land remains, it is idle for any one to plead poverty.

No. 11 may be a warning to all to lead a good life, but then follow praises of the art of agriculture; No. 12 being a verse from the Nalvali of Auvaiyar; Nos. 14, 16, 19 are from her poem Kondraivēndan; and No. 26 an extract from the benediction pronounced by her at the coronation of king Chola. No. 15 is taken from a stanza by the poet Kambar in praise of agriculture; the stanza being as follows:

வேதநூன் முதலாகி விளங்குகின்ற கலையனைத்தும்
ஓதுவாரெல்லாருழுழுவார் தந்தலைக்கடைக்கே
கோதைதவேன்மன்னவர் தங்குடைவளமுங் கொழுவளமே
ஆதலால் இவர்பெருமை யார் உரைக்கவல்லாரே?

"Even students of the Vedas and in other branches of knowledge must wait at the door of the husbandman. The prosperity of the subjects of powerful kings depends on the ploughshare. So, who can describe the importance of the agriculturist?" The poem contains 69 more stanzas on the same subject. No. 43 is from the 'Vetrivērkai' of Vīrarāma Pāndyan, king of Madura.

1. சுழன்றுமேர்பின்ன துலகமதனு
ழுழந்துழுழுவேதலை.
Howe'er they roam, the world must follow still the plougher's team;
Though toilsome, culture of the ground as noblest toil esteem.

2. உழுவாருலகத்தார்க் காணியம்தாற்று
தெழுவாரை யெல்லாம் பொறுத்து.
The ploughers are the linch-pin of the world; they bear
Them up who other works perform, too weak its toils to share.

3. உழுதுண்டுவாழ்வாரே வாழ்வார் மற்றெல்லாம்
தொழுதுண்டு பின்செல்பவர்.
Who ploughing eat their food, they truly live;
The rest to others bend subservient, eating what they give.

4. பலகுடைநிழலுந் தங்குடைக்கீழ்காண்ப
ரலகுடை நீழலவர்.
O'er many a land they'll see their monarch reign,
Whose fields are shaded by the waving grain.

5. இரவா ரிசப்பார்க் கொன்றீவர்
கரவாது கைசெய்தூண்மாலை யவர்.
They nothing ask from others, but to askers give,
Who raise with their own hands the food on which they live.

6. உழவினர் கைம்மடங்கினில்லை
விழைவதூஉம் விட்டேமின் பார்க்கு நிலை.
For those who've left what all men love no place is found,
When they with folded hands remain who till the ground.

7. தொடிப்புழுதி கஃசாவுணக்கிற்
பிடித்தெருவும் வேண்டாது சாலப்படும்.
Reduce your soil to that dry state, when ounce is quarter ounce's weight;
Without one handful of manure, abundant crops you thus secure.

8. எரினுகன்ற வெருவிடுதல் கட்டபி
னீரினுகன்றதனகாப்பு.
To cast manure is better than to plough;
Weed well; to guard is more than watering now.

9. செல்வான்கிழவ னிருப்பினிலம் புலந்
தில்லாளினூடிவிடும்.
When master from the field aloof hath stood,
Then land will sulk, like wife in angry mood.

10. இலமென்றசை இருப்பாரைக்காணி
னிலமென்னு நல்லாணகும்.
The earth, that kindly dame, will laugh to see,
Men seated idle pleading poverty.

11. ஆழ உழுது அரும்பாடுபட்டாலும், பூமிவிளைவது புண்ணியவான்களுக்கே.

However deeply one ploughs and whatever trouble one takes, still it is only the good and righteous that get good crops.

12. ஆற்றங்கரையின் மரமுமாசறிய,
வீற்றிருத்தவாழ்வும் விழுமன்றே யேற்ற,
முழுதுண்டு வாழ்வதற்கொப்பிலலைகண்டீர்,
பழுதுண்டு வேறோர்பணிக்கு.

The trees on the banks of a river will fall, and the longstanding prosperity of persons which has attracted the notice of kings will come to an end; but nothing is equal to living by agriculture, every other profession having some drawback.

13. அழிவே யழியினு முழவேயுழு.
Even though you go on losing, never give up ploughing.

14. மேழிச்செல்வம் கோழைபடாது.
The wealth of the plough is unfailing.

15. ஓதுவான் எல்லாம் உழுவான்தலைக்கடையில்.
All learned men must wait at the gate of the ploughman.

16. தொழுதூண் சுவையினு முதூணினிது.
Living by tillage is more pleasant than living by service.

17. பயிரையிட்டு பாவத்தைத் தொலை.
Wash away your sins by growing crops.

18. ஏரையிகழ்ந்தார் பேரையிழந்தார்.
Those who despise the plough forego all blessings.

19. சீரைத்தேடின் ஏரைத்தேடு.
If you wish to live well, take to ploughing.

20. ஏர்நடந்தால் பேர்நடக்கும்.
A man's influence continues only so long as his plough keeps working.

21. மண்ணை நம்பினலும், மன்னனை நம்பினலும் வீண்போகான்.
He who depends upon land or upon a king will not wait in vain.

22. அழியாச்செல்வம் விளைவே யாகும்.
Agriculture is the only imperishable wealth.

23. கொழுமீதிற் குடிகொண்ட குடிச்செல்வமே செல்வம்.
Wealth acquired by agriculture is real wealth.

24. குடிஏற நெல்ஏற.
As the cultivators improve in condition, the yield of paddy increases.*

25 குடித்தனம் செழுத்தால் துரைத்தனம் செழிக்கும்.
The prosperity of the ryots is the prosperity of the State.

26. குடி உயர முடி உயரும்.
If the ryot prospers, the king will prosper.

27. செங்கோலை காக்குங்கோல் ஏரடிக்கும் சிறுகோலே.
The goad which guides the ploughing bullocks protects the king.

28. குடித்தனமே துரைத்தனம்.
Husbandry is the independent calling; or,
The wealth of kings is but the wealth of husbandmen.

29. குடியானவனை, முடியானவனை.
A cultivator may be compared to a crowned head.

30. உழவின்மிகுந்த ஊதியமில்லை.
There is no occupation more profitable than agriculture.

31. விவசாயமோ ரஸவாதமோ.
A griculture is like alchemy.

32. தேர்வேந்தன் போர்க்களத்தில் சிலர்வெல்வர், சிலர்தோற்பர் ஏர்வேந்தன் தன்களத்தில் இரையவரும் தோலாரே.
In the battle field of a king with chariots some will win and others will be defeated while in the threshing floor of a farmer even a beggar will get plenty.

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* This may also be read conversely; viz., as the yield of paddy increases, the condition of the cultivators improves.

In Nos. 33 and onwards the uncertainty of husbandry is described, and the fact that, if reckoned by account, too often it shows loss is pointed out; still, though the profit be small, all are encouraged to adhere to agriculture, No. 36 alluding to an interview between a ruined ryot and a 'sky-clad' Jain image. As is shown in No. 50, the ryot must see to things for himself, even to making the field his bed whilst, as the previous sayings show, success will also demand much labour. Then follow a number of further sayings to show the importance of personal care and attention.

33. உழுதவன் கெட்டதில்லை.
A cultivator never comes to ruin.

34. ஊண்மிச்சம் உழவிலில்லை.
Agriculture brings in no more than bread.

35. பருத்திச்செடியும் பாலுழுள்ளவனுக்குப் பஞ்சமில்லை.
A man who has a cotton crop or milch cows will never be in want.

36. பத்து ஏர்வைத்துப் படைமாழும் தோற்றேன், எத்தனை ஏர் வைத்து கோவணமும் தோற்றாய்?
Possessed of ten yoke of oxen I lost the ploughshare; how many yoke did you possess before you lost your waistcloth?

37. உழுதவன் கணக்குப்பார்த்தால் உழக்கு மிஞ்சாது.
If the ploughman count the cost, not even a quarter of a measure will be left.

38. உழுகிறவன் கணக்குப்பார்த்தால் உழவுகோலும் மிஞ்சாது.
If a ploughman count the cost, not even his goad will remain.

39. எண்ணிப்பார் குடித்தனத்தை எண்ணுதேபார் வெள்ளாமையை.
Accounts may be kept in household matters, but not in husbandry.

40. எண்ணிச்செய்வது செட்டு எண்ணுமல்செய்வது வெள்ளாண்மை.
Keeping accounts is possible in trade, but not in agriculture.

41. செட்டுக்கு வேளாண்மை ஜன்மப்பகை.
Parsimony is an inveterate enemy to agriculture.

42. விதைமுதல் அகப்பட்டாலும் வெள்ளாமையை விடாதே.
Though the outturn only equals the seed sown, do not give up cultivation.

43. அழுதுகொண்டிருந்தாலும் உழுதுகொண்டிரு.
Though you be weeping, be always ploughing.

44. உழுவார்க்கழகு உழுதூணுண்ணல்.
To live by tillage befits the agriculturist.

45. இராஜனுக்கு செங்கோல், ஸம்ஸாரிக்கு உழவுகோல்.
As sceptre is to a king, so is the goad to a husbandman.

46. வேளாண்மை வல்லாண்மை.
Agriculture depends upon strength.

47. வெள்ளாமையெல்லாம் வல்லாண்மையாலே.
Success in agriculture depends upon strength.

48. பத்துக்குப்பின் பயிரு.
Crop (is obtained) after ten (kinds of labour).

49. வயல்முயற்சியில் தானியம் உண்டாம்.
Labour on the field produces grain.

50. வரப்பே தலைகாணி வைக்கலோ பஞ்சுமெத்தை.
The field ridge is the pillow; and the straw, the cotton mattress (of the ryot).

51. தானேற நீரேறும்.
Personal supervision leads to good watering (of the field).

52. ஒருக்கால் பார்த்தால் புஞ்சை ; இருக்கால் பார்த்தால் நஞ்சை.
Wet land requires double the supervision of dry land.

53. பாராதேகெட்டது பயிர், ஏறுதேகெட்டது குதிரை, கேளாதே கெட்டது கடன்.
A crop is lost for want of supervision, a horse for want of riding, and a debt for want of asking.

54. உழுவின்றி ஊதியமில்லை உடையவனிருந்தக்கால்.
No calling is so profitable as agriculture, if the owner personally supervises it.

55. உழுகிறநாளில் ஊர்விட்டுப்போனால் அறுக்கிறநாளில் ஆள் தேடவேண்டாம்.
An agriculturist absent from his village at the season for ploughing need not collect labourers at the time of harvest.

56. உழுகிற காலத்தில் ஊர்வழிப்போனால் அறுவடை காலத்தில் அறுவாள் தேடவேண்டாம்.
If you go abroad during the ploughing season, you need not look for a sickle at harvest.

57. தன் ஆளில்லாத வெள்ளாமையும் தான் உழாத நிலமும் தரிசு.
Husbandry not carried by one's own men, and a field not ploughed by its owner, go to waste.

58. கரம்பைசுத்தினால் கால்பணம்.
Even if you go round a waste land, you will surely get some crop.

59. சாயம்பிராத கேணித்தரிசி.
Visit your fields morning and evening.

60. உடையவன் பாராப்பயிர் ஆகுமா ?
Will crops uncared for by the owner prosper ?

61. காடுகாத்தவனும் கச்சேரி காத்தவனும் பலனடைவான்.
The cultivator who constantly watches his field and a hanger-on at a kacherri never go unrewarded.

62. ஈரூரில் உழுதவன் கெட்டான், இரண்டுபெண் கட்டினவன் கெட்டான்.
To cultivate in two different villages or to marry two wives will lead to ruin.

The next thirty sayings or so refer to several miscellaneous matters of agricultural interest. Nos. 63–65 allude to conditions which have almost passed away, the last especially to the system of dividing the produce between the State and the ryot on the estimate of an inspector. In Nos. 75 and 76, the system of cultivating on *vāram* is that where the rent is paid by the actual cultivator by a share of the produce. In Nos. 77 and 78, the evils of the joint proprietorship which is so common are alluded to, and in No. 79 the danger of getting into debt. In Nos. 80 to 85 the particular qualifications of different castes for agriculture are referred to. The Vellalars are hereditary agriculturists, the Vaisyas, the commercial or trading castes, who usually hold themselves superior to Sudras such as the Vellalars. Taken with the sayings that precede, the allusion in Nos. 82 and 83 to the unfittedness of the Brahmin to agriculture is clear. As to No. 84, it may be noted that the Pariah is so often in debt, that he rarely brings the crop to his own house.

63. அரசனோடு பகைத்தகுடிகள் கெட்டுப்போகும்.
Ryots who incur the displeasure of the king will come to ruin.

64. அடிக்கடி அரசன் பிரவேசித்த கிராமம் அருபத்தை அடையும்.
A village too often visited by the king will not prosper.

65. கொல்லைக்காரன்பாவம் புள்ளிக்காரன் கண்ணிலே.
The fortunes of the cultivator are in the eyes of the harvest estimator.

66. உழவற உழுதவன் ஊரில் பெரியவன்.
The greatest man in a village is he who ploughs the whole of his holding (or his land thoroughly).

67. வித்தும் வரும் இருக்க வழைப்பதர்.
He is miserable who possessing seed and a plough is yet poor.

68. பரப்பன் பயிரிழந்தான் இரப்பன் பெண்டிழந்தான்.
A hasty man will lose his crops, and a beggar, his wife.

69. சேற்றுழுகத்தில் சிரிப்பு நெல்முகத்தில் கருப்பு.
Be cheerful while ploughing, but be severe at harvest.

70. பன்னடி படியில் எயிதனை ஆள் கடையில் எய்தனை.
The master cheats the coolie of his wages; the coolie, the master, by loitering.

71. பேரூர்க் குடியிருப்பும் சிற்றூர் வெள்ளாமையும்.
A town is well suited for living in, and a village for farming in.

72. ஓதுவார் கூருமில்லையா, உழுவர்க்கு நிலமுமில்லையா?
Will the learned ever lack a town to find their living in, or a farmer a field to cultivate?

73. தொழில் இல்லாதவன் தோட்டம் செய்.
Let the man without work keep a garden.

74. தோட்டக்காரன்வாழ்வு காற்று அடித்தால் போயிற்று.
All the prospects of a gardener are destroyed by a gale of wind.

75. வாரமோ கோரமோ குடியானவன் மேழியின்கீழ் கிருடன்.
Giving land on *vāram* is a cause of disgust; the renter is always a thief.

76. கொண்டுவாரம் கொடுத்தவனும் உழுதுவாரம் கொடுத்தவனும் கடைத்தேறமாட்டான்.
He who pays *vāram* by purchasing grain and he who cultivates for *vāram* will not prosper.

77. இனக்கூட்டாளுலும் நிலக்கூட்டாகாது.
Joint proprietorship of land is undesirable, though relations can be permitted to live together.

78. குடியிருந்துபார் கூட்டுப்பயிரிட்டுப்பார்.
Joint tenancy of land is like the joint occupation of a house.

79. கடன்வாங்கி பயிரிட்டவனும் மரம் ஏறி கைவிட்டவனும் ஒன்று.
He who cultivates his land by borrowing resembles a man that lets go his hold of the tree he is climbing.

80. மேழிக்குடையவன் வெள்ளாளனே.
A Vellalan is a proper husbandman.

81. வைசியர்களில், பூவைசியர் சிரேஷ்டம்.
Of the Vaisyas, the agriculturists are superior.

82. செட்டிக்கும் வேளாண்மைக்கும் ஜன்மப்பகை.
The merchant has a natural aversion to agriculture.

83. ஏழைப்பட்ட பார்ப்பானும் மேழித்தொட்டுப் பார்க்கான்.
Even when a Brahman becomes poor, he will not touch the plough.

84. பார்ப்பார்பண்ணியம் கேட்பாரில்லை.
A Brahman's husbandry is uncared for.

85. பறையன் பயிரிட்டு பழங்கலமேறுவதில்லை.
The harvest of a Pariah never reaches home.

Another group follows, in which the advantages of enclosing land are clearly shown, although fencing is but little practised over the greater part of the country. The comparison of unfenced land with tillage carried on with only a single pair of cattle is very forcible. No. 856 should also be referred to on this subject.

86. அடைத்தவன் காட்டைப்பார் மேய்த்தவன் மாட்டைப்பார்.
Look at the fenced land and the well-pastured cattle.

87. வேலிவைத்துக் காப்பாற்றுத கண்ணும் ஆலைவைத்து ஆட்டாத வாணியனும் சரியல்ல.
Young plants not protected by a fence and an oilmonger not working his mill cannot thrive.

88. காட்டை விதைத்து கதவை அடை.
Sow the field and shut up the gaps in the fence.

89. வேலி பயிரை மேய்ந்தால் விளைவது எப்படி?
If the hedge consume the crop, how is the harvest to be obtained?

90. தம்மினம் தம்மைக்காக்கும் வேலி பயிரைக்காக்கும்.
A hedge protects a crop as man's kin assists him.

91. ஓரண்டை காடு காடுமல்ல ஓசோர் உழவு உழவுமல்ல.
Partially fenced land is no land; tillage with a single pair of bullocks is no tillage.

92. அடைப்பில்லாக்காடும் விடுப்பில்லா எருமும்.
An unenclosed field and bullocks ploughing without rest are alike.

93. பயிரிட்டு வேலிகட்டாதே.
Do not fence after sowing.

94. விரைப்பதுமுன் வேலி அடை.
Fence before you sow.

From No. 95 onwards, the qualities and characters of land are shown, and advice as to the selection of land is given. Too generally, the ryots' holding is much broken up, but that it should be situated in one block is considered most desirable. The sayings, Nos. 98 to 102, taken together with Nos. 86 to 94, preach the doctrine of consolidation and enclosure. Then follow references to the desirability of his land being near the residence of the ryot, which is practically always in the village, though such fields are liable to pilfering, and to be 'overlooked'. Low-lying land by the river-side is liable to damage, but still it is most valuable— *Vide* Nos. 110 to 113.

The wet-land next alluded to is more particularly the irrigated paddy fields, and is compared generally with the dry-land on which the crops are dependent on the falling rain. The former is valuable if old, the latter if fresh; the former costs much in preparation and is usually more or less manured; the latter gets but little manure, and is valuable only when newly broken. Near a hill, the washings thereof will be spread over the land below, so too wet-land near the sluices of a tank is usually best off for water-supply; see Nos. 119 to 123. Then follow a number of sayings showing what may be learnt as to the quality of land from its herbage and as to the qualities of different sorts of soil.

95. பிள்ளைபிறக்கும் பூமிபிறக்காது.
Children may increase, but the land will not expand.

96. பொன்னை விற்றுத்தின்னு மண்ணைவைத்துத்தின்னு.
Sell your gold to meet the necessaries of life; but retain your land that you may live.

97. நிலகலத்தால் விளையும்.
Good soil yields a good crop.

98. புறணியாணலும் பொருள் சேகரம் கலம்.
Secure land in one block even though it be bad.

99. புஞ்சையாணலும் பலம் சேர.
Even dry land is of value if it be in one block.

100. கச்சநிலமாணலும் கைசேர்க்கை.
Even though it is inferior land, it should be in one block.

101. உழவும் தரிசும்ஒருவிடத்தில்.
Whether cultivated or waste, the land should be in one block.

102. உள்ளூர் பெண்ணும் அயலூர் மண்ணும் ஆகாது.
A bride of the same village and land in another village are bad.

103. உத்தரத்தின் பிள்ளையும் ஊரோரத்தில் வயலுஞ்சரி.
A field close to a village and a son born under *Uttara* * are alike good.

104. கைத்த நிலமாணலும் கையேல்லை.
Though of inferior quality, the field should be near (the village).

105. வழியோரத்துப்புலம், துரவோரத்துப்புலம், மேட்டோரத்துப் புலம், ஊரோரத்துப்புலம், இவைகள் நன்றாய் விளையும்.
A field by the wayside land near a large well, that adjoining high ground, and that near the village will yield well.

106. ஊரோரம் கழனி உம்மலுக்குத்தங்தென்.
The field close to the village site will always suffer from the evil eye.

107. ஊர் ஓரத்தில் கொல்லை உழுதவனுக்குப் பயிர் இல்லை.
The cultivator of a field close to a village loses its produce (by pilferers).

108. கொல்லைப்பயிரோ கொள்ளைப்பயிரோ.
The crop in backyards is crop for thieves.

109. வழியோரம் கழனி வைக்கலுக்குத்தங்தென்.
The field by the roadside will be worth only the straw.

110. ஆற்றையடுத்தவயலும் அரசனை பகைத்தகுடியும் முன்னுக்கு வராது.
A field close to a river and a man who has offended his ruler will not prosper.

111. ஆற்றோரத்தில் ஒரு செய்யும் அஸ்தநட்சத்திரத்தில் ஒரு பிள்ளையும்.
By the river one *sey* † and a son (born) in *Hasta* † (are alike).

112. வெள்ளமேயானலும் பள்ளம் பார்த்து பயிர் செய்.
Select low land for cultivation even though it be liable to flooding.

113. வெள்ளமே போனலும் பள்ளமே விளையும்.
Though liable to flooding, the low land will be productive.

114. காடுவெட்டி நஞ்சைபண்ணு மாடுகட்டி வைக்கோல் போடு.
Clear the jungle and convert it into wet land : tie up your cattle and feed them with straw.

115. ஒருக்கால் புஞ்சை இருக்கால் நஞ்சை.
Dry-land yields one crop, wet-land two (in a year).

116. ராஜவரும்படியோ, நஞ்சைவரும்படியோ.
Is it a king's income or income from wet-land that is greater ?

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* Uttara = The star which governs the period from about the middle of September—see below.

† Sey = A piece of land; in Madura said to measure about 2·5 acres.

‡ Hasta = The star governing the period following Uttara.

117. மேனிமினிக்கியைக் கொண்டவன் கெட்டான் மேட்டிலே பயிரிட்டவன் கெட்டான்.
He who marries a flirt and he who cultivates high ground will be ruined.

118. புஞ்சையிற் புதிசு நஞ்சையிற் பழசு.
New dry-land and old wet-land (are good).

119. மலையடி புஞ்சை மதகடி நஞ்சை.
Wet-land near the sluice, dry-land near the hill.

120. மலையடி கெட்டாலும் மதகடி கெடாது.
Though land near the hill may become waste, that near the sluice will not.

121. மதகடி பாழானாலும் மலையடி பாழாகாது.
Though land close to the sluice may become waste, that at the foot of the hill will not.

122. கடைமடை பள்ளத்துக்கு முதல் மடை மேடு நலம்.
A high field close to the main sluice is superior to a low field irrigated by a minor sluice.

123. கடையோடி தரவு நிலத்துக்கும், கரையடி மேட்டு நிலம் எளிசு.
High ground near the tank-bund is better than the low grouud at the end of the channel.

124. ஆரைபற்றிய நஞ்சையும் அருகுபற்றிய புஞ்சையும் நலம்.
Wet-land in which *arai* * grows and dry-land in which *hariali* † grows are good.

125. கன்னிலங்காரந்தை நடுநிலங்கொளிஞ்சி.
The soil in which *karandai* ‡ grows is the best, and that in which *kolinji* § grows is middling.

126. ஆரைப்பற்றிய நஞ்சை அருகுபற்றிய செவ்வல் கோரைபற்றிய கரிசல்.
Wet-land on which *arai* grows, the red gravelly soil on which *hariali* grows, and black-cotton soil on which *korai* ‖ grows (are the best of their kind).

127. காணிதேடினும் கரிசல் தேடு.
Though but a *kāni* ¶ choose *karisal* **

128. கரிசல் நிலத்தில் காக்கும் ஈரம்.
'Karisal (Black soil)' will conserve moisture.

129. கள்ளிவேலியேவேலி, கரிசல் நிலமே நிலம்.
Kalli †† makes the best fence *karisal* is the best of soils.

130. சாவேரியே ராகம் காவரியே தீரம்.
Sāvēri is the best tune and Kāvēri land is the most fertile.

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* Arai = *Marsilea quadrifolia.*
† Hariali = *Cynodon dactylon.*
‡ Karandai = *Sphæranthus Indicus.*
§ Kolinji = *Tephrosia purpurea*, or wild indigo.
‖ Korai = *Cyperus bulbosus*, or nut-grass.
¶ Kani = An area of about 1½ acres.
** Karisal = black-cotton soil.
†† Kalli = *Euphorbia tirucalli* or *E. antiquorum*, or the milk hedge; it makes a very inferior fence as it produces no fuel.

131. மணலுழுது வாழ்ந்தவனுமில்லை மண்ணுழுது கெட்டவனு மில்லை.

No one thrives by tilling sandy soil, and no one is ruined by ploughing good soil.

132. கல்லுபிரளாதகாடே உழு, சொல்லுபிரளாதவனிடமே பேசு.

Plough only the land which is free from stones and have dealings only with the man who keeps his word.

133. அளர் உழுதவன் ஆண்டான், மணல் உழுதவன் மாண்டான்.

He who tills *Alar* * will reign ; he who tills sandy land will go to ruin.

134. களரை நம்பி கெட்டவனும் இல்லை, மணலை நம்பி வாழ்ந்த வனும் இல்லை.

No one was ever ruined by trusting *Kalar* † and nobody ever profited by trusting in a sandy soil.

135. உவர் நிலத்திலிட்ட விரையும் சமரிடத்தில் சென்ற சேனையும் இரண்டாம் பக்ஷம்.

Seed sown in saltish soil is as uncertain as the life of a soldier in a battle field.

136. களர் நிலத்தை உழாதே கடும்படையில் போகாதே.

Do not plough *kalar* nor go into the battle field.

137. களர்கெட பிரண்டை புதை.

Apply *perandai* † to reclaim salt land.

138. உவட்டை மாற்றிட வேப்பம் புண்ணாக்கிட.

Apply margosa cake to remove the alkalinity of the soil.

139. களர் முறிக்க வேப்பந்தழை.

Margosa ‡ leaves will improve salt land.

140. அம்பா பாக்கியம் சம்பா விளைந்தது. பாவி பாக்கியம் பதராய் விளைந்தது.

By the grace of Goddess, samba paddy was obtained. Due to the ill-luck of a sinner, only chaff was obtained, i.e., the crop was chaffy.

141. அரிசி என்று அள்ளிப்பார்ப்பாருமில்லை, உமி என்று ஊதிப் பார்ப்பாருமில்லை.

It is not necessary to handle rice to find it out or to blow off husk to know that it is so.

142. அரிசிப்பகையும், ஆருடையான் பகையும் உண்டா ?

No enmity exists between different varieties of rices, even so no enmity lasts between the wife and the husband.

143. அரிசியும் கறியும் உண்டானால், அக்காள் வீடு வேண்டுமா ?

If one has rice and curry, one will not care to go to his sister's house for food.

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* Alar and kalar = Soils containing an excess of alkaline salts.
† Perandai = *Vitis quadrangularis*.
‡ Margosa = *Melia azadirachta*.

144. ஆண்டை கூலியை குறைத்தால், சாம்பான் வேலையைக் குறைப்பான்.
Cut the wages of coolies. The coolies will curtail their work.

145. ஆல்போல் விழுதுவிட்டு (தழைத்து), அறுகுபோல் வேரோடி, மூங்கில்போல் சுற்றம் முரியாமல் வாழ்ந்திருப்பீர்.
May you prosper just like the banyan going on developing aerial roots, remain steady like the harialli root and flourish with relatives just like the bamboo which goes on multiplying.

146. ஆறுகெட நாணல் இடு, ஊருகெட நூலை இடு, காடுகெட ஆடுவிடு, மூன்றுங்கெட முதலியை (முதலையை) விடு.
To ruin a river, plant reeds in it, to spoil a village bring in people wearing sacred threads, to destroy a forest let in goats in it and to ruin all these, put in a 'Mudali'.

147. ஆறுவடிவிலேயும் கருப்பு தெளிவிலேயும் வருத்தம்.
People experience trouble both at the time a river begins to flow low and at the point of a famine's disappearance.

148. ஆற்றிலே விளைகிறது, மணலிலே சிதறுகிறது.
A river's produce is lost in the sand.

149. ஆற்றிலே ஊருகிறது, மணலிலே சுவருகிறது.
The spring in a river percolates in the sand.

150. ஆற்றுக்குப் பார்ப்பான் துணையா ? சோற்றுக்குப் பயற்றங் காய் கறியா ?
Are on-lookers of any help to a river ? Are coconuts merely kept in a bag of any use in the food ?

151. ஆன குலத்திற் பிறந்து ஆட்டை மாட்டை மேய்க்காமல் ஓலை வாரியாய்ப் போகுமே ?
A shepherd should not wander without grazing his sheep and cattle.

152. உத்திராடத்தில் ஒரு பிள்ளையும், ஊர்வாரியில் ஒரு நிலமும்.
A son born in the Utharada Nakshatram is as good as a field in the vicinity of the village.

153. உளைவழியும், அடைமழையும், பொதி எருதும், ஒருவனுமாய் அலைகிறான்.
A single man is plodding his way lonely with his bullock of burthen in a miry pathway and during a continuous rain.

154. நிலத்திற்குத்தகுந்த கனியும், குலத்திற்குத்தகுந்த குணமும்.
The quality of fruits depends upon the nature of the soil, even so the character of a man, upon the family to which he belongs.

155. நீரகம் பொருந்திய ஊரகத்திரு.
Live in a village where there is water convenience.

156. நீரில்லாநாடு, நிலவில்லா முற்றம்.
A water-less tract is just like a courtyard without moonlight.

157. வேர் நின்றால் மரம் நிற்கும். வியாபாரம் நின்றால் செட்டி நிற்பான்.
If the root of a tree is strong, it will last long and the merchant will be stable only if his business prospers.

THE WEATHER AND THE SEASONS.

As a general introduction to this section, a further group of couplets from the Kural of Tiruvalluvar (Pope's Edition) are given ; and in various ways show the overpowering dependence of agriculture on the rainfall. The uncertainty of this is illustrated by the two following sayings, Nos. 168 and 169 whilst again in those which follow, the value of rain is reiterated. Then, at No. 180, some sayings showing the characteristics desired in the rainfall, and what is undesirable. No. 185 should be compared with Nos. 231, 368, 369. After this, from No. 186 onward, come a number of popular beliefs as to what various natural phenomena foretell in respect to the rainfall. The rainbow is shown to generally foretell rain, but if one appear during the earlier months of the year, or if one appear in the east during the four months of the south-west monsoon, disaster is to be looked for, whilst if any at all appears during Ani (June—July) drought in the following months is to be expected. No. 184 amplifies and enforces that preceding it. No. 199, appears in some senses to be contradicted by those immediately following, Nos. 200 and 201 may be compared with—

> " Red at morning, shepherd's warning ;
> Red at night, shepherd's delight."

Following the above are a number of sayings based apparently on observed facts ; the point, however, of No. 204, in so far as the asses are concerned, is not clear. No. 212 is a piece of very apposite advice, Nos. 214 and 215 are complementary one to the other and may be studied in connection with Nos. 238 to 252 below relating to thunder, and what it tells.

158. வானின்றுலகம் வழங்கி வருதலாற்
றானமிழ்தமென்றுணரற்பாற்று.
The world its course maintains through life that rain unfailing gives ;
Thus rain is known the true ambrosial food of all that lives.

159. துப்பார்க்குத்துப்பாய துப்பாக்கித்
துப்பார்குத் துப்பாய தூஉமழை.
The rain makes pleasant food for eaters rise ;
As food itself, thirst quenching draught supplies.

160. விண்ணின்று பொய்ப்பின் விரிநீர்வியனுலகத்
துண்ணின்றுடற்றும்பசி.
If clouds, that promised rain, deceive, and in the sky remain,
Famine, sore torment, stalks over earth's vast ocean-girdled plain.

161. வரிஞுழா அருழுவர்புயவென்னும்
வாரிவளங்குன்றிக்கால்.
If clouds their wealth of waters fail on earth to pour,
The ploughers plough with oxen's sturdy team no more.

162. கெடுப்பதூஉங் கெட்டார்க்குச் சார்வாய் மற்றுங்கே
டெடுப்பதூஉ மெல்லாமழை.
'Tis rain works all : it ruin spreads, then timely aid supplies ;
As, in the happy days before, it bids the ruined rise.

163. விசும்பிற்றுளி வீழினல்லான்மற்றுங்கே
பசும்புற்றலை காண்பரிது.
If from the clouds no drops of rain are shed,
'Tis rare to see green herb lift up its head.

164. நெடுங்கடலுந் தன்னீர்மைகுன்றுந்
தடிக்தெழிவிதானல்காதாகிவிடின்.
If clouds restrain their gifts and grant no rain,
The treasures fail in ocean's wide domain.

165. சிறப்பொடுபூசனை செல்லாதுவானம்
வறக்குமேல் வானோர்க்குமீண்டு.
If heaven grow dry, with feast, and offering never more
Will men on earth the heavenly ones adore.

166. தானந்தவமிரண்டுந் தங்காவியனுலகம்
வானம் வழங்காதெனின்.
If heaven its watery treasures ceases to dispense,
Through the wide world cease gifts, and deeds of penitence.

167. நீரின்றமையா துலகெனின்யார்யார்க்கும்
வானின்றமையா தொழுக்கு.
When water fails, functions of nature cease, you say.
Thus when rain fails no men can walk in 'duty's ordered way.'

168. மழைப்பேறும் பிள்ளைப்பேறும் மகாதேவனுக்குந் தெரியாது.
Even Mahadeva does not know when it will rain or when child-birth will take place.

169. மழை பேய்ந்தவிடத்திலே மாடுமேய்ந்தவிடத்திலே.
Nobody knows where it will rain and nobody can say where a cattle will graze.

170. மாரியல்லது காரியமில்லை.
Nothing can be done without rain.

171. வானம்பொழியவேணும் பூமி விளையவேணும்.
The clouds should rain that the earth may produce.

172. விண்பொய்த்தால் மண்பொய்க்கும்.
If the sky fail, the earth will fail.

173. வானஞ்சுருங்கிற் ருனஞ்சுருங்கும்.
If the sky fail, charity will fail.

174. மானம் பார்த்தசீமைக்கு மழைபேய்ந்தகாள் நல்லகாள்.
The day when it rains is a good day for rain-fed tracts.

175. மழைமுகங்காணுத பயிரும் தாய்முகங்காணுதபிள்ளையும் (பிழையாது).
The crop that is not rained on and the child that does not see its mother's face (will not live).

176. பிள்ளைபெற்றுக் கெட்டவரும் மழைபேய்ந்து கெட்டவருமில்லை.
No man has been ruined by begetting childern or by rainfall.

177. மேகஞ்சஞ்சரித்தால் பயிர்கள் கிழலாகும்.
If the clouds disperse, the crops will suffer.

178. மழையில்லாததுக்கு குளிரதிகம் வரிசையில்லாததுக்கு வாய் அதிகம்.
A rainless (or cloudless) day is cold and a dowryless pride brags much.

179. பெருமழைவிழுந்தார் குளிராது.
Heavy rain is not attended with cold.

180. மாசமும்மாரி பெய்ந்தால் மூப்போகம்விளையும், மாசம் ஒரு மாரிபெய்ந்தால் இருபோகம்விளையும், மூன்றுமாசத்துக் கொருமாரி பெய்ந்தால் ஒருபோகம் விளையும்.
If it rains thrice a month, three crops can be raised; if it rains once a month, double crops can be raised; and if it rains once a quarter, a single crop can be raised.

181. மாதம் மும்மாரி.
Rain thrice a month is desirable.

182. விட்டுவிட்டுப்பெய்கிற மழையிலும், விடாமல்பெய்கிற தூவானம் நல்லது.
A continuous drizzle is preferable to heavy rain at intervals.

183. காலமறிந்து பெய்யாதமழையும் நேரமறிந்து உண்ணுத ஊணும் (சரி).
Unseasonable rain is like untimely food.

184. விடாதமழைபெய்தால் படாதபாடு படவேண்டும்.
Incessant rain is a nuisance.

185. அழுகைதூத்தல் அவ்வளவும் பூச்சி.
A drizzle is conducive to insect pests.

186. அகலவட்டம் பகல்மழை.
A large halo round the sun foretells rain during the day time.

187. சூரியன்கோட்டை கூதாமம்தருமே.
A halo round the sun forebodes famine.

188. அந்திகிழக்கு அதிகாலைமேற்கு கொடுபோட்டால் வாதமழைவரும்.
If a rainbow appears in the east in the evening or in the west in the morning, it will rain.

189. மாரிமருந்து வில்லும்போட்டால், எரிதெறிக்க மழைபெய்யும்.
A rainbow in the east foretells rain enough to breach the tank.

190. மேல்தலைவில்லு கீழ்தலைமழை.
A rainbow in the west indicates rain in the east.

191. கீழ்தலைவில்லு மேல்தலை வெள்ளம்.
A rainbow in the east indicates floods in the west.

192. கூடத்திலே கொடுபோட்டால் கம்பிலே கழுதைமேயும்.
If there be a rainbow in *Kudam* *, asses will graze on the *kambu*†.

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* Kudam = Aquarius; the period referred to is February—March—vide Calendar below.

† Kambu = Pennisetum typhoideum; asses are never provided with any fodder.

193. ஆனி ஆடி அவ்விருதிங்களில், கூனிவில் குணதிசைதோன்றிடில், பாணியாமலே மாடுவில் ஆடுகொள், தானியம் பல தேடுதற்காலமே.

If a rainbow appears in the east during *Ani* * or *Adi* * hasten to sell your cattle and purchase sheep. It is also time to store up grain.

194. ஆடி ஆவணியில் கிழக்குவில்பூண்டால் பஞ்சமுண்டு.
If a rainbow appears in the east in *Adi* and *Avani*, there will be famine.

195. ஆனி ஆடியில் ஆன செவ்வாயில் கொம்பிலே கொரடுபோட்டால் கம்பிலே கழுதை மேயும்.

If a rainbow is seen in the evening of any Tuesday in Ani or Adi, asses will graze on the kambu.

196. ஆனிமாதம் கொரடுபோட்டால் அடுத்தமாதம் மழையற்றது.
A rainbow in Ani forebodes drought in the next month.

197. புரட்டாசியில் வில்போட்டால் உணவற்றுப்போகும்.
A rainbow in *Purattasi* * forebodes a scarcity of food.

198. சுவாதியில் வில்போட்டால் சொன்னபடி மழை.
If a rainbow appears in *Swati* † rain will certainly fall.

199. காச்செம்மானம் காலத்திலும் மழையில்லை.
A red sky in the morning (even in the rainy season) foretells failure of rain.

200. ஆஸ்வீதச் செம்மானம் அடைமழைக்கு லக்ஷணம், அந்திச் செம்மானம் அழுதாலும் மழை இல்லை.
A red sky in the morning foretells heavy rain; in the evening, absence of rain.

201. காலைச்செம்மானம் கடுகுமாரி.
A red sky in the morning betokens early rain.

202. காலைச்செவ்வானம் கடலுக்குப்பெய்யும்.
If the morning sky be red, it will rain in the ocean.

203. அந்திச்செம்மானம் அப்போதே மழை.
Red clouds at sunset foretell instant rain.

204. காலை மோடமும் கழுதை வாடையும் மாலை தென்றலும் மழையில்லை.
The morning cloud, the gathering together of asses and a southerly breeze in the evening are signs of no rain.

205. பம்மலும் தூற்றலும் மருமழைக்கடையாளம்.
Clouds and drizzling foretell heavy rain.

206. அடிவானம் கருக்கிலை அப்போதே மழை.
If the sky becomes dark near the horizon, there will be instant rain.

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* Ani, Adi, Avani, Purattasi are the Tamil months running from June to October, for Calendar see below.

† Swati=The period governed by this star (about the second half of October).

207. கீழ்மானம் கறுக்கக்கருகிய மழையே.
If the sky darkens with clouds in the east, the desired rain will fall.

208. ஆகாயம் மணற்கொளித்திருந்தால் அடித்தாற்போல் மழை.
If the sky is uneven with clouds as the bed of a river, there will be immediate rain.

209. மாரி அடைக்கில் ஏரி உடைக்கும்.
If it be cloudy in the north-east, there will be breaches in the tankbunds.

210. மாரி மூலையில் மழைகருத்தால் மழைக்கு லட்சணம்.
Dark clouds gathering in the north-east (during the north-east monsoon) foretell early rain.

211. தெற்குவெறித்தால தேசம்வெறிக்கும்.
If the south gets clear, there will be famine.

212. கலையும் அப்பைக்கண்டு கட்டியிருக்கிற விதையை வட்டிக்கு விடு.
If the clouds disperse (in the rainy season), lend your stored seeds at interest.

213. ஆடிக்கருவழிந்தால் மழை குறைந்துபோம்.
If the clouds disperse in Ādi, rain decreases.

214. காலை உப்பலும் கடுந்தனிவெய்யிலும் மாலை மேகமும் மழை தனில் உண்டு.
Thunder in the morning, a hot sun at noon, and clouds in the evening are fore-runners of rain.

215. காலை மேகமும் கடுந்தனி வெய்யிலும் மாலை உப்பலும் மழை தனில் இல்லையே.
A cloudy morning, a hot sun at noon and thunder in the evening forebode no rain.

The next group relates to the winds. In June and July, the proper direction for the wind is westerly; in October and November, north-easterly; so the several sayings amplify each other. Nos. 224 and 225 referring practically to similar conditions, and Nos. 226 to 228 describing a state of things which is practically unknown. No. 229 relates to part of the south-west monsoon, during which heavy freshes usually come down the Kāveri; but No. 230 is inexplicable in the light of those preceding.

216. தென்றலும் வாடையும் சிறக்கும் பயிர்கள்.
South winds and north winds make crops excellent.

217. தென்றல்முற்றில் பெருங்காற்று.
If the southerly wind intensifies it becomes a strong wind.

218. குழுறியடிக்குங் காற்றுக்குக் கைமேல் மழை.
Wind blowing from all sides brings instantaneous rain.

219. கடுங்காற்று மழைகாட்டும் கடுஞ்சினேகம் பகைகாட்டும்.
Strong wind foretells rain, as excessive familiarity begets enmity.

220. வடகாற்றடிக்க வந்ததுமழையே.
If the north wind blows, it will surely rain.

221. வடக்தை அடித்தால் துடர்ந்த மழைபெய்யும், தென்றலடித்தால் மழை தெளிபட்டுப்போம்.
If the north wind blows, it will rain immediately: if the south wind, the rain clouds will disperse.

222. கச்சானுக்கு மச்சான் மழை.
The westerly wind is accompanied by rain.

223. ஆடித்தேரி கோடிப்பணம்.
Dust and wind in Ādi are worth a crore.

224. ஆடித்தென்றல் நாடுநடுங்கும்.
A south wind in Ādi is disastrous.

225. மாரிதென்றல் அடித்தால் மாட்டை விற்று ஆட்டை வாங்கு.
If the south wind blows in the rainy season, sell your bullocks and purchase sheep.

226. ஆடி கீழ்காற்றும் அற்பிசி மேல்காற்றும் அடித்தால் அவ்வாண்டுமில்லை மறு ஆண்டுமில்லை மழை.
If an east wind blows in Ādi and a west wind in Arpisi, there will be no rain that year nor in the next one.

227. ஆடி கீழ்காற்று, ஐப்பிசி மேற்காற்று, அண்ணனிட்ட பயிரும் தம்பியிட்ட பயிரும் ஒன்றுபோல்.
If there be an east wind in Ādi and a west wind in Arpisi, well-grown and ill-grown crops alike fail.

228. ஆவணி கீழ்காற்றும், அற்பிசி மேல்காற்றும் அடித்தால் சொற்பனத்திலும் மழை இல்லை.
With east winds in Āvani and west winds in Arpisi, it is useless even to dream of rain.

229. ஆவணி இலை அசைய காவேரி கரைபிரள.
In Āvani, the leaves of the trees shake and the Kāveri overflows.

230. ஐப்பிசி மேற்காற்றுக்கு அப்பவே மழை.
Westerly winds in Arpisi bring on instant rain.

231. மூலக்காற்று புழுவிழும்.
Crops will be infested with insects, if the wind blows in Mula.

When insects, and especially white-ants fly about in abundance there is usually rain at hand; this is remarked on in several sayings. As regards the forecasts to be made from the trees, No. 248 is noticeable as reversing the Telugu saying, which says "mangoes for a good season, tamarinds for a bad."

232. தும்பி பறந்தால் தூரத்தில் மழை.
The flight of beetles augurs rain at a distance.

233. வெள்ளை வண்ணத்திப்பூச்சி மிச்சமானால் வெள்ளம் ஜாஸ்தி.
A large swarm of white butterflies fortells heavy floods.

234. சகல் பறந்தால் மழை மாறும்.
Rain ceases when winged white-ants appear.

235. காலை செல்பூத்தால் அடித்தமழை அடங்கும்.
Should winged white-ants come out in the morning, the heavy rain will cease.

236. அந்தி ஈசல் பூத்தால் அடைமழைக்கு லட்சணம்.
Excessive rain follows, if white-ants take wing in the evening.

237. எறும்பேறில் பெரும்புயல்வரும்.
If ants crawl up (to higher places), there will be a storm.

238. எறும்பு முட்டைகொண்டு கிட்டையேறின் மழைபெய்யும்.
If ants move to high ground with their eggs, rain will follow.

239. தட்டான் பறந்தால் கிட்டமழை.
The dragon-fly is the forerunner of rain.

240. தட்டான்தாழ தட்டாதமழை.
If the dragon-fly flies low it will rain without fail.

241. தட்டான் உயர காரும்கட்டும்.
If the dragon-fly flies high, the rain will cease.

242. மாலைக்கொசுக்கடி மழையைக்கொண்டுவரும்.
If mosquitoes be active in the evening, there will be rain.

243. தவளைகத்தினால் தானேமழை.
If frogs croak, rain will follow.

244. மாடுமயங்கி மானம்பார்த்தால் மழைபெய்யும்.
If the cattle look bewildered towards the sky, it will rain.

245. கொக்கு மேடேறினால் மழைபெய்யும்.
If the cranes seek high place, it will rain.

246. நண்டு ஊர நாடு செழியும்.
If the crab crawls, the country will flourish.

247. நாகைபழுத்தால் நாடு செழிக்கும்.
If the *Jamun** fruits freely, the country will prosper.

248. பொங்குங்காலம் புளி, மங்கும்காலம் மா.
Tamarinds in good season; mangoes in a bad.

The forecasts based on the occurrence of lightning and thunder are interesting; lightning being generally held to foretell rain, thunder to be deceptive. As regards the periods referred to, a reference to the calendar given below should be made, but the sayings come practically to the statement that thunder during the hot weather is bad, though thunder-storms are frequent at that period, and that later on thunder is of good import. No. 271 suggests the necessity for artificial irrigation in the circumstances mentioned.

The luck attaching to certain days has already been alluded to, and is again mentioned, whilst the occurrence of peculiar combinations of days is again referred to in Nos. 274 to 277. Regarding No. 275, it is scarcely necessary to point out that the price of paddy does not approach that usually prevailing for rice except in times of scarcity or famine.

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* Jamun = *Eugenia Jambolana.*

Eclipses are almost always believed to be of evil import, though not always so by the ryot, but the usual evil character thereof is exemplified in Nos. 278 and 279. Following are a number of sayings illustrating the belief in the influence of the stars on the weather, as also others regarding the influence of the moon, some of which are, to say the least, peculiar.

249. மின்னுக்கெல்லாம் மின்னுக்கு மழை.
The more the lightning, the heavier the rain.

250. எருது சிரிக்கான் மூலையில்.
If there be lightning in the south-west, the bullock laughs.

251. ஈசான்னிய மின்னலுக்கு எருதும் நடுங்கும்.
Lightning in the north-east makes even a bullock tremble.

252. கொடிக்கால் மின்னல் விடியற்கால்மழை.
Lightning in the north-west brings down rain next morning.

253. ஈழமும் கொங்குமெதிர்த்து மின்னினால் குட்டியை யெடுத்து கூடையில் போடு.
Put your lambs under the basket, if there is lightning at one and the same time in *Elam* and *Kongu*.

254. ஈழமும் கொங்கும் எதிர்த்து மின்னுவது பள்ளத்திலிருக்கிற குடிலை மேட்டிற்போடு.
If there be lightning simultaneously in Elam and Kongu, shift the folds from the low ground to the higher.

255. ஆனிமாதம் அடிமின்னலைப்பார்த்து பட்டசைதிற.
If there be lightning near the horizon in Āni, open your granary.

256. அற்பிசிமாதம் ஆறுந்தேதி அடிமின்னல்பார்த்து பட்டசை திற.
If there be lightning near the horizon on the sixth of Arpisi, open your granary.

257. சோதிமின்னிடில் சோறகப்படும்.
If there be lightning in *Swati*, there will be food.

258. குலைக்கிறநாய் கடியாது இடிக்கிறமானம் பெய்யாது.
A barking dog seldom bites, and a thundering sky seldom rains.

259. மானம் அதிர்ந்தால் மழை பொழியும்.
If it thunders, there will be heavy rain.

260. கோடை இடியும் மாரிமின்னலும் மழை அதிகம்.
Thunder in the hot weather and lightning during the rainy season bring heavy rain.

261. மாரி இடியும் கோடை மின்னலும் மழையில்லை.
If there be thunder in the rainy season and lightning in the hot weather, there will be no rain.

262. அசுவனி கார்த்திகையில் இடி இடித்தால் ஆறு கார்த்திகை மழையில்லை.
If it thunders in *Aswani*, there will be no rain for six *Kartigais*.

* Elam and Kongu, that is, Ceylon and parts of the Salem, Coimbatore and Malabar districts respectively; here used to indicate opposite directions.

263. சித்திரை மின்னலாகாது கண்டக்கால் மார்கழி இடிக்கவு மாகாது.
Lightning in Chitirai and thunder in Margali are bad.

264. ஆனி ஆறுந்தேதி குடுகிலல் அறுபது காளைக்கு ம்மை இல்லே.
If it thunders on the sixth Āni, it will not rain for sixty days.

265. ஆருத்திரை ஆறுக்குள் குடுகிலல் ஆறுமழை தட்டும்.
If it thunders during the first six days of *Arudra*, six rains will be wanting.

266. சிங்கமுழங்கிலல் எங்கும் பயிருண்டு.
If it thunders in *Simha*, there will be crop everywhere.

267. ஆவணிமாதம் அஞ்சாந்தேதி சிங்கமுழக்கம் அவ்வருஷம் மழை.
Thunder on the fifth of Āvani foretells plenty of rain during the year.

268. அற்பிசி ஆறில் இடித்தால் அடிப்பானே விதைக்கும் ஆனி உண்டாம்.
Thunder during the first six days of Arpisi will injure even the seeds preserved in the undermost pot.

269. அற்பிசிமாதத்தில் இடி இடித்தால் ஆனைக்கொம்பு முளைக்கும்.
The crop will be blighted with *Anvikkombu*,* if it thunders in Arpisi.

270. அற்பிசிமாதத்தில் இடி இடித்தால் கிணற்று அடியில் அருகு முளைக்கும்.
If it thunders in Arpisi, grass will grow at the bottom of the wells.

271. துலா இடிக்கிறது பிடிடா ஏற்றத்தை.
If it thunders in *Tulam*, take to the picottah.†

272. கார்த்திகைக்கு முறல் கருந்தண்டு ஈன்றல்.
If there be thunder in Kartigai, the ears of corn will not fill.

273. சனிக்கிழமை சாயங்காலம் மழைதொடுத்தால் பயிர்கள் பிணி தீரும்; பலன் மிகவும் உண்டாகும்.
If it rains on a Saturday evening, crops will be free from disease and be fruitful.

274. ஆடிபிறந்த ஐந்தாம் நாள் ஆடும் புதனேயாகில் காவிலையும் ஒருபோகம், கல்ல வியாழன் இருபோகம், வெள்ளிபயிர் சுரவி, சனி கதிர்சாவி, ஞாயர் நாசம்.
If the fifth day of Adi be a Wednesday, there will be but one crop: if a Thursday, two crop; if a Friday, all crops will yield well; if a Saturday, the ears of corn will wither; if a Sunday, there will be ruin.

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* Anaikkombu, an obscure disease of paddy.

† Picottah; the simple lever lift generally used for raising water from moderate depths.

275. ஆடி ஞாயிறு ஐந்தாலல் அரிசிவிற்றவிலை நெல்விற்கும்.
If there be five Sundays in Ādi, the price of paddy will be equal to that of rice.

276. ஆடி ஞாயிறு அஞ்சுபட்டால் நாடுபடும்பாடு காயும்படாது.
If there be five Sundays in Ādi, the sufferings of the people will be worse than those of a dog.

277. ஆடி ஞாயிறு அஞ்சு, ஆவணி செவ்வாய் அஞ்சு, புரட்டாசி சனி அஞ்சு வந்தால் கூடாமம்.
Five Sundays in Ādi, five Tuesdays in Āvani, five Saturdays in Purattāsi are signs of famine.

278. அர்க்கனையும் சோமனையும் ஐம்மூன்றுநாளையில் நெருங்கி அரவம் தீண்டிடில், செருக்களத்தில் மன்னர் மடிவார், மடியாவிடில் அன்னம் அரிதாய்விடும்.
If solar and lunar eclipses occur within fifteen days of each other, either kings will die on the battle field or there will be scarcity of food.

279. பங்குனி, ஆனி, புரட்டாசி, மார்கழியில் பொங்காவன் தீண்டினும் புகர்படினும் எங்கெங்கும் பள்ளங்கள்தோறும் பயிரிட வேண்டாம் வெள்ளமிகுத்து வருங்காண்.
An eclipse or shooting stars in Panguni, Āni, Purattāsi or Margali are signs of heavy rain; do not then sow in the valleys or the crop will be washed away.

280. தெற்கேபோனவெள்ளி வடக்கேவந்தால் மழை.
It will rain, when Venus after setting to the south (of the moon) rises again to the north.

281. கும்பத்து வெள்ளி குடங்கொண்டுசாய்க்கும்.
When Venus enters *Kumbam*, there will be abundant rain.

282. சுவாதி சுக்கிரன் ஓயாமழை.
Rain is incessant if Venus enters *Swati*.

283. மூடத்திலே வெள்ளிசாதிக்குதே நாட்டை மூடந்தள்ளிப் பேய்ந்தால் நாடுசெய்த நன்மை.
Rains in *Sukla Moodhum** will bring ruin on the country; but if it rains subsequently, the country will prosper.

284. மாசிமகத்தில் மகம் மதியின் தெற்கோடில் தேசமும் நாடும் செழிக்கும்.
If on the day of *Makham* in Masi, that star moves to the south of the moon, the country will prosper.

285. கன்னிச்செவ்வாய் கடலும் வற்றும்.
If Mars enter into *Kanni*, the ocean will even dry up.

286. மகம்விட்டோடிலல் குடிகெட்டோடும்.
If the moon passes away from *Makham*, the ryots will have to quit their homes.

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* Sukla Moodhum = The time when Venus comes into conjunction with any star.

287. கேட்டை மூட்டை செவ்வாய் ஓட்டை விற்கச்செய்யும்.

If *Kettai* begins and the new-moon appears together on a Tuesday, the country will be poverty-stricken.

288. எப்பிசை கோணிலுலும் தைப்பிசை கோணலாகாது.

The crescent moon during Thai should never be slanting.

289. தைப்பிசை வடகொம்பு உயர்ந்தால் வடவனுக்கும் சோறுண்டு தென்கொம்பு உயர்ந்தால் தெருவெங்கும் திரியவேண்டும்.

If the Thai new-moon slope to the north, it will bring prosperity ; if to the south, adversity.

290. மீனுதெற்கு உயரமிக்கெட்டும், வடக்கு உயரதான் மகரகும்பம் சமமாக மானேகேள் சொன்னபடி கொம்பாயிரானுகில் அன்னம் அரிதாய்விடும்.

If the young moon be level in Thai and Masi, and rise a little to the south in Panguni and Chittirai and a little to the north in the remaining eight months, the rains will be good ; if not, there will be distress.

291. கடகச்சந்திரமழை கல்லைத்துளைக்கும்.

Rains when the moon enters *Karkataka* will pierce the stones.

292. கல்லணை இடித்தாலும் கர்க்கடக சந்திரன் விடாது.

Even after the stone anicut breaches, the moon in *Karkataka* will continue to rain heavily.

293. கார்த்திகைமாதத்து கற்கடகச் சந்திரயோகம் கல்லைத் துளைக்கும்.

If the moon and Karkataka meet in Kartigai, the rain will be so heavy as to pierce the stones.

294. கர்க்கடகசந்திரன் கல்லைத் துளைக்கும்.

When the moon reaches *Karkataka*, the rain will split stones.

In the sayings given above, many references to dates and periods have been given, and before proceeding further it will be well to state that the year is divided into 27 astral periods (called Kartigai), each of about a fortnight duration, during which the sun is found in conjunction with certain stars, by the names of which these periods are known. The Tamil Calendar also comprises twelve months of about 30 days each, each sub-divided into a dark and a bright period, during which the moon is in conjunction with certain stars, by the names of which the months are known. These periods are also sometimes referred to by the signs of the zodiac. For facility of reference the following statement of the approximate dates of these astral periods and months is given.

Astral periods.

Approximately.			Names.	
From	To		Tamil.	Sanskrit.
April 11	April 25	..	Asvani	Asvani.
April 26	May 9	..	Barani	Bharani.
May 10	May 23	..	Krittikai	Krittika.
May 24	June 6	..	Rogini	Rohini.
June 7	June 22	..	Mrigasiridam	Mrigasirisha.
June 23	July 4	..	Tiruvādirai	Ārdra.
July 5	July 18	..	Punarpūsam	Punarvasu.
July 19	August 1	..	Pūsam	Pushya.
August 2	August 15	..	Ayilyam	Āslēsha.
August 16	August 29	..	Makam	Makha.
August 30	September 11	..	Pūram	Pubba.
September 12	September 25	..	Uttiram	Uttara.
September 26	October 8	..	Attam	Hasta.
October 9	October 22	..	Chittirai	Chitta.
October 23	November 4	..	Shōdi	Swāti.
November 5	November 17	..	Visākam	Visākha.
November 18	November 30	..	Anusham	Anōradha.
December 1	December 14	..	Kēttai	Jēshta.
December 15	December 27	..	Mūlam	Mūla.
December 28	January 9	..	Pūrādam	Pūrvāshāda.
January 10	January 22	..	Uttirādam	Uttarāshāda.
January 23	February 4	..	Tiruvonam	Srāvaṇam.
February 5	February 17	..	Avittam	Dhanishta.
February 18	March 2	..	Satayam	Satabhisha.
March 3	March 15	..	Pūrattāsi	Pūrvābhādra.
March 16	March 27	..	Uttarattādi	Uttarābhādra.
March 28	April 10	..	Revati	Rēvati.

Months.

Approximately.*	Names.		Star.	Sign of the Zodiac.	
	Tamil.	Sanskrit.		Sanskrit.	English.
April—May ..	Chittirai ..	Chaitra ..	Chittirai ..	Mēsha ..	Aries.
May—June ..	Vaiyāsi ..	Vaisākha ..	Visākam ..	Rishabha.	Taurus.
June—July ..	Āni ..	Jēshta ..	Mūlam ..	Midhuna ..	Gemini.
July—Aug. ..	Ādi ..	Āshāda ..	Utterādam ..	Karkataka.	Cancer.
Aug.—Sept. ..	Āvani ..	Srāvaṇa ..	Avittam ..	Simha ..	Leo.
Sept.—Oct. ..	Purattāsi.	Bhādrapada.	Pūrattādi ..	Kanya ..	Virgo.
Oct.—Nov. ..	Arpisi ..	Asvija ..	Asvani ..	Tulām ..	Libra.
Nov.—Dec. ..	Kārtigai ..	Kārthika ..	Krittikai ..	Vrichchika.	Scorpio.
Dec.—Jan. ..	Mārgali ..	Mārgasira ..	Mrigasiridam	Dhanusu ..	Sagittarius.
Jan.—Feb. ..	Thai ..	Pushya ..	Pūsam ..	Makara ..	Capricornus.
Feb.—March ..	Masi ..	Māgha ..	Makam ..	Kumbha ..	Acquarius.
March—April.	Panguni ..	Palguna ..	Uttiram ..	Mina ..	Pisces.

The remainder of this portion of the collection relates chiefly to clearly specified periods. In No. 295, the advantages of the rains coming early are forcibly put, for then the fat ox will become lean by hard work. The rain must not, however, come too early in Aswani; nor, it would appear, in Chittirai at all, though in Bharani, which is usually included in that month, rain is greatly valued. No. 280, moreover, appears to contradict the sayings following it, as it refers to the ceremonies attendant on the commencement of cultivation. The

* Beginning at about the eleventh of first and ending about the tenth of the second month mentioned.

rains over the greater part of the country do not set in till June—in Ani—and increase in amount thereafter. "In *Āni*, half a riverful; in *Ādi*, a full river." In several of these sayings, the importance attached to the setting in of the rains with the new-moon of Ādi is alluded to, but the sayings on the point are rather contradictory. The uncertainty of rain throughout the year or rather during the season of rainfall is again and again alluded to, but October is generally mentioned as the time for the heaviest rainfall, though it is said to be so continuous in the succeeding months as to prevent even the cleaning of the household vessels. After *Kartigai*, or early in December, the rain generally ceases, and rain at the latter end of the month is looked upon as injurious and useless, though the dry weather is not said to be fully set in until Thai. Then comes the season of dew, when, if rain falls, it causes loss, chiefly because the crops will be ready for harvest. This portion of the collection concludes with a couple of sayings that illustrate the beliefs as to the effect of weather on insect attacks.

295. *கார்மழைபெய்து கடும்பட்டம்வர யானைபோன்ற எருதும் பூனைபோல்.*
If the Kar rains come and times are busy, the fattest ox becomes as lean as a cat.

296. *விஷுக்கழிந்த மறுநாள் கொழுப்பதிய மழைபெய்யவேண்டும்.*
There will be enough rain on the day after Vishu* for the ploughshare to sink into the earth.

297. *அசுவனி சர்வ நாசனம்.*
If there be rain in Aswani, every crop will be lost.

298. *பரணிபெய்ந்தால் தரணிவிளையும்.*
If it rain in Bharani, the land will be productive.

299. *பரணிமழை தரணியெல்லாம்பொலி.*
If there be rain in Bharani, the soil will yield well everywhere.

300. *சித்திரை மழைபெய்ந்தால் பொன்னேர் கட்டலாம்.*
If it rains in Chittirai, you may till with a golden ploughshare.

301. *சித்திரைமழை சின்னப்படுத்தும்.*
Rain in Chittirai will spoil the outturn.

302. *சித்திரைமாதத்து மழை சினையை அழிக்கும்.*
Rain in Chittirai renders the earth unfruitful.

303. *சித்திரைமாதத்து மழை சிவத்துரோகம்.*
Rain in Chittirai is as bad as sin against Siva.

304. *சித்திரை பத்துக்குமேல் சிறந்த பெருங்காற்று ஐப்பிசி பத்திலடங்கும்.*
After the tenth of Chittirai, high winds commence and last till the tenth of Arpisi.

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* Vishu = The day of the quinox: the application to the vernal equinox is doubtful.

305. வையாசிமாதம் மதிகுறைந்த காலாம்நாள் பெய்யுமேயாகில் பெருமழையாம், பெய்யாக்கால் மாசிமறுத்து மருகடலும் நீர் வற்றி வரிக்குள் எள்ளுவிளை.

If it rains on the fourth day in the dark fortnight of Vaiyāsi there will be plenty of rain; if not, clouds will not even be visible, the sea will dry up and gingelly can be raised in the tank-beds.

306. வைகாசிமாதம் வாய்மடையில் வர்பூட்ட பொய்யாமல் பூக்கும் புளி.

If the season helps ploughing in Vaiyāsi, the tamarind will blossom abundantly.

307. ஆருத்திர கார்த்திகை பகலில் பிறந்தால் ஆறுகார்த்திகை மழையில்லை.

If Arudra begin in the day-time, there will be no rain for the next six *Kartigais*.

308. ஆனிகுறுகிலுல் அறுபதுநாளைக்கு மழையில்லை.

If there be no rain in Āni, then there will be none for sixty days afterwards.

309. ஆனி அரையாறு ஆவணி முழு ஆறு.

In Āni the river will be half full and in Avani quite full.

310. ஆனி அடைசாரல் ஆவணி முச்சாரல்.

There will be drizzling in Ani and rain in Āvani.

311. ஆடி அரைமழை.

Rain in Adi will be scanty.

312. ஆடி வெப்பல் ஆட்டுக் கெடைக்குச்சமானம்.

Sunshine in Ādi is equal to sheepfolding.

313. ஆடி அமாவாசைதன்னில் ஆதித்தன் ஒளியை மூடி முகில் மறைந்து மேகிலுல், காடிய தோகிளங்கலங்கி அலைக்கடலும் வத்தித் தலைக்கேடு மேதையள்வும்தான்.

If the Ādi new-moon be obscured, rain will hold off till Thai, the sea will dry up, and there will be much distress.

314. ஆடி அமாவாசையில் மழைபெய்தால் அடுத்த அமாவாசை வரையில் மழையில்லை.

If it rains on the new-moon day in Ādi, there will be no rain till the next new-moon.

315. ஆடி அமாவாசையில் மழைபேய்ந்தால் அரிசிவிற்றவிலை நெல் விற்கும்.

If it rains on the new-moon day in Ādi, paddy will be as dear as rice.

316. ஆடி முதல்தேதி ஆயிரம்கண்ணுடையான் முடிமுகழ்விரியான் ஆமாகில், ஆழிவரண்டும் அண்டம் புரண்டும் காடு விளையாது காழி.

If there be no rain on the first of Ādi, the sea will dry up, the land will be ruined and the yield will not be even a measure.

317. ஆடி அரவட்டை அகவிலை நெல்விலை.
If the Ādi harvest fails, the price of dry grain will be equal to that of paddy.

318. புப்பைபெய்தால் கதிர்விளையும்.
If it rains in Pubba, the ears of corn will be full.

319. ஆவணிமாதம் அழுகைத் தூற்றல்.
Āvani drips continually.

320. ஆவணி தலைவெள்ளமும் அற்பிசிகடைவெள்ளமும் கெடுதி.
Freshets in the early part of Āvani and at the end of Arpisi are destructive.

321. புரட்டாசி பெய்தாலும் பெய்யும் காய்ந்தாலும் காயும்.
Rain in Purattāsi is uncertain.

322. பொன்னுருகக்காயும் மண்ணுருகப்பெய்யும் புண்ணியப் புரட்டாசி.
In the good Purattasi month, the sun will be so hot as to melt gold and the rain so heavy as to liquefy the earth.

323. புரட்டாசி பெருமழை.
Heavy showers fall during Purattāsi.

324. புரட்டாசி பேய்ந்து பிறக்கவேண்டும், அற்பிசி காய்ந்து பிறக்க வேண்டும்.
Purattāsi should begin with rain and Arpisi with a clear sky.

325. பெய்ந்தால் பேயும் புரட்டாசி, பெய்யாவிட்டால் பேயும் அற்பிசி.
It may or may not rain in Purattāsi, but it is sure to rain in Arpisi.

326. அற்பிசி அடைமழை.
Continuous rain in Arpisi.

327. அற்பிசிமாதம் பசுகறக்குமுன் பனிரெண்டு பாட்ட மழை.
There will be twelve showers before the milking, every day in Arpisi.

328. அற்பிசிமாதத்து வெயிலில் அன்று உறித்ததோல் அன்றைக்கே காயும்.
The solar heat in Arpisi is so great, that a skin will dry on the day the animal is flayed.

329. அற்பிசி பனி அத்தனையும் மழை.
Dew in Arpisi is so much rain.

330. சித்தை பேய்ந்தால் தேசம் பாழாம்.
If it rains in Chitta, the country will be ruined.

331. அற்பிசிமாதம் பிரையைக்கண்ட வேளாளா கைப்பிடி நாத்தைக்கொண்டு கரையேறு.
Oh farmer! get out of the field with the young seedlings in your hand, should you see the first crescent moon in Arpisi.

332. அற்பிசி அடியோடேகாய்ந்தால் அண்டைபுலம்போல் என் புலமும்.

If there be no rain in Arpisi, my field will resemble that of my neighbour.

333. அற்பிசிமாதம் அறக்காய்ந்தால் அண்ணனிட்ட பயிரும் தம்பியிட்ட பயிரும் சரி.

If there be no rain in Arpisi the yield obtained in the case of good and bad cultivators will be the same.

334. அற்பிசி தலைவெள்ளமும் கார்த்திகை கடைவெள்ளமும் கெடுதி.

Freshes at the beginning of Arpisi and at the end of Kartigai are injurious.

335. அற்பிசிமாதம் அடைமழை கார்த்திகைமாசம் கனமழை.

In Arpisi, there will be continual rain ; in Kārtigai heavy rain.

336. அற்பிசிக்கும் கார்த்திகைக்கும் மழையில்லாவிட்டால் அண்ணனுக்கும் சரி தம்பிக்கும் சரி.

If the rains of Arpisi and Kārtigai fail, the elder and younger brother will be equal.

337. கார்த்திகைமாதம் கலங்கழுவ மழைவிடாது.

In Kartigai, the rain will not allow you even to clean your vessels.

338. கார்த்திகைமாத்தது மழையில் கல்லுக்குள்ளிருக்கும் புல்லும் கதிராகும்.

Even the grass amongst the rocks will bear seeds with the rains of Kārtigai.

339. கார்த்திகை கனமழை.

It will rain heavily in Kārtigai.

340. காய்ந்தால் காயும் கார்த்திகை.

Drought in Kārtigai is possible.

341. கார்த்திகைப் பிரைகண்ட வேளாளா கைகாத்துடன் கரையேறு.

If in Kārtigai the crescent be seen, do not plant even the seedling you have in hand.

342. கார்த்திகைப் பிரை கண்டாற்போல்.

Rare like the Kārtigai moon.

343. கார்த்திகை கண்டு கலம்வில்லு.

Wait till Kārtigai to sell your grain.

344. கார்த்திகைமாதம் கால்நாழிகைப் பொழுதிருந்தாலும் காற்றடிக்கும்.

The wind will blow hard, if there be day-light even for a fourth of *naligai* * in Kārtigai.

345. கார்த்திகைக்குப்பிறகு கால்கோடை.

It is one-fourth summer after Kārtigai.

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* *Naligai*=24 minutes.

346. கார்த்திகைக்கப்பால் மழையுமில்லே, கர்ணனுக்கப்பால் கொடையுமில்லே.

No rain after Kārtigai and no donor after *Karnan*.*

347. விளக்கிட்டால் மழைகிழக்கிடும்.
Rain will cease after the lamp-lighting festival in Kārtigai.

348. மூலமழைபெய்ந்தால், நவதான்னியத்துக்கு கேடு.
If there is rain in Mula, the *Navadhdnyam* † will suffer.

349. மார்கழி மத்தியில் மாரிபொழிந்தால் சீரொழுகும் பயிர்களுக்கு கேஷமமிக உண்டாகும்.
If there be rain in the middle of Mārgali, crops carefully looked after will thrive.

350. மார்கழிபிறந்தால் மழையுமில்லே, பாரதம் முடிந்தால் படையுமில்லே.
No rain from Mārgali and no army after the Bharata war.

351. மார்கழிமழை மண்ணுக்குதவாது.
Rain in Margali is of no use to the land.

352. மார்கழிக்கோடை மரம்வெட்டிச்சாய்த்தாற்போல்.
Drought in Mārgali is like felling trees.

353. தைபிறந்தால் தலைக்கோடை.
Summer commences in Thai.

354. தைபிறந்தது தரைவறண்டது.
The soil gets dry at the commencement of Thai.

355. தை ஈறுப்புல்லுமில்லே மாசி ஈறுமரமுமில்லே.
There is no grass which does not thrive in Thai, nor any tree which does not put forth fresh shoots in Māsi.

356. தைவெள்ளம் தாய்க்குச்சோறு.
If there be freshets in Thai, a ryot can feed his mother.

357. மாசிப்பனி மச்சையுந் துளைக்கும்.
The dew in Māsi will even soak through a terrace.

358. மாசிமின்னல் மரந்தழையும்.
If there be lightning in Māsi, trees will shoot.

359. பங்குனி மழை பத்துக்கும் கஷ்டம்.
Rain in Panguni is ruinous in several ways.

360. பங்குனிமாதத்தில் மழைபெய்தால் பத்து எட்டு சேதம்.
Rain in Panguni causes great loss.

361. பங்குனிமழை பெய்தால் பலனெல்லாம் சேதம்.
If it rain in Panguni, the harvest will be damaged.

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* *Karnan* was king of the country called Anga and an ally of Duryodhana (*see the* Mahabharata).

† The *Navadhanyam* are wheat, paddy, the common pulses and gingelly; the term isused here to describe grain crops generally.

362. உதயத்தில்வந்த மழையும் அஸ்தமிக்கவந்த மாப்பிள்ளையும் விடாது.

Rain in the morning will not stop soon, nor will a son-in-law arriving in the evening depart.

363. அந்திமழையும் ஒளவையாரைப்பிடித்த பிணியும் விடாது.

Evening rain and disease in old women will not cease.

364. அந்திமழை அழுதாலும் விடாது.

Evening rain will never cease.

365. பனிக்கண்ணடைத்தால் மழைக்கண் திறக்கும்.

When dew ceases, rain begins.

366. பனிபெய்தால் மழையில்லை, பழமிருந்தால் பூவில்லை.

If there be dew, there will be no rain, as a tree which bears fruit will have no flowers.

367. மூடுபனிபெய்தால் முந்நூறும் நாள் மழை.

If there be mist on a day, there will be rain on the 300th day after.

368. அற்பிசிமாதம் அழுகைத்தூத்தல் அவ்வளவும் பூச்சி.

A continuous dripping in Arpisi conduces to insect-pests.

369. விசாகத்தில் மழைபெய்தால் பயிர்களுக்கு புழு உண்டாம்.

If it rains in Visāka the crops will be attacked by insects.

370. ஈழையும் கொல்லையும் எதிர்த்து மின்னினால் பள்ளத்தில் இருக்கிற குடிலை மேட்டிலே போடு.

If there be lightning in the south east corner and north west corner, remove the hut from the low ground to the high ground (meaning there would be heavy rain so as to flood the low level lands).

371. உப்புநீர் மேகம் சேர்ந்தால், உலகிற்பிரவாகம்.

If the sea-water evaporates and forms into clouds, very heavy rains are expected and in consequence high floods are anticipated.

372. தைமழை, நெய்மழை.

A rain in the month of 'Thai' (January-February) is golden.

373. வடக்கே கறுத்தால், மழைவரும்.

If the sky in the north darkens, rains may be expected.

374. வேனலுக்குக் கனமழைவரும், வேந்தனுக்குக் கனசனம்.

Sultriness brings on heavy rains; the King gets many guests.

FIELD HUSBANDRY.

Tillage.

Reference may be made here to the couplet, No. 7 quoted from the Kural of Tiruvalluvar. In the three opening sayings, the necessity for tillage is pointed out and enforced with homely metaphors. Then follow a number of sayings that indicate the advantages of good tillage, and the necessity for making the operation complete. The operation must not be conducted hastily, but should be spread over as long a period as possible (Nos. 387 and 388) whilst, when so thoroughly performed that the soil is as soft and mellow as butter, tillage is equal to or better than manuring, and without it no manuring is of avail. The value of a deep furrow is fully recognised in Nos. 397 to 404 whilst No. 400 should be specially noticed and read with No. 389, as the facts stated, though not as yet accepted by all men of science, have an important bearing on the agricultural question of combating droughts or failures of rain. The succeeding sayings refer chiefly to the necessity for ploughing at the proper time, but No. 405 illustrates a peculiar prejudice regarding lucky days. No. 410 illustrates the necessity for speed in despatching agricultural operations in India; it refers to the necessity for getting sowing done quickly; No. 411, on the other hand, alludes to the benefits of thoroughly aerating the soil during the dry weather. Then follow sayings that show the value attached to ploughing in the premonsoon or *Kar* period or even earlier, probably to secure the thorough aeration alluded to.

The remaining sayings included in this portion of the collection further inculcate the necessity for tillage being thorough; that in ploughing, the object should be to thoroughly clean the land, state certain well-known facts as to the manner of carrying on ploughing, and the necessity, for economical cultivation, of working with more than one plough at a time. A comparison of No. 430 with No. 36 *supra* should also be made. In No. 432, a very evil, but common, habit of beating cattle on the head, is justly condemned, and the saying may be compared with No. 88 below. The next saying merely says, cultivate wet-land deeply, and set the seedlings deeply, and then another says cultivate either wet-land or dry-land. The last saying alludes to giving land rest from cropping and the advantage thereof. It is peculiar in being a solitary allusion to the practice.

375. மூலைக்கரைகூட விளைந்தால் சேலைக்கு உதவும்.
Even the corner of a field, if cultivated, will produce enough to buy a cloth.

376. உழவு கட்பில்லாத நிலமும் மிளகு கட்பில்லாத கரியும் வழ வழ.
Untilled soil and curry not seasoned with pepper are useless.

377. கொழுனன் கட்பில்லாத பெண்ணும் உழவு கட்பில்லாப் பயிரும் பிரயோசனமில்லை.
A girl not loved by her husband, and a crop on unploughed land are useless.

378. உழுதவன் காட்டைப்பார் மேய்ச்சவன் மாட்டைப்பார்.
Look! the field of one who has ploughed well and the cattle that are grazed (are good).

379. வெண்காராபுழுதிக்கு விளையாத பயிர் உளதோ ?
Will not any crop flourish in well-ploughed soil ?

380. புழுதியுண்டானால் பழுதில்லை.
Soil reduced to fine tilth will not fail.

381. உழுது அலர்ந்தது பழுதாகாது.
Soil ploughed and exposed to air will be benefited.

382. அதிர அடித்தால் உதிரவிளையும்.
A field well tilled will heavily yield.

383. வெண்ணெப்போல் உழவும் குண்ணுப்போல் விளையும்.
If the soil be ploughed to the consistency of butter, the yield will be a mountain-heap.

384. உழுதகாலாலே உழப்பிவிடு.
Tread the clods as you plough.

385. உழ அற உழுதால் விளைவற விளையும்.
Thorough ploughing gives a full crop.

386. உழவுகள்ளன் இழிவுகள்ளன்.
Who grudges the ploughing is contemptible.

387. ஓடி ஓடி நூறு குழி உழுவதைப்பார்க்கிலும் அமர்ந்து அமர்ந்து ஆறு குழி உழு.
Better to plough six *kulis** slowly and well than a hundred hastily.

388. ஆறுகாள் நூறுழவு உழுவதிலும், நூறுகாள் ஆறுழவு உழுவது நலம்.
Better plough six times in 100 days than 100 times in six days.

389. ஆற்றப்புழுதி ஈரம்தாங்கும்.
A mellow furrow will retain moisture.

390. பசு உரத்திலும் பழம்புழுதி நல்லது.
A mellow furrow is better than cowdung.

391. உழுவால் பயிராகிறது எருவாலுமாகாது.
Ploughing can do what manuring cannot.

392. எழுழவு உழுதால் எருப்போடவேண்டாம்.
Land ploughed seven times needs no manure.

393. எருவிலும் வலியது உழவுதான் ஆமே.
Ploughing is superior to manuring.

394. உரத்தைத்தள்ளும் உழவு.
Ploughing makes manuring unnecessary.

395. உழவிலும்பகை எருவிலும் தீராது.
Defective tillage cannot be made up for by manure.

396. உழவுபசையாலுல் எருவினுல் தீராது.
Defective ploughing cannot be made up by manuring.

397. ஜாண் உழவு முழ எருவுக்குசமம்.
Ploughing a span deep and manuring a cubit deep are equal.

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* *Kuli* = An area of 576 square feet

398. அடர விதைத்து ஆழ உழு.
Sow thick and plough deep.

399. ஆடுவைத்தலினும் ஆழ உழுவதே நலம்
Deep ploughing is better than sheep-folding.

400. ஈர்ந்துழும் புஞ்சை ஈரம் தாங்கும்.
Deep ploughed dry-land retains moisture.

401. ஆழ உழுது தேடி எடு.
Plough deep and enjoy the profit.

402. தாழ உழுதால் தளிசோடும்.
Deep ploughing produces a good crop.

403. ஆழ உழுதாலும் அடுக்க உழு.
While you plough deep, plough thoroughly.

404. அகல உழுவதை ஆழ உழு.
Plough for depth instead of breadth : *i.e.*, plough thoroughly.

405. பூரணந்தன்னில் புலையனும் உழான்.
Not even a Pariah will plough on a (Purnami) full-moon day.

406. மேலைக்கு உழுவார், கூழுக்கு அழுவார்.
Those who delay their ploughing will not get enough even for their gruel.

407. காரைக்கண்டு வர் உழு.
Be sure of rain and then plough.

408. பனியைநம்பி வர்கட்டி யலுத்தான்.
He will be tired of ploughing who depends upon the dew-fall.

409. ஈரநிலத்தில் வரைப்பிடி.
Plough the field when it is moist.

410. புழுதி உலர்ந்தால் உழுமுதல் காணாது.
If the ploughed field dries before it is sown, the cost of cultivation cannot be recouped.

411. உழவு உழுதுகாய்ந்தால் வித்திரட்டிகாணும்.
If soil be allowed to dry after ploughing, the yield of grain will be doubled.

412. கார்த்திகைமாதத்தில் உழுதால் கடுகு மிளகுக்கும்காணாது.
Ploughing in Kartigai yields very tittle.

413. தை உழவு ஐயாட்டுக்கிடை.
Ploughing in Thai is equal to folding sheep five times.

414. தை உழுவோ நெய் உழுவோ.
Ploughing in Thai is ploughing ghee.

415. சித்திரைமாதம் புழுதி பத்திரமாத்துத் தங்கம்.
Tilth in the month of Chitrai will be as fine as pure gold

416. காளைகட்டி காருழவைஓட்டு.
Yoke young and strong bullocks and speed the *kar* plough.

417. மூரி எருத்தினுழவில்லை.
Ploughing with lazy bullocks is bad.

418. கழுதை உழுது கம்புவிளையுமா ?
Can cumbu grow if asses plough ?

419. உழவிற்கு ஏற்றகொழு.
Adapt the share to the ploughing.

420. கார் அடித்தால்தான் கலப்பை உழும்.
Only when the ploughshare is sharpened will the plough work.

421. எட்டுழவு உழுதாலும் கட்டைக்குத்தகாது.
Even for the eighth ploughing, a wooden share will not do.

422. கொம்பால் உழுது குண்டியால் மரமடி.
Plough with the pointed edge and level with the broad face.

423. கையைப்பார்த்து கலப்பையைவெட்டு, காலைப்பார்த்து மேழியைவிட்டு.
Regulate the size of the plough by the strength of your arm and that of the stilts by the length of your legs.

424. எடுப்புண்டகலப்பை இருந்துண்டுழாது.
A plough that runs out often will not plough properly.

425. புல்லற உழு.
Plough well so as to completely eradicate the weed.

426. புல்லற உழுதால் நெல்லறவிளையும்.
If you plough so as to remove grass thoroughly, paddy will grow very well.

427. நஞ்சைக்கு ஏழுழவு புஞ்சைக்கு நாலுழவு.
Wet-land requires seven ploughings ; and dry land, four.

428. ஏழுமடிப்பு உழுதபுலமும், ஏழு உலர்த்து உலர்த்தின் விதையும் எழுபதுநாள் காச்சல் தாளும்.
Wet-land ploughed seven times and seed-dried seven times can withstand drought for seventy days.

429. மார்பேரில்லாதபயிரும் வளமரியாதகுடியும் சமம்.
Cultivation with a single plough and an unsuccessful cultivator are alike.

430. ஒரு ஏர்க்காரன் உழுதுகெட்டான் நாலு ஏர்க்காரன் நிறுத்திக் கெட்டான் பத்து ஏர்க்காரன் பார்த்து கெட்டான்.
A ryot with a single pair of bullocks is ruined by ploughing continuously ; one who has four pairs, by frequent stoppages ; and one who has ten pairs, by looking on.

431. வேலி ஒன்றுக்கு ஈரணை மாடும் இரண்டு ஆளும் வேண்டும்.
For one *veli* * of land, two pairs of cattle and two drivers are necessary.

432. முன்னேர்மாட்டை முகத்தில் அடியாதே.
Do not beat on the head the bullocks that draw the first plough.

433. ஆழவெட்டி தாழுதை.
Dig deep and plant deep.

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* Veli = An area of 6·66 acres Tanjore. This refers to irrigated land on which paddy is grown.

434. ஒன்று கட்டிவிதை, ஒன்று வெட்டிவிதை.
Flood and sow or dig and sow.

435. கஷ்டத்துக்குத்தக்ககூலி வெட்டினதுக்குத்தக்க விளைச்சல்.
Wages are proportionate to the work done and the yield to the amount of soil dug.

436. போகுகாலில் தேடிப்போடு.
When you sow seed in fallow land, be careful about the selection of land.

437. உழுதொழில் நிற்கின் மற்றதொழில்நடவா.
If agriculture ceases, the world cannot go on.

438. அமிஞ்சிக்கு உழுதால், சரியாய் விளையுமா ?
Can good crops be obtained from carelessly ploughed lands ?

439. உண்பாரைப் பார்த்தாலும், உழுவாரைப் பார்க்கலாகாது.
Even though one may be looking at a man eating and remain idle, one should not remain so after seeing a man-plouging his lands, but should begin his work of preparing the lands.

440. உழுகிறதை விட்டு நழுவுகிறவன், தெய்வம் ஆடிஞற்போல.
A ploughman slipping off leaving his work is like one who pretends that God has come on him and goes in claiming etc.

441. உழுத எருதாணலும், ஒரு முடிநாற்றைத் தின்னவொட்டார்.
Even the bullocks engaged in ploughing will not be allowed to eat even a single bundle of seedlings.

442. உழுதவனுக்கு ஊர்கணக்குப் பண்ணத்தெரியாது.
A ploughman cannot understand village politics.

443. உழுவானுக்கு ஏற்ற கொழு, ஊரார்க்கேற்ற தொழு.
A ploughman should have a suitable plough share; even so the village folk should have proper punishments for offences.

444. ஏரை அடித்தேனே, கூழை அடித்தேனே.
Reduce the number of ploughs, then you reduce the output of food.

Manuring.

Next to tillage, the manuring of the land is of the greatest importance, and in this connection reference may be made to the two couplets, Nos. 7 and 8 above, from the Kural of Tiruvalluvar, wherein the apparent contradiction observable between No. 445 and some of the sayings regarding tillage is also to be seen; the meaning being that the tillage must be effective to make the application of manure of any value. No. 447 alludes to the well-known fact that cows in India are not trained to give down their milk unless their calf be by their side. Then follow a number of sayings illustrative of the fact that manure is a necessity to the production of good crops, and of its value generally. In No. 457 is found the principle of giving back to the land what you take from it; and in the next an appreciation of the superior value of old cattle manure and of good drainage. Following this are sayings recognising the value of sheep (and goats) as manuring agents,

but none so forcible as "the foot of the sheep is of gold." The rapid action of sheep manure, which is usually applied by folding them on the land, is then compared with that of cattle dung, and the leaves of plants and shrubs which are so much used for manuring paddy land; whilst superiority, as affecting the outturn of grain, is attributed to one of the latter. In No. 469 appears to be recognised the fact that manure from (*paracherris*) the villages of flesh-eaters, where also a good deal of animal refuse may be found, is extremely rich, and in the next, that the mixing of soils is good practice. This is done in many cases. The last saying of this group alludes to the benefit of covering in manure when it is applied.

445. எரோட்டுவதிலும் எரு இடுதல் நன்று.
Better to manure than to plough the land.

446. எருக்குழையின்றி எர்பிடியாதே.
Do not plough without manure ready to hand.

447. எரு இல்லா வயல் கன்றில்லாமாட்டைப்போல.
A field without manure is like a cow without a calf.

448. அறிவிலே விளையுமா எருவிலேவிளையுமா?
It is manure and not one's knowledge that makes plants grow.

449. தெய்வத்துக்குச் செய்வதும் செய்க்குரம் போடுவதும் பழு தல்ல.
Worshippiug God and manuring the field will not be without reward.

450. எருசெய்வது இனவன்செய்யான்.
Relatives will not be as serviceable as manure.

451. உரம் உதவுவது ஊரார் உதவமாட்டார்.
One's neighbours will not help as much as manure.

452. எருமணமில்லாத பயிரும் கறுமணமில்லாத மலரும்.
Crop without manure is as worthless as a flower without scent.

453. குப்பையில்லாவெள்ளாமை சப்பை.
Crop with no manure is useless.

454. எருச்செய்வது எமை செய்யாது.
Manure is better than good soil.

455. குப்பை உயர்ந்தால் குடி உயரும்.
As the rubbish heap rises, the ryot prospers.

456. நிலத்தில் எழுந்தபூண்டு நிலத்தில் மடியவேண்டும்.
Plants should perish on the soil where they grow.

457. பாயும் ஜலம் முழுவதும் வத்து பழைய எருவை எடுத்துக் கொட்டு.
Drain off all the water and apply rotten manure.

458. ஆடு ஊடாடாக் காடுவிளையாது.
Untrodden by sheep, no land will produce.

459. ஆடு மிதியாக்கொல்லையும் ஆளனில்லாப்பெண்ணும் வீண்.
A field untrodden by sheep and maid without a husband are useless.

460. ஆடுமடித்தவன் செய்வினையுமா அங்கலாயத்தவன் செய்வினையுமா.
Will sheep penning give good yield or the jealousy of one's neighbour will produce the same result.

461. ஆடே எரு ஆரியமே வெள்ளாமை.
Sheep manure is the best and ragi is the best crop to be grown with this manure.

462. ஆடுமடித்த தொளியைவிட்டு ஆறினதொளியை வாங்கு.
Abandon sheep-folded land, and obtain a mellow fallow.

463. ஆட்டுரம் ஓராண்டு நிற்கும் மாட்டுரம் ஆறுண்டு நிற்கும்.
Sheep dung lasts one year, and that of cattle for six.

464. ஆட்டெரு அந்த வருஷம் மாட்டெரு மறு வருஷம்.
Sheep manure serves in the first; cattle manure in the second year.

465. ஆடு அப்பு, ஆவாரை மூப்பு.
Sheep-folding is good for one crop, *ávarái* * leaves for three.

466. ஆடு பயிர்காட்டும் ஆவாரை நெல்காட்டும்.
Sheep dung has effect on the plant; *ávrái* on the grain of paddy.

467 கார் ஆடு பிசானம் குழை.
Kar crop † requires sheep-penning and *pishanam* or Samba. paddy requires application of ‡ leaf manure.

468. காணிக்கு ஒரு கருவேறும் வேலிக்கு ஒரு மூங்கிலும்.
One *babul* § tree is enough to manure *káni* ||, and one cluster of bamboos to destroy a *véli*.

469. சேரி எருவு எல்லா எருவைவிட சேகரமுண்டாக்கும்.
Paracheri manure gives a better yield than any other manure.

470. ஆத்துமண்ணுக்கு வேத்து மண் உறம்.
One kind of soil is manure to another.

471. உரம் எற்றி உழவுசெய்.
Plough after manuring.

472. நிலத்தைப் பொறுத்து உரத்தை இடு.
Manure the land to suit the requirement of the soil.

473. ஆற்று வண்டல் தேற்றும் பயிரை.
Silt will improve the growth of the crop.

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* Avārai=*Cassia auriculata*
† Kār crop=The early crop, only occupying the land a short time.
‡ Pishanam = The crop of longer growth.
§ Babul = *Acacia arabica* || Kani=an area of about 1¼ acres.

474. தொழுவின் நீரே பழுதிலா உணவு.
Cattle urine is the best manure.

475. பசுந்தாள் உரமே பக்குவ உணவாம்.
Green leaf manure is the right manure (for wet lands).

476. ஈரம் போகாமல் எருவை மூடு.
Cover the manure without loss of moisture.

477. அடித்து உரம் எடுத்துப் போடு.
Be constantly manuring your lands.

Irrigation.

In India, it is questionable whether irrigation is not of greater importance in agriculture than even tillage and manure and therefore we find the saying 'cultivation should not be undertaken without water'; and the watering of land compared to conferring blessings. In this portion of the collection, the necessity for personal care is again alluded to, and though irrigation by gravitation, especially from a spring or a river, is preferable, the value of the well as a protective agency is recognised. The dangers attaching to the use of the picottah or simple lever-lift, are noted and also the heavy cost of raising water. So also the advice in Nos. 499 and 500 is remarkably sound; the latter may be taken with No. 458; and in most cases the advice in No. 499 might be followed probably with advantage in the irrigation of paddy. The last saying alludes the multifarious duties falling on a Tahsildar, but yet the duty of distributing water amongst conflicting claimants is considered more difficult. Some further allusions to the irrigation of paddy will be found below (Nos. 601—614.)

478. நீரில்லாமல் பயிர்செய்யலாகாது.
Cultivation should not be undertaken without water.

479. நீரைச்சிந்தினையோ சீரைச்சிந்தினையோ?
Wasting water is like wasting presents.

480. மூச்சாலடித்து முதல் வெள்ளாமையிட எக்காலுமில்லை பஞ்சமிவர்க்கு.
If the land is ploughed three times and sowing done early in the season, there will be never a famine.

481. நீர்வளமுண்டாஞல், நிலவளமுண்டாகும்.
If the water-supply be good, the soil will be productive.

482. ஆளேற நீரேற, நீரேற நெல்விளைய, நெல்விளைய போரேறும்.
The more the men, the more the water; the better the irrigation the better the paddy; the greater the paddy crop, the higher the straw heap.

483. எண்ணெய் காணுத மயிரும் தண்ணீர்காணுத பயிரும்.
Crops without water are like unoiled hair.

484. தண்ணீரில்லாத வெள்ளாமையும் தானுழாத நிலமும் தரிசு.
Cultivation without water and land not ploughed by the owner will be waste.

485. கானேரிவிளையுமேயல்லது நீரேரி விளையாது.
Crops grow by personal care and not merely by watering.

486. கள்ளனையும் தண்ணீரையும் கட்டிவிடு.
Water and a thief should be secured.

487. ஊற்றுப்பாச்சல் ஆற்றுப்பாச்சல் பத்துக்குழியும், எரிப்பாய்ச்சல் நூறுகுழியும் சரி.
Ten *kulis* irrigated by a spring or a river will equal in yield a hundred *kulis* irrigated from a tank.

488. எருமடைக்கு நீர்பாய்ச்சாதே.
Do not attempt to water a field except by natural flow.

489. கிணற்றைக்காத்தால் வயிற்றைக்காக்கும்.
If you take care of the well, the well will take care of your stomach.

490. கிணத்தைத்தூற்றினால் வயிற்றைத்தூர்க்கும்.
Fill up your well and you starve.

491. நீரிருந்தபோதிலும் பட்டறை இறைவையிருக்கவேண்டியது.
Though there are other sources of irrigation, yet baling is necessary.

492. புத்துகண்டு கிணறுவெட்டு.
Sink a well where there is an ant-hill.

493. கல் உள்ளதே கிணர், கரை உள்ளதே தோட்டம்.
A well in rocky ground and a garden with bunds all round (are good).

494. தொட்டு அனைத்தூறுமணற்கேணி.
In a sandy stratum, the deeper you bore the deeper the water.

495. இறைத்த கிணறு ஊறும், இறையாத கிணறு நாறும்.
The more you bale out water the greater will be the spring. If no baling is done the water will stink.

496. எமன் ஒருவனைக்கொல்வான், எற்றம் மூவரைக்கொல்லும்.
Yama * kills but one man at a time; the picottah will kill three.

497. இறைப்பெல்லாம் ஒரே விளைப்பு.
Baling is good only for a single crop.

498. பாய்ச்சலும் வேணும் காய்ச்சலும் வேணும்.
Crops require water and drying alternately.

499. நிழலுக்கிடங்கொடுத்தாலும் நீருக்கிடங்கொடாதே.
Though you allow shade, allow no water to stand.

500. தாசில் பண்ணிறலும் பண்ணலாம் தண்ணிமாற முடியாது.
It is easier to conduct the duties of a Tahsildar than to distribute water.

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* Yama=Pluto.

501. ஆறுநிறைய ஜலம்போனாலும் பாய்கிறது கொஞ்சம், சாய் கிறது கொஞ்சம்.
Even though the river runs full, only some quantity of water is used for irrigation and some quantity is wasted.

502. இறைக்க ஊறும் மணற்கேணி, ஈயப்பெருகும் பெருஞ்செல் வம்.
A well in the sandy soil springs as water is baled out just as the wealth of a man goes on increasing as it is spent in charity.

503. ஏரி பெருகில் எங்கும் பெருக்கு.
If the tank becomes full, there will be water everywhere.

504. ஏற்றக்கோலுக்குப் பிடித்தால், அரிவாட்பிடிக்குவரும்.
If you begin to prepare a pole for the picottah, you will get one big enough at least for the handle of a sickle, that is to say, if one attempts at big things, at least small things will be secured.

505. ஏற்றப்பாட்டுக்கு எதிர்பாட்டில்லை.
No work is equivalent to that of picottah.

Weeding.

Here the first four sayings allude to a common practice of running the ordinary native plough amongst the standing crops, and urge that this should not be missed. Weeding too must not be neglected, but carried on till even the crop is ripe, and the reward will be great. Neglect thereof is a sure cause of loss. Korai (*Cpperus bulbosus*) and haraili (*Cynodon dactylon*) are the very common weeds, and both are difficult to eradicate. What is referred to as *tadana* in No. 526 is not identifiable. The *palli* in No. 527 is the *Striga densiflora*; a common parasite on some cereals.

506. அடர விதைத்து அழிய உழு.
Sow thick; plough out the thick spots.

507. அடர்த்தியை அப்போபார் புழுக்கத்தை பின்னாலே பார்.
Look to the thick growths first, afterwards to the bare spots.

508. பட்டத்தில் பயிருழவடி.
Hoe at the proper season.

509. கரைந்த பயிர் இருந்து வளரும்.
A thinned crop will thrive.

510. ஈயுந்தனையும் எருவைகாயுந் தனையும் களைபறி.
Manure the field till the crop begins to ear and Weed it till the ears are ripened.

511. கதிர்களைந்தும் களைபிடுங்கு.
Weed the land even after gathering the ears.

512. களைகளிறபோதே களையைக்கிள்ளு.
Root out weeds when they begin to sprout.

513. களை யெடுக்காதான் கபோதி.
He is blind who does not weed.

514. களை யெடுத்தவன் கைமூடியுள்ளவன்.
One who weeds thoroughly has a treasure.

515. பயிருக்குக் களை யெடுத்தால் பலனை மிக அடைவார்.
He who weeds his crop will reap good produce.

516. களை யெடாதவன் விளைவெடான்.
Who does not weed will not reap.

517. களை யெடுத்தால் முளை யெடுக்கும்.
Weeding leads to vigorous growth.

518. வெட்டிக் களையெடுத்தால் கட்டு முக்கலங்காணும்.
If the crop is dug round and weeded, three fourth *kalams* * of grain may be obtained from a bundle of sheaf.

519. களைபிடுங்காப்பயிர் கால்பயிர்.
Crop not weeded is but one-fourth of a crop.

520. கவுடிருந்த நெஞ்சும் களையிருந்த பயிரும் கடைத்தேறாது.
Deceitful hearts and fields foul with weeds will never thrive.

521. கோரை குடியைக் கெடுக்கும்.
Korai is ruinous to the cultivator.

522. கோரைக்கொல்லையை பிடித்தவனும் மலடி ஸ்திரீயை கட்டிக்கொண்டவனும் பலனடையமாட்டான்.
He who has land overgrown with *Korai* and he who has married a barren woman will not reap any benefit.

523. அருகுமூளைத்த கொல்லையும் அரசரோடெதிர்த்த குடியும் ஈடேறாது.
A field overgrown with *hariali* grass and a man who opposes his King will not thrive.

524. அடங்காப்பெண்டிரைக் கொண்டவனும்கெட்டான், அருகங்காட்டை உழுதவனும் கெட்டான்.
The husband of an unruly wife and he who cultivates a field full of *hariali* grass will be ruined.

525. தாசி இருந்தவீடும் தாதணுமூளைத்தகாடும் பாழ்.
A house with a harlot and a garden with *tadana* go to ruin.

526. கொல்லைக்குப் பல்லி குடிக்குச் சகுனி.
The *palli* is as fatal to a field as *Sakuni* † was to the family.

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* A kalam usually contains from 24 measures of grain in Tanjore, to 36 measures in parts of South Arcot and Chingleput : the measure containing about 2 lb. of paddy.

† Sakuni is the name of the evil councillor of Duryodhana— *see* Mahabharata.

CROPS AND THEIR MANAGEMENT.

As an introduction to this section, in which will be found an especial wealth of sayings relating to the growth and management of paddy, a number are given which relate more generally to crops as a whole, whilst the two following may be quoted to illustrate the importance attaching to the grain crops:—

அஃகம் குறைய ஐந்தும் குறையும்.
Want of grain means want of everything.

அஃகம் மலிந்தால் ஐந்தும் மலியும்.
If grain is cheap, everything is cheap.

In the selection made below, first come a number which express the axiom that like produces like, then follow others, which will be further illustrated below, showing the necessity for sowing crops on suitable soil, and the importance of sowings being made in due season, disregard of which may leave the richest soil (No. 539) unproductive.

527. விரையொன்றுபோட செடியொன்று முளைக்குமா ?
If one seed be sown, will plants of another kind grow ?

528. யதாபீஜம் ததாங்குரம்.
As is the seed, so is the plant.

529. அவரை விதைத்தால் துவரை முளைக்குமா ?
Would a crop of red-gram * grow if *avarai* † be sown ?

530. எள்ளுவிதைத்தால் கொள்ளு முளைக்குமா ?
Would horse-gram ‡ grow if *gingelly* § *be sown* ?

531. பாத்திரமறிந்து பிச்சையிடு, கேஷத்திரமறிந்து விதையிடு
கோத்திரமறிந்து பெண்ணைக்கொடு.
Alms to them who do deserve ;
Seed for land that it will serve ;
And girl for wife, you should bestow,
In family that you do know.

532. நிலத்திற்கேற்ற விதை, குலத்திற்கேற்ற பெண்.
Seed suitable to the land is like a girl suitable to a family.

533. பருவத்தே பயிர்செய்.
Cultivate in due season.

534. காலத்தில் பயிர்செய்தால் கடன் வாங்கவேண்டாம்.
If you sow in proper season, you need not borrow.

535. காலப்பயிர் கடைக்கநிற்கும்.
Timely crops stand to the end.

536. பாழில்போட்டாலும் பட்டத்தில்போடு.
Even on poor land, sow in season.

537. காலத்துவிரை கரம்பில் போடு.
Sow the seed in time, even though the land be not fully ploughed.

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* Red-gram = *Cajanus indeus.*
† Avarai = *Dolichos lablab.*
‡ Horse-gram = *Dolichos biflorus.*
§ Gingelly = *Sesamum orientale.*

538. கோப்புத்தப்பிஞல் குப்பையும் பயிர் வராது.
If the seed-time be missed, even the dunghill cannot grow a crop.

539. பட்டம் தப்பிஞல் நட்டம்.
If the seed-time be missed there will be loss.

The next group of sayings includes a number of allusions to the best general seed-time, in connection wherewith a reference to the earlier part of this collection, *sub voc* the weather, should be madel the calendar given wherein may be found of use Ādi (about July) is specially named as the best of seasons for sowing. The comparisons between the virtues of man begetting a son in his twenty-fourth year, and the sowing of seed in Adi, and if possible the early part of the month, will be found repeated in other forms further on. The next month, Avani, is not so good, but later in the astral period of Uttara the sowing of the late crops comes on. Panguni (March-April) is rarely a sowing season, save in exceptional cases. In several cases, and especially in the last two sayings, the ryot's belief in lucky days for particular kinds of labour is shown.

540. சித்திரை மாதத்தில் சீராய் விதை விழுந்தால் பத்தரை மாற்றுப் பசும்பொன் அதில் விளையும்.
If seed be properly sown in Chittirai, best yield will be obtained.

541. ஆடிப்பட்டம் தேடி விதை.
Look for Ādi and sow.

542. ஆஷாடஸ் ஸர்வபீஜாகாம்.
All crops in Ashada.

543. ஆடி மாதத்தில் விதைத்த விதையும் அய்யஞ்சில் பிறந்த பிள்ளையும் ஆபத்துக்கு உதவும்.
Seed sown in Adi and a son begotten at the age of 25 will be of help.

544. ஆடி ஐந்தில் விரைத்த விரைப்பும், புரட்டாசி பதினைந்தில் நட்ட நடவும், அறுநால்வதில் பெற்ற புதல்வரும், இம்மூன்றும் பெரியோர்கள் புதைத்துவைத்த தனம்.
Sowing finished before the 5th of Adi, transplanting before the 15th of Purattāsi, and a son born in the father's 24th year are like treasures buried by the elders.

545. ஆடி பதினெட்டில் விதைத்தவிதையும் ஆறு நான்கில் பிறந்த பிள்ளையும் தேடாமல் தேடிய தனம்.
Seed sown before the 18th of Adi and a child begotten at the age of 24 are treasure obtained without endeavour.

546. ஆடி பதினெட்டில் விதைக்கிற விதையும் பதிஞறு வயதில் பிறக்கிற புத்திரனும் பெரியோர்கள் தேடிய தனம்.
Seed sown before the 18th of Adi and a son begotten at the age of 16 are like ancestral treasure.

547. ஆடிக்கொரு விரைபோட்டால் கார்த்திகைக்கு ஒரு காய் காய்க்கும்.
If you sow a seed in Adi, you will have a fruit in Kartigai.

548. உத்தரம்பார்த்து வித்து எடு.
Sow your seeds when you see the sun in *Uttara*.

549. சிங்கத்தில் சிதறினால் கும்பத்தில் குவிக்கலாம்.
If land be sown in *Simha*, the produce may be heaped up in *Kumbam*.

550. ஆவணி பட்டம் அழகு பட்டம்.
Avani is a deceptive season for sowing.

551. பங்குனியில் பறையனும் பயிரிடான்.
Even a Pariah will not cultivate in Panguni.

552. வெள்ளி விதைபிடி, வியாழன் கதிர்பிடி.
Sow on Friday and reap on Thursday.

553. வெள்ளியில் விரைபிடி, சனியில் கதிர்பிடி.
Sow on a Friday and reap on a Saturday.

Below follow sayings giving advice as to the proper state of the soil for sowing, and others urging promptitude in performing the operation, the loss of a single day often meaning the loss of a crop, on which point reference to No. 410 should also be made. Further advice not to be grudging in the seed sown, and yet that thin-sown crops are the best, follows; and, in connection with the questions of thick or thin sowing, reference may also be made to Nos. 398 and 507 above. Then come some sayings illustrative of the belief in the evil eye; regarding the possibility of forecasting the outturn; and as to the time of harvest, together with one to show how much damage is done to the crops by parrots. In conclusion, the benefit of drying seed thoroughly before storage is alluded to.

554. விருஷ்டியில் விதையேல்.
Do not sow while it is raining.

555. ஈரவிதைப்பும், ஈரூர் வேளாண்மையும், தாரமிரண்டும் தனக் குப்பகை.
Sowing land when it is very wet, farming in two villages and having two wives are injurious.

556. வெப்பில் விரைப்பும் வைப்பாட்டி பிள்ளையும் சரி.
A sowing in dry soil and the offspring of a concubine are alike.

557. பயிருக்கு முந்தவேணும் படைக்குப் பிந்தவேணும.
Be foremost in cultivation and hindmost in an army.

558. முற்படச்செய்யும் பயிரே நன்று.
Early sowing is best.

559. படி விரைக்குப் பிடி விதை மூத்தது.
Seed in the hand is better than that in a measure.

560. மடிவிரை காய்ந்து பிடி விரை விளைந்தது.
While seed kept in waist-cloth dried, that taken in hand grew well.

561. மடிவிதைக்குப் பிடிவிதை முந்தி.
The seed in hand will sprout before that in the waist-cloth.

562. விரை அகல இடு.
Sow far apart.

563. அசையோ பயிர், அடம்போ குடித்தனம்.
People must live close together, but plants must be wide apart.

564. தாளடர்ந்தே பயிர், ஆளடர்ந்தே படை.
A thick crop and a numerous army are the best.

565. கம்மலிட்ட பயிரும் ஒம்மலிட்ட குடித்தனமும் முன்னுக்கு வராது.
A blighted crop and a family that is overlooked do not thrive.

566. விளையும் பயிர் முளையிலே.
The nature of the harvest is known by the young shoot.

567. வளருங்காய் பிஞ்சிலேதெரியும்.
The growth of the fruit may be known when it is tender.

568. கார்த்திகை பிறக்தால் கட்டியின்கீழ் கதிர்.
The ears will be bowed to the earth early in Kartigai.

569. கார்த்திகைகண்டு களமிடு.
Prepare threshing floor when Kartigai month commences.

570. கிழவி இருந்தவீடும் கிளி இருந்தகாடும் ஈடேறமாட்டாது.
A house with an old woman in it and a field with a parrot in it will not thrive.

571. காய்ந்த வித்துக்குப் பழுதில்லை.
Seeds well dried will keep without harm.

572. அருகங்கட்டைபோல் அடிவேர் துளிர்க்கிறது.
The bottom root shoots up like the stubble of harialli.

573. அறுப்புக்காலத்திலே, எலிக்கு ஐந்து பெண்சாதி.
At the harvest time the rat has five wives; that is to say, he does lot of damage to the produce.

574. எலிமிச்சஞ்செடிக்கு, எருபோட்டாற்போல.
Like manuring lime trees.

575. எள்ளும், கரும்பும், இறுக்கினல் பயன்தரும்.
The gingelly and the sugarcane will yield their products only by pressing them.

576. கண்டறியவேண்டும் கரும்புசுகம், உண்டறியவேண்டும் உடல்.
The sweetness of sugarcane can be known only by actually tasting it, just as the wholesomeness of the food can be enjoyed only by eating it.

577. கரும்புக்கு கணு இருந்தாலும் கசக்குமா?
The presence of nodes in the sugarcane does not make it bitter?

578. காரையை வெட்டிக்காணிபோட்டால், இடையும், பணமும் காணும்.
If waste land is dug and cropped with elephant yam, the yield will be good resulting in a good money return.

579. கோடையால் காய்கிற பயிர், வாடையால் தளிர்க்கும்.
The crop that suffers from the heat, will flourish with the breath of owners of the crop.

Paddy.

Of the sayings referring more or less specifically to different crops, by far the greater number allude to paddy alone, and in this connection it is scarcely necessary to point out that, in Southern India, "wet cultivation" and the growth of paddy are practically synonymous terms. The crop of wet-land is paddy, although small areas of other crops, such as sugar-cane, plantains, betel vines, turmeric, etc., are found on this class of land also. It is to the cultivation and management of such land, where it exists, that the greatest, and often almost exclusive, attention is paid. In the first group of the collection relating to this crop below, the recommendation to take to the cultivation of wet land is strongly put, although in No. 584 a discrepant note is sounded. The particular variety of salt land referred to in No. 585 is not clear, but some varieties of paddy do flourish on land not too strongly impregnated with alkaline salts. In the next two sayings, the necessity for personally superintending paddy cultivation is expressed even more forcibly than it has been as regards agriculture generally, and then follow others inculcating thorough tillage. In No. 590, the custom of puddling, or reducing the soil of paddy fields to a condition of semi-fluid mud, is alluded to. Such puddle should never be allowed to dry up. Nor should rain fall on a newly-sown paddy field, nor on one recently planted out. The last lot of sayings, in this group, refers to the small banks made between the plots into which paddy fields are sub-divided, these banks being made to retain the water on the land; they inculcate order and neatness in trimming these field-ridges; No. 600 being an extract from the blessing of Auvayar on king Chola at his coronation. The explanation of the value of high field-ridges is that the deeper the water the more the silt that can be deposited on the land.

580. நெற்பயிர் விளை
Cultivate paddy.

581. எள்ளுப்பயிராகிலும் நெற்பயிர்செய்.
Take to paddy cultivation, no matter however small the extent.

582. நஞ்சை லாபம் புஞ்சையில்.
The gain from the wet land will be lost on the dry land.

583. நஞ்சைக்கு அழுதையோ கஞ்சிக்கு அழுதையோ.
Working in wet land is like working for gruel merely.

584. வெள்ளைகளரில் விளையும் நெற்பயிர்.
Paddy yields well in white salt-land.

585. நெல்லுக்குத் தானும் பொன்னுக்குத் தோழனும்.
Paddy demands the personal attention of the owner, but a friend may be trusted to buy gold.

586. நெல்லுக்குத் தானும் பெண்ணுக்குத் தோழனும்.
Paddy must be supervised by the owner, but a friend may select a bride.

587. உண்ட உடலுக்கு உறுதி, உழுத புலத்தில் நெல்லு.
A well-fed body is vigorous; paddy grows strongly in well-ploughed land.

588. பாடு அறிந்து பாடுபட்டால் பாழும்காடும் நெல் விளையும்.
With judicious labour even very poor land produces a good crop of paddy.

589. உழுதசேர் காய்ந்தால உழக்கு நெல்லும் காணாது.
If the ploughed mire dries up, you cannot get even a *ulak* * of paddy.

590. நெல்லடுவை கொள்ளடுவையாகாது.
Rain falling on paddy or horse-gram before germination is bad.

591. நட்டன்று மழையும் கெட்டன்று விருந்தும்.
Rain on the day of transplantation is like guests arriving when one is reduced to poverty.

592. நாலாங்கொம்புத்தண்ணீர் நஞ்சுக்குச்சமானம்.
Watering on the fourth day after sowing is like poison.

593. ஏன் உழக்கரிசி?
Why only one *ulak* rice?
பங்கால் அற்றபடி.
For want of proper tilling.
ஏன் இடிந்துபோச்சு?
Why does the rice get powdered under the pestle?
மேல்மழை பட்டவாசி.
Owing to heavy rain.

594. வரப்படிவெட்டின் விரைப்படிகாணும்.
If the foot of the ridge be trimmed, the yield will be full.

595. வரப்புத்தேய வயிறுநிறையும்.
The more the trodden bund the more the yield.

596. கழனிக்கு அண்டை வெட்டிப்பார் கண்ணுக்கு மை இட்டுப் பார்.
To trim the field-ridge and to apply black to the eye are alike good.

597. கிடாக்கழுத்தைப்போல அண்டைவெட்ட.
Trim the field-ridge as clean as the butcher cuts the neck of a sheep.

598. மோட்டைபோனால் கோட்டைபோகும்.
If there be a hole in the field-ridge, you will lose one *kottah* † of grain.

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* Ulak = Two ollocks, or one-fourth of a measure.
† Kottah = 168 to 192 measures of grain.

599. வரப்புயர நெல் உயரும், நெல் உயரக் குடி உயரும், குடி உயரக் கோல் உயரும், கோல் உயரக் கோ உயரும்.
The higher the field-ridge the more the paddy; the more the paddy the richer the husbandmen; the richer the husbandmen the richer the country; the richer the country the stronger the king.

To the successful growth of paddy, an abundant supply of irrigation water is, in most cases, a necessity; so too a strictly orthodox Brahmin requires abundance of water for his ablutions. Too much water may, however, be injurious to paddy, and at about the time of flowering and harvest, special attention is devoted to the manner of watering; still considering the importance of the subject, the number of sayings is small, and those that do exist are not of great import; reference should, however, be made to the sayings relating to irrigation already given above, Nos. 479 to 506.

600. நீரைக்கண்டு நெல்விதை.
See that there is sufficient water and then sow paddy.

601. பனிபெய்து நெல்விளையுமா?
Will paddy grow with the help of dew?

602. நெல்லுப்பயிரும் நேருள்ளப்பார்ப்பானும் நீரின்மேல்.
A paddy crop and a strict Brahmin depend on water.

603. வாய்க்கால் வெட்டி வயலுழு.
Dig the channel and plough the wet land.

604. பாவினிறைய சாவிவிளையும்.
If the tank be full, paddy will thrive.

605. மடை ஏறப்பாய்ச்சினால் தடையறவிளையும்.
Water the field well and a good crop will grow.

606. ஒரு ஓடைதண்ணீர் ஒரு கலநெல்லு.
One flow of water is one *kalam* of paddy.

607. பெருகியநீர் நெல்லுக்குப்பகையாம்.
Too much water is injurious to paddy.

608. நீர்பெருத்தால் நெல் சிறுக்கும்.
The more the water, the less the paddy.

609. நீர் ஏற நெல் ஏற.
More water, more paddy.

610. நீர் வற்றினால் நெல் வற்றும்.
The less the water, the less the paddy.

611. கல்லில் ஈனவேண்டும், கசத்தில் விளையவேண்டும்.
When flowering, the land should be hard; when ripening the field should be flooded.

612. பாய்ச்சி அறுத்தால் பதக்கு நெல் கூடக்காணும்.
If watered and then reaped, the yield of paddy will be increased by a *padakku*.*

613. காக்கைநீர் கார்விளையாது.
Clear water is not good for *kar*.

* Padakku = 16 measures.

In connection with paddy, as for crops generally, there is a general belief in certain days being inappropriate for carrying on field work, as shown in the following sayings :—

614. நெல்விதைக்கு சனிகுறுக்கும் செவ்வாய்குறுக்கும் ஆகாது.
The sowing of paddy should not be continued over a Saturday nor a Tuesday.

615. அருகிகத்திரியும் அமாவாசை நெல்விதையும் ஆகாது.
Paddy should not be sown on a new-moon day, nor during *Kathri*.

616. செவ்வாய் நட்டு புதன் அறுக்கலாகாது.
Do not plant on a Tuesday, nor reap on a Wednesday.

There are two great systems of raising paddy, to which further detailed references will be found below. They are primarily (1) the sowing of the seed direct in the field, and (2) the transplanting of seedlings raised in nursery beds into the prepared and puddled field. On the former system, the land may either be puddled or prepared on the 'dry system;' that is, before being irrigated. The general estimate in which the two principal systems are held is shown in the following :—

617. நடவுக்குத்தூவல் காலத்தாருபங்கு.
Sowing is one-fourth of transplanting.

618. கைவிதைப்பைவிடக் கலந்த நடுகை நல்லது.
Transplanting apart is better than sowing broadcast.

619. விதைத்துப்போட்டு உற்றுப் பார்ப்பதைப்பார்க்கிலும் நட்டுப்போட்டுச் சுற்றிப்பார்.
It is better to transplant and watch the growth than to sow and look anxiously for the sprouts.

As regards sowing, a general rate of seeding is prescribed in Tanjore; the *kalam* containing 2,400 cubic inches and the *véli* measuring 6·66 acres; thus—

620. வேலி ஒன்றுக்குப் பன்னிரண்டு கலம் விதைப்பாடு.
Twelve *kalams* of seed for one *véli*.

As for other crops generally, Ādi is looked upon as the best for sowing paddy, though there is scarcely any month in which the crop is not sown somewhere or other. Āvani again is not favourably looked upon; the paddy sown then being said to be liable to the obscure, though not uncommon, disease, mentioned above at No. 269, called *anaikkombu*—see also No. 588. The succeeding month is looked upon as favourable for sowing, but later the results are described as disastrous.

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* Kathri = *Agni Nakshatram* (Sans.) or when the Dog-star prevails.

Whatever be done, however, all the wet-land should be sown or planted even though a man has to neglect already planted crops in order to do it or to flee from his enemies as soon as it is done.

621. ஆடி விறைப்பு ஆவணி நடவு.
Ādi for sowing and Āvani for transplanting.

622. ஆடி புழுதி ஆவணி சேறு.
The dry system in Ādi, the puddle during Āvani.

623. ஆவணி மாதத்தில் நெல் விதைத்தால் ஆனைக்கொம்பு விழும்.
Paddy sown in Āvani will suffer from *anaikkombu*.

624. பருவத்தில் பெற்ற சேயும் புரட்டாசிப் பாதிச்சம்பா நடுகையும்.
To beget a son in our prime and to sow *sambah* about the middle of Purattāsi are equal.

625. அற்பிசி மாதத்தில் நெல் விதைத்தால் அவலுக்கும் நெல்லாகாது.
Paddy sown in Arpisi will not yield enough even for *wafers*.

626. கார்த்திகை மாதத்து சாகுபடி கஷ்க்கத்தில் வைக்கலும் கொட்டாங்கச்சியில் நெல்லுமாம்.
Cultivation in Kārtigai gives an armful of straw and paddy that will fill a cocoanut shell.

627. சேற்றிறுடுபோகிறது காற்றிறுடுபோகட்டும்.
Better to lose seedlings in the nursery rather than to puiddle the land and then allow the same to dry up.

628. கெட்டோடினலும் நட்டோடு.
Plant first even though you must run away.

The sayings already given show that sowing should, if possible, be completed before the end of Purattāsi, or the middle of October. Although some of the sayings given below inculcate the advantages of planting for the earlier season, the greatest importance is attached to the late crop transplantation being completed with promptitude, for in Arpisi, it is almost, and in Kārtigai quite, useless.

629. அஸ்தத்தில் நாத்துவிடு.
Sow the nursery in *Hasta*.

630. ஆடி அரணை வால் ஒத்த கரும்பும், ஆவணி முப்பதில் நட்ட நடவும், அறுநான்கில் பெற்ற புதல்வனும் பெரியோர்கள் வைத்த தனம்.
Sugarcane in Ādi like the tail of an *Aranai*, † planting before the 30th of Āvani, and son begotten at the age of 24, are like ancestral wealth.

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* Waters; what is here referred to are grains of rice beaten flat after boiling.

† Aranai = The *Lacerta interpunctata*; a species of lizard, very smooth and shining its lick is considered poisonous.

631. அறுகான்கில் பெற்ற பிள்ளையும் ஆவணி ஐம்மூன்றில் நடுகையும் அனுகூலம்.
A son begotton at the age of 24 and transplanting before the 15th of Āvani are both good.

632. ஆவணி முதலில் நட்டபயிர் பூவணி அரசர் புகழ்போலும்.
Transplanting at the beginning of Āvani is like the fame of great kings.

633. ஆடி முதல்பத்து, ஆவணி நடுபத்து, புரட்டாசி கடைபத்து, அற்பிசி முழுதும் நடலாகாது.
The first ten days in Ādi, the second ten days in Āvani, the last ten days in Purattāsi; and the whole of Arpisi, are unfavourable for transplantation.

634. புரட்டாசி பதினைந்தில் நடவேநடவு.
Transplantation by the 15th of Purattāsi is the best.

635. புரட்டாசி நடுகை திரட்சியான படுகை.
Paddy transplanted in Purattāsi will grow as though in alluvial soil.

636. புரட்டாசி மாதத்திய நடவு பெரியோர் தேடிய தனம்.
Transplanting in Purattāsi is like ancestral wealth.

637. புரட்டாசி விரையாகாது அற்பிசி நடவாகாது.
Purattāti-sowing and Arpisi-transplanting are bad.

638. அற்பிசி மாதத்து நாத்து அருகிலே சாத்து.
Put aside the seedlings in Arpisi.

639. அற்பிசி மாதத்து நடவு அவலுக்கு நெற் காணாது.
Transplanting in Arpisi will not yield even grain for wafers.

640. அற்பிசி மாதத்தில் நட்ட நடவும் அன்பது வயதில் பெற்ற பிள்ளையும்.
Seedlings transplant in Arpisi are like a son begotten in a man's fiftieth year.

641. அற்பிசி மாதத்தில் நடவுநட்டால் ஆனைக்கொம்புவிழும்.
If you transplant in Arpisi your crops will suffer from *anaikkombu*.

642. கார்த்திகை பிறந்தாற் கைநாற்றை எறிந்துவிடு.
Throw away the plants after the first of Kārtigai.

The next group of the collection comprises detailed advice regarding the carrying out of planting. To allow the planted field to dry up is as fatal to the cultivation as it is to plant in a flooded field; to plant too closely is equally inadvisable; No. 647, being a description of planting ill-done. Still thin planting may be overdone and it is better to plant a few plants in clumps close together than a large number in bundles wide apart. Then again, the different varieties of paddy need to be planted somewhat differently.

643. நட்டுக்காய்ந்தால் நாழி நெல் காணாது.
Plants dried after planting will not yield even a *nāli* * of grain.

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* *Náli* = quantity of rice required by a man for a day's food.

644. கட்ட அடியில் காய்ந்தால் காணுழிநெல்லும் காணாது.
If the field dries up after planting not even four *nālis* of paddy can be got.

645. வேசிக்கு அழுதவனும் வெள்ள உழவில் கட்டவனும்.
Keeping a concubine and transplanting in a flooded field cause loss.

646. ஐதுநெல் அடர்ந்தது சுற்றம்.
Distance between paddy-plants and closeness in relationship are desirable.

647. நண்டுதுழையாத கட்டவு.
Too close planting for crabs to creep between.

648. முதலைக்குறைத்து நெருங்க நடு.
Transplant closely but with a few seedlings in each bundle.

649. முடிமுடியாய் நட்டால் கொட்டைகொட்டையாய் விளையுமா ?
Will planting in large bundles yield grain in abundance ?

650. முடிமுடியாய் நட்டால் பொதிபொதியாய் விளையுமா ?
If you plant in bundles, will bullock loads be produced ?

651. நெருக்கநட்டு நெல்லைப்பார் கலக்கநட்டு கதிரைப்பார்
Plant closely and look at the (amount of) grain; plant thinly and look at the (size of the) ears.

652. அள்ளியகாரும் கிள்ளிய பிசானமும் கொள்ளைபோகாது.
Kar in clusters and *pishānam* one by one never fail.

653. கார்ப்பயிர் கலந்துகெட்டது பிசானப்பயிர் நெருங்கி கெட்டது.
Thin planting spoiled the *kar* crop and thick planting the *pishānam*.

654. அள்ளிய கார் கிள்ளிய சம்பா.
Transplant *kar* in handfuls, and *samba* little by little.

655. அள்ளி நடவேணும் சம்பா, கிள்ளி நடவேணும் பொற்சாலி.
Plant *samba* together, but *porchāli* thinly.

656. அள்ளிய சம்பா கிள்ளிய நவரை.
Plant *samba* together, but *navarai* thinly.

657. நட்டகுழி நாற்பதுநாள் காக்கும்.
A transplanted field may stand for 40 days.

658. நாத்து முப்பது சாத்து முப்பது.
Thirty days nursery and thirty days in the field.

659. சேத்திலே முப்பது, நாத்திலே முப்பது; சாத்திலே முப்பது, அது நூத்துக்கு முப்பது.
Thirty days in the mire, 30 days in the nursery, 30 days in the field; you get 30 (*kalams*) from a hundred (*kulis*).

The next group of sayings relates to the characteristics of the chief varieties of paddy. The kar crop is usually an early one, and suffers if the weather be cloudy, but owing to the season at which it is chiefly

raised, the land soon dries up and requires abundant irrigation. The kar fields also require a large amount of weeding; hence No. 669 to describe heavy labour. *Kuruvai* is a three months' variety of kar, usually raised during June and the following months.

In the use of the terms *pishānam* and *samba*, there is often a good deal of confusion; but what is known as *chinna samba* is in many places called *pishānam*. In contradistinction to kar, the pishānam is raised in the rainy season, when the sky is cloudy. *Samba* usually produces a white rice of quality superior to kar, the rice of which is usually dark; hence the comparisons of value given below. The white *kar* is so classed because it is grown in the *kar* season; but it is in many places called *kodan samba*, the rice being white.

The other varieties mentioned—*manalvari*, *thillanayakam*, *porchali*, *navarai*, *mosanam*, *manakattai*—all possess more or less distinctive qualities, which are named. Navarai is a variety of *kar* that requires as little water as red-gram (*Cajanus indicus*) does rain—*see* No. 694. Manakkattai is another *kar* variety, raised during the driest weather, from February—May, which also requires very little water.

This portion of the collection concludes with a few sayings of general import regarding the crop. Old paddy is more valuable than fresh, and in Panguni, paddy is usually cheap because that is the harvest-time. Unlike gingelly, which deteriorates rapidly if stored, paddy can be stored safely, so long as it is not attacked by insects.

660. காரும் குமரியும் கதிரிலே.
Girls coming to maturity and *kar* coming in ear are alike.

661. கடலே தூர்த்தாவது கார்விரைக்கவேணும்.
Sow *kar* paddy at any cost, though you have to fill up the sea.

662. ஆனிக்கார் சாவியும், குரங்கு பிணமும் கண்டதில்லே.
No one has seen *kar* paddy sown in Āni withering nor a dead monkey.

663. ஆவணிகாரில் பூசனிப்பூ.
Kar in Avani is like the flower of a pumpkin.

664. மின்னிக்கெட்டது கார் முழங்கிக்கெட்டது பிசானம்.
Kar will fail if there be lightning, and *pishānam*, if there be much thunder.

665. காக்காய் ஓடுவதும் கார்நெல் காய்வதும்.
Kar paddy will dry as quickly as a crow flies.

666. ஆரை நம்பித்தோழா, காருக்கேற்றம் போட்டாய்.
O friend, trusting whom have you put up a picottah for the *kar* crop?

667. காக்காய் பறக்க கார் வெளுக்கும்.
The flight of a crow is enough to whiten the *kar* paddy.

668. காருக்கு களையெடுத்தால்போல்.
Like the weeding of the *kar* field.

669. வெண்கார் அழிந்தால் விரை முதலும் காணாது.
If white *kar* fails at all, even the seed sown cannot be recovered.

670. காரும் கம்பும் கண்ணைக்கட்டி அற.
Harvest *kar* and *kambu* blindfold.

671. தைக்குருவையோ பொய்க்குருவையோ.
If *kuruvai* is sown in Thai, it will yield poorly.

672. தைக்குருவை தரையை விட்டெழும்பாது.
Kuruvai sown in Thai will not rise above the ground.

673. தைக்குருவை தவுட்டுக்கும் உதவாது.
Kuruvai sown in Thai will not yield even bran.

674. எட்டுக்கார் தீஞ்சாலும் ஒரு பிசானம் தீயக்கூடாது.
Pishānam will never fail even though *kar* fails eight times.

675. கார்காய்ச்சல் பிசானம் விளைச்சல்.
Rest in the *kar* season means a good yield in *pishānam*.

676. காய்ந்துகெட்டது பிசானம் காயாமல் கெட்டது கார்.
The *pishānam* crop is damaged by drought; the *kar* crops suffer from moisture.

677. மானம் கருத்தால் பிசானம் கருக்கும்.
The *pishānam* crop turns a deep green under a gloomy sky.

678. ஆண்டுமாறின காரும் அன்றறுத்த சம்பாவும் ஆனவன் கண்ணுக்கு அரிது.
Kar paddy one year old and new *samba* are rarely on hand at the same time.

679. ஆண்டு மாறினகார் அன்றறுத்த சம்பாவுக்கு ஈடாகாது.
Kar paddy one year old cannot equal *samba* just reaped.

680. கார் கடைவிலை சம்பா தலைவிலை.
The highest price of *kar* is the lowest price of *samba*.

681. கார்த்திகைக்கார் கடைவிலை, தைசம்பா தலைவிலை.
The highest price of *kar* in Kartigai equals the lowest price of *samba* in Thai.

682. எல்லா தானியத்தைவிட கருடபக்கி, குண்டுசம்பா, சன்ன சம்பா சிரேஷ்டம்.
Of all grains, *garuda samba*, *gundu samba* and *sanna samba* are the best.

683. கொஞ்சித்தழைபோட்டு சேடை உழுதால் கெட்டிசம்பா கொல்லையும்.
If you plough a field after manuring it with *konji** leaf, superior *samba* will be produced.

684. கொம்பில் ஒரு கொல்லைனந்தாலும், சம்பாவுக்கு இணையாகாது.
No crop can compare with *samba*, though the yield may be but a grain for each plant.

685. தாளால் ஒருமணி விளைந்தாலும், சம்பாவுக்கிடாகாது.
Even if each stalk of *samba* paddy bears but a single grain, no other crop can equal it.

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* Konji; probably a corruption of kolin; (*Tephrosia purpurea*) seed much valued as green manure for paddy fields.

686. வெம்பா பேய்ந்தால் சம்பா விளையும்.
Should there be mist, *samba* paddy will yield well.

687. சோதி பிறவாதோ சம்பா விளையாதோ.
Will not *Swāti* come and will not *samba* thrive.

688. மண்மாரி பேய்ந்தால் மணல்வாரி விளையும்.
If there be a dust storm, there will be a good crop of *manalvari*.

689. கட்டாலும் தில்லைநாயகம் கடவேணும்.
If you plant at all, you should plant *thillainayakam*.

690. அதிர உதிர அடித்தால் ஒதிர பொற்சாலி விளையும்.
If the soil be thoroughly ploughed, the yield of *porchāli* will be abundant.

691. நவரைக்கு உழுதாயோ, நஷ்டப்பட்டாயோ.
If you plough a large area for *navarai*, you will surely lose.

692. நவரைக்கு நிலமும், மோருக்கு சாதமும்.
Reserve a small area for *navarai* and a small quantity of rice to take with buttermilk.

693. நவரையோ துவரையோ.
Navarai is like red-gram.

694. நவரைக்கு சேறுகூடாது.
Puddle is not suitable for *navarai*.

695. போசனத்திற்கு மோசனம்.
Mosanam is the best for food.

696. மழை வரண்டால் மணக்கத்தை விதை.
If rain fails, sow *manakkattai*.

697. கதிருக்கு முந்நூறு நெல் இருந்தால் முழுவெள்ளாமை.
Three hundred grains in an ear of paddy indicate a full yield.

698. கட்டுக்கலம் காணும் கதிர் உழக்கு நெல்காணும்.
(In a rich soil) one ear of paddy will yield a quarter measure and one sheaf a *kalam*.

699. கதிர்நீக்க கட்டுகலம்.
If the ears be threshed, one sheaf will yield one *kalam*.

700. நெல்லளக்கக் குறையும் நிலம் அளக்க வளரும்.
When measured paddy will decrease, but land will increase.

701. நெல்லிருக்கப் பொன் எள்ளிருக்க மண்.
Paddy never gets damaged by keeping, while gingelly if kept on will go to dust.

702. ஆயிரக்கல நெல்லுக்கோரந்து.
One insect will suffice to destroy 1,000 *kalams* of paddy.

703. பங்குனி மாதம் பதர்கொள்.
Purchase paddy in Panguni.

704. நெல்லுக்குப் பிறகு சோர்ந்ததெல்லாம் புல்லு.
All crops other than paddy are but grass.

Other Crops.

The last saying above is of special interest, and perhaps explains why, although of much greater importance collectively, and in some cases separately, and although many of them are grown on very large areas, there is so singularly small a number of sayings relating to the unirrigated cereals, on which the bulk of the population depend for their food supply, and the important industrial crops which are raised to be turned into money. Amongst the former probably the most important is cholam (*Sorghum vulgare*), which is said to be a poor man's crop, and as will be seen further on, is recognised as producing a valuable fodder. In No. 708, the allusion made is to certain varieties sown under wells in January or February (in Coimbatore). Kambu (*Pennisetum typhoideum*) is a heavy yielder, and does not require much tillage ; and regarding this crop, a reference may also be made to No. 670 *supra*. The reference in No. 711 is to the practice of ploughing amongst the standing crops—*see* No. 506 *et seq*. Ragi (*Eleusine coracana*) is said to be as good a crop as any, on which point also see No. 461, and responds at once to watering. The Italian millet or tenai (*Setaria italica*) is a rapid grower, but an exhausting crop and one that encourages the growth of weeds, especially as the custom of the Tamil country is to sow broadcast. Varagu (*Paspalum scrobiculatum*) may be raised by any one, its cultivation being so simple. Samai (*Panicum miliare*) is only alluded to as a precarious crop, on which point No. 771 may also be referred to.

705. சோத்துக்கு ஏமாந்தால் சோளத்தை விதை.
If you have little to eat, sow cholam.

706. சோற்றுக்கலைந்தவன் சோளத்தைப்போடு, காய்க்கலைந்தவன் பீர்க்கைபோடு.
A starving man should sow cholam, and he who has no vegetables, should grow the furrow gourd.

707. சோம்பேறி சோளம்விதை.
A lazy man should sow cholam.

708. மகரப்பட்ட சோளம் மணமச்செல்வம் ஏகாள் மச்சு.
Cholam sown in *Makara* makes a cottage a palace.

709. பூலாபழுக்க சோளம்விளைய.
If the *pūla* † fruit ripens, cholam yields well.

710. சோளம் கட்டாப்போல் கம்பு ஏகட்டாப்போல்.
Cholam should look as though just planted ; kambu as if it were destroyed.

711. காம்பு உழுது கம்பு விதை.
Break up the waste and sow kambu.

712. கம்புக்கு கால் உழவு.
Kambu requires only a quarter ploughing.

713. கம்பும் காரும் கதிரிலே முடுகும்.
The ears of both kambu and kar dry too much in the earhead stage.

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* Furrow gourd = *Luffa acutangula*. † Pala = *Phyllanthus reticulatus*.

714. கொல்லுக்கு நேரே புல்.
Kambu is as good as paddy.

715. கொட்டாஞல் விரைக்கும் கம்பு கடகத்தில் வாரிக்கொட்டு கிறது.
If we sow a small basketful of kambu we can get basketfuls of produce.

716. மிருகசீரிஷம் மழையில் கம்பு விதைத்தால் முருங்கைக்காய் போல விளையும், ரோகணி மழையில் விதைத்தால் ரொட்டிக்குகூட கம்பு விளையாது.
If kambu be sown in *Mrigasira*, the ears will be like drumsticks;* if in *Rohini*, the grain will not be sufficient even for bread.

717. கார்த்திகை மாதத்தில் கம்பு விதைத்தால் கூத்தியாள் வாயில் மண்போட்டான்.
If kambu be sown in Kartigai, the concubine will get nothing.

718. ஆய்ந்தாய்ந்தெடுத்தாலும் ஆரியத்துக்கு இணையாகாது.
Whatever you select, there is not a better crop than ragi.

719. ஆடே படைப்பு ஆரியமே வெள்ளாமை.
Sheep for wealth, ragi for cultivation.

720. எட்டாவது தண்ணீர் புட்டுங்கழியும்.
Even water used for the eighth time will cause a ragi crop to yield largely.

721. தினைவிரைக்க வினைவிளையும்.
Tenai encourages the growth of weeds.

722. தினைவிரைத்த கொல்லையில் பனையும் முளையாது.
Even the palmyrah refuses to grow in a field which has carried tenai.

723. எள்ளுந்தினையும் எழுபது நாள்.
Gingelly and tenai ripen in seventy days.

724 பூமியில் வரகுகொடுத்தால் கொடுக்கலாம் இல்லாவிட்டால் ராஜன் கொடுக்கவேணும்.
In this world varagu may perhaps give wealth; if that fails, the king alone can give it.

725. மடவன் வரகு விதை.
Varagu is the crop grown by a bad cultivator.

726. வைகாசி மாசம் வரகு விதைத்தால் கையாடல் கலம் காணும்.
Every handful of varagu sown in *Vaiyasi*, will produce a *kalam*.

727. குருவிஏற கொம்பிருந்தால் குறுணி வரகு குறைவாகும்.
If there be a stick for birds to alight on, the yield of varagu will be less by one *kuruni*. †

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* Drumsticks = The fruit of the *Moringa pterygosperma*.

† Kuruni = Eight measures, the same as a marakal.

728. பனிக்குப் பலிக்கும் வரகு உளுந்து மழைக்குப் பலிக்கும் நெல்லு.

Varagu and black gram yield with the help of dew and paddy with that of rain.

729. சாமைப்பயிர் விளைந்தால் தெரியும, சக்கிலிப்பெண் சமைந்தால் தெரியும்.

A crop of samai can be valued only when ripe and a chuckler girl when she attains maturity.

As with the dry cereals, so with the pulses, the sayings are few. About horse-gram (*Dolichos biflorus*), the bulk of the sayings turn, regarding which No. 590 *supra* should be referred to. This is a specially hardy crop that will grow on the poorest soils and needs but little cultivation. In a favourable season it is very productive and a most improving crop, but is contrasted in No. 739 with gingelly from which, if successful, the immediate profits are much greater. It, like the other pulses, enriches the soil for succeeding crops—*see* Nos. 741 and 745. In the latter, it is shown that Bengal-gram (*Cicer arietinum*) is equally valuable. This crop is said to do well on salt-land, but apparently only the variety of the black-cotton soil on which it is usually grown is meant. Green gram is the *Phaseolus mungo*, and the concluding saying apparently alludes to the great superiority of new over old green-gram.

730. ஐப்பிசிக்காணம் அப்பிப்பிடிக்கும்.

Horse-gram will strike root firmly in Arpisi.

731. கார்த்திகை மாதத்தில் கலக்கொள்ளு விதைத்தாலும் விதைக்கொள்ளுகூட காணாது.

Even if you sow one *kalam* of horse-gram in Kārtigai you cannot get the seed back.

732. கார்த்திகை மாதத்தில் கலக்கொள் விதைத்தால் மரக்கால் கொள் விளையும்.

If one *kalam* of horse-gram be sown in Kārtigai, the yield will be one *marakal*. †

733. கார்த்திகை மாதத்தில் கொள் காடைபதுங்கும்படி இருக்க வேண்டும்.

In Kārtigai, the horse-gram should be such that partridges may well hide therein.

734. கொள்ளுக்கு இரண்டு சால்.

Two ploughings for horse-gram.

735. கொள்ளுக்கோருழவு எள்ளுக்கு ஈருழவு.

Plough once for horse-gram and twice for gingelly.

736. கோரையைக்கீறி கொள்ளைவிதை.

Scratch the field in which *korai* grows and sow horse-gram.

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* It is not clear here whether the *varagu* referred to so is *Paspolum scrobiculatum* or not. Probably the saying does not apply to this crop; possibly the reference to *Panivaragu* (Panicum miliaceum).

† The inference is that the outturn (one marakal) is about one-third of the seed (one kalam).

737. கல்லுப்பிளந்து காணத்தைவிதை.
Break up the stony soil and sow horse-gram.

738. எள்ளுவிதைக்க எறங்காடு கொள்ளுவிதைக்க கல்லாங்காடு.
Black soil for gingelly and a stony soil for gram.

739. இளைத்தவன் எள்ளுவிதைக்கவேண்டும், கொழுத்தவன் கொள்ளு விதைக்கவேண்டும்.
A poor man should sow gingelly; a rich man should sow horse-gram.

740. கொள்ளுவெள்ளாமை கொள்ளை வெள்ளாமை.
Horse-gram is a very productive crop.

741. கொண்ட பெண்ஜாதியை விட்டாலும் கொள்கடகாலை விடக்கூடாது.
Rather abandon your wife than give up horse-gram stubble.

742. கொள்ளில் கொத்தான் முளைத்தால்போல்.
As ruinous as *kottan* * amidst horse-gram.

743. கொள்ளுச்செடி கொடி ஏறாது.
Horse-gram cannot climb as a creeper.

744. கொள்ளுக்குப்புல் கொள்கொம்பு கொடுத்ததுபோல்.
Grass amongst horse-gram serves as a prop to it.

745. கடலைவிதைத்தால் கடுத்த உறம்.
Bengal-gram enriches the soil.

746. காரைக்காய்க்காய்க்க கடலைவிளையும்.
If the *karai* † bears fruit, Bengal-gram yields well.

747. களர் உழுது கடலைவிதை.
Plough salt-soil and sow Bengal-gram.

748. கடலை விதைப்பது கரிசல்காட்டில்.
Bengal-gram should be sown in black-cotton soil.

749. பயறுக்கு பஞ்சபூமி
Poor soil for green-gram.

750. பசித்தவன் பயறைவிதை.
A hungry man should sow green-gram.

751. கலப்பயர் விதைத்து உழக்குப்பயர் விளைத்தாலும் புதுப்பயர் புதுப்பயர்தான்.
Though one *kalam* sown yields but one *ulak*, new green-gram is always new green-gram.

Gingelly (*Sesamum orientale*) is the only industrial crop regarding which many sayings are forthcoming. Those given show that it is a very profitable crop; that is, when it succeeds; but also that it rapidly exhausts the land. In these respects, the comparisons drawn between this crop and horse-gram, which have already been mentioned, are again alluded to. In No. 759, the great risks attendant on the growth

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* Kottan = *Cassytha filiformis*, a weed specially harmful to this crop.
† Karai = *Canthium parviflora*.

of this crop are specified, and then follow statements as to the thorough tillage required, the necessity for sowing the seed thinly, and that the seed should be sown when the land is dry. This is naturally the usual state of the land during the earlier months of the year, though too early sowing is said to certainly lead to loss. There are, however, two seasons for the crop, an early and a late. That the crop is a delicate and uncertain one, and not to be counted on till threshed is also shown, and also that the yield of oil, from the seed, will depend greatly on the labour spent on tillage.

752. இளைத்தவன் எள்ளை விதை.
A poor man should sow gingelly.

753. இளைத்தவன் எழுவருஷத்திற்கு எள்ளு விதைக்கவேண்டும்.
The poor man should sow gingelly for seven years.

754. இளைத்தவன் எள்ளு வலுத்தவன் வாழை.
The poor man should sow gingelly, the rich man should plant plantains.

755. இட்டுக்கெட்டவன் எள்ளுவிதை.
He who has lost in farming should sow gingelly.

756. இளைக்க எள்ளுவிளை கொளுக்கக் கொள்ளுவிளை.
To impoverish the soil, sow gingelly ; to enrich it, horse-gram.

757. எள்ளுவிதைத்த வயலில் எழுகெல் பிடியாது.
A field that has carried gingelly will not yield even seven grains of paddy.

758. எள்ளுவிதைத்த காட்டில் கொள்ளும்விளையாது.
Even horse-gram will not grow on land that has carried gingelly.

759. எள்ளுக்கு எழுஉழவு உழுதுங்கெட்டேன் வீச்சுக்கு எழு எள்ளு விதைத்துங்கெட்டேன் வட்டிலைப்பயிற்றிலே மான் மேய்ந்துங்கெட்டேன் கருங்காய்பதத்திலே மழைபேய்ந்துங் கெட்டேன் விதைத்ததுங்குறுணி கண்டதுங் குறுணி.
I am ruined by having ploughed seven times for gingelly ;
I am ruined by having sown in casts of seven seeds ;
I am ruined by deer having grazed on the plants when they were in rounded leaves ;
I am ruined by heavy rain when the fruit was full black ;
I sowed one *kuruni* and reaped one *kuruni*.

760. எள்ளுக்கு எழுஉழவு போடவேணும்.
Plough seven times for gingelly.

761. எள்ளுக்கேழுழவு கொள்ளுக்கோருழவு.
Gingelly requires ploughing seven times ; horse-gram only once.

762. எள்ளு பிடிக்கு எழு வீச்சுபிடிக்கு எழுகாய்.
A handful of gingelly seed sown in seven casts will yield seven pods for a handful.

763. எள்ளும் கொள்ளும் சுள்ளெனவிதை.
Sow gingelly and horse-gram when the soil is dry.

764. புரட்டாசி மாதத்தில் பேர் எள் விரை சித்திரைமாதத்தில் கூர் எள் விரை.
Sow the large variety of the gingelly in Purattāsi and the small in Chittirai.

765. தை எள்ளு தரையில்.
Gingelly sown in Thai remains in the soil.

766. மாசி எள்ளு மடியிற்பணம்.
Gingelly sown in Māsi is like money in hand.

767. வைகாசி எள்ளு வாயிலே.
Gingelly raised in Vaiyasi is certain.

768. எள்ளு விதைக்க இறங்காடு கொள்ளு விதைக்க கொறங்காடு.
Black loamy soil for gingelly and waste land for horse-gram.

769. எள்ளும் கொள்ளும் எழுபதுநாள்.
Gingelly and horse-gram are seventy days' crops.

770. எள்ளுக்கெண்ணிறந்த நோய்.
Gingelly is subject to innumerable diseases.

771. எள்ளுகஞ்சேரவேணும், சாமைகளஞ்சேரவேணும்.
Gingelly must come home and samai must reach the threshing floor.

772. எள்ளும்கொள்ளும், எரி எதிர்வாய்ப்பயிரும் விளைந்துவந்தால் வெள்ளாளன் பாக்கியம்.
The cultivator is lucky if he brings home his gingelly, his horsegram or the crop on the tank-bed.

773. எட்டு எள்ளுக்கு ஒரு சொட்டெண்ணெய்.
Eight gingelly seeds will give one drop of oil.

774. எட்டுழவு உழுதால் ஒரு சொட்டெண்ணெய்.
If you plough eight times you may get a drop of oil.

The sayings regarding Cotton (*Gossypium sp.*), which is a widely-grown crop, are few, and begin with a comparison with gingelly in its favour though the crop requires much labour, especially in picking. Unirrigated black soil is usually called cotton-soil. No. 783 alludes to crops sown broadcast as they always are in the Tamil country. On this land the sowing season is usually much later than Ādi, so that the advice in No. 784 is not of general application.

775. பத்துவருஷம் கெட்டவன் பருத்திவிதை, எட்டுவருஷம் கெட்டவன் எள்ளுவிதை.
If a man has been losing for ten years he should sow cotton; if for eight years, gingelly.

776. காசையும் எள்ளையும் கைவிடாதே.
Do not fail to grow cotton and gingelly.

777. காசையும் எள்ளையும் கருதிப்பயிரிடு.
Cultivate gingelly and cotton with care.

778. பருத்திக்குப்பாடு பன்னிரண்டு.
Cotton requires twelve kinds of labour.

779. ஆமணக்கும் பருத்தியும் அடரவிதைப்பாரு?
Would any one sow cotton and castors thickly?

780. பாயாத கருங்காட்டிற்கு பருத்திவிதைத்தால் பலன்தரும்.
If cotton be grown on unirrigable black land, there will be profit.

781. பணம் சேர்த்தாலும் பருத்திசேராது.
Though you may hoard money, cotton cannot be kept long.

782. பாலும் பருத்தியும் பத்துநாள்.
Good milking and good cotton-picking last for ten days only.

783. இளம்பருத்திகாடு எழுழுவுசெய்தால் சொப்புபணம்வரும்.
Plough amongst the young cotton crop seven times and you will get a potful of money.

784. ஆடிப்பருத்தி தேடிவிதை.
Watch and sow cotton in Adi.

Again as regards sugarcane, a comparison is drawn with gingelly, the raising of which is comparatively inexpensive; for this crop entails heavy charges, and can, it is said, be only grown on a small scale.

The cocoanut and palmyrah are both valuable palms and from both the juice is obtained for fermentation; whilst the leaves of the latter are especially valuable for thatching and the like.

The allusions to plantain cultivation go to show that though it is remunerative, it is not so much so as that of either sugarcane or cotton. The season for planting, the age of the sets, as well as the manner of planting, and the care the crop requires are all alluded to. Why the fruit-branches should lean to the north is not clear, but so it is believed. The leaves should not be removed, as otherwise the plant suffers; but they often are for sale as plates, and even in rural villages the temptation thereto is great.

The brinjal, or egg plant (*Solanum melongena*) is an extensively-grown vegetable and a remarkably hardy plant and heavy yielder.

The remainder of this portion of the collection consists of miscellaneous references to a variety of minor crops, etc.

785. இளைத்தவன் எள்ளுவிதைப்பான் வலுத்தவன் கரும்பு போடுவான்.
A poor man will sow gingelly, a rich man will plant sugarcane.

786. கதித்தவன் கரும்புவைக்க வேணும்.
The rich should plant sugarcane.

787. கரும்புவைப்பது காணிநிலத்தில்.
Sugarcane planting is done in a *Kani*.

788. களர்நிலத்தில் கரும்புவை.
Plant sugarcane in alkaline soil.

789. வலுத்தால் கரும்பு இளைத்தால் இரும்பு.
When well-grown, sugarcane; when ill-grown, iron.

790. (மாடுமேய்ந்தால்) இரும்புதுளுத்தாலும் கரும்புதுளுக்காது. கரும்புகெட்டால் துரும்புக்கும்கடை.
(When grazed by cattle) sugarcane will never shoot, though iron may; sugarcane when grazed down is of less value than straw.

791. மாசி பங்குனியில் கரும்பறு.
Harvest sugarcane in Māsi and Panguni.

792. மாசிக்கரும்பும் மகரவாழையும்.
The sugarcane of Māsi and the plantains of *Makara* (are good).

793. ஆனி ஆனைவாலொத்த கரும்பும், ஆடி பூனைவாலொத்த பூசினியும், அறுநான்கில் பெற்ற புதல்வனும், புரட்டாசி பதினைந்துக்குள் கட்ட கடுகையும் பெரியோர்கள்வைத்த தனம்.
Sugarcane in Ani resembling an elephant's tail, a pumpkin in Adi resembling a cat's tail, a son born in a man's 24th year, and crop transplanted before the 15th of Purattāsi are like ancestral property.

794. ஆனி ஆனைவாலொத்தகரும்பு.
In Ani, sugarcane is like an elephant's tail.

795. ஆனியில் அரணைவாலொத்த கரும்பும், ஆடியில் விதைத்த கம்பும், புரட்டாசி பதினைந்தில் நட்ட கடவும் பெரியோர்கள் வைத்த தனம்.
In Ani a sugarcane like an *aranai*, kambu sown in Adi, and paddy planted by the 15th of Purattāsi are like ancestral wealth.

796. கோடைமழை அடர்ந்ததென்னை.
Rain in the hot weather produces a heavy yield of cocoanuts.

797. ஆடிப்பிள்ளை தேடிப்புதை.
Watch and plant cocoanuts in Adi.

798. பெத்தபிள்ளை சோறுபோடாவிட்டாலும் வைத்தபிள்ளை சோறுபோடும்.
Even when your own son fails to feed you, the cocoanut will not.

799. வைத்தபிள்ளையை பாதுகாத்தால் பெற்றபிள்ளைக்குதவும்.
If carefully tended, the cocoanuts will be of use to our children.

800. வெட்டிக்கெட்டது தென்னை வெட்டாமல் கெட்டது பனை.
Cocoanut palms are spoiled by cutting the leaves, the palmyra is by not cutting them.

801. தைப்பாளையைத்தடவி எடு.
Look out for and trim the spathe of the palmyra in Thai.

802. வாழையிலிருக்கிறது வைப்பு சோலையிலிருக்கிறது சொப்பு.
Plantain cultivation gives a treasure and the growth of sugarcane (or cocoanuts) gives a potful (of money).

803. வாழைக்கு வைப்பு பருத்திக்கு சொப்பு.
A treasure by cultivating plantains and a potful (of money) by cotton.

804. ஏழைக்கு வாழை.
Plantains are the poor man's crop.

805. ஆடி வாழை தேடி நடு.
Seek for Adi and plant plantains.

806. தைவாழை தரையில்போடு.
In Thai, throw away the plantain suckers.

807. எட்டடி வாழையும் பத்தடி பிள்ளையும்.
Plantains should be planted 8 feet apart and cocoanuts 10 feet.

808. எட்டடி வாழைக்கமுகு, ஈரடிகரும்பு கத்திரி, இருபதடி பிள்ளை
Plantains and areca-nuts should be planted 8 feet apart, sugar-cane and brinjals 2 feet, and cocoanuts 20 feet.

809. வாழைக்கு வெட்டும் வழுதலங்காய்க்கு தண்ணீரும்வேண்டும்.
Plantains ruquire digging round and brinjals require water.

810. ஆறுகொத்து நூறுதண்ணீர்வாழை.
Give plantains six diggings and a hundred waterings.

811. வைகாசி மழை வாழைபெருகும்.
Rain in Vaiyāsi increases the vigour of plantains.

812. வாழைக்கு வடக்கு தென்னைக்கு தெற்கு.
Plaintain bunches facing north and cocoanuts facing south.

813. வாழை வடக்கு வான்கமுகு தெற்குசோலை கிழக்கு தும்பப் பிலாமேற்(க்குலை).
The plantains fruit to the north, the areca to the south, the cocoanut to the east, and the jack to the west.

814. வாழைவாழ வடக்கு, வைத்தவன்வாழ கிழக்கு, வாழை சாக மேற்கு, வைத்தவன்சாக தெற்கு.
If a plantain bunch faces the north, the plant will flourish; if towards the east, the planter will prosper; if towards the west, the tree will die; and if towards the south, the planter will die.

815. இலைதின்னி காயறியான்.
He who cuts the (plantain) leaves will not see any fruit.

816. நத்தவாழையிலை நித்தம் காற்பணம்.
The village plantain leaf fetches a quarter *fanam* * daily.

817. வாழை இளசும் வழுதலைமுற்றலும் நடு.
Transplant plantains when young, and brinjals when old.

818. வாழைவத்தலும் கத்தரி முத்தலும்.
Plaintains should be planted when dry and brinjals when old.

819. கத்திரிக்கு கிழமில்லை.
Brinjals do not get old.

820. காயைப்பறித்து கத்திரியைநடு.
Brinjals may be transplanted even after picking fruit.

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* Fanam=About four annas usually, though in some places it was as little as 1¼ or 2 annas.

821. சித்திரைமாதத்தில் சிறந்துழுத புழுதியிலே கத்திரிகடாமல் கரும்புகட்டு வீணனேன்.
I lost by planting sugarcane instead of brinjals in well-ploughed soil in Chittirai.

822. காருக்கும் கத்திரிக்கும் காலமில்லை.
There is no special seasons for sowing kar paddy nor for planting brinjals.

823. கக்கிரிபந்தல் கத்திரிகொத்து.
A support for the cucumber and digging round for brinjals (are necessary).

824. புகையிலைக்கு புழுதிகொல்லை.
Friable soil for tabacco.

825. கள்ளனையும் புகையிலையும் கண்டபோதே கட்டவேணும்.
Tabacco leaves and a thief should be tied up the moment they are seen.

826. இஞ்சிலாபம் மஞ்சளில்.
Loss sustained in ginger is made good in turmeric.

827. எழுகொத்து எழுபது தண்ணீர் மஞ்சள் தன்னிறம் பொன்னிறம்.
With seven hoeings and seventy waterings, turmeric will be of the colour of gold.

828. மஞ்சள்வைப்பது மதவைநிலத்தில்.
Turmeric should be planted in (black and red) loam.

829. எழுவருஷம் மஞ்சள் பயிரிட்டால் என்னிறம் ஆக்கிவிடுகிறேனென்று அது சொல்லும்.
Turmeric says "Grow me for seven years and I will turn you to my colour."

830. வெற்றிலைக்கு தண்ணீரும் வேசிக்கு மஞ்சளும்.
Water is to betel as turmeric to a prostitute.

831. வெற்றிலைக்கொடி விசாகக் கார்த்தியில் விசிறிப்போட்டாலும் செழிக்கும்.
If betel vines are only thrown away in *Visaka* they will grow well.

832. காட்டுக்கோர் அவரை ஊருக்கோர் கவரை.
One *avarai* * plant is enough for a field, and one *Kavarai* † for a village.

833. ஆடி அவரை தேடிபோடு.
Watch and sow *avarai* in Adi.

834. ஆடிமாதம் அவரைபோட்டால் கார்த்திகை மாதம் காய்க்கும்.
If *avarai* be sown in Ādi, it will fruit in Kārtigai.

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* Avarai = *Dolichos lablab*, a variety grown in gardens
† Kavarai = A monopolising section of the *Niafdus*.

835. ஆடி ஒருகுழி அவரை போட்டால் கார்த்திகை ஒரு சட்டி கரி.
If you sow one plot of *avarai* in Ādi you can have one pot of curry in Kārtigai.

836. ஆனிமாதம் அவரை கட்டால் கார்த்திகைமாதம் காய்க்க வாகும்.
If you sow *avarai* in Ani, it will fruit in Kārtigai.

837. அவரை யெம்மாதம் போட்டாலும் தைமாதங்காய்.
Avarai bears fruit in Thai, in whatever month it is sown.

838. ஈரவங்காயத்துக்கு இருபத்தெட்டுபுரை.
An onion has twenty-eight coverings.

839. கீரைக்கு புழு வேரில்.
Insects attack the roots of greens.*

840. கறணைக்குகலகொத்து கொத்திலல் தருணத்தில் பலன் தரும்.
Karan † if well dug round will yield in good season.

841. சேம்புக்குத் தண்ணீர் சோம்பாமலிறை.
Water the edible arum ‡ freely.

842. கற்கடகச் சேனை களவாண்டு தின்பார்கள்.
The *senai* § tuber in *Karkataka* is so delicious that it will be stolen and eaten.

843. ஆனிமாதம்போடுகிற பூசினியும் அய்யஞ்சுவயதில் பிறக்கிற புத்திரனும் ஆபத்துக்குதவும்.
Pumpkins planted in Āni and a son begotten in one's 25th year will serve in time of need.

844. வெள்ளரிக்காய் விற்றகூடை வெறுங்கூடை; பாகற்காய் விற்ற கூடை பணக்கூடை.
A basket that contained cucumbers for sale will be empty, but a basket that was full of the bitter gourd ‖ will be full of money.

845. மாசிமழை மாதளை பூக்கும்.
Rain in Māsi makes the pomegranate blossom.

846. எந்த இலை உதிர்ந்தாலும் ஈச்ச இலை உதிராது.
The leaves of all trees fall; but those of the date palm do not.

847. பாறை முறிக்கவேலமரம்.
A babul tree splits rocks.¶

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* Greens = *Amaranthus* † Karanai = *Typhoniam orixense.*
‡ Edible arum = *Colacasia antiquorum*; another reading of No. 788 is :—
சோம்புக்குத் தண்ணீர் சோம்பாமல் இறை.
Water aniseed freely
§ Senai = *Amorphophallus campanulatus.*
‖ Bitter gourd = *Momordica charantia.*
¶ Compare this saying with Auvayar's saying in the Nalvali, viz.—
நெட்டிருப்புப்
பாரைக்கு நெக்குவிடாப்பாரைப் பகுமரத்தின்
வேருக்கு நெக்குவிடும்.
that is, "a rock which cannot be split by a long crowbar is split asunder by the root of living trees."

848. வெட்டிக்கெட்டதுவேம்பு, வெட்டாமற்கெட்டது பூவரசு.
Lopping spoils a *margosa* tree, and the want of it the *portia*.*

849. பூஅரசு இருக்கப் பொன்னுக்கு அழுவானேன்.
Why should you cry for gold so long as you possess a *portia* tree.

850. ஆடிப்பழத்தைத் தேடிப்பறி.
Look out and gather the fruits that ripen in Adi.

851. அகத்தி ஆயிரங்காய் காய்த்தாலும் புறத்திபுறத்தியே.
Though the *Agathi*† bears plentifully, its fruit remains ungathered.

852. பருத்திக்கு பத்துழவு.
Ten ploughings are required for cotton.

853. எள்ளும் கரும்பும் எடுக்கும் பயிராம்.
Gingelly and sugarcane are exhausting crops.

LIVE STOCK.

The wealth of sayings relating to paddy, and to subjects of general agricultural interest is such that it is rather wonderful that no very great number is forthcoming on this branch of Agriculture. The importance of cattle to the prosperity of arable farming in India is however fully recognised in the following:—

854. காடுவளம் குண்டைவளம்; குண்டைவளம்; குடிவளம்; குடிவளம் கோயில்வளம்; கோயில்வளம் கோன்வளம்.
Rich forests make strong cattle; strong cattle, prosperous husbandmen; prosperous husbandmen will care for the temples; well-cared for temples are the glory of the king.

It is, however, clear that the word (காடு) translated 'forest' must also be taken to include pastures, and in these days, as the country is filling up, these should no longer be the wild common-grazing grounds on which hitherto dependence has been placed, but enclosed and cultivated pasture fields, regarding which it is said in some parts:—

855. வெக்கைக்கு வேலிமறைப்பு.
A fence shuts out rinderpest.

The value of enclosures has already been alluded to earlier in this collection, but the use now mentioned is not one of the least.

Next may be quoted the following showing the great value attached to cattle:—

856. பிள்ளைபெற்றவனுக்கும் மாடுவைத்தவனுக்கும் வெட்கமில்லை.
Those who have children and those who own cattle will not be ashamed.

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* Portia = *Thespesia populnea.*

† Agathi = *Agati grandiflora*; as a matter of fact, however, the fruit is preserved in salt and eaten.

857. குண்டை சாவுகொடுத்தவனும் பெண்டுசாவு கொடுத்தவனும் ஒன்று.
The death of the plough cattle and the death of one's wife are equal calamities.

858. குண்டை இளைத்தால் குடி இளைக்கும்.
The ryots will get lean if his cattle get lean.

859. எருது இளைத்தால் எல்லாம் இளைக்கும்.
If the bullock becomes lean, all else will grow lean.

860. குண்டை விளங்கினால் குடிவிளங்கும்.
The fatter the cattle, the more prosperous the cultivator.

861. குண்டைபெருத்தால் குடி பெருக்கும்.
If the bullocks thrive the ryot will thrive.

862. குண்டைபலமோ குடிபலமோ.
The prosperity of the ryot depends upon his cattle.

863. பாலுள்ளவன் விருந்துக்கஞ்சான்.
One possessing a milch cow will welcome guests without anxiety.

864. ஆடுமாடு இல்லாதவன் அடைமழைக்கு ராஜா பெண்டு பிள்ளை யில்லாதவன் தண்டுக்கு ராஜா.
The man without cattle fears the heavy rain no more than a single man the battle-field.

865. அருகங்காட்டை விட்டவனும் கெட்டான், ஆனமாட்டை விற்றவனும் கெட்டான்.
Ruin awaits the man who gives up pasture or one who sells a lucky bullock.

866. ஆனமாட்டை விற்றவனும் அருகங்காட்டை தொட்டவனும் கெட்டான்.
He is ruined who sells a lucky bullock or works a field foul with hariali grass.

The above show how much the ryot depends on the welfare of his cattle; how wealthy the owner of a milch cow feels; and how little the weather affects a man who does not own cattle. So also is the faith in luck shown as well as the value set on pasture. This latter point is further brought out indirectly in the next group relating chiefly to grazing. Grooming is not usually resorted to to any great extent for bullocks, but undoubtedly improves their appearance No. 873 alludes to the specially luscious character of cholam (*Sorghum*) fodder.

867. மாடுமுக்கிவர வீடு கக்கிவரும்.
If the cattle come home hungry, ruin will befall the family.

868. மாட்டுக்கு மேய்ப்பும் குதிரைக்கு தேய்ப்பும்.
Grazing for cattle and rubbing for horses.

869. மேய்த்துத் தெளியாதமாடு தேய்த்துத்தெளியும்.
When grazing does not improve the bullock, rubbing will.

870. அற்பிசி அறக்காய்ந்தால் ஆடு ஒருமாடு, மாடு ஒருமலை.
If Arpisi be quite dry, sheep will grow to the size of cattle and cattle to that of a mountain.

871. மாசிகிடாவும் மார்கழிகும்பியாணும்.
Cattle in Māsi are like the temple priest in Margali (fat).

872. எரிமிதக்தால் இடையனை மதியாது.
If the hump of the ox grow high, he will not fear the herdsman.

873. சோளப்பயிரை மேய்ந்த எருதுக்கு சொர்க்கலோகம் வேண்டுமா?
Does the ox that fed on growing cholum wish for heaven?

The next portion of the collection relates more especially to the qualities shown by various characteristics of cattle. First for commendation come the short-legged bullocks, then the Alambādi cattle are condemned, although much valued all over the south, but more particularly for coach and cart work. Colour is always much attended to, a peculiar bluish grey being specially appreciated, but black cattle are rejected, as showing cunning, though, if not such, black bullocks are said to be excellent, whilst if the cow be black that will not alter the value of her milk. The tail is also considered carefully, but there is singularly little to be learnt from these sayings, except No. 886, and there it is shown that a bullock should be examined whilst it is walking.

A few items of advice regarding the management of bullocks follow, together with a couple regarding the buffalo, and one as to the feeble character of the ass as a beast of draft. No. 894 refers to the custom, followed in some parts, of tethering cattle around the sheep-folds.

874. சடன் பாடஞ்சான் கூழை எருதுசுழம்பஞ்சாது.
A strong man will not fear hard work; a short bullock will not fear work in puddle.

875. ஆலம்பாடி அழகெருது உழவுக்குதவாத இழவெருது.
An Alambādi bullock is good to look at, but is useless for ploughing.

876. வல்விலைக்கூறையும் மெல் விலைக்காளையும் ஆகாது.
High-priced cloths and low-priced bullocks are bad.

877. முழுமயிலை, முக்கால் பில்லை, அரைவெள்ளை, கால்கறுப்பு.
In bullocks, grey is the best, dun the next, white the next and black is the last.

878. கருப்புமாடு கபடமாடு.
A black bullock is a wily one.

879. கருப்புமாடு கால்மாடு.
A black bullock is one-fourth of a bullock.

880. காரிகால்மாடு கபடுவிட்டால் ஒண்ணேகால்மாடு.
Though a black bullock is but the fourth of a bullock, if it be without cunning it is a bullock and a quarter.

881. பசுகருப்பாலல் பாலும்கருப்பாமா ?
Because the cow is black, would her milk also be black?

882. பசு வறுவாலும எருது கூழைவாலும் ஆகாது.
A cow with a very long tail and a bullock with a short tail are bad.

883. வால்நீளம் வயசுநீளம்.
A long tail is a sign of long life.

884. மாடுவாங்க அறியாதவன் மாடக்கொம்பு மாடு வாங்கு.
He who does not know how to select a good bullock should buy one with horns bent backwards.

885. மாடறியாதவன் மட்டையைக்கொள்ளு.
He who knows nothing of oxen should buy hornless oxen.

886. மாட்டை நடையில்பார் ஆட்டை கெடையில்பார்,
Judge a bullock when walking and a sheep while it is in the flock.

887. உழுகிறவன் இளப்பமாலல் எருது மைத்துனன் கொண்டாடும்.
If the ploughman be a fool, the ox will play the brother-in-law with him.

888. அடியாதமாடு படியாது.
A bullock not beaten will not obey.

889. உழுதமாட்டை முகத்திலடிக்கலாமா ?
Is it proper to strike the ploughing bullock on its head?

890 உழவுக்குப் பிணைத்துவிடுகிறமாடும் கூட்டுக்குப்பிடித்து விடுகிற ஆளும் உதவாது.
An unaccustomed bullock yoked for ploughing and casual labourer will not be useful.

891. உழவுமறந்தால் எருதுபடுக்கும்.
A draft ox will lie down if it has forgotten the plough.

892. கள்ளமாடு சந்தையேறாது.
A cunning (shirking) bullock will not find a market.

893. உழவொழிந்தமாடு பட்டிப்புரத்திலே.
A bullock let loose from the plough should be tethered at the fold.

894. சண்டிகலைந்தால் காடுகொள்ளாது.
If a stubborn bullock gets frightened the field cannot hold him.

895. போர் அடிக்கிறமாட்டின் வாயைக்கட்டுகிறதா ?
Is it right to muzzle the ox that treads out the corn?

896. எடுத்தெடுத்து உழுதாலும் எருதாகுமா கிடா.
A buffalo will not equal a bullock, even if the ploughshare be lifted up now and then.

897. நடவு நட்டாலும் காற்று மீந்தாலும் கான்நடக்கிறநடை யிது தான் என்று சொல்லுமாம் கிடா.
The buffalo says—"I will always walk at this pace though you are in haste to transplant and the seedlings will be spoiled."

898. கழுதை உழவுக்குவாது.
The donkey is unfit for ploughing.

Although, in the next group of sayings, the value of the milch cow is very fully recognised, there is little to be noted as to what is said of this class of stock except the allusion in No. 847, to the influences of heredity and the absolute indifference to what filth a cow may feed on shown in No. 905, although it is quite true that various surplus food matters in an Indian household may be usefully fed to cows. No. 913 alludes to the great delicacy of young buffalo calves.

899. கறக்கிறபசுவையும், கைகுழந்தையையும் கண்ணுகப்பார்க்க வேணும்.
A milch cow and a baby in arms should be cared for like one's eyes.

900. கறவைமாடு கண்ணுக்குச்சமானம்.
A milch cow is as precious as one's eyes.

901. ஆவும் தேவும் ஐந்து வருஷத்தில் பலன் தரும்.
Providence and the cow give return in five years.

902. காராம்பசுவுக்கு புல்லுமாம் கந்தவனத்திற்கு மழையுமாம்.
Grass to the cow is as rain to the flower-garden.

903. பாலைப்பார்த்து பசுவைக்கொள்ளு, தாயைப்பார்த்து மகளைக் கொள்ளு.
Purchase a cow after milking her and choose a bride after seeing her mother.

904. மலம் தின்னும் மாட்டின்பால் மலமா?
Will the milk of a cow that eats filth be also filth?

905. பாழாய்போகிறது பசுவின்வாயில்.
That which would otherwise be wasted may be given to cows.

906. வைக்கல்தின்கிற மாட்டுக்குப்பால்கொஞ்சம், மதுரம் அதிகம்.
A cow fed upon paddy straw yields a small quantity, but very sweet milk.

907. வடலிவெட்டி ஆள் எருமையை கட்டி ஆள்.
Preserve young palmyrahs by lopping, and buffaloes by tying.

908. பாடிக்கறக்கிறமாட்டை பாடிக்கறக்கவேண்டும். ஆடிக்கறக் கிறமாட்டை ஆடிக்கறக்கவேண்டும்.
A cow which requires singing or dancing to whilst being milked must be treated accordingly and milked.

909. கட்டிக்கறக்கிறமாட்டை கட்டிக்கறக்கவேண்டும். கொட்டிக் கறக்கிறமாட்டை கொட்டிக்கறக்கவேண்டும்.
The cow that requires to be tied up for milking should be tied and milked; and the cow that requires to be beaten before milking should be beaten and milked.

910. குடப்பால் கறந்தாலும் கூரைப்பிடுங்குகிற மாடாகாது.
A cow that pulls down the thatch is bad though she may be giving a potful of milk.

911. இளங்கன்று பயமறியாது.
A young calf knows no fear.

912. எருமைக்கன்று அருமைக்கன்று.
A buffalo calf is a dear calf.

The remainning sayings refer to the sheep and the goat; the most noticeable of which are those in which the destructive results of the grazing of sheep and goats are alluded to, though here again the word 'காடு' alluded to may either be the jungle or the field with a crop in it. The concluding saying shows that it is recognised that even in what appears so simple a thing as shepherding skill is required.

913. ஆடு கொழுத்தால் இடையனுக்கு லாபம்.
If the sheep fattens, the shepherd gains.

914. மாடுமேயாத மட்டபுறக்கட்டையை ஆடுமேய்த்து அதிகிருப்தி யாகும்.
Sheep may graze usefully on stubble no longer useful for cattle.

915. யானைவயிறு நிறைந்தாலும் ஆட்டுவயிறு நிறையாது.
Though an elephant's stomach may be filled, a sheep's never is.

916. காடுகெட ஆட்டைவிடு.
If you want to spoil the jungle, let in sheep.

917. காடுகெட வெள்ளாட்டை விடு.
If you want to ruin the field, let in goats.

918. எருமைக்கு வெள்ளாடு எத்தக்கறக்குமா?
Will a goat give as much milk as a buffalo?

919. கண்டதெல்லாம் ஓடித்தின்னும் ஆடு, நின்று நின்று மேய்ந்து போகும் மாடு.
Goats run from place to place and eat what meets their fancy; cattle graze on all that is worth eating and then move on.

920. சித்திரைமாதம் சிறந்துமழைபெய்யாமற்போனால் விலவா தாதைவிற்று வெள்ளாடுகொள்ளு.
If rain fails in the month of Chittirai, buy a flock of goats somehow.

921. கோடைமழை பெய்யாதா குரும்பு ஆடு சாகாதா தூட்டுக்கெட்டாடு தூக்கிக்கொடுக்காளு.
Oh! that summer rain may fail and the woolly sheep die, so that eight sheep be had for a thuttoo (4 pies).

922. இடையன்செய்வது மடையன் செய்யான்.
A fool cannot be a shepherd.

923. அருமையற்ற வீட்டில், எருமையும் குடியிராது.
Even a buffalo would not like to remain in an unkind home.

924. ஆடுகொடாத இடையன், ஆவைக்கொடுப்பானே ?
A shepherd unwilling to part with his sheep is not likely to give away his cows.

925. உழவுக்கு ஒரு சுற்றும்வராது, ஊணுக்குப்பம்பரம் (முன்னே வரும்).
The cattle which will not come even one round in the plough, will rush up for food.

926. உழுகிறகுண்டையானால், உள்ளூரில் விலையாகாதா ?
A good plough animal will find a sale in its own home.

927. முந்நாழி கறக்கிற பசுவானாலும், முன் இறப்பைப் பிடுங்குகிற பசு ஆகாது.
If a cow has a tendency to eat the roof thatch, it should be avoided even though it may yield $\frac{3}{4}$ m.m. of milk.

928. மேய்ப்பு பாதி, தேய்ப்பு பாதி.
Grooming an animal is as good as grazing it.

Note by Mr. C. K. SUBBA RAO.

As already stated in the remarks made above. a number of the sayings quoted may be traced to classical works; this being the case as regards—

Nos. 533 and 580 from Auvaiyar's *Āttichūdi*; and Nos. 14, 16, 19 150, 153, and 229 from her *Kondraivēndan*.

No. 15 from Kambar's *Ēr Yēlubadu*.

No. 44 from Vira Rama Pandya's *Vetriverkai*.

No 17 may be contrasted with the following couplet from the Parāsara Smrithi :—

వృక్షాగ్ర ఛిల్వా మహీంచిత్వా హత్వాతు కృమికీటకాన్ | కృషకః కర్షయఞ్ఛేన సర్వపాపైః ప్రముచ్యతే ||

"By giving alms at the-thrashing floor, the husbandman is absolved of the sins incurred in cutting down trees, splitting the earth, and killing insects and worms."

It is, however, worthy of note that in the case of other sayings, corresponding passages may be found in the works above mentioned and in others of equal celebrity; thus, No. 11 has the same force as the saying in the *Kondraivendan* :—

"பண்ணியபயிரிற் புண்ணியங்தெரியும்."

"Whether a man's life has been virtuous may be judged from his success in agriculture."

No. 67 is derived from the couplet in the Vetrivērkai :—

"வித்துமேரு முளவாயிருப்ப
எய்த்தங்கிருக்கு மேழையும்பதரே."

"A man who has a plough and seed and yet remains languid and poor is indeed worthless.

Nos. 408 and 409 may be compared with the following passage from the *Nāladiyār* :—

"புல்லீரப்போழ்தி னுழவேபோல்மீதாடிச்
செல்லாவாம்நல்கூர்ந்தார் சொல்."

"The words of poor men will have as little effect as the ploughing of soil which is wanting in moisture."

No. 417 is derived from the following passage in *Innā nārpadu* :—

"மாரிவளம் போக்கினார் கின்னுவாங்கின்னு
மூரியெருத்தினுழவு."

"Failure of rain is bad for the country and so is the tillage performed by old bullocks."

The value of high field-ridges referred to in No. 600, is explained in the following passage from the *Kānchipurānam* :—

"பெருகயாத்தநீர்க்கலங்கல் போய்த்தெளிந்த பின்முழுது,
மருவுகால் வழிவடிக்குறக்கவிழப்பார்கண்மள்ளர்."

"After the water which is abundantly confined within the bunds has deposited its silt and become clear, the ryots get rid of the whole of it by drainage channels.

No. 903 may be compared with the following line from the Nāladiyār :—

"கல்லாவின் கன்றுயிலுகும் விலைபெறாஉம்."

"Even a calf will fetch a high price, if it be the offspring of a good cow."

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