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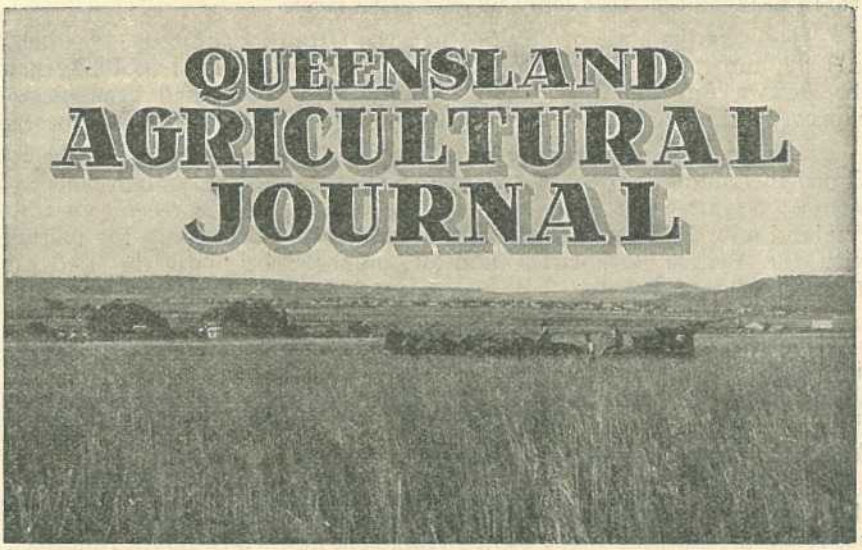

VOL. XLVI. 1 SEPTEMBER, 1936. PART 3

Event and Comment

An Imperial Show.

"THIS is not only a Queensland Show; it is far more than that—it is an Imperial Show," said His Excellency the Governor, Sir Leslie Wilson, in opening the Brisbane Exhibition officially in the presence of a large gathering of representative citizens. They showed, continued the Governor, that day at the Exhibition, and in many other ways, an Empire bound together by ties of loyalty, by ties of affection to the Throne, by an identity of interests, and by a similarity of customs, and, above all, an Empire which stood for liberty. No such Empire had been known in the world before—not even in the days long since gone by, even in the days of the great Roman Empire. The Association's address had quoted the beautiful words of Brunton Stephens, at the opening of the first Exhibition held here in 1876—exactly sixty years ago. They had progressed since that year, due to the stout hearts, enterprise, and courage, in the early years, of the great pioneers of the past, but if ever there was a State blessed by Divine Providence in all its natural wealth, it was Queensland. Let them, therefore, put to the best use for the benefit of the greatest number, the good gifts with which they were blessed, and let each one in every sphere of life devote his life to this great aim.

The Future of the Chilled Beef Industry.

THE Meat Hall, in which was displayed a complete range of animal products and derivatives, was one of the outstanding features of the Brisbane Show—one of the greatest events of Queensland's agricultural year. The Hall was opened officially by the Premier, Hon. W. Forgan Smith, who, in the course of a notable address to a large assemblage of graziers and others interested in the development of our export trade,

said that since the war South American countries had, with chilled beef, virtually captured the English import trade, leaving little demand for frozen beef, and, at that, only on low price levels.

That was the state of affairs when the Ottawa Conference was held in 1932, and it was clear to him, when he visited England in 1934, that the Ottawa Agreement, so far as it applied to beef, had brought no improvement to the unfavourable situation of Australian cattle producers.

During 1935 negotiations for a long-term beef agreement were continued in London between the United Kingdom and Australian Governments. Negotiations were resumed this year, and his recent visit to England afforded him the opportunity of further discussing the matter with the British authorities, and of collaborating with the Federal Ministers then in London.

It had, in fact, always been his opinion that to arrest the development of the cattle industry would mean, in effect, that little or no further development could be expected in the vast areas of cattle country in Queensland, the Northern Territory, and North-western Australia, and the more intensive use of these areas was admittedly to-day one of Australia's most outstanding problems.

It had been claimed by people with various interests in Argentina that with respect to beef Australia could never become a strong competitor in the markets of the United Kingdom, into which South American countries export almost 5,500,000 quarters of chilled beef annually, as compared with about 1,000,000 quarters exported from Australia, which, until recently, were shipped as frozen beef. Such claims, however, are made after Australian beef producers have suffered more or less "bankrupt" prices for frozen beef during the last fifteen years, and who, in endeavouring more recently to land chilled beef on English markets, have had to overcome many difficulties.

It was his firm belief that, given certain circumstances, Australia could become a much more important supplier of beef to English markets than she had been in the past, and export meat of a quality and in a condition suitable to English consumers.

The first essential is that as the quality is improved to the desired standard the beef must be exported chilled instead of frozen, and that chilled beef should be aboard ship for the least possible time.

Under present transport arrangements the bulk of chilled beef exports—the most highly perishable product we export—are the first Australian loading, and are required to traverse the equivalent of almost half the distance between Argentina and England before it actually leaves the Australian coast. This long voyage naturally depreciates the appearance of the beef when offered for sale in English markets.

In examining the Australian exports of beef, pork, mutton, lamb, butter, and cheese, he found that of the total of those refrigerated products—some 320,000 tons—95 per cent. is shipped from the three Eastern States, and 44 per cent. from Queensland alone.

Continuing, the Premier said: "There is, of course, not only an inter-relationship between the producing interests of these various commodities, but there is an interdependence, inasmuch as one class of product assists the other in securing adequate transport tonnage. In my opinion, therefore, there is an obvious answer to the question of the means of furthering the joint meat and butter interests of Eastern Australia, which is that, instead of the general route

for vessels trading between Australia and the United Kingdom being south-about, a sufficient number of vessels to provide a weekly service for refrigerated produce and general cargo should come out to Australia via Torres Strait, making Melbourne the final outward port, from where, also, the homeward voyage via Torres Strait should begin. I am aware, of course, that such a service would require sufficient depth at the Queensland loading ports, and that perhaps, also, so as to reduce the loading time to a minimum, consideration would need to be given to some plan of centralising the loading to a fewer number of ports, but these difficulties are not insuperable. The chief consideration is that a service via Torres Strait would not only serve the requirements of the shippers of refrigerated produce in the Eastern States, but it would make possible, and so far as I can see will be the only means of making possible, the proper development of the areas of the northern belt of Australia. In beef production the difficulties of distance between Australia and the United Kingdom would be overcome immediately, and with that difficulty out of the way it is possible to visualise a complete economic reorganisation of beef production, as between the functions of breeding and fattening. While we have vast breeding areas, undoubtedly we also possess, in many of our reliable coastal areas, country highly suitable for the fattening of cattle, and this subject at the present time is being studied scientifically and with promising results."

Mr. Forgan Smith added that the undeveloped area of Northern Australia was a matter of concern, not only to Australians but to the people of the whole Empire.

Confidence in the State.

"CONFIDENCE spells prosperity; distrust generally means adversity." That was the keynote of an impressive speech by the Governor, Sir Leslie Wilson, at an important Show week function. Some people, he added, thinking on the great problems confronting the world to-day, were inclined to believe they were impossible of solution. There was nothing impossible in this world, and he would like to see the word "impossible" removed from the dictionary of every person in a country like Queensland.

Addressing the same gathering, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said that this year's Show struck a note that was in the ascendant in the State to-day—a note of confidence. When His Excellency had said that nothing was impossible his own mind went back over the history and development of agriculture in Australia, and he agreed that nothing was impossible. Things that were regarded as incapable of attainment in other years were now accomplished facts. Only a few years ago wheat was being imported; to-day Australia was a granary contributing to world supplies. Until fairly recently the cry that Australia could not ship chilled beef was ringing in their ears; yet to-day Australia was shipping chilled beef equal to anything finding its way to the Smithfield market.

They could not hope for an expansion of land consciousness unless they could show what the land was capable of producing. The most potent factor in developing that consciousness was the splendid array they saw on every side that day. Some people had no confidence in anything. Some decried agriculture, but it was worth remarking that both His Excellency's son and the son of the Premier were training for careers on the land.

The Species of Diplodia Affecting Forest Trees in Queensland.

H. E. YOUNG, M.Sc.Agr., Assistant Plant Pathologist.

SINCE the planting of exotic species of *Pinus* on a plantation scale was first commenced in Queensland the most important fungus parasites on the living trees have been relegated to the genus *Diplodia*. Two distinct species have been identified, and the nature of the injury caused by them is typically the same.

The first definite record of the disease caused by one of these fungi was in August, 1930, when the death of the leading shoots of *Pinus radiata*, at Benarkin, in the Brisbane Valley, was reported by R. B. Morwood, Plant Pathologist, as being caused by a species of *Diplodia*. In May of the previous year what may have been an earlier observation of the disease was made in the same locality when a dieback of the leading shoots was noted but no pathological examination made.

The next mention of the disease was in December, 1932, when, following a severe hailstorm, there was a heavy incidence of the infection. Since this date there has been a recurrence of the trouble during the warmer months of each year. It has appeared in the meantime at Imbil, in the Mary Valley, where, again, the chief host is *Pinus radiata*, the same fungus being associated with the lesions.

In September, 1934, a tree affected with *Diplodia* dieback was found at the forestry plantation at Beerwah, and in October a number of trees succumbed to the disease. Affected trees were found throughout the summer. The fungus associated with the trouble in this locality proved to be a species of *Diplodia* which differed from that found on *Pinus radiata* in other localities, and so far the attack of *Pinus* spp. by this particular pathogen has been confined to Beerwah.

Owing to the possible extension of the damage caused by these two fungi, considerable attention has been focussed on the disease during the last two years.

Identification of the Fungi Associated with Dieback.

Specimens of diseased material and pure cultures of the fungi associated with the two types of dieback were forwarded to the Imperial Mycological Institute, and the organisms were kindly identified by S. F. Ashby. The species associated with "dieback" of *Pinus radiata* proved to be *Diplodia pinea* Desm. Kickx., whilst that associated with dieback of *Pinus tæda* and *P. caribæa* at Beerwah closely resembled *Diplodia natalensis* Pole-Evans. Although the latter fungus has not previously been recorded from *Pinus*, later observations will show that there does not appear to be much doubt as to this being its rightful designation.

Proof of Pathogenicity of the Fungi Associated with Dieback.

Specimens of *Pinus insularis*, *P. patula*, *P. tæda*, and *P. caribæa* have been successfully inoculated with pure cultures of *Diplodia pinea* isolated from *P. radiata* (Table 1). The inoculations resulted in the

production of symptoms typical of dieback, followed by death of the plants. The usual inoculation procedure adopted was to take a young, actively growing culture in a petri dish, and having cleaned with alcohol the site where the inoculation was to be carried out the tree was wounded with a sterile scalpel. The scar was approximately 1 inch long and ¼ inch wide.

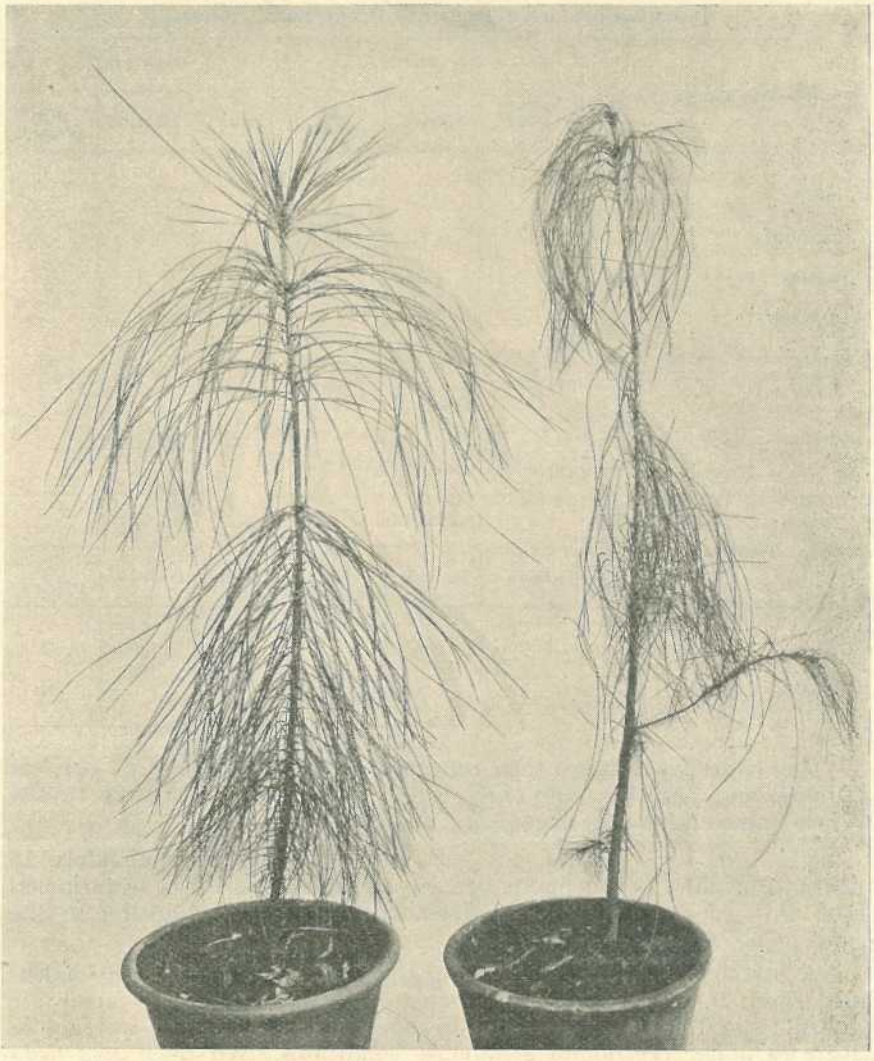

Plate 131.

Left.—Healthy plant of *Pinus caribæa.*

Right.—*Pinus caribæa* plant artificially inoculated with *Diplodia pinea,* resulting in dieback and finally death.

A piece of the inoculum was then removed from the edge of plate culture, and, aseptic precautions being observed, it was placed on the wound. A swab of damp, sterile cotton wool was then placed over

the inoculated wound and the whole wrapped with a piece of tinfoil. After three days the tinfoil and wool were removed. Symptoms of dieback usually developed within three weeks, and when the plant or part of it had succumbed (Plate 131), pycnidia of the fungus used as an inoculum developed on the dead wood. The fungus was then reisolated in the usual manner.

TABLE 1.

INOCULATIONS WITH DIPLODIA PINEA DESM. KICKX.

Tree Species.	GLASSHOUSE.			OPEN AIR.		
	Dead.	Dieback.	Unaffected.	Dead.	Dieback.	Unaffected.
P. taeda	7	..	..	..	3	..
P. caribaea	7	..	..	..	3	..
P. patula	7	..	..	2	1	..
P. insularis	7	..	..	2	1	..

TABLE 2.

INOCULATIONS WITH DIPLODIA NATALENSIS POLE-EVANS.
(Strain isolated from *Pinus tæda*.)

Tree Species.	GLASSHOUSE.			OPEN AIR.		
	Dead.	Dieback.	Unaffected.	Dead.	Dieback.	Unaffected.
P. taeda	7	..	..	1	..	2
P. caribaea	7	..	..	..	..	3

The experiments were then repeated using *P. tæda* and *P. caribæa* as hosts, and *Diplodia natalensis* as the inoculum, and similar results were obtained with this organism (Table 2).

The tests were carried out with pine seedlings approximately 18 inches in height. Seven plants of each of the species listed were inoculated with each fungus under glasshouse conditions, resulting in the death of all the inoculated plants.

A further three plants of each of the species mentioned were inoculated with *D. pinea* and the inoculated plants placed in open air conditions in full sunlight. The damage in these instances was not so severe as under the humid glasshouse conditions. All the *Pinus tæda* and *P. caribæa* plants exhibited dieback of the plant above the point of inoculation, and in some cases almost down to ground level, but the plants produced healthy shoots again below the area of "dieback." Pycnidia were formed on the dead tissues. Two of the *P. patula* plants succumbed and one suffered only from dieback, from which it recovered by making new growth from below the infected area. In the case of *P. insularis* two of the inoculated trees died and one recovered, as did the *P. patula* plant.

In addition, three trees each of *P. caribæa* and *P. tæda* were inoculated with *Diplodia natalensis*, which was isolated from an infected *P. tæda* tree at Beerwah. Only one of the inoculated plants was affected. This decrease in the severity of the attack in the open air was probably due to the low humidities prevailing at the time.

Plate 132.

Pinus radiata tree affected with dieback caused by *Diplodia pinea*. Hampton, Queensland.

Appearance of the Disease as caused by Diplodia pinea Desm. Kickx.

The disease appears in the summer months and is manifested by a bronzing and finally browning of the needles on the affected area, which is usually a leader or terminal shoot of a lateral branch. The

shoot then wilts and dies, giving rise to the popular name of dieback. The trouble spreads downwards from the leader attacking the branches of the nearest whorl below and so on down the tree. (Plate 132.) In many cases, however, the fungus is confined to the terminal shoot and does not extend beyond it. If the attack commences in a lateral branch the fungus on reaching the trunk of the tree usually first attacks the other branches in the same whorl before invading other whorls to which it makes its way by penetrating the tissues both up and down the trunk. A number of cases have been noted in which the needles were the initial point of attack; from the needles the fungus makes its way into the branches and may then invade the remainder of the tree.

A severe hailstorm which bruises and cuts the bark of the tree is often, in districts subject to dieback, followed by that complaint, the hail providing openings through which the fungus can make its entry. The scarring is chiefly on the more exposed parts of the trees, such as the leaders and ends of the lateral branches, and accordingly the dieback in these cases makes its first appearance in those parts of the tree. Suitable weather conditions following the hailstorm are, of course, a necessary adjunct to the appearance of the disease.

In many cases the tree may produce new shoots from below the infected area and continue its healthy growth, but usually where infected tissue is present on the tree the disease will again become active and cause further dieback. In the case of the more susceptible trees the dieback extends until the tree is killed. Sometimes, however, only a severe needle cast is caused, and new needles replace them, and the tree regains its vigour. Where a dieback is present, it would appear possible that the whipping of healthy tissue of neighbouring trees with this diseased wood would inoculate the previously uninfected tissues.

Severely affected trees exude much resin from cracks in the bark up the trunks. On account of this the trunk often has a greyish-white appearance.

Trees from ten feet in height and upwards appear to be most susceptible to the condition, those of smaller size being infrequently attacked. In such small trees there is, in ordinary circumstances, no closure of the crowns, consequently the trees are better ventilated and the sun reaches most parts of them. This produces drier conditions than are suitable for spore germination and fungus growth.

On examination of a dying branch or leader it will be seen on cutting the bark that there is a browning of the cambium and the rest of the cortex. This colouration gradually darkens until, when the twig

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DESCRIPTION OF PLATE 133.

Diagrammatic drawing of a section of a *Pinus radiata* stem illustrating infection by *Diplodia pinea*.

(*a*) Ostiole of pycndium.
(*b*) Cuticle.
(*c*) Parenchyma.
(*d*) Resin passage.
(*e*) Fungal hyphæ.
(*f*) Phlœm.
(*g*) Cambium.
(*h*) Xylem.
(*i*) Medullary ray.
(*j*) Epithelial cells of resin passage.
(*k*) Developing spore.
(*l*) Uniseptate spores.
(*m*) Unilocular spore.

x 150.

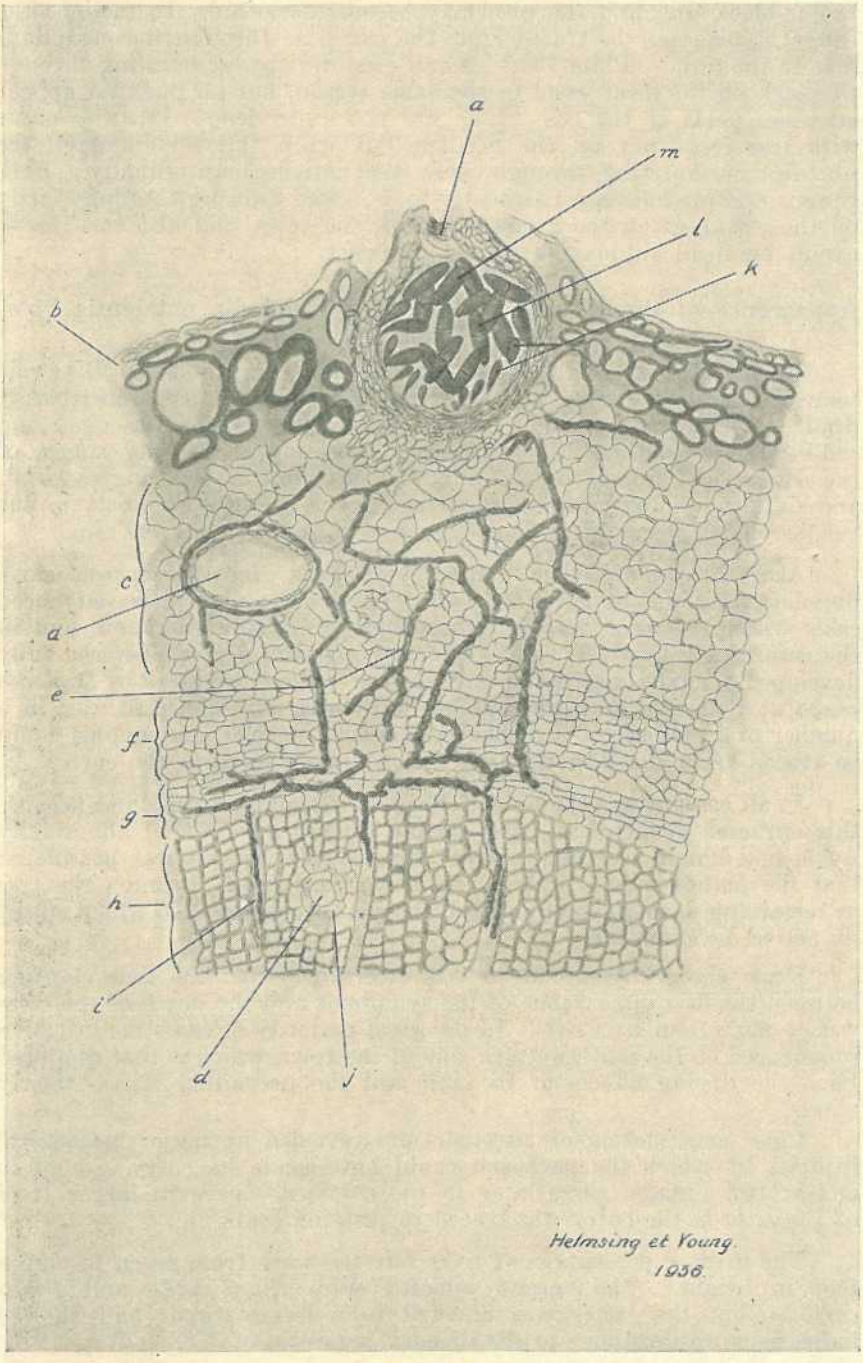

Plate 133.

is dead, the cortical tissues are black and even the wood below has a blue-black tint, and the pith may become darkened. In sections the fungal hyphæ may be traced from the cambium through the medullary rays to the pith. (Plate 133.) Small pustules appear bursting through the bark on the dead wood in the same season, but no pustules appear on those parts of the tree which are not quite dead. Pustules occur with less frequency on the needles, but when this does happen the pustules on bursting through, split the cuticle longitudinally. Both fungus and pustules are frequently to be found growing saprophytically on the prunings on the ground beneath the trees, and also to a lesser extent on dead suppressed lateral branches.

Appearance of the Disease as Caused by Diplodia natalensis Pole-Evans.

In the case of the form of dieback so far confined to Beerwah, some of the affected trees, when the trouble was first noted, were already dead; in other cases an odd lateral branch or a leader was dead and red-brown in colour. In specimens illustrating the earlier stages of the disease the foliage of the affected parts had a bronzy-green tint, and darker coloured water-soaked looking areas were apparent in the needles which were dying from the fascicle and towards the tips.

As in the case of dieback caused by *Diplodia pinea* brown to blackish discolouration was apparent on lifting the bark, and in more advanced cases where the wood was dead incipient pycnidia were found, and in the case of a tree which had evidently been dead for some weeks fully developed pycnidia macroscopically similar to those produced by *Diplodia pinea* at Benarkin and other places were present. The pith was, in a number of instances, of a darker colour than normal, and hyphæ could be traced from the pith through the medullary rays to the cortex.

In all cases it was the older foliage which suffered first, and because this outbreak occurred in early spring during a period of abnormally warm and humid weather for that time of the year, it was postulated that the pathogen had probably been working slowly through the tree or remaining dormant therein until the conditions occurred which suited its active development.

From observations made it was ascertained that the time elapsing between the first appearance of the symptoms and the death of the trees was no more than six weeks. In the great majority of cases the infection commenced on the south-western side of the trees, which is that sheltered from the drying affects of the sun and the prevailing north-easterly winds.

Close examination of affected trees revealed no major mechanical injuries by which the pathogen could have made its entry except in one or two isolated cases later in the summer, where in larger trees of *Pinus tæda* the entry was traced to pruning scars.

The greater percentage of trees affected were from seven to eleven feet in height. The species affected were *Pinus tæda* and *Pinus caribæa*, but the latter was affected to a lesser extent and showed indications of resistance to the dieback organism.

A number of trees, on removal of the affected parts, recovered and made normal growth, whilst others did not respond to the treatment but became fully affected. In the latter case, it was assumed that all

affected material had not been removed. A number of trees from which damaged foliage had been pruned showed healthy wood and no darkening of the cambium, but the pith was darker than normal. This seemed to indicate that the fungus might in certain cases work through the pith of the tree in advance of the infected cambium. Pure cultures of the fungus were isolated from the pith and thus supported this view.

The fungus has been found on dead pine branches on the ground and on trees which have been infected whilst living. But the cleaning of the forest floor of such dead material does not at present appear essential.

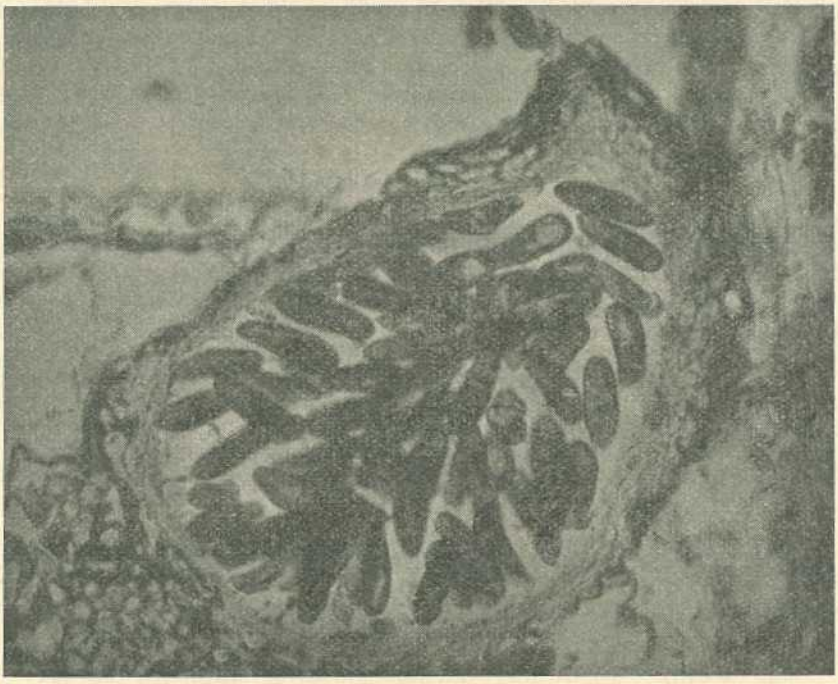

Plate 134.

Micrôphotograph of pycnidium of *Diplodia pinea* on *Pinus radiata*. K3 filter. Exposure 5 seconds. Verichrome film pack. x 300.

Species Attacked.

In 1907 *Diplodia pinea* Desm. Kickx. was noted as causing a dieback in *Pinus radiata* trees in New Zealand, and the same fungus has also caused considerable damage to plantations in South Africa, where curtailments of planting operations with that species have in some places been brought about by this fungus.

The most important host species in Australia for *Diplodia pinea* is *Pinus radiata*. Other species are also attacked but to a lesser extent. As already mentioned, this is the chief cause of dieback in *Pinus radiata* plantations in Queensland. Other species attacked in Queensland are:— *P. pinaster, P. patula, P. tæda,* and *Cupressus sempervirens. Pinus insularis* has been artificially infected, but has not yet been recorded

as being attacked in the field. The same organism has been isolated by the author from *P. radiata, P. longifolia, P. caribæa, P. coulteri,* and *P. pinaster* from Northern New South Wales.

The species attached by *Diplodia natalensis* are *P. tæda* and *P. caribæa,* the former being the more susceptible of the two. The only locality in which this organism has been recorded from *Pinus* spp. is an isolated area at Beerwah, where prompt control measures appear to have cleared up the trouble.

Description of the Queensland Strain of Diplodia pinea.

Perithecia globose, carbonaceous, erumpent, about 300 microns in diameter, spores 33 to 45 by 11 to 18 microns, oblong with rounded ends, at first unilocular and yellow-brown, but later one septate sometimes somewhat constricted at the septum and dark-brown. Mycelia brown 3 to 4 microns in diameter. Habitat in bark, needles, medullary rays, and pith of *Pinus* spp. (Plate 134.)

Cultural Characteristics.

It grows rapidly on most ordinary culture media. On potato-dextrose-agar the mycelium is at first white and later turns black, and stains the media to the same colour. Pycnidia containing spores form after the cultures have been left for some weeks, and are usually plentiful on the dead wood of *Pinus radiata* trees in infected areas.

The optimum temperature for growth is 27·0° C. Growth occurs at a minimum temperature of 10·0° C. and at a maximum temperature of 39·0° C. The growth rate decreases much more rapidly from the optimum temperature to the maximum than it does to the minimum. Brown's Media α was used in order to regulate the quick growth of the fungus to a speed suitable for measurement.

The fungus is easily isolated in pure culture from the pith or cambial regions of infected areas. Single spore isolations are also successful.

Weather Conditions.

The weather conditions during the first authentic attack in December, 1932, were as follows:—

5th December—Severe hailstorm in the evening.	
Mean maximum temperature—5th-31st December	32° C.
Mean minimum temperature—5th-31st December	14° C.
Mean relative humidity—5th-31st December ..	40 per cent.
Rainfall—5th-31st December	256 points

Rain fell on six days of the twenty-six, and the period was marked by cloudy days with the rainfall occurring as storms.

The attack was first noticed on the 22nd December, and it is assumed that the fungus entered the trees after damage had been done by the hailstorm which severely bruised and scarred the trees on 5th December. On referring to Plate 134 and consulting Curve B on Plate 135 it will be seen that the temperature range for the period is well within that which is productive of vigorous growth of the parasite.

Control Measures Adopted.

All diseased trees are removed, attention being paid to this during thinning operations as well as at other times.

The planting of *Pinus radiata* and *P. pinaster* has been stopped, as these species appear to be very susceptible to this and other troubles in Queensland, and are likely to act as a reservoir for the infection of other species which have proved to be less subject to attack.

It is questionable whether the removal of prunings from the plantation floor in infected areas is economically practicable. Such prunings are usually infected with the pathogen, which spores freely on them. However, being on the ground, the spores are not as liable to cause infection as are those on the standing trees.

Insect Associations.

In some districts, notably in Northern New South Wales and the Pechey district in Queensland, a scale insect, usually referred to as *Chermes* sp., but generally regarded as belonging to the family *Adelgidæ*, is found chiefly on *Pinus radiata*. It does a considerable amount of damage by sucking the plant juices causing wilting, and in some cases actual death of the tree. The insect frequents the thin barked parts of the plant, and accordingly is found abundantly on the growing shoots and just below them. In trees badly infested, however, the whole trunk may be parasitized, and as the insects are covered with a white waxy coat the tree is given a greyish appearance. Some trees recover from the attack and may become completely free of the insects, but usually the infestation continues and the vigour of the tree is materially affected.

The localities infested with *Chermes* are also places in which *Diplodia pinea* occurs, and while both may and do occur in the absence of each other it would appear possible that, in localities where both occur, the fungus may be aided in its destructive work by the presence of the insect. The insect, while feeding, wounds the tree, and accordingly makes available possible entries for fungus parasites, and the spores of *D. pinea* being very plentiful, owing to the heavy incidence of infection in some areas, the tree may be readily infected. Trees severely affected by *Chermes* wilt in the terminal shoots, and in this depressed condition are more liable to fungus attack. The dead wood which results from this wilting is also very susceptible to invasion. *D. pinea* grows vigorously as a saprophyte on dead branches, &c., of *Pinus* spp., and is found very abundantly on prunings and droppings of pine trees in infected areas. A dead infected shoot on a living tree, particularly when the remainder of the tree has been scarred by *Chermes*, would consequently provide a suitable and contiguous source of the pathogen which then might make its way into the living tree through the insect scars as already described.

Description of Diplodia natalensis Pole-Evans.

Diplodia natalensis was originally described by Evans as causing a decay in lemon fruits in South Africa. It occurs also in Florida, Cuba, Puerto Rico, California, and the Philippines. It is not uncommon in Queensland, causing a stem and rot in citrus fruits.

Pycnidia are usually abundant on the dead wood of citrus trees and provide reservoirs from which spores may be disseminated. The pycnidia appear during the warmer months of the year.

The fungus was described by Evans as follows:—"Pycnidia scattered, at first covered by epidermis, afterwards bursting through, black, membranous, subglobose, papillate 150-180 microns in diameter. Spores elliptical, one septate, not constricted at the septum, dark coloured, 24 x 15 microns. Exospore ornamented by striated bands. (Plate 136.) On fruits of all citrus varieties from Natal."

The strain isolated from *Pinus tæda* and *Pinus caribæa* at Beerwah agreed closely with this description excepting that the spore measurements differed a little. The Beerwah strain had slightly narrower spores, the measurements being 20-29 x 13-15 microns, whilst those from an authentic culture of *D. natalensis* supplied to the Imperial Mycological Institute at Kew by Dr. Doidge (Principal Plant Pathologist, Union of South Africa), were 22-29 x 14-16 microns. These details were supplied by S. F. Ashby, who also states that the nearest *Diplodia* recorded from species of *Pinus* is *Diplodia sapinea* (Fr.) Fckl., of which the spores are brown (not opaque), septate, nonstriate, and not constricted, and 22-27 x 11-13 microns (mostly 23-26 x 13 microns), being about the same length but narrower. However, Ashby cannot identify this species with that under discussion, and there appears to be little doubt that the fungus is *Diplodia natalensis*.

Cultural Characteristics.

On most culture media the strain of *D. natalensis* being considered grows very rapidly, producing at first a light to greyish mycelium, which later becomes dark and almost black. Pycnidia and spores are produced in old cultures, the fungus fructifying readily on potato-dextrose-agar slants kept at room temperature.

The optimum temperature for growth is 31·5° C., the minimum temperature is 12·0° C., and the maximum temperature 41·0° C. (Plate 135.) In order to investigate the temperature requirements Brown's Media *a* was used. In richer media the mycelium covered the plates too rapidly for convenient measurement.

Isolation.

Pure cultures were readily obtained from diseased tissues of *Pinus tæda* and *Pinus caribæa*. The pith of diseased trees or infected tissue from beneath the cuticle formed satisfactory inocula. Spore isolations from spores obtained from pycnidia on diseased wood were also generally successful.

Association of "Dieback" in Pinus at Beerwah with Lemon Trees.

The Pinus trees affected in the plantation appeared to be in most cases arranged in groups with an odd individual tree scattered about the infected area. The majority of the infected trees were situated on areas which had previously been farmed. On these areas a number of lemon trees in a very unthrifty state were still present as remnants of the cultivated crops. All the living lemon trees were stag headed with only a few green shoots coming up from the base and many were completely dead. In most cases there were one or more citrus trees close

to each group of pine trees affected with dieback, and in the case of the first discovery of this particular *Diplodia* dieback in pine trees, the tree affected was situated close against the south-western side of a large, dead lemon tree. Examination of the dead wood of the lemon tree showed it to be severely affected with a fungus which produced carbonaceous pycnidia; these proved to be the pycnidia of *Diplodia natalensis,* the fungus agreeing in every way with the description of the

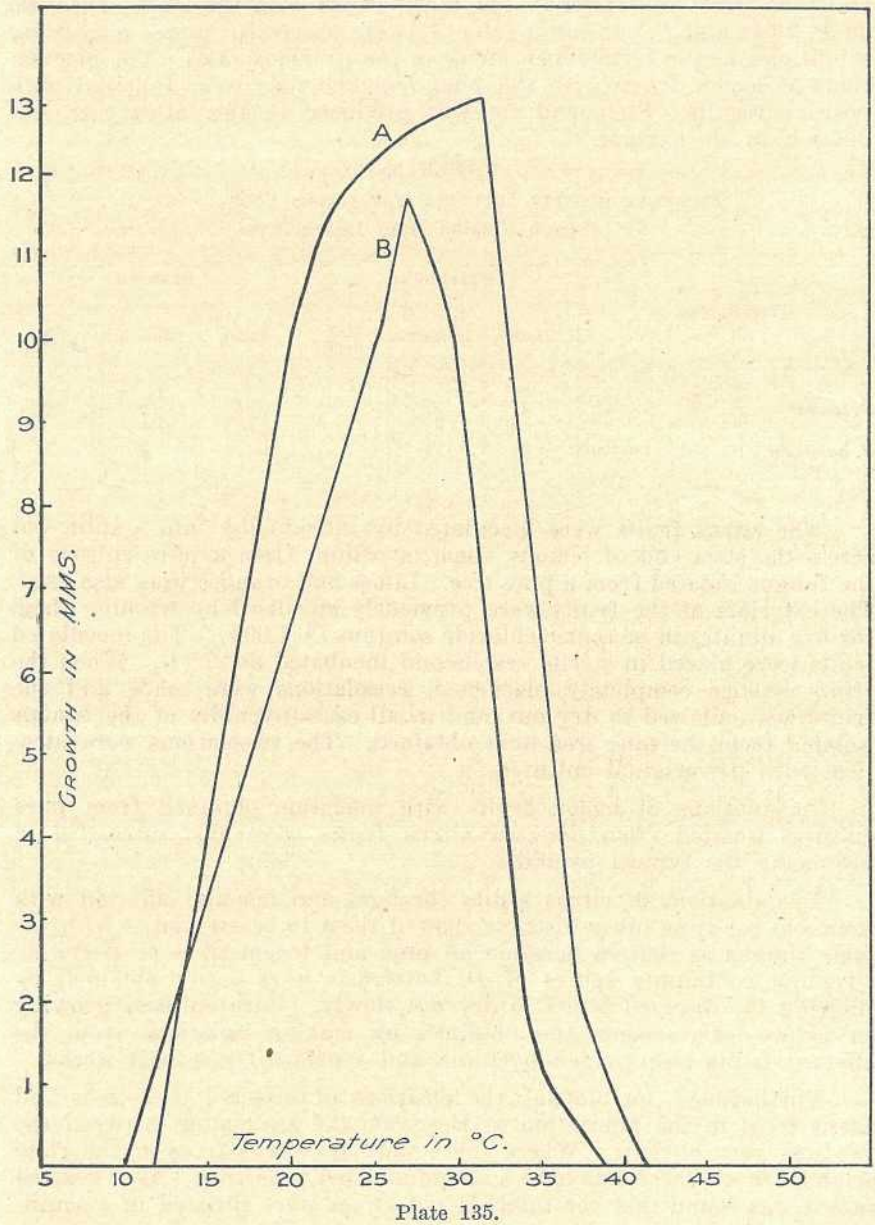

Plate 135.

Growth-temperature curves for the two species of Diplodia. A.—*Diplodia natalensis* Pole-Evans. B.—*Diplodia pinea* Desm. Kickx.

species except that a proportion of the spores were somewhat constricted at the septa. This fungus is common in Queensland, causing stem end rot of various citrus fruits. Isolations proved that the fungus was morphologically identical with that on the pine trees.

It was then thought that the citrus trees might be acting as a permanent source of infection for the pine trees, and inoculations were carried out with isolations of the *Diplodia* obtained from the lemon trees and pine trees respectively. The inoculations with the lemon *Diplodia* on *P. tæda* and *P. caribæa* (Table 3) were successful under glasshouse conditions, less so in the open air as in the previous cases. The inoculations of lemon fruits with the pine *Diplodia* also were followed with positive results. Stem end rot was produced in the latter case and dieback in the former.

TABLE 3.

INOCULATION WITH DIPLODIA NATALENSIS POLE-EVANS.

(Strain isolated from Lemon Tree.)

Tree Species.	GLASSHOUSE.			OPEN AIR.		
	Dead.	Dieback.	Unaffected.	Dead.	Dieback.	Unaffected.
P. taeda	4	..	..	1	..	1
P. caribaea	3	1	..	..	1	1

The citrus fruits were inoculated by introducing into a split, cut across the stem end of lemons, some mycelium from a pure culture of the fungus isolated from a pine tree. Limes and oranges were also used. The exteriors of the fruits were previously sterilised by washing them for five minutes in mercuric chloride solution (1:1,000). The inoculated fruits were placed in sterile vessels and incubated at 27° C. When the fruits became completely blackened, reisolations were made and the fruits were allowed to dry out, and in all cases pycnidia of the fungus isolated from the pine tree were obtained. The reisolations were identical with the original cultures.

Inoculations of lemon fruits with inoculum obtained from pure cultures isolated from diseased citrus fruits were also successful in producing the typical pycnidia.

Examinations of citrus fruits (oranges and lemons) affected with stem end rot from other districts showed them to be associated with the same fungus as that in question on pine and lemon trees at Beerwah. Pycnidia containing spores of *D. natalensis* were easily obtained by allowing the diseased fruits to dry out slowly. Pure cultures growing on potato-dextrose-agar and obtained by making isolations from the affected fruits also yielded pycnidia and spores after several weeks.

Furthermore, on plotting the positions of infected pine trees and citrus trees in the plantation at Beerwah, the association between the two was very obvious. Where there were no citrus trees in the close neighbourhood there was only a single affected pine tree. As a general rule it was found that the infected pine trees were situated in a south-westerly direction from the position of the citrus trees, and, the prevailing summer winds being from the north-east, the association was linked

up further, the direction in which the spores would be expected to be carried by air drifts being south-west. In very few cases were pine trees suffering from dieback situated on the windward side of the citrus trees.

On account of all these considerations it was decided that the citrus trees were acting as a source of infection for *Diplodia* dieback of *Pinus taeda* and *Pinus caribæa* at Beerwah, the *Diplodia* in question being *Diplodia natalensis* Pole-Evans.

Weather Conditions Associated with the Incidence of "Dieback," as Caused by Diplodia natalensis.

A number of days prior to the time when the effects of the dieback were first noticed the weather had been very humid, and during the month in which the greatest damage was done, namely, October, 1934, weather data were as follows:—

Mean maximum temperature 28·0° C.

Mean minimum temperature 13·0° C.

	7.30 a.m.	11.30 a.m.	12.30 a.m.	4.30 p.m.
	Per cent.	Per cent.	Per cent.	Per cent.
Mean Relative Humidity ..	76·6	65·1	65·3	65·0

Rainfall .. .. .. 268 points

Rain fell on fourteen days of the thirty-one, and the sky was generally overcast for the whole period.

On referring to the temperature relations curve for *Diplodia natalensis* (Plate 135) it will be seen that the mean maximum temperature is very close to the optimum, and the whole range was in that in which the fungus grows actively.

The overcast sky, the rainfall, and humidity, together with the temperature, should have provided suitable growing conditions for the fungus and account for the rapid onset of the disease and its vigorous development on affected trees.

Control Measures Adopted.

In order to check any further spread of the disease it was considered advisable that all infected wood should be destroyed before spores were developed and distributed. Accordingly, all dead and dying wood on living trees was pruned back into healthy wood and all the prunings burned. All trees which were considered to be past the stage at which pruning might be of value in saving the tree, such as dead and dying trees, were cut off below ground level and removed and burned.

A close watch was then instituted and each case of dieback appearing was treated on its merits as above described. In the meantime, all the citrus trees and stumps in the plantation were removed below ground level, and any living butts left in the ground were poisoned to prevent suckering.

Only isolated trees suffering from the complaint were found during the remainder of the summer and none through the winter, save an odd specimen or two which had obviously been missed in the summer patrols. A close watch is henceforth to be kept on the plantations during the danger season.

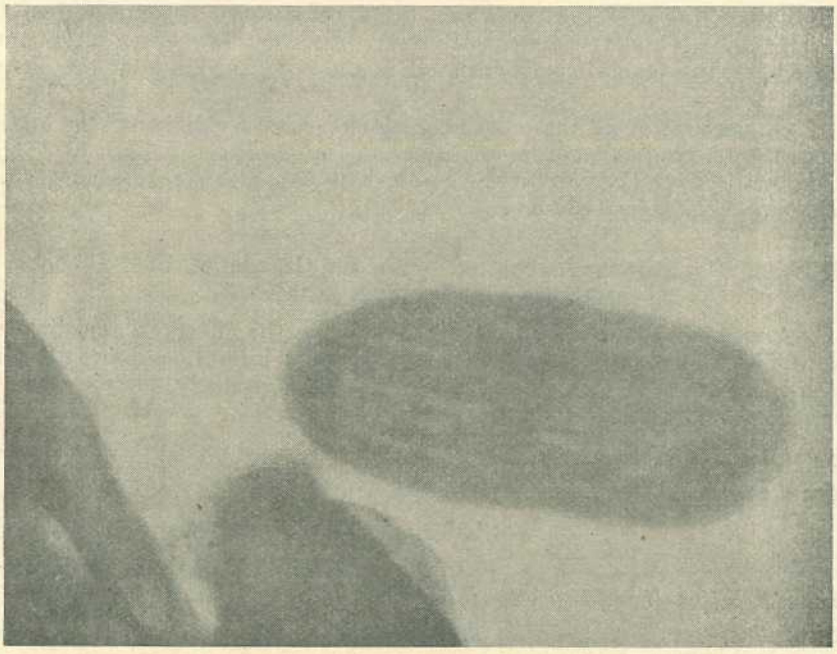

Plate 136.

Microphotograph of exosporium of spore of *Diplodia natalensis* showing striations. "Daylite" filter, exposure 20 seconds, oil immersion objective. x 1700. Verichrome film pack.

DIFFERENCES EVIDENCED BY DIPLODIA DIEBACK AS CAUSED BY D. PINEA AND D. NATALENSIS.

Diplodia pinea.	Diplodia natalensis.
Species of conifer susceptible— *P. radiata, P. pinaster, P. patula, P. longifolia, P. taeda, P. coulteri, P. caribaea, P. insularis, P. canariensis, Cupressus sempervirens.*	Species of Conifer susceptible— *P. taeda, P. caribaea.*
Speed of Development in the host— Usually slowly but in one case within three weeks.	Speed of Development in the host— Usually with rapidity taking approximately six weeks.
Distribution—General.	Distribution—Confined to Beerwah.
Association with trees not conifers— Not associated.	Association with trees not conifers— Common on citrus and other trees.
Temperature relations— Minimum 10° C. Optimum 27° C. Maximum 39° C.	Temperature relations— Minimum 12° C. Optimum 31.5° C. Maximum 41° C.
Spore measurements— 33-45 microns x 11-18 microns.	Spore measurements— 20-29 microns x 13-15 microns.
Spore markings— Exosporium plain (Figure 5).	Spore markings— Exosporium striate (Figure 6).

Botryodiplodia Theobromæ Pat.

The only other diplodia-like fungus which has as yet been recorded as a coniferous parasite in Queensland is *Botryodiplodia theobromæ* Pat. This was isolated by R. B. Morwood from the seed of Hoop Pine (*Araucaria cunninghamii*) which had failed to germinate on the seedbeds, and was also found on hoop pine seedlings which had apparently been killed by the fungus. The first record was from a forest nursery in the Kilkivan district. It has also been recorded on rotted seed from the forest nursery at Imbil.

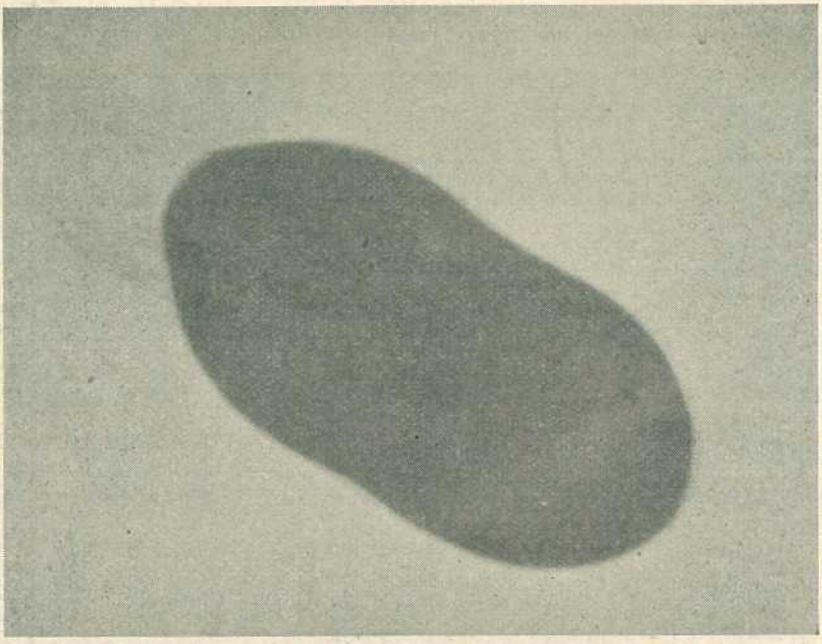

Plate 137.

Microphotograph of spore of *Diplodia pinea* showing absence of markings. "Daylite" filter, exposure 20 seconds, oil immersion objective. x 1700. Verichrome film pack.

The fungus was kindly identified by S. F. Ashby, and may be described as follows:—Perithecia black, 200 microns in diameter, sometimes villous, stromata villous, spores 27-34 x 14-16 microns, hyaline and unilocular with thick walls, then becoming uniseptate and brown, basidia hyaline 50 microns long. It is a very widely distributed saprophyte and semi-parasite on a wide range of host plants especially within the tropics, and may occur as a wound parasite on citrus, banana, and other fruits.

Inoculations on to lemon fruits with pure cultures of the fungus produced a stem end rot similar to that caused by *Diplodia natalensis*. The pycnidia are readily produced on the lemon fruits when old and also on potato-dextrose-agar after some weeks. The cultural characteristics are similar to *Diplodia natalensis*.

The fungus has not yet proved to be of any great importance in Queensland forestry practice.

Reactions of Hoop Pine (Araucaria Cunninghamii) to Diplodia Pinus, D. Natalensis, and Botrodiplodia theobromæ.

Owing to the importance of hoop pine as a timber tree in softwood plantations in Queensland it was thought that the susceptibility of this species to the three fungi under discussion should be tested. In the case of *D. pinea* and *D. natalensis* inoculations of hoop pine seedlings were carried out at the same time and in the same manner as were the *Pinus* inoculations. Six trees were inoculated with each fungus, and in all cases the trees proved to be unsusceptible to attack by these pathogens. Small seedlings of hoop pine, 2 inches high, were inoculated with a culture of *Botryodiplodia theobromæ,* the seeds being planted in seed-boxes and the plants inoculated in situ. In this instance, the plants were killed by the fungus, the injury taking the form of damping off.

Plate 138.

Microphotograph showing spores of *Diplodia natalensis,* K3 filter, exposure 5 seconds. x 400.

Summary.

A brief historical account of the occurrence of *Diplodia* dieback in Queensland forestry areas is given and the two species of *Diplodia* noted in association with the trouble. The species are identified as *Diplodia pinea* Desm. Kickx. and *Diplodia natalensis* Pole-Evans.

The pathogenicity of these fungi is established by inoculation studies, and both are determined as being causes of dieback.

The appearance of the disease as caused by each of the pathogens is described, and a list of the species attacked by each fungus is given.

The fungi are discussed individually, and a description of each of the two species, noting their morphological and cultural characteristics, together with their temperature relationships, is given. The weather conditions prevailing at the time of heavy attacks are included.

Insect associations with dieback caused by *D. pinea* are discussed in relation to *Chermes* sp.

The association of dieback of *Pinus tæda* and *P. caribæa* with diseased citrus trees is noted and reasons for concluding that the citrus trees were acting as a source of infection advanced.

The control measures adopted are outlined for both species.

A summary of the differences between the two diseases is given.

The occurrence of *Botryodiplodia theobromæ* on hoop pine seed and seedlings is noted as causing a rot of the former and death of the latter. Inoculations of lemon fruits with the fungus are described, and its characteristics, cultural and otherwise, are briefly noted.

The reactions of hoop pine (*Araucaria cunninghamii*), an important forest tree in Queensland, to inoculations with *Diplodia pinea, D. natalensis,* and *Botryodiplodia theobromæ,* are noted.

Thanks are due to Mr. I. W. Helmsing for the co-operation received in the preparation of the microphotographs.

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Studies on the Biology and Control of the Large Roundworm of Fowls, Ascaridia galli (Schrank 1788) Freeborn 1923.

F. H. S. ROBERTS, D.Sc., Animal Health Station, Yeerongpilly.

[*Continued from p.* 191, *August*, 1936.]

PART III.

4. THE PATHOGENICITY OF INFESTATION WITH ASCARIDIA GALLI.

I. Previous Investigations.

OUR present knowledge of the pathogenicity of *A. galli* is due largely to controlled studies by Herrick and Ackert. Herrick[63] reported that the first visible effects of an infestation in chicks one month old are denoted by loss of appetite accompanied by drooping wings, ruffled feathers, weakness and decreased activity. Death may occur as early as the ninth or tenth day. Significant differences in gains in weight were observed between infested and control chicks, especially during the first two weeks. Infested chicks may eventually throw off most of their worms and recover to a great extent, if not entirely.

Guberlet[58] found that a single dose of 750 eggs to chicks one month old may have serious effects, causing droopiness and death on the ninth to tenth day. Heavy infestations were noted to be fatal as early as the eighth day. These effects were considered by Guberlet to be due to intestinal irritation and a toxæmia.

Ackert,[7] summarising the results of his investigations, showed that chicks two to seven weeks old to which doses of 1,000 to 2,000 eggs had been given may lose their appetite within ten days. By the twelfth day the birds may be visibly affected, with a depressed, humped-up appearance, ruffled feathers, and drooping wings. The invasion of the intestinal wall by the larvæ causes conspicuous hæmorrhages, and the larvæ destroy the intestinal glands. From the twelfth to the seventeenth day there is little gain in weight by infested birds, and many birds may lose weight. During this period mortalities may be serious. The appetite of the birds that survive may thereafter be voracious, and recovery may be rapid. As a result of infestation, the thymus gland is greatly reduced in size, and the blood may lose a significant portion of its sugar. There is marked retardation of muscular and osteological development, accompanied by excessive deposition of urates in the ureters. These effects are considered by Ackert to be due to injury to the intestinal wall by the larvæ, to loss of blood from intestinal hæmorrhage, to bacterial infection, to partial starvation through loss of appetite, and to the absorption of metabolic wastes.

Itagaki[67] reported that in Tokyo, Japan, the larvæ cause the formation of nodules in the intestinal wall, but makes no other comment upon the pathogenicity of Ascaridia.

Baker[26] had noted that in experimentally produced cases of ascaridiasis, there is a marked distension of the blood vessels of the parenchymatous organs and a noticeable enlargement of the heart. He has also observed that in chickens that survive the acute stages of infestation there is an increased tendency to the formation of neoplasms.

As regards the effect of the adult worms upon the host, various workers have drawn attention to the emaciation and anæmia which may accompany an infestation. Intestinal impaction has been frequently reported, associated in some cases with a rupture of the intestinal wall.

Ackert[1] has recorded an observation regarding the number of worms chickens may tolerate, and notes that thirty or more worms may visibly affect, and in some cases be fatal to grown birds. Von Mocsy[76], from observations on poultry farms in Germany, reported that as few as four to five adult worms may be fatal to young chickens, and fifteen to twenty worms to young hens.

It is generally conceded that this roundworm may also have a marked effect upon egg production, though, as far as the writer can determine, there is no experimental evidence which confirms this view. Ackert and Herrick[6] found that chickens given several doses of eggs, sufficiently great to produce marked symptoms of infestation, may eventually recover and that no effects of the infestation on egg production may be visible several months later, when the birds become mature.

Other observations on the effect of *A. galli* upon egg production have been made by comparing production before and after the employment of an anthelmintic. These trials have been carried out under field conditions, and the birds have been infested with other helminths as well as *A. galli*. The information secured by these means has been very difficult to interpret, as it has been shown that an anthelmintic itself may have a depressing action upon producing birds, and that such birds may become reinfested shortly after treatment. In some treatment trials carried out by Thomas,[100] however, there were indications that there may be little correlation between the degree of infestation and egg production, as three of the best layers in the flock under observation passed seventy-seven, sixty-four, and thirty-seven worms, respectively, after treatment.

Much has been written regarding the association of leg paralysis with *A. galli* infestation, and in one case reported by Rover (Cram[43]) the paresis completely cleared up when this roundworm was removed by treatment. This type of leg paralysis, which is due to extreme leg weakness, is not to be confused with neurolymphomatosis gallinarum, which disease is now considered to be unassociated with parasite infestation, though in some quarters the opinion is held that the presence of *A. galli* and other helminths may assist in the production of the disease.

II. Observations Recorded in these Investigations.

In the following experiments the pathogenicity of *A. galli* was studied under conditions involving—

(i.) A single dose of varying numbers of infectious eggs.

(ii.) Continuous infestation, in which chickens were fed a number of eggs per day.

(i.) Observations from Experiments in which a Single Dose of Eggs was Employed.

(*a*) *Birds Employed for Life Cycle Studies.*

The observations recorded here were made on chickens given single doses of 50 to 2,000 eggs at thirty days old, and on three further birds given 10,000 to 15,000 eggs at forty-three days old. (See Table VII.)

Doses of 50 *and* 100 *Eggs.*—No visible symptoms were manifested by any of the chickens to which these doses of eggs had been administered.

Dose of 500 *Eggs.*—The five birds given this dose of eggs remained bright and normal up to the period of autopsy, except that the combs became pale in colour and there was slight evidence of intestinal hæmorrhage during the third week after infestation.

Dose of 1,000 *Eggs.*—Chickens Nos. 10, 12, 14, and 16 were each fed 1,000 eggs and autopsied after twelve, thirteen, fifteen, and seventeen days, respectively. With the exception of No. 16, all birds showed some evidence of infestation. From about the twelfth to sixteenth day the fæces was diarrheal in consistency and streaked with blood. The birds were depressed and not very active, with decreased appetite. No. 14 was most affected, and at the time of autopsy was humped up in appearance, with ruffled feathers and drooping wings. In all four birds the combs were pale.

Dose of 2,000 *eggs.*—The three birds given 2,000 eggs and examined within three days of infestation (Nos. 2, 3, and 4) were not affected to any noticeable degree. When the period of infestation was extended to six and ten days, especially with the longer period, however, the infested birds showed diarrhœa, decreased activity, and an impaired appetite.

Doses of 10,000 *to* 15,000 *Eggs.*—Three chickens forty-three days old were given a single dose of 10,000, 10,000, and 15,000 eggs, respectively. As early as three days after infestation these birds were considerably depressed, humped-up, with ruffled feathers, drooping wings, pale combs and legs, inactive, and with a conspicuously impaired appetite and abnormal thirst. The next few days were marked by a rapidly increasing weakness and diarrhœa, the birds remaining squatting or lying, and showing a disinclination to move when disturbed. By about the eleventh day all birds had become extremely emaciated, and were voiding blood-streaked fæces. Birds Nos. 11 and 13, fed 10,000 and 15,000 eggs, respectively, died on the twelfth and thirteenth day, but No. 15, given 10,000 eggs, was still alive on the sixteenth day when it was autopsied.

(*b*) *Group Studies.*

These experiments were undertaken in order to check up the observations regarding pathogenicity made during the life cycle studies, and also to ascertain, if possible, the pathogenic effects of the various stages in the life cycle by allowing the infestation to extend over a longer period.

In the first series of experiments three groups of chickens thirty days old, each of five birds, were given a single dose of 100, 500, and 1,000 eggs, respectively. When planning the experiment it was found that a suitable uninfested control group could be secured for Group III. only (1,000 eggs). It was therefore decided to select all birds of even weight for Group I. (100 eggs) and Group II. (500 eggs), so that each of these two groups, by being equal not only in the initial mean weights, but also in the weight of each individual bird, could act as controls one to the other. Throughout, all groups were weighed weekly, and, as accommodation was not available for individual birds, they were housed in the respective groups of five.

Group I.—This group was fed a single dose of 100 *eggs at thirty days old.*

Symptoms as might be associated with the feeding of this number of eggs were observed in this group only towards the latter part of the sixty-three-day period that the birds were kept under observation. Commencing from about the fifth week there was, in general, particularly in chickens Nos. 38 and 40, a distinct loss of colour in the combs and legs and of brightness in the plumage.

GRAPH No. 1.

(A)—ACTUAL MEAN WEEKLY BODY WEIGHTS.

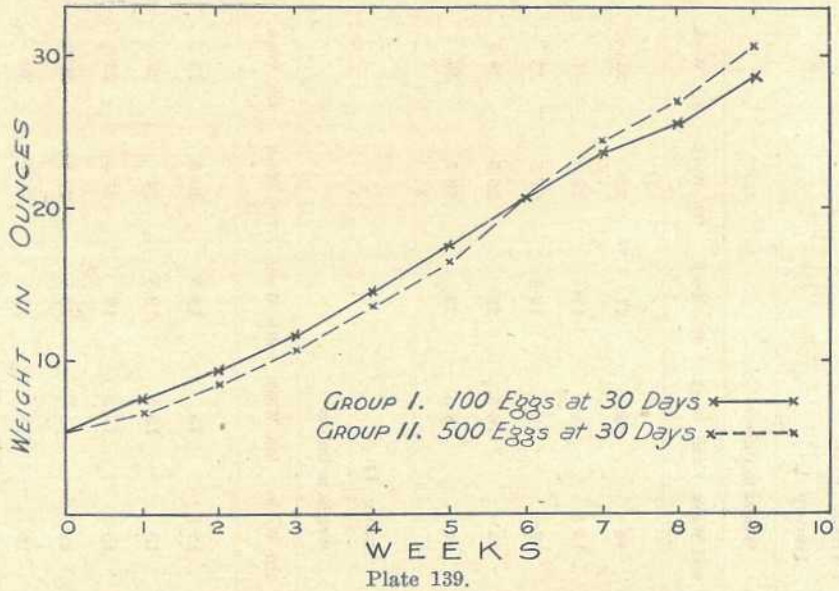

Plate 139.

(B)—DIFFERENCES BETWEEN MEAN WEEKLY GAINS IN WEIGHT OF GROUPS I. AND II.

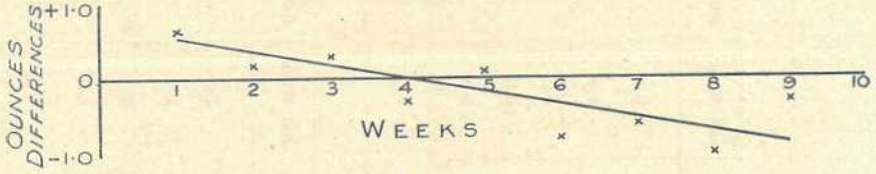

Plate 140.

$y = 0{\cdot}6 - 0{\cdot}16\,x.$

$y = 0$ when $x = 3{\cdot}7$.

b significant.

(i.e.) downward slope.

Group II.—This group was fed a single dose of 500 *eggs at thirty days old.*

The effects of this infestation were first observed towards the end of the second week. At this time and during the third week the combs were pale, the plumage somewhat dull, and the droppings gave evidence of a slight degree of intestinal hæmorrhage. Thereafter all birds recovered to a great extent, but towards the sixth week Nos. 43 and 45 again became slightly unthrifty in appearance. As with Group I., the period of infestation was sixty-three days.

TABLE VIII.

GROUP I.

No. of Bird.	Weight in Ounces.										No. Worms at Autopsy.
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	7th. Week.	8th. Week.	9th. Week.	
38	5·25	7·5	9·5	11·5	16	19·5	21	22	23	23·5	36
39	5·25	7	8·5	11	14·5	15·5	19·5	22·5	24	28·5	5
40	5·25	6·5	8	11	13·5	16	18·5	21·5	23	25·5	32
41	5·25	7·5	10·5	12·5	15	16·5	22	25·5	28·5	32·5	15
42	5·25	7·5	9·5	12·5	14	18·5	23	26·5	29	34	24

GROUP II.

No. of Bird.	Weight in Ounces.										No. Worms at Autopsy.
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	7th. Week.	8th. Week.	9th. Week.	
43	5·25	6	7·5	9·5	12·5	15	18·5	20·5	23·5	26	34
44	5·25	6·5	8	10·5	13	15·5	19·5	24	27·5	33	..
45	5·25	6·5	9	12	15·5	17·5	19	21·5	23·5	25·5	29
46	5·25	7	8·5	10	12	15·5	23·5	27·5	30·5	34	17
47	5·25	7	9	11	16	18	23	27	30	34·5	11

In Table VIII. are set out the weekly weights in ounces of each bird in each group, together with their analyses and the number of worms occurring in each bird on autopsy.

TABLE VIII.—*continued.*
ANALYSIS OF GROUPS I. AND II.

	Weight in Ounces.				
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.
Mean weekly weights, Group I.	5·25	7·2	9·2	11·7	14·6
Mean weekly weights, Group II.	5·25	6·6	8·4	10·6	13·8
Mean gain in weight per week, Group I.	..	1·90 ± 0·20	2·00 ± 0·27	2·50 ± 0·22	2·90 ± 0·51
Mean gain in weight per week, Group II.	..	1·30 ± 0·19	1·80 ± 0·20	2·20 ± 0·26	3·20 ± 1·02
Differences between mean gains per week of Groups I. and II. ..	..	+0·60	+ 0·20	+ 0·30	− 0·30
Significance of difference	..	N.S.	N.S.	N.S.	N.S.

	Weight in Ounces.				
	5th. Week.	6th. Week.	7th. Week.	8th. Week.	9th. Week.
Mean weekly weights, Group I.	17·2	20·8	23·6	25·5	28·8
Mean weekly weights, Group II.	16·3	20·7	24·1	27	30·6
Mean gain in weight per week, Group I.	2·60 ± 0·64	3·60 ± 0·72	2·80 ± 0·47	1·90 ± 0·37	3·30 ± 0·82
Mean gain in weight per week, Group II.	2·50 ± 0·28	4·40 ± 1·07	3·40 ± 0·49	2·90 ± 0·25	3·60 ± 0·75
Differences between mean gains per week of Groups I. and II. ..	+ 0·10	− 0·80	− 0·60	− 1·00	− 0·30
Significance of difference	N.S.	N.S.	N.S.	N.S.	N.S.

Throughout these tables—N.S. = non significant ($P > \cdot05$). A.S. = approaching significance ($\cdot01 < P < \cdot05$). S. = significant ($P < \cdot01$).

A preliminary interpretation of these weights was made by comparing the actual mean weekly body weights of each group (Graph No. 1 (A). The plotted points show that during the first few weeks after infestation the heavier infestation (500 eggs) was apparently responsible for the smaller mean weekly weights of Group II. The differences between the mean weekly weights of the two groups showed thereafter a gradual decrease, until at about the end of the sixth week the difference approached zero, and thereafter favoured Group II.

An analysis of the mean weekly gains in weight of the two groups shows that up till the end of the third week the group given 100 eggs gained more than the group given 500 eggs, but thereafter, except for the difference at the end of the fifth week, the mean weekly gains were greater in the group given the greater number of eggs.

When the differences between the amounts of mean weekly gain in weight of the two groups are plotted (Graph No. 1 (B)), the points are best fitted by a straight line which crosses the axis and has a downward trend which is statistically significant. This line crosses the axis during the fourth week after infestation. That is, at this point Group II. overtook Group I. in amount of mean weekly gain, and thereafter its gains were greater. As Group I. contained more worms than Group II. at autopsy (see Table VIII.), it would appear that from this point the heavier infestation of Group I. was responsible for influencing this group's weekly gains to this extent. It is interesting to note that at the point where Group II. overtook Group I. in amount of weekly gain, that is, during the fourth week after infestation, the worms were approaching maturity.

It may therefore be considered that for the first four weeks after infestation a single dose of 500 eggs is more pathogenic than a single dose of 100 eggs. Thereafter the effects are correlated with the number of well-grown worms surviving, being more conspicuous in the case of the heavier infestation.

GRAPH No. 2.

(A)—ACTUAL MEAN WEEKLY BODY WEIGHTS.

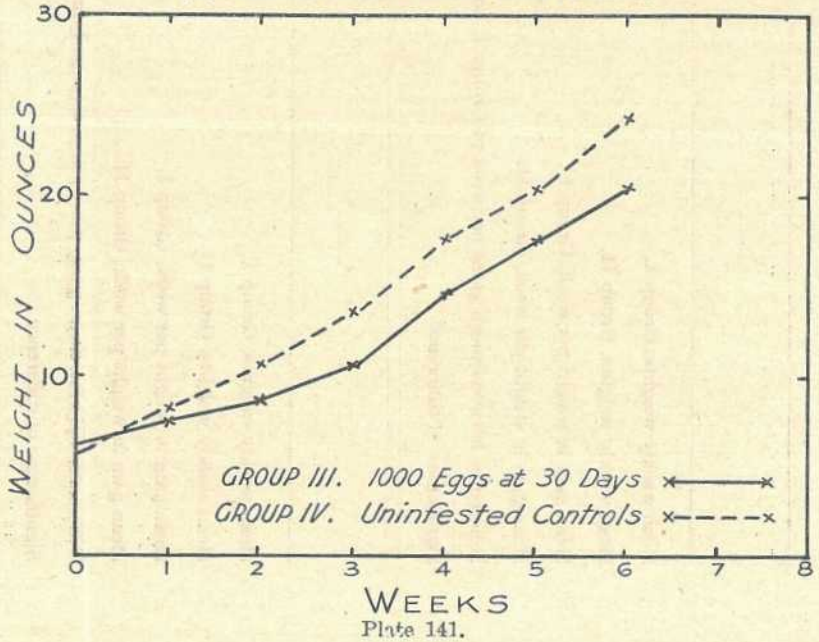

Plate 141.

(B)—DIFFERENCES BETWEEN MEAN WEEKLY GAINS IN WEIGHT OF GROUPS III. AND IV.

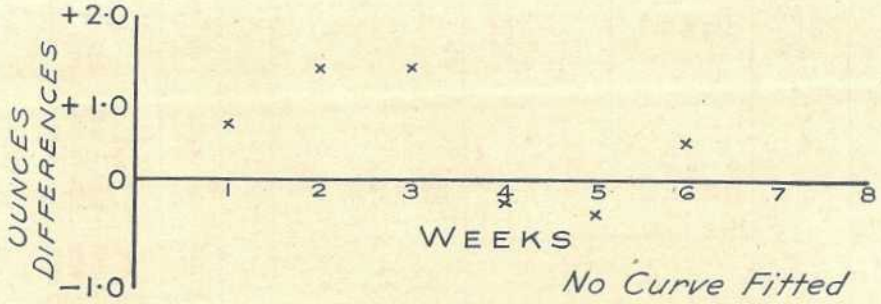

Plate 142.

Group III.—This group was fed a single dose of 1,000 *eggs at thirty days old.*

At the end of the first week all birds were somewhat depressed, and in some of the birds the droppings were diarrheal in consistency. From the twelfth to the seventeenth day the droppings were tinged with blood and the birds showed loss of appetite and activity, with pale combs and dull plumage. Chicken No. 50 was most affected, with drooping wings and ruffled feathers. By the end of the fourth week all birds had recovered to a great extent, and except for pale combs and dull plumage showed no other evidence of infestation.

The weekly weights of this group and of the uninfested control group, Group IV., are compared in Table IX., in which is also given the number of worms found at autopsy in each bird of Group III.

A consideration of the actual mean weekly body weights of Group III., and of its control, Group IV. (Graph No. 2 (A)) shows that up till the end of the third week the mean weekly weights of the uninfested group gradually drew away from those of the infested group. After the third week, however, the graph indicates that the infested birds recovered to some extent, so that thereafter the plotted points for the two groups follow a somewhat parallel course, the mean weekly weights of the control group being always the greater.

An analysis of the differences between the mean gains in weight per week of each group shows that up till the end of the third week the gains were greater in the controls. Then followed a short period of two weeks in which the infested birds gained in weight to the greater extent. The fact that the amount of gain during the sixth week again favoured the controls may possibly be due to the number of well-grown worms in the infested group adversely influencing its gain.

When these differences in amount of mean weekly gain of the two groups were plotted no mathematical curve could be fitted to the data supplied, as no definite turning point or point of zero difference could be determined (Graph No. 2 (B)). The fact that one difference is statistically significant, namely, 1·40 oz. at the third weighing, shows, however, that the fall of the graph to below zero has a definite downward trend.

TABLE IX.

GROUP III.

No. of Bird.	Weight in Ounces.							No. Worms at Autopsy.
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	
48	6·75	8·5	9	11	15	18·5	22·5	14
49	6·25	8·5	9·5	11·5	16	20·5	25	31
50	6	7·5	9	11·5	16·5	18	20·5	26
51	5·75	6·5	7·5	9·5	11·5	14	16·5	43
52	5·75	7	9·5	10	14	17·5	22	5

GROUP IV. (CONTROLS).

No. of Bird.	Weight in Ounces.							No. Worms at Autopsy.
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	
53	6·5	7	9	12·5	16·5	18·5	22·5	..
54	6	8·5	13	16	20·5	24·5	28	..
55	6	8·5	11·5	14·5	18	20	25	..
56	5·5	8	9·5	13	16·5	20	24·5	..
57	5·5	8	10·5	13·5	16·5	18·5	21·5	..

ANALYSIS OF GROUPS III. AND IV.

	Weight in Ounces.						
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.
Mean weekly weights, Group III.	6·1	7·6	8·9	10·7	14·6	17·7	21·3
Mean weekly weights, Group IV.	5·9	8	10·7	13·9	17·6	20·3	24·3
Mean gain in weight per week, Group III.	..	$1·50 \pm 0·25$	$1·30 \pm 0·39$	$1·80 \pm 0·39$	$3·90 \pm 0·51$	$3·10 \pm 0·51$	$3·60 \pm 0·46$
Mean gain in weight per week, Group IV.	..	$2·10 \pm 0·40$	$2·70 \pm 0·52$	$3·20 \pm 0·12$	$3·70 \pm 0·26$	$2·70 \pm 0·44$	$4·00 \pm 0·36$
Differences between mean gains per week of Groups III. and IV.	..	$+ 0·60$	$+ 1·40$	$+ 1·40$	$- 0·20$	$- 0·40$	$+ 0·40$
Significance of difference	..	N.S.	N.S.	S.	N.S.	N.S.	N.S.

The interpretation given this analysis indicates that the birds in Group III. were affected during the first three weeks. Thereafter followed a period of recovery, but the upward trend of the graph during the sixth week shows that Group III. were once more affected, probably on this occasion by the infestation of well-grown worms.

GRAPH No. 3.

(A)—ACTUAL MEAN WEEKLY BODY WEIGHTS.

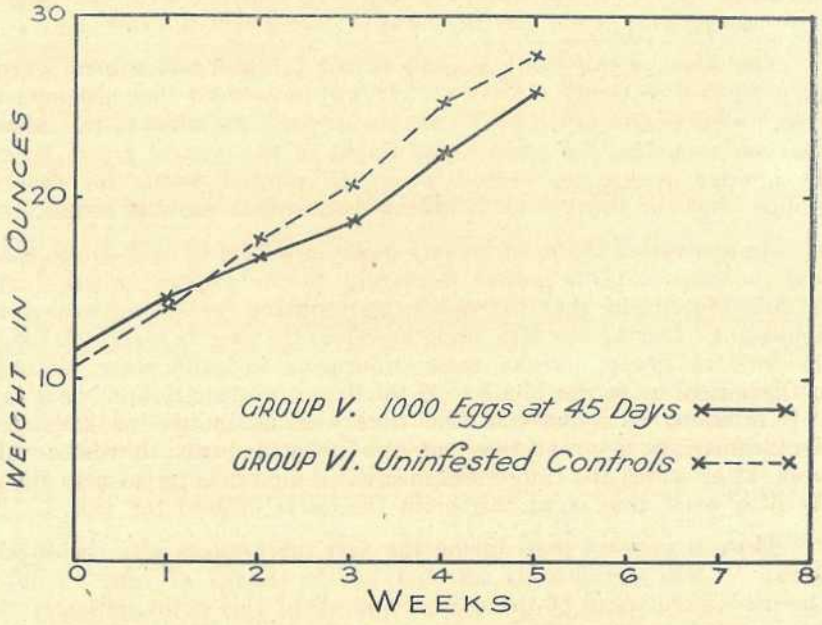

Plate 143.

(B)—DIFFERENCES BETWEEN MEAN WEEKLY GAINS IN WEIGHT OF GROUPS V. AND VI.

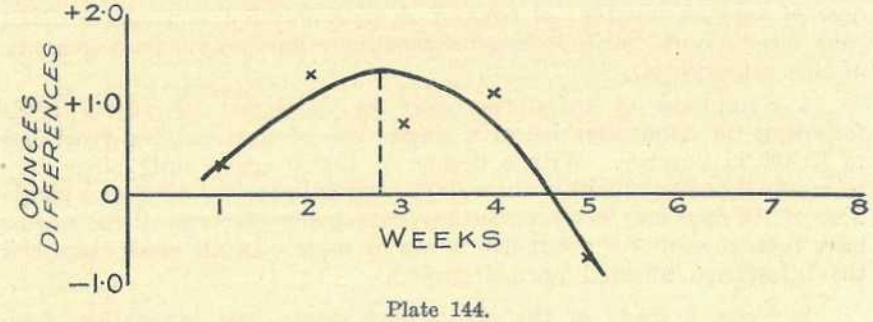

Plate 144.

$y = -1{\cdot}38 + 2{\cdot}02 \times -0{\cdot}37\ x^2$.

Turning-point when $x = 2{\cdot}7$.

$y = 0$ when $x = 4{\cdot}6$.

b and c approaching significance.

(i.e.) both upward and downward trends.

Group V.—This group was fed a single dose of 1,000 *eggs at forty-five days old.*

The final experiment in this series was to determine the effect of a single dose of 1,000 eggs upon chickens forty-five days old.

The symptoms exhibited by this group and their sequence did not differ to any marked extent from those exhibited by Group III., though in general they were not so marked. The weekly weights of Group V. and those of its control group, Group VI., together with the number of worms present at autopsy in Group V. are given in Table X.

The mean weekly body weights of the infested and control groups are compared in Graph No. 3 (A). It will be noticed that although the mean initial weight of Group V. was the greater, the effect of the infestation was such that the mean body weight of the control group became the heavier during the second week, the plotted points for the two groups after the third week following a somewhat parallel course.

An analysis of the mean weekly gains in weight of each group shows that the control birds gained in weight to the greater extent during the first four weeks, the difference in gain during the second week being significant. During the fifth week, however, the gain in weight favoured the infested group. When these differences in gains were plotted a mathematical curve was found to fit the data supplied (Graph No. 3 (B)). This fitted curve shows that the weekly gains by the controls drew significantly away from those of the infested birds until the third week, after which the differences decreased significantly to zero during the fifth week, that is, at this point the curve crossed the axis.

Thus, it appears that during the first three weeks after infestation Group V. was significantly affected by the dosage of eggs employed. The downward trend of the curve from about this point indicates that the infested birds were recovering, until at the fifth weighing their amount of weekly gain exceeded that of the controls.

Discussion.

The data secured from the above experiments in which a single dose of varying numbers of eggs of *A. galli* was fed to young birds is considered to yield the following information regarding the pathogenicity of this roundworm.

1. Symptoms of infestation may be displayed by young birds following the administration of a single dose of eggs varying from 100 to 15,000 in number. With a dosage of 15,000 eggs young birds may be markedly affected within three days after infestation, whereas a single dose of 100 eggs may not produce any pathogenic effects until the worms have been present for about five weeks or more. In all cases examined the infestation affected normal growth.

2. From a study of the effects of a single dose infestation upon body weight, as interpreted by an analysis of the amounts of mean weekly gain in weight of infested and control birds, and correlated with the manifestations of clinical symptoms of infestation, the effects of an infestation may, it is considered, be divided into three distinct stages:—

TABLE X.

GROUP V.

No. of Bird.	Weight in Ounces.						No. Worms at Autopsy.
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	
58	13·5	17	19	21·5	24·5	28	..
59	11·5	14·5	16·5	19	22·5	26·5	20
60	11	13	16	18·5	20	21·5	94
61	11	14·5	17·5	18·5	22	26·5	14
62	10·5	13	15·5	17	21·5	26	24

GROUP VI. (CONTROLS).

No. of Bird.	Weight in Ounces.						No. Worms at Autopsy.
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	
56	9·5	13	16·5	20	24·5	28	..
63	11·5	14·5	18	20·5	25	27	..
55	11·5	14·5	18	20	25	27·5	..
64	13	16	20·5	24·5	28	31·5	..
65	9	12·5	16·5	18·5	22·5	25·5	..

ANALYSIS OF GROUPS V. AND VI.

	Weight in Ounces.					
	At Infestation.	1st. Week.	2nd Week.	3rd Week.	4th Week.	5th Week.
Mean weekly weights ,Group V.	11·5	14·4	16·9	18·9	22·1	25·7
Mean weekly weights, Group VI.	10·9	14·1	17·9	20·7	25	27·9
Mean gain in weight per week, Group V.	..	$2·90 \pm 0·29$	$2·50 \pm 0·23$	$2·00 \pm 0·32$	$3·20 \pm 0·50$	$3·60 \pm 0·56$
Mean gain in weight per week, Group VI.	..	$3·20 \pm 0·12$	$3·80 \pm 0·20$	$2·80 \pm 0·42$	$4·30 \pm 0·28$	$2·90 \pm 0·29$
Differences between mean gains in weight per week, Groups V. and VI.	..	+ 0·30	+ 1·30	+ 0·80	+ 1·10	−0·70
Significance of difference	..	N.S.	S.	N.S.	N.S.	N.S.

(*a*) During the first three weeks after infestation the pathogenic effects may be very marked. These effects may be in evidence during the first week, but become more pronounced during the second and third weeks. During this three-weekly period there may be a significant difference between the amount of gain by infested and control birds. A consideration of the life history shows that the pathogenicity of *A. galli* during the first week after infestation must be due solely to the presence of the larvæ, and that the more marked effects during the second and third weeks are associated with the period when the larvæ attack the intestinal tissues (tenth to nineteenth day).

(*b*) Following the return of the larvæ to the lumen of the intestine, and providing the infestation is not too severe, there is a short period of recovery when infested birds may gain in weight to a greater extent than uninfested controls.

(*c*) Finally, there is a period which in young birds may commence as early as the fourth week, when the surviving larvæ, by this time mature, or almost so, and if sufficiently numerous, may be responsible for a further adverse effect upon body weight, infested birds during this period again failing to equal the gains in weight by the controls.

Throughout this investigation an attempt was made to ascertain the number of adult worms which could be tolerated by young and grown birds. In so far as the above experiments are concerned it is unfortunate that the periods of infestation were not of sufficient duration to yield any accurate information on this point. Such information would have been extremely valuable in so far as it would have been secured under controlled conditions. An attempt to secure some information by considering a regression of the gains in weight by the individual birds from the fourth week, that is, from about the period when the worms were approaching maturity, to the end of the respective trials, on the number of worms present, indicated that in young birds two to three months old twenty-five or more worms may affect growth. From the graphs secured it also appeared that in some cases smaller numbers of worms than this may possibly stimulate growth.

An interpretation of the results given by an examination of some hundreds of young and old naturally infested birds was even more difficult, as in these naturally infested cases it was practically impossible to eliminate other factors which may have contributed to the abnormal appearance of the birds under consideration. Two-months-old birds have been seen with worm burdens of twenty to thirty worms without any marked effects of the infestation, and, on the other hand, this number of worms appeared responsible for emaciation and anæmia in birds as old as six months. It may be said, however, that in young birds two to four months old about twenty to thirty worms, and at six months of age thirty to forty worms, respectively, may be harmful.

In laying hens on an adequate diet fifty or more worms may be harmful. The number of worms adult birds can tolerate without manifesting any conspicuous evidence of infestation is, however, in some

cases, astounding. Worm burdens of up to 150 large and many small worms have been observed in individual birds without the body weight or the appearance of the bird being affected to any marked degree.

Further discussion on the effect of *A. galli* on adult birds will be found in the section, "Control of *Ascaridia galli*."

(ii.) Observations from Experiments in which Continuous Doses of Eggs were Employed.

This series of experiments was undertaken in order to determine the effects of infestation under conditions involving the continuous administration of eggs, thereby approaching the conditions of hyper-infestation existent in the field.

Three groups, each of five birds, were employed, and each group was given a number of eggs per day, commencing at the ages of thirty days, fifty-eight days, and seventy-nine days, respectively. Each of these three groups was controlled by an uninfested group of five birds of similar age.

As in the experiments in which a single dose of eggs was administered, the weights of all birds were taken weekly, and in the following tables are expressed in ounces.

GRAPH No. 4.

(A)—Actual Mean Weekly Body Weights.

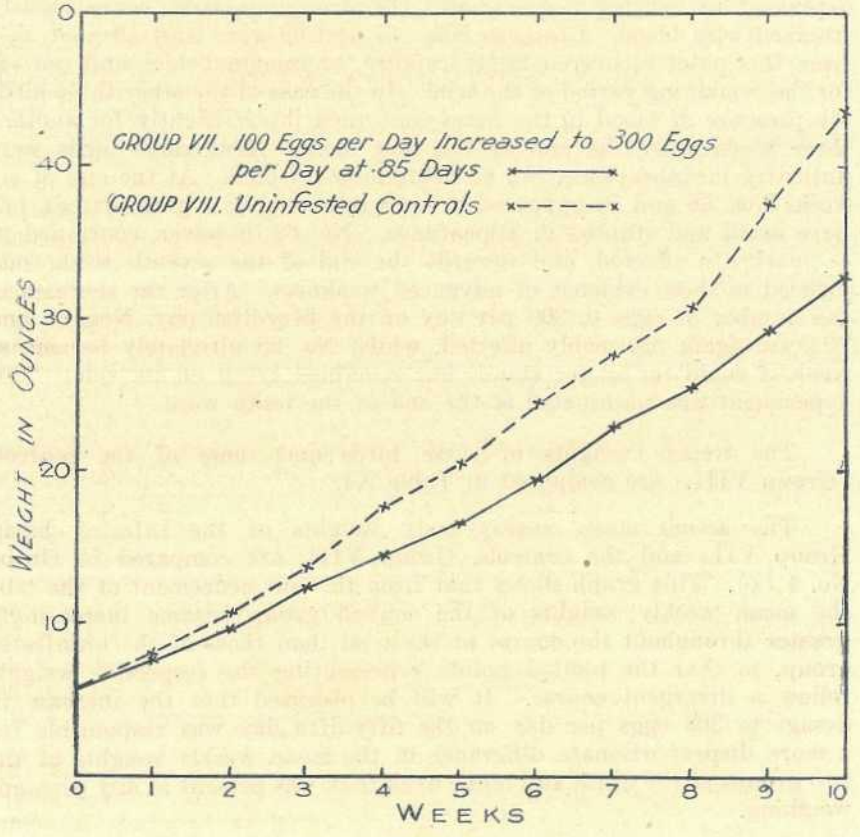

Plate 145.

(B)—DIFFERENCES BETWEEN MEAN WEEKLY GAINS IN WEIGHT OF GROUPS VII. AND VIII.

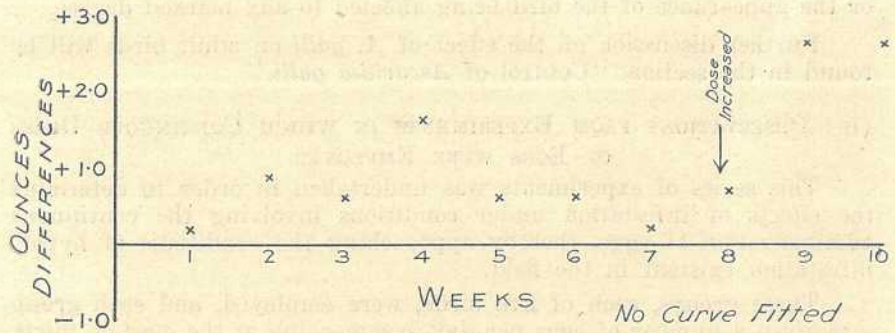

Plate 146.

Group VII.—This group was given 100 *eggs per day from the age of thirty days, the dose being increased to* 300 *eggs per day from the age of eighty-five days.*

Sixteen days after the administration of the first dose of eggs the droppings were diarrheal in consistency, and showed evidence of intestinal hæmorrhage. By the twenty-second day all birds were depressed to varying degrees, and the droppings were conspicuously streaked with blood. Chickens Nos. 67 and 69 were least affected, and from this point recovered fairly rapidly, to remain bright and normal for the remaining period of the trial. In the case of the other three birds the presence of blood in the fæces continued intermittently for another three weeks. By the end of the first month these three birds were unthrifty in appearance, No. 68 being most affected. At the end of six weeks Nos. 66 and 70 appeared to have recovered to a great extent, but were small and stunted in appearance. No. 68, however, continued to be markedly affected, and towards the end of the seventh week commenced to show evidence of advanced weakness. After the increase in the number of eggs to 300 per day on the fifty-fifth day, Nos. 66 and 70 were again noticeably affected, whilst No. 68 ultimately became so weak it could no longer stand, but remained lying on its side. This experiment was terminated at the end of the tenth week.

The weekly weights of these birds and those of the controls (Group VIII.) are compared in Table XI.

The actual mean weekly body weights of the infested birds, Group VII., and the controls, Group VIII. are compared in Graph No. 4 (A). This graph shows that from the commencement of the trial the mean weekly weights of the control group became increasingly greater throughout the course of the trial than those of the uninfested group, so that the plotted points representing the respective weights follow a divergent course. It will be observed that the increase in dosage to 300 eggs per day on the fifty-fifth day was responsible for a more disproportionate difference in the mean weekly weights of the two groups at the ninth and tenth week than was present at any previous weighing.

TABLE XI.

GROUP VII.

No. of Bird.	Weight in Ounces.										
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	7th. Week.	8th. Week.	9th. Week.	10th. Week.
66	6	6·5	8·5	13	14·5	15·5	20	23	23	25·5	28·5
67	6·75	8·5	10·5	13·5	16·5	20·5	23	26·5	30	35·5	42·5
68	5·75	7·5	8	9	10·5	11·5	13·5	18	21·5	22	21
69	5·75	9	11	14·5	17	20·5	26	30	32·5	39	45
70	5·25	7·5	10	11	13	14	16·5	17·5	20	23·5	26·5

GROUP VIII. (CONTROLS).

No. of Bird.	Weight in Ounces.										
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	7th. Week.	8th. Week.	9th. Week.	10th. Week.
65	6·5	7	9	12·5	16·5	18·5	22·5	25·5	28·5	33·5	40
64	6	8·5	13	16	20·5	24·5	28	31·5	36	42·5	50·5
55	6	8·5	11·5	14·5	18	20	25	27·5	30	37	42
56	5·5	8	9·5	13	16·5	20	24·5	28	31	37·5	43·5
71	5·5	8	10·5	13·5	16·5	18·5	21·5	26	28·5	35	41

TABLE XI—*continued.*
ANALYSIS OF GROUPS VII AND VIII.

	Weight in Ounces.					
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.
Mean weekly body weights, Group VII.	5·9	7·8	9·6	12·2	14·3	16·4
Mean weekly weights, Group VIII.	5·9	8	10·7	13·9	17·6	20·3
Mean gain per week, Group VII.	..	1·90 ± 0·45	1·80 ± 0·34	2·60 ± 0·70	2·10 ± 0·29	2·10 ± 0·68
Mean gain per week, Group VIII.	..	2·10 ± 0·40	2·70 ± 0·52	3·20 ± 0·12	3·70 ± 0·26	2·70 ± 0·44
Differences between mean gains per week of Groups VII. and VIII.	..	+ 0·20	+ 0·90	+ 0·60	+ 1·60	+ 0·60
Significance of difference	..	N.S.	N.S.	N.S.	S.	N.S.

	Weight in Ounces.				
	6th. Week.	7th. Week.	8th. Week.	9th. Week.	10th Week.
Mean weekly body weights, Group VII.	19·8	23	25·4	29·1	32·8
Mean weekly weights, Group VIII.	24·3	27·7	30·8	37·1	43·4
Mean gain per week, Group VII.	3·40 ± 0·68	3·20 ± 0·61	2·40 ± 0·64	3·70 ± 0·96	3·70 ± 0·92
Mean gain per week, Group VIII.	4·00 ± 0·36	3·40 ± 0·33	3·10 ± 0·37	6·30 ± 0·34	6·30 ± 0·49
Differences between mean gains per week of Groups VII. and VIII.	+ 0·60	+ 0·20	+ 0·70	+ 2·60	+ 2·60
Significance of difference	N.S.	N.S.	N.S.	A.S.	A.S.

An analysis of the differences between the mean weekly gains in weight of the two groups shows that throughout the whole period of the experiment the gain was always greater in the control group, a significant difference occurring at the fourth weighing. Following the increase in the number of eggs per day to 300, the differences in gain during the ninth and tenth weeks were sufficiently great to be regarded as approaching significance. Over the whole period of the experiment the infested birds gained an average of 26·90 $\pm$ 4·02 oz., and the controls an average of 37.50 $\pm$ 1.87 oz., the difference, namely 10.60 oz., approaching significance.

No mathematical curve could be found which fitted the points representing the differences in amount of mean weekly gain between the two groups (Graph No. 4 (B)). Up to the time of the increase in dose there is a general upward and downward trend, indicating possibly that the infested birds were at first affected and then recovered to some extent. After the seventh week the curve again rises, showing that the birds were again affected, this time, possibly, by the increase in the daily dose on the fifty-fifth day. The general trend of the curve, however, cannot be accurately analysed, as no negative differences were recorded.

GRAPH No. 5.
(A)—ACTUAL MEAN WEEKLY BODY WEIGHTS.

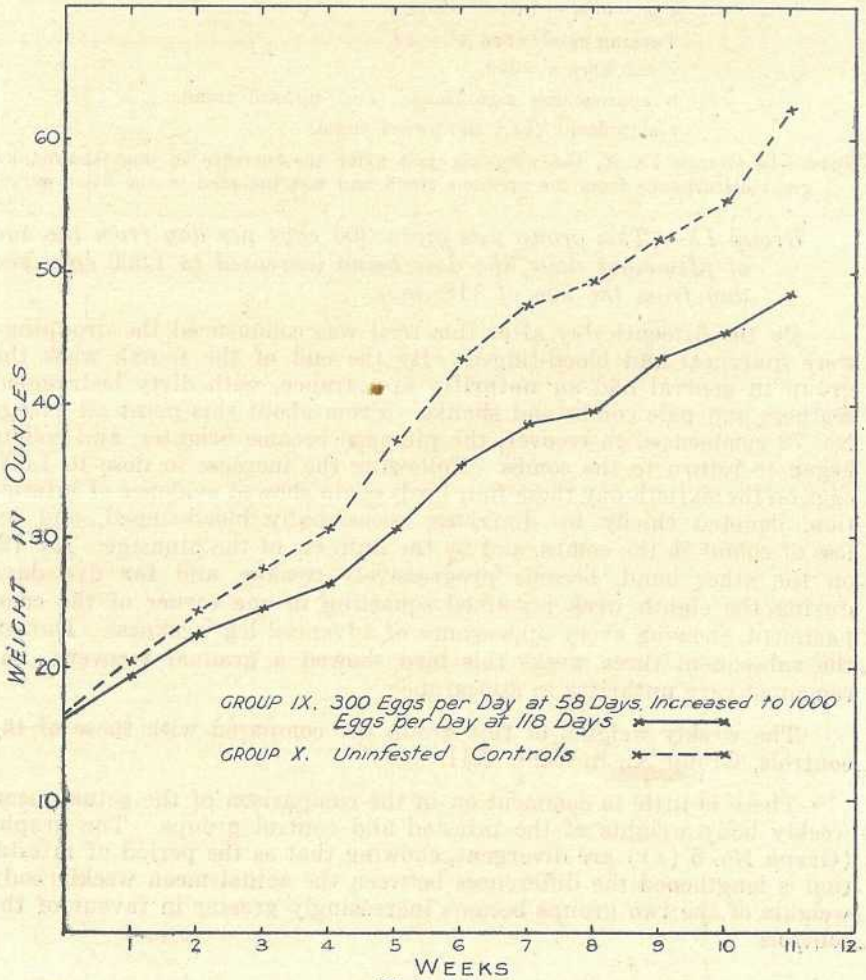

Plate 147.

(B)—DIFFERENCES BETWEEN MEAN WEEKLY GAINS IN WEIGHT OF GROUPS IX. AND X.

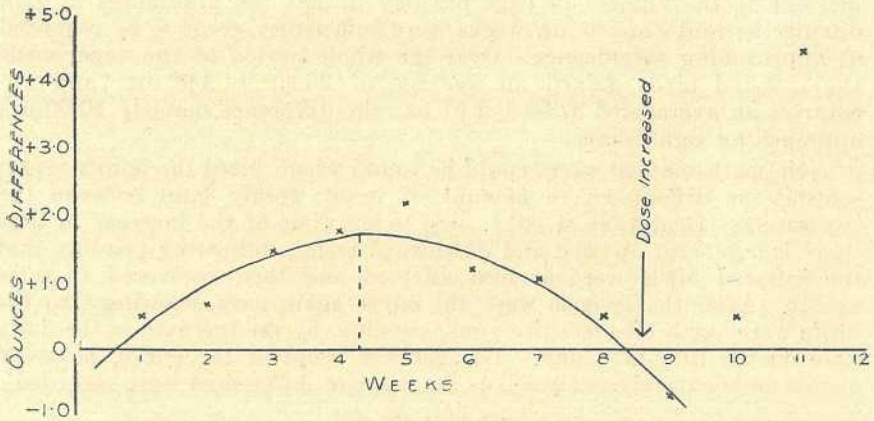

Plate 148.

$y = -0{\cdot}66 + 1{\cdot}09 \times -0{\cdot}12\,x^2$.

Turning-point when $x = 4{\cdot}2$.

$y = 0$ when $x = 8{\cdot}3$.

b approaching significance (i.e.) upward trend.

c significant (i.e.) downward trend.

NOTE.—In Groups IX.-X. the weighing just after the increase in dose showed no great disturbance from the previous trend and was included in the fitted curve.

Group IX.—This group was given 300 *eggs per day from the age of fifty-eight days, the dose being increased to* 1,000 *eggs per day from the age of* 118 *days.*

By the fifteenth day after this trial was commenced the droppings were diarrheal and blood-tinged. By the end of the fourth week the group in general had an unthrifty appearance, with dirty bedraggled feathers and pale combs and shanks. From about this point all except No. 72 commenced to recover, the plumage became brighter, and colour began to return to the combs. Following the increase in dose to 1,000 eggs on the sixtieth day these four birds again showed evidence of infestation, denoted chiefly by diarrhœa, occasionally blood-tinged, and by loss of colour in the combs, and by the dullness of the plumage. No. 72, on the other hand, became progressively weaker, and for five days during the eighth week remained squatting in one corner of the compartment, showing every appearance of advanced leg weakness. During the subsequent three weeks this bird showed a gradual recovery, but remained very unthrifty in appearance.

The weekly weights of this group are compared with those of the controls, Group X., in Table XII.

There is little to comment on in the comparison of the actual mean weekly body weights of the infested and control groups. The graphs (Graph No. 5 (A)) are divergent, showing that as the period of infestation is lengthened the differences between the actual mean weekly body weights of the two groups become increasingly greater in favour of the controls.

TABLE XII.

Group IX.

No. of Bird.	Weight in Ounces.											
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	7th. Week.	8th. Week.	9th. Week.	10th. Week.	11th. Week.
72	17·5	20·5	23·5	22	20·5	24	27	28	27·5	30	32	34·5
73	17·5	20	23·5	27	28	33·5	38	43	44·5	48	52·5	54
74	18	20·5	25	28	31·5	36·5	41·5	45·5	48	51·5	56	58·5
75	17·5	19	22·5	25·5	27·5	31	36·5	39·5	40	44·5	46·5	48·5
76	16·5	18	20	21·5	23	26	33·5	36	38	42	42	45·5

Group X. (Controls).

No. of Bird.	Weight in Ounces.											
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	7th. Week.	8th. Week.	9th. Week.	10th. Week.	11th. Week.
65	16·5	18·5	22·5	25·5	28·5	33·5	40	44·5	47·5	51	54	60·5
55	18	20	25	27·5	30	37	42	46·5	48·5	52·5	57·5	62
71	16·5	18·5	21·5	26	28·5	35	41	46·5	46·5	50	52	59
56	16·5	20	24·5	28	31	37·5	43·5	48	50·5	52·5	56	64·5
64	20·5	24·5	28	31·5	36	42·5	50·5	52·5	54	55·5	57·5	65·5

TABLE XII.—*continued.*

ANALYSIS OF GROUPS IX. AND X.

	Weight in Ounces.					
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.
Mean weekly weights, Group IX.	17·4	19·6	22·9	24·8	26·1	30·2
Mean weekly weights, Group X.	17·6	20·3	24·3	27·7	30·8	37·1
Mean gain in weight per week, Group IX.	..	2·20 ± 0·30	3·30 ± 0·42	1·90 ± 0·92	1·30 ± 0·82	4·10 ± 0·49
Mean gain in weight per week, Group X.	..	2·70 ± 0·44	4·00 ± 0·36	3·40 ± 0·33	3·10 ± 0·37	6·30 ± 0·34
Differences between mean weekly gains of Groups IX. and X.	..	+ 0·50	+ 0·70	+ 1·50	+ 1·80	+ 2·20
Significance of difference	..	N.S.	N.S.	N.S.	N.S.	S.

	Weight in Ounces.					
	6th. Week.	7th. Week.	8th. Week.	9th. Week.	10th. Week.	11th. Week.
Mean weekly weights, Group IX.	35·3	38·4	39·6	43·2	45·8	48·2
Mean weekly weights, Group X.	43·4	47·6	49·4	52·3	55·4	62·3
Mean gain in weight per week, Group IX. ..	5·10 ± 0·73	3·10 ± 0·68	1·20 ± 0·54	3·60 ± 0·33	2·60 ± 0·86	2·40 ± 0·33
Mean gain in weight per week, Group X. ..	6·30 ± 0·49	4·20 ± 0·59	1·80 ± 0·52	2·90 ± 0·49	3·10 ± 0·56	6·90 ± 0·70
Differences between mean weekly gains of Groups IX. and X.	+ 1·20	+ 1·10	+ 0·60	− 0·70	+ 0·50	+ 4·50
Significance of difference	N.S.	N.S.	N.S.	N.S.	N.S.	S.

The differences in amount of mean weekly gain also increased in favour of the controls to a significant difference of 2·20 oz. at the end of the fifth week. Thereafter, up to the increase in dosage on the sixtieth day, these differences show a gradual decrease until, during the ninth week, the gain by the infested birds is greater than that by the controls. Following the increase in dosage, the effect on Group IX. was apparently such that during the eleventh week the mean gain in weight by this group was significantly less (by 4·50 oz.) than that of the controls. Up to the time of the increase in dosage, the total mean gain by the controls was 8·90 oz. greater than that of the infested birds, which difference is approaching significance; the total subsequent mean gain was 5.00 oz. greater, and the total mean gain over the whole trial 13·90 oz. greater, both these differences being significant.

GRAPH No. 6.

(A)—ACTUAL MEAN WEEKLY BODY WEIGHTS.

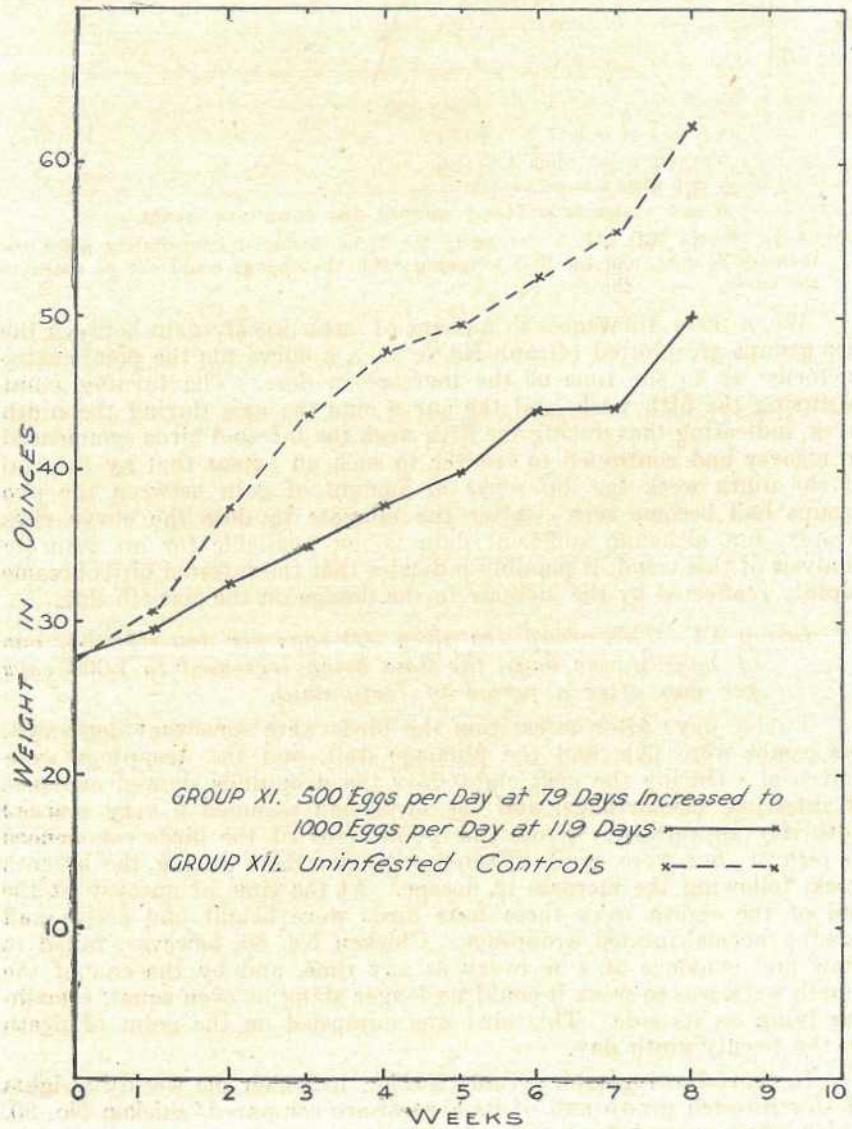

Plate 149.

(B)—DIFFERENCES BETWEEN MEAN WEEKLY GAINS IN WEIGHT OF GROUPS XI. AND XII.

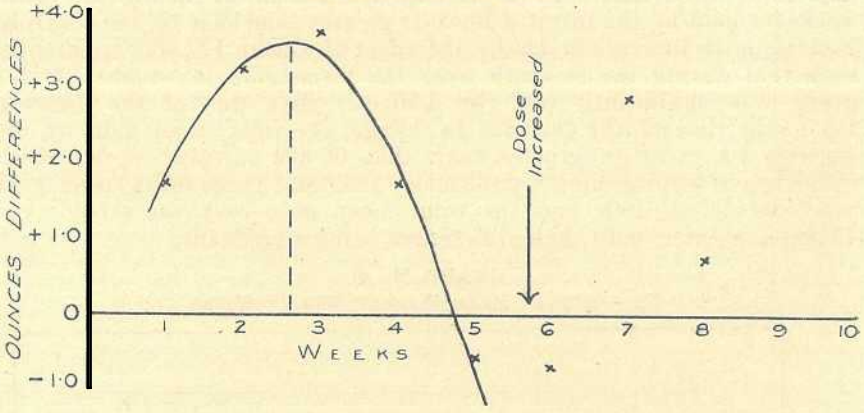

Plate 150.

$y = -1{\cdot}34 + 3{\cdot}77 \times -0{\cdot}73\,x^2$.

Turning-point when $x = 2{\cdot}6$.

$y = 0$ when $x = 4{\cdot}7$.

b and c significant (i.e.) upward and downward trends.

NOTE.—In Groups XI.-XII. a change in the trend occurred immediately after the increase in dose, and the first weighing after the change could not be fitted to the curve.

When these differences in amount of mean weekly gain between the two groups are plotted (Graph No. 5 (B)), a curve fits the points satisfactorily up to the time of the increase in dose. The turning point is during the fifth week, and the curve cuts the axis during the ninth week, indicating that during the fifth week the infested birds commenced to recover and continued to recover to such an extent that by the end of the ninth week the difference in amount of gain between the two groups had become zero. After the increase in dose the curve rises steeply, but although sufficient data is not available for an accurate analysis of this trend, it possibly indicates that the infested birds became rapidly reaffected by the increase in the dosage on the sixtieth day.

Group XI.—This group was given 500 *eggs per day from the age of seventy-nine days, the dose being increased to* 1,000 *eggs per day after a period of forty days.*

Twelve days after infestation the birds were somewhat depressed, the combs were pale and the plumage dull, and the droppings were diarrheal. During the next eight days the droppings showed evidence of intestinal hæmorrhage, and the birds had assumed a very marked unthrifty appearance. From this point, four of the birds commenced to recover, but were again affected with diarrhœa during the seventh week, following the increase in dosage. At the time of autopsy at the end of the eighth week these four birds were bright and active and passing normal-formed droppings. Chicken No. 80, however, failed to show any evidence of a recovery at any time, and by the end of the fourth week was so weak it could no longer stand or even squat, remaining lying on its side. This bird was autopsied on the point of death on the twenty-ninth day.

In the following table (Table XIII.), in which the weekly weights of this infested group and of its control are compared, chicken No. 80, which was removed from the infested group on the twenty-ninth day, is omitted.

TABLE XIII.

GROUP XI.

No. of Bird.	Weight in Ounces.								
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	7th. Week.	8th. Week.
77	31·5	32·5	35	36·5	37·5	39·5	42·5	41	48·5
78	25·5	27·5	30·5	33·5	37	40·5	43·5	45	50·5
79	28·5	29·5	32·5	36	39·5	42·5	46·5	47·5	54·5
80	29·5	32	35	36·5	33	..	..	..	..
81	26	27·5	31·5	34	36	37	41·5	41·5	46·5

GROUP XII. (CONTROLS).

No. of Bird.	Weight in Ounces.								
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.	5th. Week.	6th. Week.	7th. Week.	8th. Week.
65	25·5	28·5	33·5	40	44·5	47·5	51	54	60·5
55	27·5	30	37	42	46·5	48·5	52·5	57·5	62
71	26	28·5	35	41	46·5	46·5	50	52	59
56	28	31	37·5	43·5	48	50·5	52·5	56	64·5
64	31·5	36	42·5	50·5	52·5	54	55·5	57·5	65·5

TABLE XIII.—*continued.*
ANALYSIS OF GROUPS XI. AND XII.

No. of Bird.	Weight in Ounces.				
	At Infestation.	1st. Week.	2nd. Week.	3rd. Week.	4th. Week.
Mean weekly weights, Group XI.*	27·9	29·3	32·4	35·0	37·5
Mean weekly weights, Group XII.	27·7	30·8	37·1	43·4	47·6
Mean gain per week, Group XI.*	..	1·40 ± 0·24	3·10 ± 0·32	2·60 ± 0·44	2·50 ± 0·75
Mean gain per week, Group XII.	..	3·10 ± 0·37	6·30 ± 0·34	6·30 ± 0·50	4·20 ± 0·59
Differences between mean weekly gains of Groups XI. and XII.	..	+ 1·70	+ 3·20	+ 3·70	+ 1·70
Significance of difference	..	S.	S.	S.	N.S.

	Weight in Ounces.			
	5th. Week.	6th. Week.	7th. Week.	8th. Week.
Mean weekly weights, Group XI.*	39·9	43·5	43·8	50
Mean weekly weights, Group XII.	49·4	52·3	55·4	62·3
Mean gain per week, Group XI.*	2·40 ± 0·68	3·60 ± 0·46	0·30 ± 0·81	6·20 ± 0·81
Mean gain per week, Group XII.	1·80 ± 0·52	2·90 ± 0·49	3·10 ± 0·56	6·90 ± 0·70
Differences between mean weekly gains of Groups XI. and XII.	− 0·60	− 0·70	+ 2·80	+ 0·70
Significance of difference	N.S.	N.S.	S.	N.S.

* One bird (No. 80) which died early in the experiment was omitted.

The actual mean weekly body weights of the infected and control groups are compared in Graph No. 6 (A). This graph shows that the actual mean weekly weights of Group XI. were markedly affected by the infestation. The plotted points are strongly divergent for the first four weeks, but during the next two weeks become slightly convergent. The effect of the increase in dosage to 1,000 eggs on the fortieth day is readily seen by the appearance of the graph during the seventh week.

A consideration of the differences in the amounts of the mean weekly gains in weight of the two groups shows increasing and significant differences in favour of the controls during the first three weeks. During the fifth and sixth weeks, however, the mean gain in weight by the controls is overtaken by that of the infested birds. The increase in dosage on the fortieth day, then, apparently affected Group XI. to such an extent that during the seventh and eighth weeks the controls gained in weight to the greater amount, the difference at the end of the seventh week being significant. An analysis of the amounts of the total mean gain of each group up to the time of the dose increase on the fortieth day, subsequent to the dose increase, and over the whole period of the trial, respectively, shows that over these respective periods the controls had gained 9·0 oz., 3·6 oz., and 12·5 oz. more than the infested birds, all of which differences are significant.

When these differences in amounts of mean weekly gains are plotted, a curve can be satisfactorily fitted up to the last weighing before the dose increase (Graph No. 6 (B)). The turning point occurs during the third week, indicating that during this week the infested birds began to recover, so that towards the end of the fifth week, when the curve cuts the axis, the differences in amount of mean weekly gain between the two groups becomes zero. Subsequent to the increase in dose during the sixth week, the rapid rise and fall of the curve possibly indicates that the increase in dose was responsible for the birds becoming rapidly affected again and just as rapidly recovering, but not sufficient points were available for an accurate analysis of this trend.

Discussion.

The interpretation given to the results obtained from exposing these three groups of birds to a continuous infestation shows that whilst the infestation employed affected body weight and induced conspicuous symptoms of ascaridiasis in all three groups, it was also responsible for the development of a resistance which enabled the groups to recover to varying extents. It is felt that had the number of eggs given per day been considerably reduced, the development of this resistance would have been sufficiently delayed to give more accurate information regarding the behaviour of birds under natural conditions of hyper-infestation. The symptoms manifested did not differ in any way from those observed in birds subjected to a single infestation, except they were generally not so acute.

III. Clinical Symptoms and Lesions Associated with Infestation.

From the above studies on the pathogenicity of infestation with *A. galli*, assisted by observations on naturally infested birds, the clinical symptoms and lesions associated with infestation may be summarised as follows:—

Clinical Symptoms.

In young birds marked symptoms of infestation may be visible within the first week after coming into contact with infested soil. There is firstly an impaired appetite, and the birds show decreased activity and an abnormal thirst. Diarrhœa, paleness in the comb, loss of colour in the legs and of brightness in the plumage are evident. The feathers become ruffled, the wings droop, and the bird assumes a hunched-up, drowsy appearance (Plate 151.) As a consequence, growth is arrested.

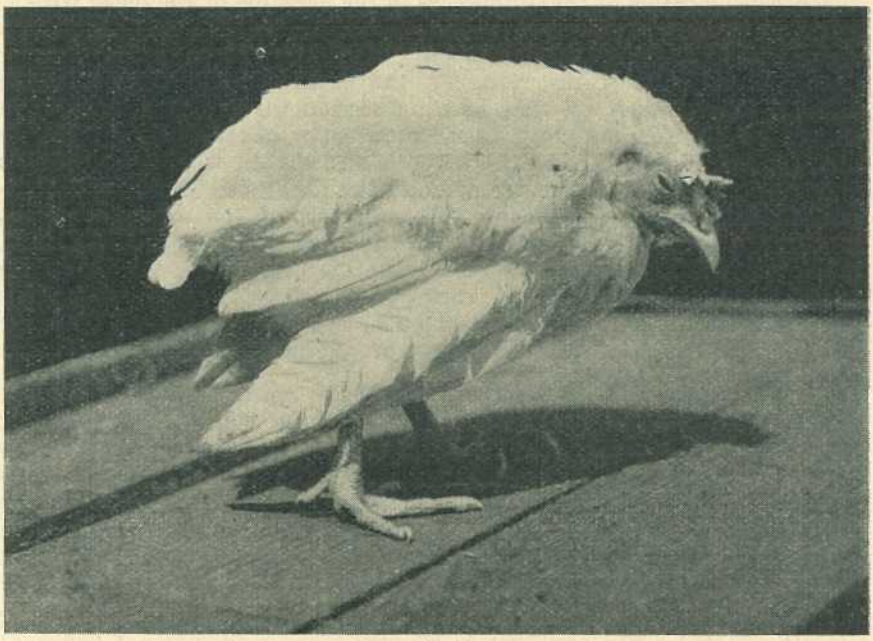

Plate 151.

Young Bird, experimentally Infested with *Ascaridia galli*; Six days after Infestation.

During subsequent periods, the droppings continue to be diarrheal in consistency, and may show evidence of intestinal hæmorrhage. In those birds that recover some may show a voracious appetite and a rapid growth; others, however, may fail to grow to a normal extent, and remain stunted. If, however, the infestation is too severe to permit a recovery, the birds become progressively anæmic and emaciated. There is a gradual loss of strength, which may be eventually manifested by a conspicuous leg weakness, such birds walking with a staggering gait when disturbed, and eventually remaining prostrated till death intervenes, which may occur as early as during the second week after infestation.

In older birds a heavy infestation may be denoted by paleness of the comb and shanks, dull plumage, increased food consumption, and a decrease in egg production. Eventually, the birds become markedly anæmic and emaciated, and in some cases the weakness accompanying the disease may manifest itself as a form of "leg paralysis."* Unless

* NOTE.—On occasions spontaneous symptoms of "leg paralysis" may occur without warning, accompanied by severe enteritis.

other disease conditions intervene, however, death from ascaridiasis is much less frequent in old birds than in young birds.

Lesions.

Experimental infestations have shown that the macroscopic lesions associated with infestation are most prominent in the small intestine, liver, and kidneys.

Small Intestine.—The lesions visible in the small intestine in the early stages of infestation include minute hæmorrhages, larger and more deeply situated hæmorrhages, areas of congestion, distinct loss of muscle tone, and, in cases of long standing, marked thickening of the wall. The hæmorrhages and areas of congestion are situated in that portion of the intestine favoured as a habitat by the larvæ. The larger hæmorrhagic spots referred to are considered to be caused by the more deeply penetrating larvæ, and are most conspicuous when the intestine is viewed from the peritoneal surface. They are not very numerous, however, and in time gradually assume a whitish appearance, to eventually disappear entirely. In the latter stages they are somewhat similar to the nodules described by Itagaki,[67, 68] but have an entirely different distribution in the small intestine, and are in no way concerned with the development of the larvæ, as recorded by him.

In acute cases loss of muscle tone in the intestine and stomachs is very pronounced, and is usually accompanied by an enlarged, flabby heart, with fluid present in the pericardial sac and peritoneal cavity.

A heavy infestation with well-grown worms may cause a severe enteritis, sometimes restricted to that portion of the small intestine infested, with which loss of muscle tone and thickening of the wall may be associated.

Histological examination indicates patches of inflammatory reaction in the mucous membrane, with some degree of superficial erosion. In these inflammatory areas there is an accumulation of histiocytes and some polymorph neutrophiles, with fibroblastic proliferation and distention of the interstices of the connective tissue with moderate amounts of inflammatory exudate. The blood vessels in such areas are congested. The areas of infiltration are most marked towards the surface of the mucous membrane, but occasionally occur deep down near the basis of the glands. Others, again, spread diffusely from base to tip. Catarrhal changes are visible at the tips of the villi.

Sections of worms are seen lying free in the lumen of the gut, and some are also present in the glandular crypts, in the muscle layers, and in the mesenteric folds.

Liver.—The liver may be paler or darker than normal, and in severe cases may be noticeably enlarged. Small subcapsular hæmorrhages and whitish spots may be present.

Microscopic examination shows the presence of a moderate to marked congestion, fatty infiltration, with areas of histiocytic infiltration, mostly in the vicinty of the small vessels, though occasionally subcapsular.

Kidneys.—These may be paler than normal, and enlarged with distended ureters.

Histologically, the tubular epithelium shows cloudy swelling, and some of the convoluted tubules patchy, fatty degeneration. There is

endothelial proliferation in some of the glomerular tufts, and the cortex shows small areas of round cell infiltration, with tubular atrophy and degeneration. Moderate to diffuse congestion is present, and hæmorrhages of considerable size are seen between the cortical tubules.

Discussion.

A consideration of the life history of *A. galli* shows that the larvæ attack the intestine wall during the tenth to nineteenth day. The mechanical effects of this attack are shown microscopically by the degree of superficial erosion of the mucous membrane, the epithelium lining the crypts becoming entirely destroyed and permitting hæmorrhages into the lumen of the gut.

An interpretation of the histo-pathological picture presented by the liver and kidneys indicates the distribution of some blood-borne pathogenic agents to these organs, in which they have become localised, and have given rise to local aggregations of histiocytes with some general congestion and, in some places, small hæmorrhages also. Such a condition is no doubt the result of a toxæmia caused by the absorption of the waste products of the worms and their distribution throughout the body by the blood stream.

[TO BE CONTINUED.]

THE SELECTION AND MATING OF POULTRY BREEDING STOCK.

ALTHOUGH many poultrymen have already mated their birds for this season's operations they are urged to study these notes carefully, then check over their work, making sure that it has been well done. This suggestion is put forward, for breeding has a most important influence on the success or otherwise of the pullet harvest.

Before selecting breeding stock a thorough knowledge of the particular breed is essential. Therefore, if not conversant with it, obtain a copy of breed standards, illustrated, which is free on application to the Department of Agriculture and Stock.

Having in mind the type in accordance with the standard, select the birds to be used as breeders from among those which are typical. By keeping closely to the standard a more uniform flock will result. This first selection must be made while the bird is on the ground, at the same time taking notice of its action and movements, and bearing in mind that the active and alert bird is not only a good layer but is also an excellent breeder. Invariably it will be found that the dull, lazy bird, or one which spends much time resting on the perches or remaining stationary is a poor breeder as well as a poor layer. The good breeder-layer usually is first off the perch in the morning, last on the perch at night, with a full crop. The good male has similar habits, and besides being somewhat pugnacious he is very attentive to his hens.

Constitutional vigour and stamina are most important characteristics to aim at in breeding, birds strong in these features being essential to produce fowls that will live and lay. On the other hand, any weakness in the parents will produce weak birds, resulting in a very heavy mortality, also a rapid degeneration of size of birds and average egg production. These features are indicated by general habits, as already explained.

Size of Body, Shanks, and Head.—The body of a strong bird is long, wide, and deep, these measurements being proportionate with each other; full fronted, full abdomen, with fairly close-fitting plumage. The most common faults in weak birds are narrow and shallow bodies, cut-away chest or tucked-up abdomen, and loose plumage. The strong bird always has strong shanks without coarseness, and the legs well apart. The weak bird has spindle shanks, possibly loose-jointed or stilty.

The head is also an excellent guide in the selection of breeders. It indicates the nervous temperament, health, and also stamina and constitutional vigour. The head should indicate strength, be of medium size, proportionate in length, depth, and thickness. Principal faults: Very large and coarse, long and shallow, small and narrow. The eye should be bright, full, prominent, and expressive; avoid making use of birds with beetle brows, almond-shaped or sunken eyes, or greenish-coloured eyes in a bird that should have red eyes, or red eyes in a bird that should have dark eyes. The face of a good bird is full and free from wrinkles, bright, red, and usually free from feathering. The poor bird is indicated invariably by reverse characteristics. The beak of a good bird is of medium length, strong and nicely curved, whilst a short, thick or long, straight beak indicates weakness.

The number of hens to mate with a male depends on the breed, age, and vigour of that bird. Light breeds, such as White Leghorns—a vigorous cockerel could have twenty hens, cock ten to twelve, dubbed cock fourteen to sixteen. Heavy, utility breeds, as Australorps—cockerel fourteen to sixteen, cock eight to ten.

THE NECESSITY FOR CULLING.

Poultry breeders generally appreciate the necessity of giving careful consideration to the selection of the stock that are to be used for breeding purposes in order to ensure, as far as possible, the production of birds that will inherit the ability to lay. The same consideration, generally speaking, is not given to the laying ability of the flock as a whole. It does not necessarily follow that even the best of our stock will transmit laying characteristics sufficiently desirable to justify the retention of all their progeny.

Again, the laying ability of any individual can be marred by incorrect management, disease, and parasitical infestation during its growing period. These several factors necessitate the culling of individuals.

Culling is not a practice that can be regulated to one period of the year. To obtain the best results it is necessary for it to be continuous. It must be applied equally to young and old, commencing from the time the chicken is hatched.

Culling is more essential just now than at almost any period in the history of the poultry industry in this State, owing to the reduced profit per unit that naturally follows a fall in egg values and an increase in fodder prices. This condition arises yearly, it is admitted, but the great increase in fodder values during the past few months calls for particular attention.

On many farms will be found 5 per cent. of culls, and on others again a percentage far in excess of this. Flocks of a thousand birds carrying only 5 per cent. of culls cost their owner an additional 30s. per month. This may not be much to many individuals, but if those engaged in the industry as a whole were to keep their flocks well culled, it would reduce the demand upon the fodder available, with the consequent reduction in costs.

The regular and frequent culling of individual flocks would also give a better spread of the birds that are to be disposed of for table purposes. It would prevent to some extent the glutting of the market during the early months of the year, and by doing so increase the value by some pence of a great proportion of the birds that are sold for table purposes.

Poultry raisers as a whole should make a careful study of feeding in order to obtain the best possible production from their flocks. The same careful study is necessary in relation to the birds they feed.

Principles of Botany for Queensland Farmers.

C. T. WHITE, Government Botanist.

[*Continued from p.* 228, *August*, 1936.]

CHAPTER V.

The Inflorescence or Flowering Shoot.

THE previous chapters have dealt mainly with vegetative shoots. More particular attention is now devoted to the flowering ones. Flower buds originate in the same way as leaf buds, and like them are terminal or axillary.

In some trees, as in the Moreton Bay Chestnut or Black Bean

Plate 152.

VARIOUS POSITIONS FOR THE INFLORESCENCE.

1. On the old wood (Black Bean—*Castanospermum*).
2. Terminal (Crow's Ash—*Flindersia*).
3. Terminal and axillary (Yellow Stringybark—*Eucalyptus acmenioides*).
4. Leaf-opposed (Pepper Vine—*Piper novæhollandiæ*).
5. Axillary (Red Ash—*Alphitonia excelsa*).
6. Supra-axillary (*Glochidion Ferdinandi*, var. *supra-axillaris*).

(Inflorescences such as Nos. 1 and 6 which are not terminal nor borne in a leaf axil are commonly described as *lateral*.)

[*Photo.: Department of Agriculture and Stock, Brisbane, from "Elementary Text-book of Australian Forest Botany."*

(*Castanospermum australe*) (Plate 152, fig. 1), the flowering shoots spring from the older branches from which the leaves have fallen, or they may be developed, not only on the older branches, but on the trunk, as in the Cluster Fig (*Ficus glomerata*), Wild Apple (*Eugenia cormiflora*), &c.

Plate 153.

A Wild Apple Tree (*Eugenia cormiflora*) in the jungle, Malanda, North Queensland.

[*Photo.: Queensland Government Tourist Bureau.*

(Plate 153); when developed opposite to a leaf, as in different species of Piper, they are said to be leaf-opposed (Plate 152, fig. 4); when developed in a leaf axil they are said to be axillary (Plate 152, fig. 5).

The flowering shoot often branches and rebranches, and produces not only one, or several, but sometimes thousands of flowers. The collection of flowers thus formed—whether only one, several, or numerous—is termed the inflorescence.

In its simplest form the inflorescence is composed of only one flower, in which case the flowers are described as solitary. They may be terminal,

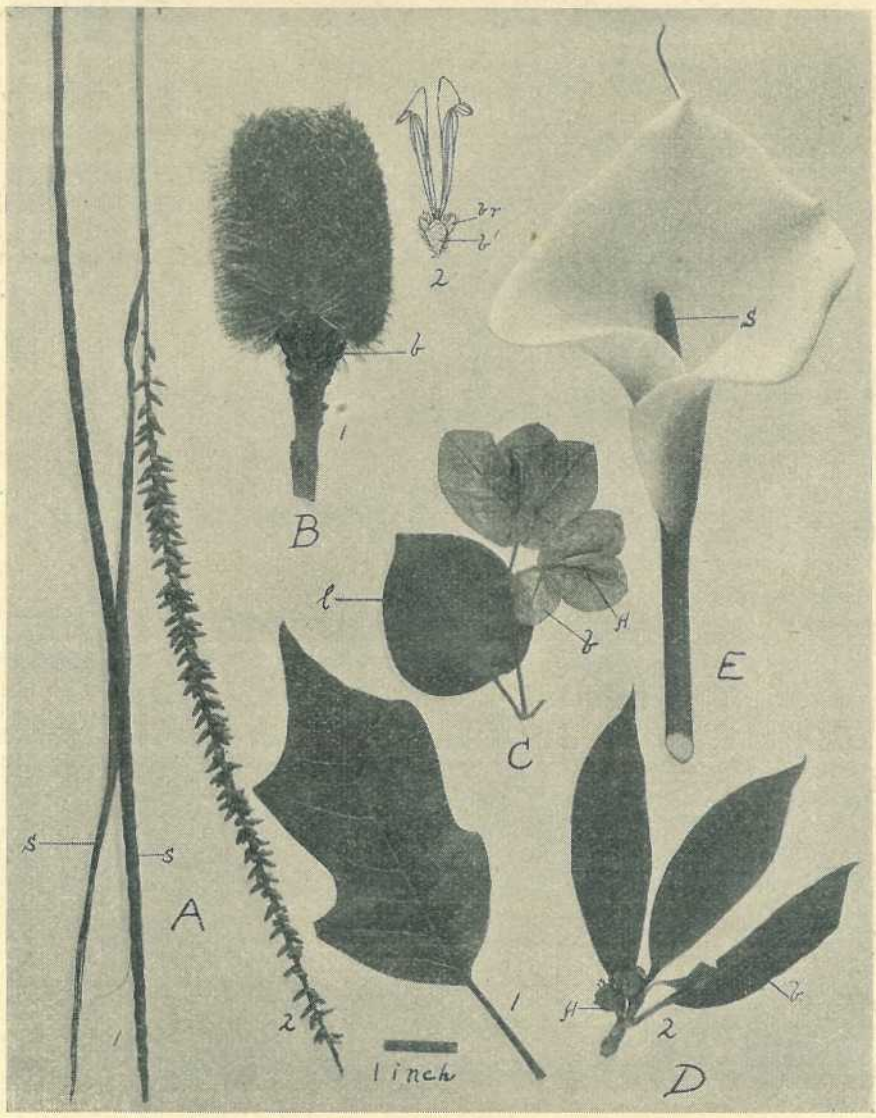

Plate 154.

[*Photo.: Department of Agriculture and Stock, Brisbane, from "Elementary Text-book of Australian Forest Botany."*

as in the native *Crinum uniflorum, Hibbertia* spp. (Guinea Flowers), &c., or they may be axillary, as in different species of Geebung (*Persoonia*) and Wild May (*Leptospermum*).

Generally speaking, however, it develops a branch system, and may be described as many- or few-flowered, and much- or little-branched, according to the development reached.

The stalk on which is borne a solitary flower, or the primary stalk of a compound inflorescence, is termed the peduncle, while the secondary branches or stalks are termed pedicels, and the central or main axis from which the lateral branches spring is the rhachis. When borne on a peduncle the inflorescence is said to be pedunculate, and when borne on pedicels the flowers are said to be pedicellate, or they may be without a stalk and seated directly on the rhachis or member from which they spring, as in the Tea Tree (*Melaleuca*) or Bottlebrush (*Callistemon*), when they are termed sessile.

Bracts and Bracteoles (Plate 154).—In most branched inflorescences it will be observed that the branches spring from the axils of variously modified leaves, usually smaller than foliage leaves, but sometimes green and fairly large, when they perform the same duties as foliage leaves. At other times they may be large and coloured, as in the Poinsettia (*Euphorbia pulcherrima*) (Plate 154, fig. D), where they are a bright red, the Flannel Flower (*Actinotus*) (Plate 155, fig. 1), where they are white or cream-coloured, or Bougainvillea (Plate 155, fig. C), where they are purple or red.

These modified leaves subtending branches of the inflorescence are termed bracts, and those borne on the ultimate branches or under the individual flowers are bracteoles. Sometimes they fall away before or soon after the full development of the flower. In *Casuarina* (She-oaks) they are persistent, and with the development of the fruit become hard and woody, and welded together with the rhachis forming the "cone" borne by these trees.

DESCRIPTION OF PLATE 154.

BRACTS AND BRACTEOLES.

A. Walking-stick or Midgen Palm (*Bacularia*).
   1. Young flower spike enclosed in the spathe.
   2. The same further advanced; *s*, spathe.

B. *Banksia Robur.*
   1. Inflorescence.
   2. A pair of flowers (the flowers are arranged in pairs packed closely on the rhachis); *b*, bracts at the base of the inflorescence; *b'*, secondary bract subtending each pair of flowers; *br*, bracteoles subtending each single flower.

C. *Bougainvillea.*
   1. Ordinary foliage leaf; *b*, bright-coloured red or purple bracts; *fl* flower adnate to a bract.

D. Poinsettia (*Euphorbia pulcherrima*).
   1. Ordinary green foliage leaf.
   2. Flowering branchlet; *fl*, flowers; *b*, large red bract.

E. *Richardia æthiopica* (Calla or Arum Lily); *s*, spadix or spike of flowers enclosed in the big white spathe.

In other cases the whole inflorescence when young may be enclosed in a large bract distinguished by the term spathe; it may be tough and strong, as in the Palms (Plate 154, fig. A), or membranous, as in many of the Lily and Amaryllis families. It may be white and conspicuous, or coloured, as in the Arum or Calla Lilies (*Richardia*) (Plate 154, fig. E).

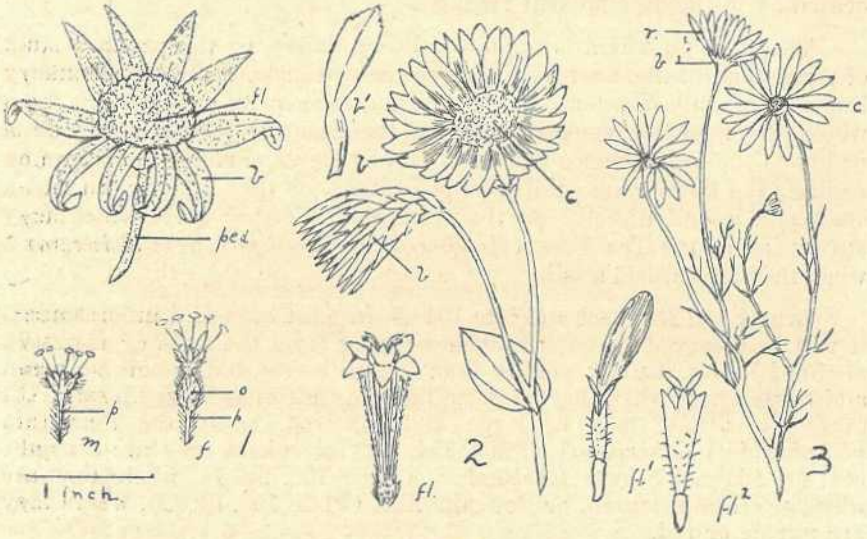

Plate 155.

SOME INFLORESCENCES SUPERFICIALLY ALIKE BUT OF SOMEWHAT DIFFERENT STRUCTURE.

1. Umbel of Flannel Flower (*Actinouts Helianthi*). The flowers (*fl*) are small and crowded together, and surrounded by an involucre of woolly bracts (*b*); *ped*, peduncle; *m*, a single male flower from an outer row of the umbel; *f*, female flower from the centre of the umbel; *p*, pedicel; *o*, ovary.
2. Heads or Capitula of a Western Australian Everlasting (*Helipterum Manglesii*). The flowers are small and crowded together in a head (*c*) surrounded by several rows of bright-coloured imbricate bracts (*b*); *b'*, a single bract from an inner row of the involucre; *fl*, a single flower.
3. Heads or Capitula of the Swan River Daisy (*Brachycome iberidifolia*). The involucral bracts (*b*) are small; the flowers are in a close head or capitulum (*c*); those of the outermost row (*r*) have bright-coloured, strap-shaped corollas; those of the inner row are small and insignificant; fl^1, a ray floret or flower of the outer row; fl^2, a disk floret or flower of the centre.

[Main figures all reduced to the same scale, analytical details enlarged to various extent. Nos. 2 and 3 adapted from Hooker, in the "Botanical Magazine."]

In Hibiscus the bracteoles form a whorl immediately below the flower, forming what is termed an epicalyx. The calyx and epicalyx together form the edible part of the Rosella (*Hibiscus Sabdariffa*). Sometimes one or more series of bracts may form a whorl or whorls under a head of flowers, as in the Dahlia, Zinnia, Aster, &c., or at the bases of flowering branches, as in the Carrot, Parsley, &c.; such a collection of bracts is termed an involucre, and the individuals forming it are known as involucral bracts. In the Noogoora Burr (*Xanthium pungens*) and in Bathurst Burr (*Xanthium spinosum*) the involucral bracts are united into a hard, ovoid involucre covered with hooked spines and enclosing the fruits. In the Everlastings (*Helichrysum* and *Helipterum* spp.) (Plate 155, fig. 2), in the Flannel Flowers (*Actinotus*) (Plate 155,

fig. 1), and some other plants, the bracts of the involucre are large and petal-like and sometimes brilliantly coloured, and give to the inflorescence whatever distinctive beauty it possesses.

In some plants a gradual change may be traced from the ordinary foliage leaves to the bracts; in others there is no such gradation, but the bracts or bracteoles are immediately marked off as very distinct, as in Hibiscus, Bougainvillea, &c.

Main Types of Inflorescence.—Inflorescences are classified according to their system of branching; they branch in various ways and take on different forms, but on the whole can be grouped under the two main heads of—

(*a*) Racemose (indefinite).—There is a distinct main axis or rhachis on which a number of flowers are developed in regular succession.

(*b*) *Cymose* (definite).—The main axis is short and terminates in a flower, lateral branches being produced, and the energy of growth, instead of being devoted to the main rhachis, is transferred to these lateral branches, so that they usually grow more vigorously than the primary axis from which they arose.

The racemose inflorescence is often called the indefinite inflorescence, because the axis goes on elongating after the first flower has been formed; it is also known as the centripetal inflorescence, as the flowers open from without inwards; this is more easily observable in a widened flower-head, such as that of Sunflower, Lantana, or other plant where the older flowers are on the outside and the younger in the centre, than in narrow inflorescences like those of the Macadamia or Queensland Nut, Snakeweed (*Stachytarpheta*), &c., where the oldest flowers are at the bottom and the youngest at the top.

In the cymose inflorescence the main axis is terminated by a flower, and its further elongation is checked, development being by the formation of successive lateral branches, the ends of which are terminated in the same way; hence inflorescences of the cymose type are often called definite. Naturally, in such a branch system, the oldest flowers are in the centre and the youngest outside, so that the central flowers open first and the others in succession outwards or centrifugally, and such inflorescences are called centrifugal.

Types of Racemose Inflorescences.—1. Spike (Plate 156), when the main axis is elongated, unbranched, and bears a number of sessile flowers, as in the Black Wattle (*Acacia Cunninghamii*), Mulga and some other wattles, Red Bottle Brush (*Callistemon*), Broad-leaved Tea Tree (*Melaleuca*), &c.

The spadix (plural spadices) only differs from the spike in having a thick and fleshy rhachis; it is generally enclosed in a spathe, as in the Arum Lily (Plate 154, fig. E) and Cunjevoi.

The catkin or amentum (plural amenta) (Plate 156, figs. 5 to 10) is a spike of unisexual flowers which usually falls off entire from the plant after flowering and fruiting, as in the Pines, Willows, She-oaks, &c.

2. Raceme (Plate 159), when the rhachis is elongated, unbranched, and bears a number of stalked flowers, as the Darling Pea (*Swainsona*), Macadamia Nut.

3. Corymb, when the main axis is comparatively short, and the lower flowers are borne on successively longer stalks than the upper, so that the top of the inflorescence is more or less on a plane, as in the Candytuft. This form is not very well marked, for often the rhachis elongates in fruit to assume the more ordinary racemose type of inflorescence, as is the case in the example quoted.

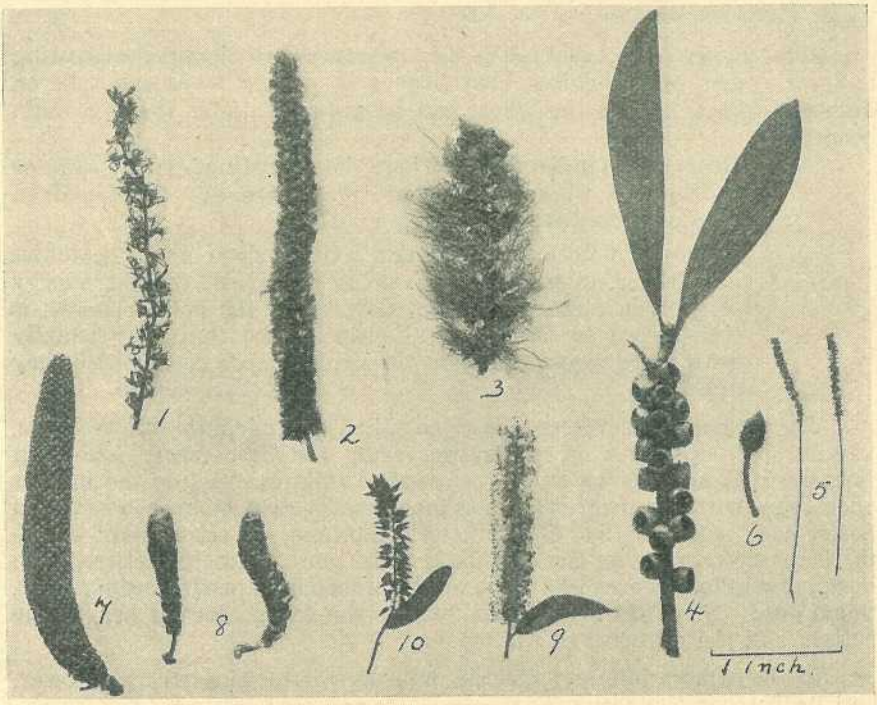

Plate 156.
SPIKES.

1. Spike of White Beefwood (*Orites*).
2. Spike of Black Wattle (*Acacia Cunninghamii*).
3. Flowering and
4. Fruiting spike of Paper-barked Tea Tree (*Melaleuca viridiflora*).
5. Male and
6. Female amenta of *Casuarina suberosa* (She Oak).
7. Male amenum of the Hoop Pine (*Araucaria Cunninghamii*).
8. Male amenta of Chir or Long-leaved Pine (*Pinus longifolia*).
9. Male and
10. Female amentum of Black Willow (*Salix nigra*).

[*From "Elementary Text-book of Australian Forest Botany."*

4. Umbel (Plate 157, figs. 1-4 and 9-11), when the main axis or stalk develops a number of stalked flowers from its apex; the flower-stalks which thus radiate out are termed the rays of the umbel; the umbel may be simple, when each ray bears a single flower, as in some Eucalypts, or compound (Plate 157, fig. 11), when each ray bears a secondary umbel—termed an umbellule (as in Parsley, Bishop's Weed, Fennel, &c.). Often the rays of an umbel bear at their base a number of bracts, forming an involucre, and the umbellules in their turn also bear a number of bracts forming an involucel.

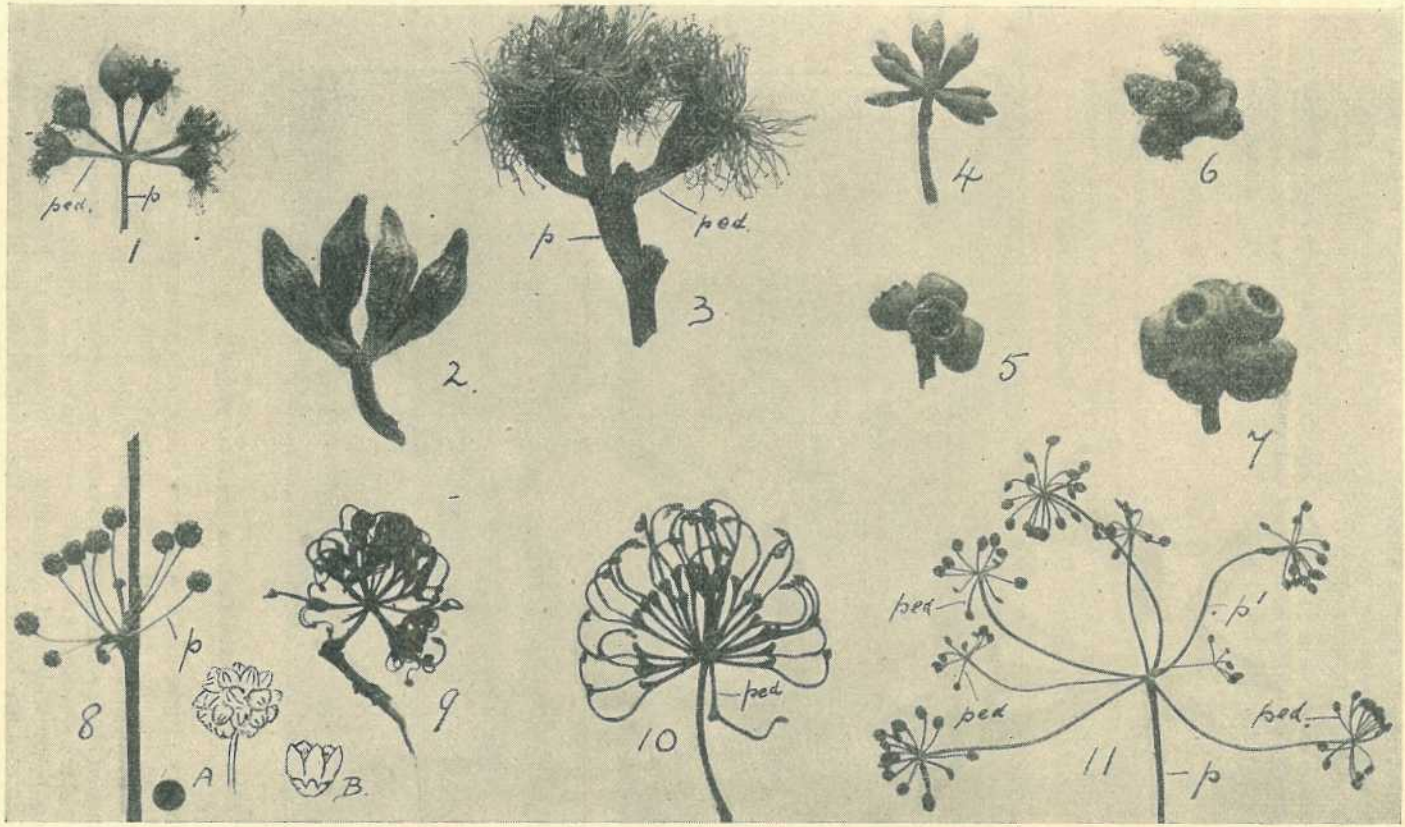

Plate 157.

UMBELS AND HEADS (CAPITULA).—Umbel of Yellow Stringybark (*Eucalyptus acmenioides*). 2 and 3. Umbels of *E. Planchoniana*. 4. Flowering and 5. Fruiting umbel of White Stringybark (*E. eugenioides*). 6. Flowering and 7. Fruiting umbel of Brown Stringybark (*E. capitellata*). 8. Fascicle of heads of Brigalow (*Acacia harpophylla*); A. A single head or capitulum. B. A single flower (both enlarged). 9 and 10. Umbels of Brush or Scrub Beefwood (*Stenocarpus salignus*). 11. Compound umbel of *Apium australe*; *p*, peduncle; *p'* secondary peduncle; *ped* pedicel. It is often very difficult to distinguish between a head and an umbel, especially in the inflorescences of such plants as the eucalypts, where the calyx-tube gradually merges into the pedicel, the latter being very short, but is usually more easily discernible in fruit as in *E. eugenioides* and *E. Planchoniana* figured above.

—[*From "Elementary Text-book of Australian Forest Botany."*

In the umbel of *Actinotus* (Flannel Flower) (Plate 155, fig. 1) it is the bracts of the involucre which give to it its peculiar appearance and form the larger part of the "flower," which in this case is really a collection of small flowers surrounded by a conspicuous involucre.

5. Head or capitulum (Plate 157, figs. 5-8).—The main axis or stalk of the inflorescence bears a number of sessile flowers at its apex, forming a compact cluster, as in the Turpentine (*Syncarpia*), many Eucalypts, and Wattles.

Often, as in the Dahlia, Thistle, Cape Weed (and other plants of the family *Compositæ*), the flower-head is subtended by a number of bracts forming an involucre. The shortened and modified rhachis on which the flowers are borne is flattened out, and may be flat, convex, or conical, and is often called the receptacle. Small scale-like bracts are often formed, subtending the individual flowers in the head.

Plate 158.
Green Cestrum (*Cestrum parqui*).

6. Panicle (Plate 158), when the main axis gives off a number of branches, each bearing two or more flowers. The term is one in very general use in descriptive botany, being applied to many compound or much-branched inflorescences. It may be narrow and spike-like, as in some grasses—e.g., Parramatta or Rat's Tail grass (*Sporobolus Berteroanus*)—or wide and spreading, as in species of *Flindersia*, &c.; when the flowers are borne more or less on a plane, as in some species of *Pavetta, Ixora,* and *Pittosporum,* it is said to be corymbose or corymbosely branched.

When the flowers in a raceme or branch of a panicle are all turned to or borne on one side of the rhachis, the raceme or panicle branch is said to be unilateral, while the flowers themselves are said to be secund, as in the Silky Oak (*Grevillea robusta*) and Black Bean (*Castanospermum*) (Plate 159, fig. 4).

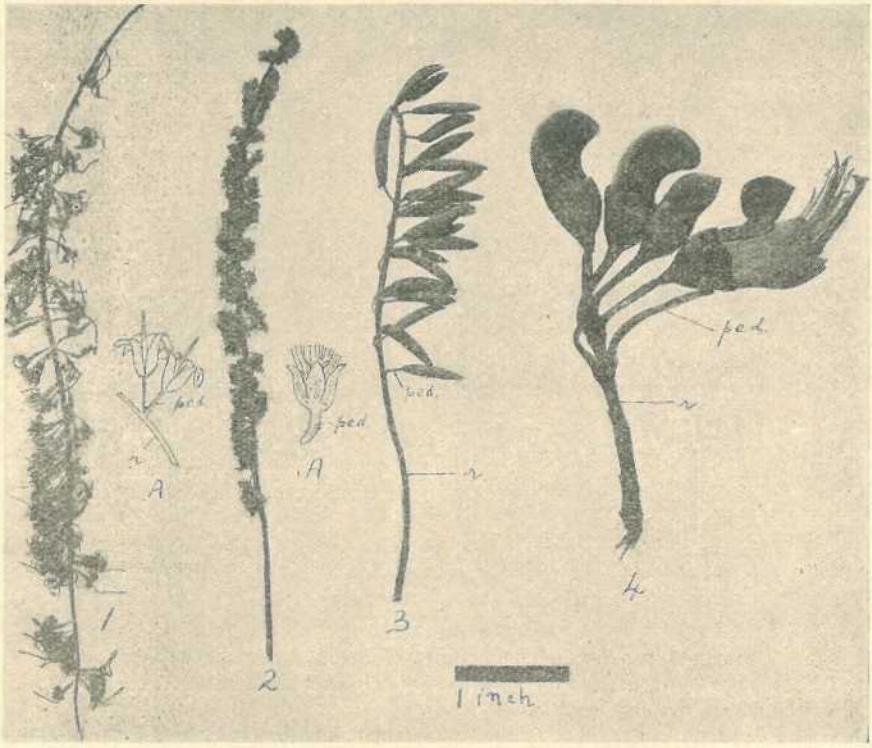

Plate 159.

RACEMES.

1. Macadamia Nut (*Macadamia ternifolia*); the flowers are arranged in pairs along the rachis; a pair of flowers is shown at A.
2. A flowering and
3. A fruiting raceme of the Red Carrabin (*Geissois Benthami*); A, single flower.
4. Black Bean (*Castanospermum australe*); *ped*, pedicel; *r*, rachis.

[*From "Elementary Text-book of Australian Forest Botany."*]

A thyrse is a form of mixed inflorescence in which the main or central axis is indefinite, but the secondary and ultimate branches are definite or cymose. Examples: White Beech (*Gmelina*), Wild Ginger (*Alpinia cærulea*).

Types of Cymose Inflorescences.—The principal kinds of cymose inflorescences are:—

Dichotomous Cyme (Plate 160, fig. 1).—Here the main axis terminates in a flower, beneath which two lateral branches of equal development are formed. These generally grow more vigorously than

the main axis, and repeat the same process. Where three lateral branches are produced instead of two, the inflorescence is known as a trichotomous cyme. (Plate 160, fig. 2).

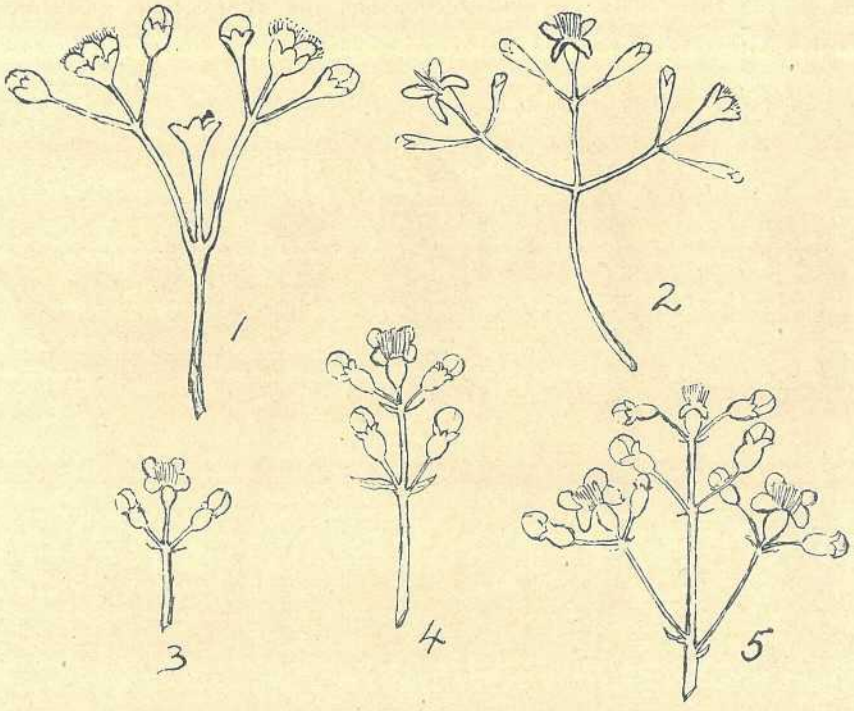

Plate 160.

CYMOSE INFLORESCENCES OF SOME COMMON AUSTRALIAN TREES.

1. Dichotomous cyme of Swamp Mahogany (*Tristania suaveolens*).
2. Trichotomous cyme of *Acronychia lævis*.
3, 4, and 5. Scrub Stringybark (*Rhodamnia trinervia*), showing range from a simple three-flowered cyme to panicled cyme.

[Note that in these inflorescences the oldest flowers are always in the centre.]

[*From "Elementary Text-book of Australian Forest Botany."*

Fascicle (Plate 161) is a term commonly applied to flowers or flowering shoots that arise in a cluster, and the true nature, whether racemose or cymose, cannot readily be determined. Examples: Pepper Bush (*Drimys*), Black Apple (*Sideroxylon australe*), Milky Plum (*Niemeyera prunifera*), &c.

The forms of inflorescence met with in plants are very numerous, and are not always easily made out at once. Thus, a panicle may simulate a spike, when it is spoken of as a spike-like panicle, or it may be raceme-like or umbel-like, according to which form of inflorescence it most superficially resembles.

CHAPTER VI.

The Flower.

The flower may be regarded as a shoot of limited growth, the parts of which are specially modified for the work they have to perform —that of reproduction.

Parts of a Complete Flower (Plate 162).—A complete flower, if examined, is seen to consist of four whorls of members, usually of very distinct appearance the one from the other. Particularising these whorls, commencing with the outside one, they are—

1. Calyx—generally green—may be a cup, or lobed or toothed, or divided into a number of distinct parts called sepals.

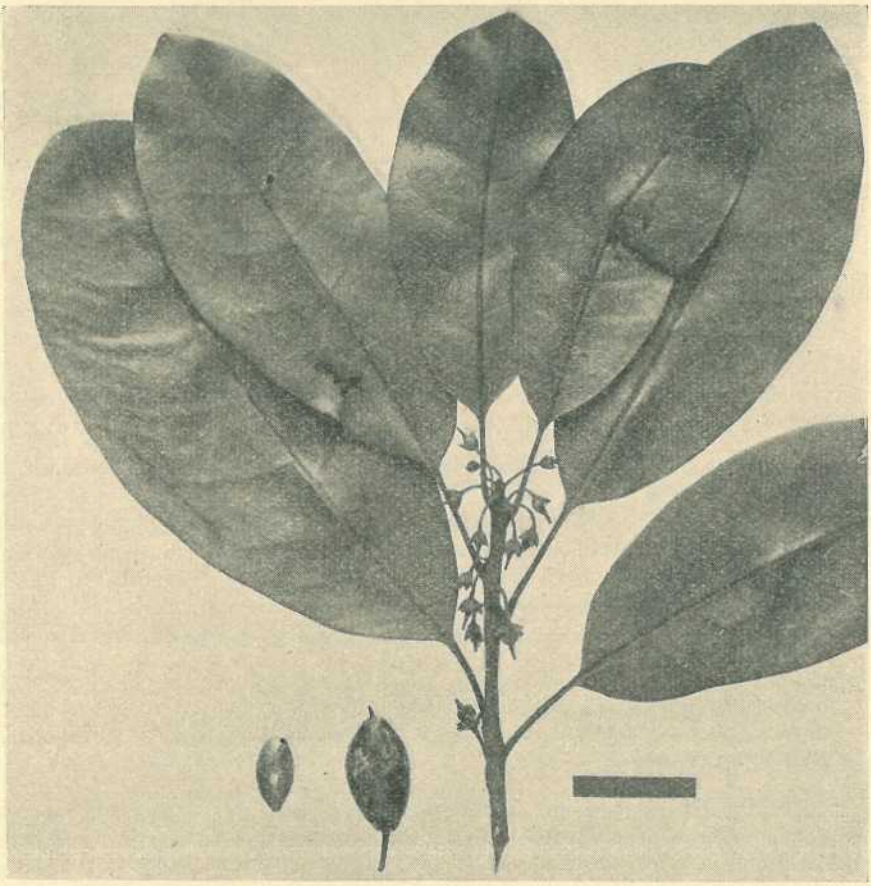

Plate 161.
COONDOO (*Sideroxylon Richardi*).
The flowers of this tree and others of the same family are borne in fascicles in the leaf-axil.

2. Corolla—usually white or coloured; like the calyx, it may be tubular, lobed, or divided into a number of distinct parts, in this case called petals, which usually alternate with the sepals—i.e., the middle or central line of a petal is generally over the interval between two sepals. The chief function of the calyx and corolla in the bud stage of the flower is to protect the inner parts or reproductive organs of the flower.

3. Androecium consists of a number of stamens, the male organs of the flower; each typically consists of a swollen portion, the anther, borne on a slender stalk, the filament. The anther is full of a yellow

powder, the pollen, consisting of a number of minute pollen-grains, the male fertilizing bodies necessary to the production of fertile seed. The filaments may be absent, when the anthers are said to be sessile; combined in a tube (staminal column), as in the White Cedar (*Melia*); united into bundles, as in the Brush Box and Mahogany (*Tristania*); slightly coherent in a ring at the base, as in the Red Bottle-brush (*Callistemon viminalis*); or, as is most often the case, may be altogether free.

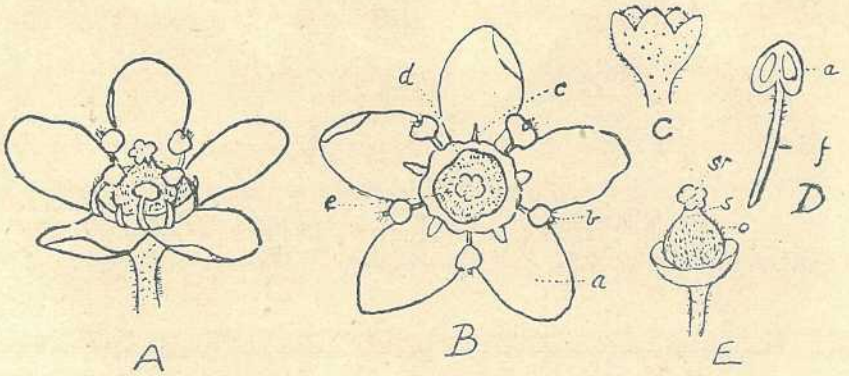

Plate 162.

PARTS OF A COMPLETE FLOWER—*Flindersia Oxleyana* (YELLOW WOOD).

A. Flower, side view.

B. Flower laid out to show parts; *a*, petal, the five petals constitute the corolla; *b*, stamen; *c*, staminode, the stamens and staminodes constitute the *androecium*; *d*, torus, disc, or thalamus (floral receptacle); *e*, *gynœceum* or *pistil*.

C. Calyx (hidden in the other figures by the petals).

D. Stamen consisting of a slender filament (*f*) topped by a somewhat heart-shaped anther (*a*).

E. Pistil (*Gynœcium*) consisting of the ovary (*o*), a very short style (*s*), and a comparatively large terminal stigma (*st*).

[All figures enlarged and adapted from illustrations in Maiden's "Forest Flora of New South Wales.]

4. The Gynœceum or pistil consists of one or more carpels, or female organs of the flower. Typically the pistil consists of a swollen basal portion, the ovary (which eventually develops into the fruit). It contains a number of small, rounded bodies, the ovules (which eventually develop into seeds); an elongate, stout, or slender neck, termed the style, which terminates in a more or less expanded apex, the stigma. Often the style is very short, as in *Flindersia* (Teak or Crow's Ash, Yellow Wood, &c.), or may be quite absent, as in the Mangosteens (*Garcinia* spp.) and species of *Capparis* (Bumbil Tree or Native Pomegranate, Mulpup, &c.), when the stigmas are said to be sessile.

The floral receptacle, on which are inserted the members just described, is known as the torus, and must not be confused with the receptacle of the inflorescence (p. 366). The disk or disc is a thickening of the receptacle at the base of the pistil, and is usually either cupular (i.e., cup-shaped), as in *Dysoxylon*, or a flat, fleshy disc, as in *Flindersia, Elæocarpus*, &c.

The disk may be entire, toothed or lobed, or divided into a number of parts. When the parts of a disc are distinct they are termed glands;

often they secrete a sugary fluid known as nectar, and the glands themselves are known as nectaries. Nectaries are not confined to the disc, but may be developed on the petals as pits or scales, or be merely a secreting surface.

Together the calyx and corolla constitute the perianth. In descriptive works on botany, such as "Queensland Flora," the term perianth-leaves or perianth segments is often used to denote parts of a perianth where their true character, whether sepals or petals, is not obvious; when sepals are white or coloured and conspicuous they are said to be petaloid—e.g., Christmas Bush (*Ceratopetalum*); similarly, when petals are green and insignificant they are sepaloid.

The calyx and corolla are spoken of as the non-essential, and the stamens and pistil as the essential parts of the flower.

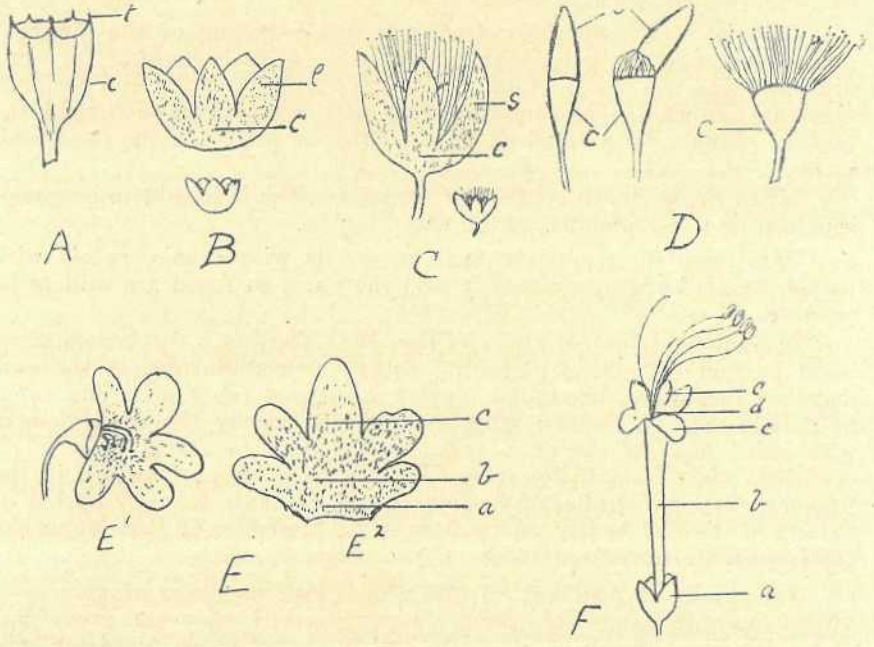

Plate 163.

GAMOPHYLLUS PERIANTHS.

A. Calyx of Apple Tree (*Angophora*), toothed; *c*, calyx tube; *t*, teeth.

B. Calyx of Crow's Ash (*Flindersia*), lobed; *c*, calyx tube; *l*, lobes.

C. Calyx of Red Carrabin (*Geissois*) parted; *c*, the very short, connate base; *s*, segments.

D. Different stages in a Eucalyptus flower; *c*, calyx tube; the calyx lobes are coherent into a cup or operculum (*o*), and fall off when the stamens attain maturity.

E. Flower of White Beech (*Gmelina*); E¹, an individual flower; E² corolla laid open; *a*, the very short corolla tube; *b*, the throat; *c*, corolla lobes or limb.

F. Flower of *Clerodendron floribundum*; *a*, calyx; *b*, corolla tube; *c*, corolla lobes or limb; *d*, throat. The smaller figures alongside B and C represent natural size; all the other figures are approximately natural size.

The Gamopetalous condition (E and F) is a very important one in plant classification, as all plants possessing such belong to a class distinguished from those with free petals; the gamosepalous condition, on the other hand (A-D), is a common feature in many plants, and little importance is attached to it in systems of plant classification.

[*From "Elementary Text-book of Australian Forest Botany."*

Special Terms Applied to Flowers.—A flower is hermaphrodite or bisexual when in possession of both stamens and pistil; unisexual when one sex, either andrœcium or gynæceum, is absent or imperfect; male when the gynæceum or pistil is absent or imperfect; and female when the stamens are absent or imperfect.

When an individual plant possesses only flowers of one sex, either male or female, the species is said to be diœcious—that is, the male and female flowers are always borne on distinct individuals, as in the Date Palm, *Cycadaceæ*, or "Zamia Palms," Carob Bean (*Ceratonia*), &c.; when the flowers are unisexual, but both occur on the same individual, the plant is said to be monœcious, as in most Pine trees, Kurrajong, Flame Tree, &c.; and when both unisexual and hermaphrodite flowers are borne on the same individual plant it is said to be polygamous, as sometimes happens in the Papaw.

Cohesion and Adhesion.—Owing to the crowding of the different parts of the flower, the members often cohere at their bases or for some distance along the whole length. When describing a flower the perianth segments are said to be connate at the base, connate to or beyond the middle, connate for a third of their length, or nearly to the apex, and so on.

When the perianth consists of connate leaves it is said to be gamosepalous or gamopetalous, as the case may be.

The union of like parts, such as sepals with sepals, petals with petals, &c., is known as cohesion, and the parts so fused are said to be connate.

In gamophyllous perianths (Plate 163) there is a distinct narrow, basal portion called the perianth-, calyx-, or corolla-tube, as the case may be; the upper, expanded portion is termed the limb. The calyx or corolla may be toothed when connate for nearly the whole length with small teeth at the apex—e.g., the calyx of the Bean Tree; cleft or lobed, when connate for some distance, with larger divisions in the upper part—e.g., corollas of *Jasminum* and *Clerodendron*; or parted or partite, if divided nearly to the base—e.g., the calyx of Red Mangrove (*Rhizophora*), Christmas Bush (*Ceratopetalum*), &c.

The union of members of one whorl with members of another—as stamens with petals—the former appearing as if they had grown out of the latter, is known as adhesion, and the members so fused are said to be adnate—e.g., the capsule of Eucalyptus and allied plants is said to be adnate to the calyx tube.

The position of the other whorls of the flower in relation to the gynæceum is of considerable importance in plant classification.

When there is no adhesion and the perianth and andrœcium are placed under the ovary, the sepals, petals, and stamens are said to be hypogynous or inferior, and the ovary is described as superior; or the whole may be referred to as a hypogynous flower, as in peas and beans. In the flower described as epigynous the other floral whorls, instead of being under or round the gynæceum, are adherent to and placed above it, the ovary being inferior, as in the Guava and Coffee.

Symmetry of Flowers.—When all the members of the individual whorls of floral leaves are similar and equal in size to one another, the flower is regular, as in the flowers of a single rose, apple, &c.; when the various members are unequal in shape and size or unequally spaced round the central axis, the flower is irregular, as in peas and beans,

Sweet Pea, &c.; in general descriptive works the terms regular and irregular are more or less confined to the perianth and more particularly to the corolla, slight inequalities in the members comprising the androecium and gynæceum not preventing the flower being referred to as regular; the terms regular and irregular are also applied in the same sense to the individual whorls of the flower. Illustrations of regular and irregular flowers are shown in Plate 164.

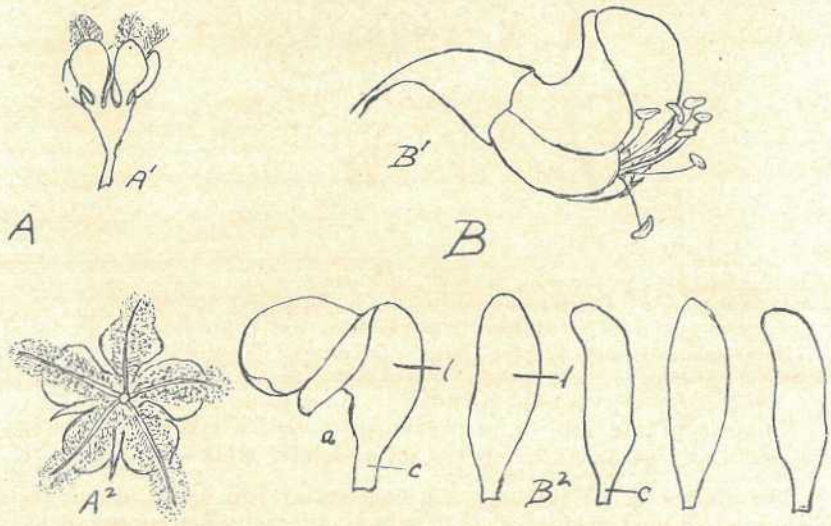

Plate 164.

REGULAR AND IRREGULAR FLOWERS.

A. Scrub or Brush Box (*Tristania conferta*). A^1, single flower; A^2, flower flattened out. There are five calyx lobes, approximately equal, five petals, and five bundles of stamens, similarly equal.

B. Black Bean (*Castanospermum*). B^1, single flower; B^2, the five petals. The back petal (*a*) is very dissimilar to the other four, and the corolla is markedly irregular.

The petals of the Black Bean are slightly clawed (unguiculate); *c*, claw; *l*, lamina.

[*From "Elementary Text-book of Australian Forest Botany."*

Aestivation (Plate 165).—The arrangement of the different floral members in the bud is called æstivation. The æstivation of the sepals

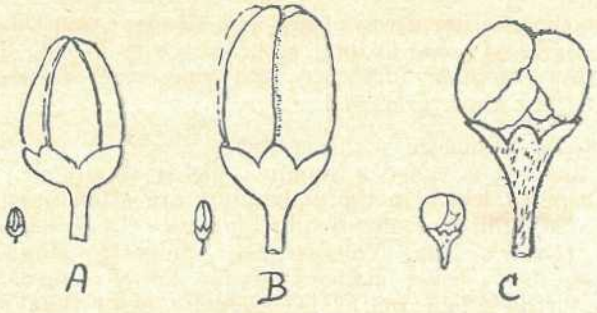

Plate 165.

AESTIVATION.

A. Valvate petals of *Pentaceras australis* (Bastard Crow's Ash or Teak).

B. Slightly imbricate petals of Red Cedar (*Cedrela*).

C. Very imbricate petals of Swamp Mahogany (*Tristania suaveolens*).

[The smaller figures represent natural size.]

and petals or the free parts of the calyx and corolla is crumpled when irregularly folded, as in the petals of the Poppy; valvate, when their margins are placed against each other in the whorl but do not overlap; and imbricate, when the margins overlap.

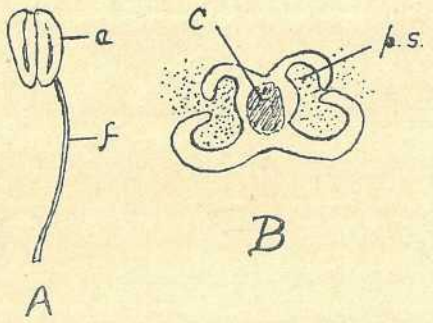

Plate 166.

A. A typical stamen (*Eucalyptus calophylla*); *a*, anther; *f*, filament.
B. Transverse section of the anther; *c*, connective; *p.s.*, pollen-sac.
[Both enlarged and adapted from illustrations in Mueller's "Eucalyptographia."]

Stamens (Plate 166).—As previously noted, a typical stamen consists essentially of an anther borne on a slender stalk—the filament.

The anther in its typical form consists of two longitudinal halves or lobes called anther-lobes, each of which, at least when young, consists of two cells or chambers which contain the dust-like pollen, and are called the pollen-sacs.

Anther lobes usually open in a longitudinal slit, and occasionally —as in the Potato and other species of *Solanum*, some Eucalypts, &c.— by small openings called pores. The shedding of the pollen by the anther, either by splitting or by pores, is called its dehiscence.

The anther lobes are placed on the right and left sides of a connecting strip of tissue known as the connective. This is sometimes continuous with the filament, and is usually narrow, but at times is comparatively wide. Occasionally it is continued in the form of a small appendage the presence or absence of which in closely-allied plants is often a ready means of identification.

The filament is not always long and slender; sometimes it is flattened and nearly as broad as long, as in the Ivory Wood (*Siphonodon*). In the Castor Oil plant (*Ricinus*) and some other *Euphorbiaceæ* the stamens are very much branched.

Staminodia.—Sometimes the anther is absent or rudimentary, and the sterile filament is called a staminodium or staminode, the number, size, and shape of which in the andrœcium are often important points to note in distinguishing closely-allied plants. In different species of *Flindersia* (Crow's Ash, Yellow-wood, Cudgerie, Maple, &c.), for instance, the five perfect stamens of the flower alternate with five staminodia. (See Plate 163.) Occasionally more than one form of staminode is present in a flower, as in some Laurels—e.g., native species of *Cryptocarya*, where there is an outer row of six club-shaped and an inner row of three cordate or pointed staminodia.

Pollen.—Pollen is usually in the form of a dust or powder, which viewed under the microscope, is seen to be composed of a number of pollen-grains, the shape and size of which vary considerably in different species of plants. The surface is often very beautifully sculptured, warted, grooved, &c.

Gynœceum.—The gynœceum or pistil is the inner essential part of the flower, and is the most complex and highly modified of the floral members.

As previously stated, the pistil consists of one or more carpels.

A pistil consisting of one carpel is said to be simple, as in practically all the *Leguminosæ* (peas and beans, &c.), and the *Proteaceæ* (Silky Oaks, &c.), *Lauraceæ* (Laurels).

If it consists of more than one carpel, as in oranges and other citrus fruits, it is said to be compound.

The compound form of pistil is much the commoner of the two referred to. It may consist of a number of carpels quite free or distinct from one another, as in the Buttercups, when it is termed apocarpous; or the carpels may be more or less united or joined together, as in Eucalypts, Tea Trees, Crow's Ash, &c., which state is termed syncarpous.

In the syncarpous pistil the carpels may be fused along their edges only, as in Passion-fruit (*Passiflora*), and the pistil is consequently only one-celled; or the margins of the carpels (carpellary leaves) may project inwards and unite in the centre of the pistil, as in *Eucalyptus*; the partitions thus formed are called dissepiments, and the parts into which they divide the ovary are called cells or loculi, and the ovary itself is termed multi-locular, or, more frequently, 2-, 3-, 4-celled, &c., according to the number of cells formed.

Occasionally the margins of the carpellary leaves unite and project for some distance inwards, but are not continued to the centre of the pistil, forming what is known as a chambered or imperfectly multilocular ovary; such a condition occurs in the Poppy (*Papaver*).

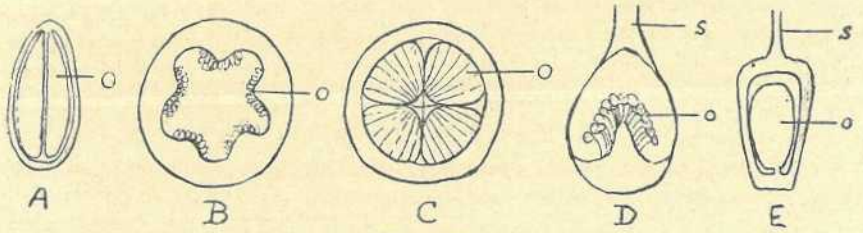

Plate 167.

PLACENTATION.

A. Parietal (sutural)—*Grevillea.*
B. Parietal—Papaw (*Carica*).
C. Axile—*Eucalyptus.*
D. Free Central—Pig Weed (*Portulaca*).
E. Basal—Sunflower (*Helianthus*).

[All figures diagrammatic; *o*, ovules; *s*, base of style.]

Placentation (Plate 167).—The portion of the ovary on which the ovules are borne is called the placenta, and the way in which the placentas are arranged in the ovary is called the placentation.

Rarely the ovules are developed over the whole of the inner walls of the ovary, as in the Water Lilies (*Nymphæa* spp.), the placentation in this case being termed superficial.

Usually the placentation is marginal, the ovules being borne on the margins of the carpellary leaves; of marginal placentation there are two well-marked forms—(*a*) Parietal, which occurs in the unilocular ovary, the adjacent united margins of the carpels forming so many placentas on the inner wall of the ovary; (*b*) axile, or axillary (Plate 167), which occurs in the multicellular ovary, the placentas occurring in the inner angle formed by the margins of the cell-wall. Sometimes the ovules are borne on a central axis, which is a prolongation of the torus into the ovary, which is free from the cell-wall, and is not connected with it by dissepiments; in this case the placentation is described as free-central. When the central axis is short the placentation is often spoken of as basal, but this term in a more limited sense is confined to cases where a single ovule is borne on the basal wall of the ovary, as in Daisies, Sunflower, and other plants of the large family *Compositæ*.

In the simple monocarpellary pistil, as in peas and beans, the placenta is formed on the ventral suture; and as it is borne on the inner wall of the ovary it is parietal, but is generally referred to as simply marginal or sutural. The true monocarpellary pistil can easily be told by the presence of this single placenta.

Style and Stigma.—The style is commonly a slender, cylindrical neck, but is sometimes flat, or even leafy and petaloid, as in the Iris; sometimes it is very short, appearing merely as a constriction between the ovary and stigma, or it may be absent, as in the Mangosteens (*Garcinia* spp.).

The stigma is usually terminal, rarely lateral. Its surface may be covered by small papillæ, or hairs, and secrete a sugary fluid by means of which the pollen grains adhere when they fall upon it.

Ovule.—The ovules appear as rounded outgrowths from the ovary. They may be sessile or attached to the placenta by a slender stalk—the funiculus or funicle. The point where the body of the ovule is attached to the funicle is termed the hilum, and is often seen as a prominent scar on the matured seed.

CHAPTER VII.

The Fruit and Seed.

The fruit is the result of the fertilization and development of the ovary, the process of which will be described in a later chapter.

After fertilization the pistil continues to develop, the other floral members, stamens, petals, &c., usually perishing and falling away, their work of protection to the younger parts of the flower, or the part taken by them in the fertilization of the ovary, having been finished.

Usually the fruit consists simply of the ripened ovary, containing a number of seeds—the ripened ovules. Sometimes, however, other parts of the flower go to form the mature fruit. To quote two instances, in the Strawberry the main fleshy portion consists of the enlarged floral receptacle which bears on its surface a number of small bodies, the ripened carpels. In Eucalyptus and allied trees the calyx-tube enlarges, becomes woody, and encloses the seed vessel. The Pome is a form of fruit restricted to the Apple, Pear, Quince, and a few allied

plants. It consists of five imperfectly fused carpels, forming what is popularly known as the "core," surrounded by a fleshy mass of tissue developed from the floral receptacle, which bears at its top the withered calyx of the flower. The "hip" of the rose consists of an enlarged calyx-tube (receptacle) enclosing a number of dry, one-seeded fruits.

The wall of the ovary in the matured fruit becomes the pericarp, which may be soft and fleshy, as in the Peach, Plum, &c., or hard and dry as in the Wooden Pear, Sida retusa, Sweet Pea, &c. Sometimes the pericarp is differentiated into three distinct layers—(*a*) The outermost layer or skin, the epicarp; (*b*) the middle layer or mesocarp; and (*c*) the inner layer or endocarp. These layers are well seen in such stone fruits as the Peach, Apricot, &c.

Fruits which, when ripe, open naturally to disperse their seeds are said to be dehiscent, and those which do not to be indehiscent.

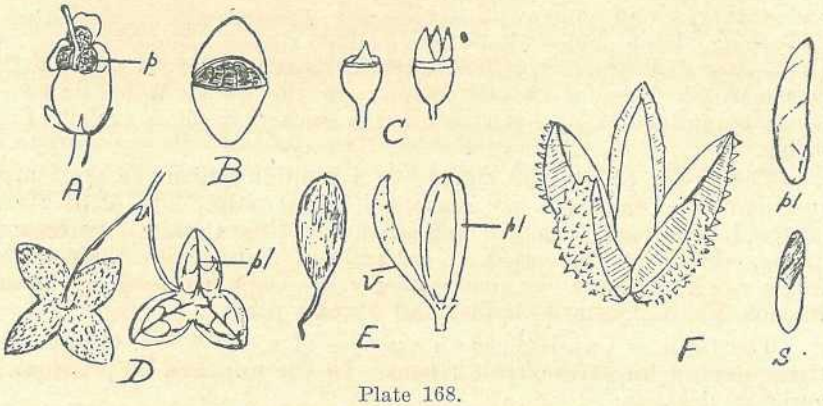

Plate 168.

CAPSULES AND THEIR DEHISCENCE.

A. By pores—Snapdragon (*Antirrhinum*).
B. Circumsciss—Pigweed (*Portulaca*).
C. By valves—*Eucalyptus*.
D. Loculicidal—Maiden's Blush (*Sloanea*).
E. Septifragal—Red Cedar (*Cedrela*); the five valves are thrown off, leaving the placentas in a column in the centre; one valve is shown in the diagram.
F. Septicidal—*Flindersia*.

p, Pore; *pl*, placenta; *s*, seed; *v*, capsule valve.

Dehiscence (Plate 168) may be through pores or slits in the pericarp, as in the Snapdragon (*Antirrhinum*) and Poppy. The pericarp may separate into two parts along a horizontal line, the upper portions falling away like a lid, as in Pigweed (*Portulaca*) and Pimpernel (*Anagallis*); occasionally the pericarp may burst irregularly, as in Red Ash (*Alphitonia*). Usually the pericarp splits along its whole length, as in simple fruits like the pea, bean, and allied plants, Silky Oak, Kurrajong, Bottle Tree, &c.

In multilocular fruits the pericarp may split down (1) along the middle of the carpels, breaking up into a number of valves with the placenta or septa running down the centre of each, as in *Jagera* (Foam Bark), *Pittosporum, Celastrus, Sloanea* (Maiden's Blush, Yellow Carrabin), &c.; (2) along the dissepiments, the placentas separating in the middle, as in *Flindersia* (Crow's Ash or Teak, Cudgerie), &c.; (3)

longitudinally into a number of valves, but the placentas and seeds are left in the middle, as in the Red Cedar (*Cedrela*), in the Thorn Apple or Stramonium (*Datura*), Silk Cotton Tree (*Bombax*), &c.

There are a great number of terms applied to different types of fruits. In many cases the peculiar fruits of certain families of plants have distinctive terms applied to them.

Principal Types of Succulent Fruits.—The Drupe (Plate 169, fig. C)—In this the pericarp is differentiated into three distinct layers of (*a*) epicarp, (*b*) mesocarp, and (*c*) endocarp. The mesocarp is generally succulent and fleshy, the epicarp forming a comparatively thin outer rind or skin. The endocarp is either cartilaginous (of the consistence of parchment), or hard and woody, when it is commonly termed a stone, and the drupe referred to as a stone-fruit, as the Peach, Plum, Apricot, &c.

The mesocarp is not always thick and fleshy. Sometimes it is thin and scanty, as in some wild fruits, for instance, different species of Quandong, Deep Yellow-wood or Yellow Cedar (*Rhodosphæra*), &c. In the Coconut (*Cocos nucifera*), the mesocarp is fibrous and the fruit is sometimes called a fibrous drupe. In the allied Wine Palms (or *Butia capitata* and its varieties) the mesocarp is more succulent and edible.

The Berry (Plate 169, fig. A) is a fruit in which the mesocarp is succulent, and the seeds are immersed in the pulp. The seeds are not enclosed in a hard putamen, and in this it differs essentially from the drupe. Familiar cultivated or naturalised plants with typical berry fruits are the Grape, English Gooseberry, Cape Gooseberry, Tomato, Passion Fruit, Custard Apple, and Prickly-pear.

The Chili or Capsicum is an example of a dry berry, the succulent tissue drying up as the fruit ripens. In the nutmegs (*Myristica*) the pericarp dehisces.

The fruit of the Orange, Lemon, &c., is a form of berry which has received the distinctive term of hesperidium; the outer skin or rind is the epicarp, the inner white substance the mesocarp, and the thin membrane lining the loculi or cells the endocarp.

The Date may be recognised as a berry on account of the absence of a hard putamen. The outer skin is the epicarp, the fleshy, sweet part of the fruit the mesocarp, and the endocarp is a very thin, membraneous layer surrounding the hard seed.

Principal Types of Dry and Dehiscent Fruits.—Follicle (Plate 169, fig. E) consists of a single carpel and dehisces along one suture only. Examples: Silky Oak, Flame Tree, Bottle Tree, Kurrajong, Milky Pine, Native Cinchona (*Alstonia* spp.), Milky Cotton, &c.

Legume (Plate 169, fig. F) typically consists of one carpel, and dehisces along both sutures. It is the typical fruit of plants of the Order *Leguminosæ*, pea and bean family, to which the term is confined.

The siliqua is a long and the silicule a short, dry fruit opening in two valves from below upwards. They are the characteristic fruits of the *Cruciferæ* (Cabbage, Turnip, Wallflower, &c.). In separating, the valves leave their margins, and the margins and placentas are left behind, with a membranous partition stretched between them and against which the seeds lie.

We often find in descriptive works that the terms legume, siliqua, and silicule are rarely used, all forms going under the comprehensive term of pod.

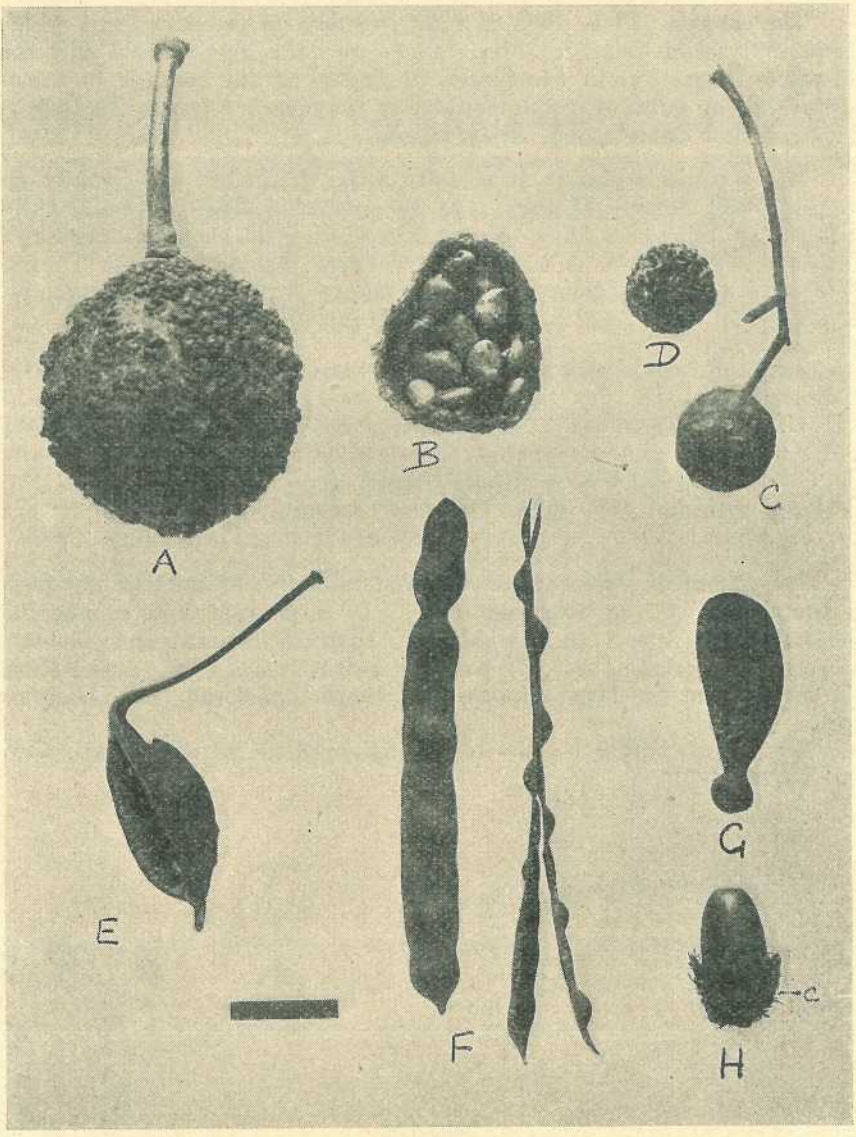

Plate 169.

FRUITS OF SOME FOREST TREES.

A. Berry of *Capparis Mitchellii* (Bumbil Tree, Wild Orange, or Native Pomegranate;

B. Transverse section of same, showing numerous seeds embedded in soft pulp.

C. Drupe of *Elæocarpus grandis* (Blue Quandong or Caloon);

D. Putamen of same.

E. Follicle of Kurrajong (*Brachychiton populneum*).

F. Face and side view of legume (pod) of a Wattle; notice that it dehisces along both sutures.

G. Samara of *Tarrietia Argyrodendron* (Booyong, Crow's Foot Elm or Stavewood).

H. Nut (acorn) of *Quercus Cerris* (Turkey Oak); *c*, cupule, composed of fused woody bracts.

(All the above, with the exception of H., are natives of Eastern Australia.)

[*Photo., Department of Agriculture and Stock, Brisbane, from "Elementary Text-book of Australian Forest Botany."*]

The capsule (Plate 168) is a dry, usually syncarpous fruit which opens and sheds its seeds either in two or more longitudinal slits for its whole length (as in *Flindersia*) by valves at the top (as in *Eucalyptus*), or by pores or small openings in the pericarp (as in the Poppy, *Papaver,* and Snapdragon, *Antirrhinum*).

The capsule is almost universally a dry fruit, but occasionally, as in the Wood Sorrel (*Oxalis*), may be somewhat fleshy. Occasionally it is rather difficult to know exactly whether a fruit should be termed a rather fleshy capsule or a rather dry berry, as in the Blue Tongue (*Melastoma malabathricum*), a very common shrub in coastal swamps, which might be termed a fleshy capsule opening irregularly.

Dry and Indehiscent Fruits.—Nut (Plate 169, fig. 8), a one-seeded fruit with a hard, dry pericarp. A few familiar examples are the "Hazel" or "Barcelona" Nut (*Corylus avellana*), the acorns of the Oak (*Quercus*), and the Spanish Chestnut (*Castanea sativa*). Usually the nut is surrounded by a cupule formed by bracts. In the Hazel Nut they are thin and dry, in the Oak they are united together to form a cup or cupule; in the Chestnut two nuts are enclosed in a spiny cupule.

The examples given above are true examples of nuts as the term is understood in the botanical sense. In a popular and commercial sense the word has a much wider use; thus the Walnut and Almond, as presented for sale, are only parts of a drupaceous fruit, Brazil Nuts, the seeds from the large capsule of a South American tree (*Lecythis* sp.).

The term nutlet is one commonly applied to any small, dry, indehiscent fruit.

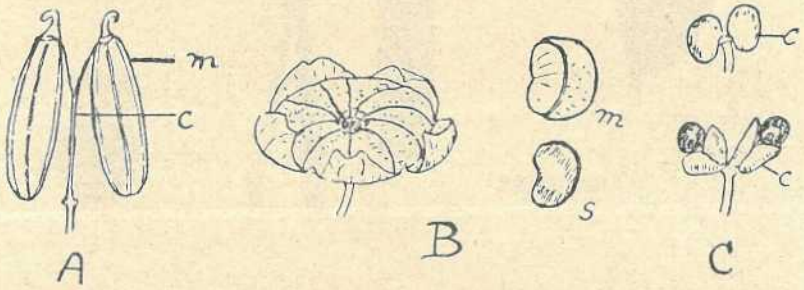

Plate 170.

SCHIZOCARPIC FRUITS.

A. Cremocarp of Fennel (*Fæniculum*); *c*, carpophore; *m*, mericarp.
B. Carcerulus of Mallow (*Malva*); *m*, a single mericarp; *s*, seed.
C. Regma of Wilga (*Geijera*); *c*, cocci.

Samara (Plate 169, fig. G), any dry, indehiscent fruit provided with a membrane or wing developed from the pericarp—e.g., White Bean and Tree of Heaven (*Ailanthus*), *Ventilago* (Supple Jack), Elm (*Ulmus*), Crow's Foot Elm (*Tarrietia*), &c.

Sometimes a fruit may simulate a samara by parts of the perianth developing into wings, thus in *Gyrocarpus Jacquini,* a common soft-wooded tree found round the coasts of North Queensland, two of the

calyx lobes are developed into comparatively big upright wings. In *Terminalia*, a genus of trees common in North Queensland, the drupes of some species may have the pericarp flattened into prominent wings, sometimes into a prominent wing surrounding the whole drupe; there is, however, a gradual transition among the species from the ordinary fleshy drupe to this winged form. True samaræ, also, must not be confused with winged seeds such as those of the Teak or Crow's Ash, Silky Oak, Wheel of Fire, &c.

Some fruits, when ripe, split into a number of one-seeded, usually indehiscent carpels. When indehiscent, resembling achenes, the individual carpels are termed mericarps, as in plants of the large family *Umbelliferæ* (Carrot, Parsley, Parsnip, Celery, &c.), (Plate 170, figs. A and B). These mericarps are popularly called "seeds," as in Caraway, Dill, &c., and in sowing plants belonging to the family *Umbelliferæ* it is the mericarps which are sown. Each mericarp contains a seed. When dehiscent the individual carpels are termed cocci, as in the Castor Oil, Cape Chestnut, Wilga, &c. (Plate 170, fig. C).

Syncarps or Composite Fruits.—These are not very common. They are the result of a whole inflorescence, sometimes of several, sometimes of very many individual flowers, not of a single flower, as in the forms previously described. Descriptions of the more familiar examples are here given:—

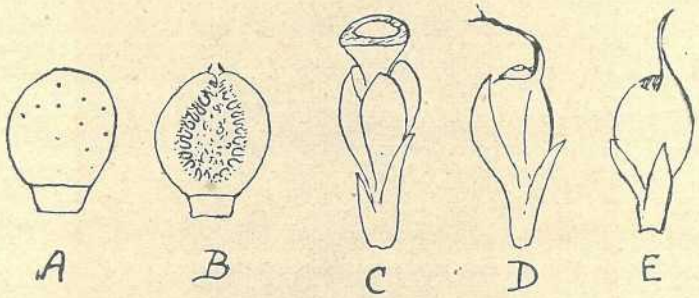

Plate 171.

STRUCTURE OF FRUIT OF A FIG (*Ficus rubiginosa*)—PORT JACKSON FIG (adapted from illustration in Maiden's "Forest Flora of New South Wales").

A. The Fig. B. Section of same. C. Male. D. Female. E. Gall-flower. A and B, natural size; C, D, and E, much enlarged.

(1) Fig (Plate 171).—The flowers are minute, and are borne closely packed on the inner wall of the receptacle. The ovaries of the female flowers develop into achenes, which are popularly regarded as the seeds.

(2) Pineapple and Mulberry.—The flowers are borne in a spike. In the pineapple the fleshy axis and the individual flowers all fuse together. The axis is continued, and bears a crown of leaves at the top. In the Pineapple seeds are rarely produced on cultivated plants, reproduction being performed by means of "suckers" and "crowns." In the Mulberry the male and female flowers are borne in separate spikes. The perianths of the female flowers become fleshy, and enclose the carpels.

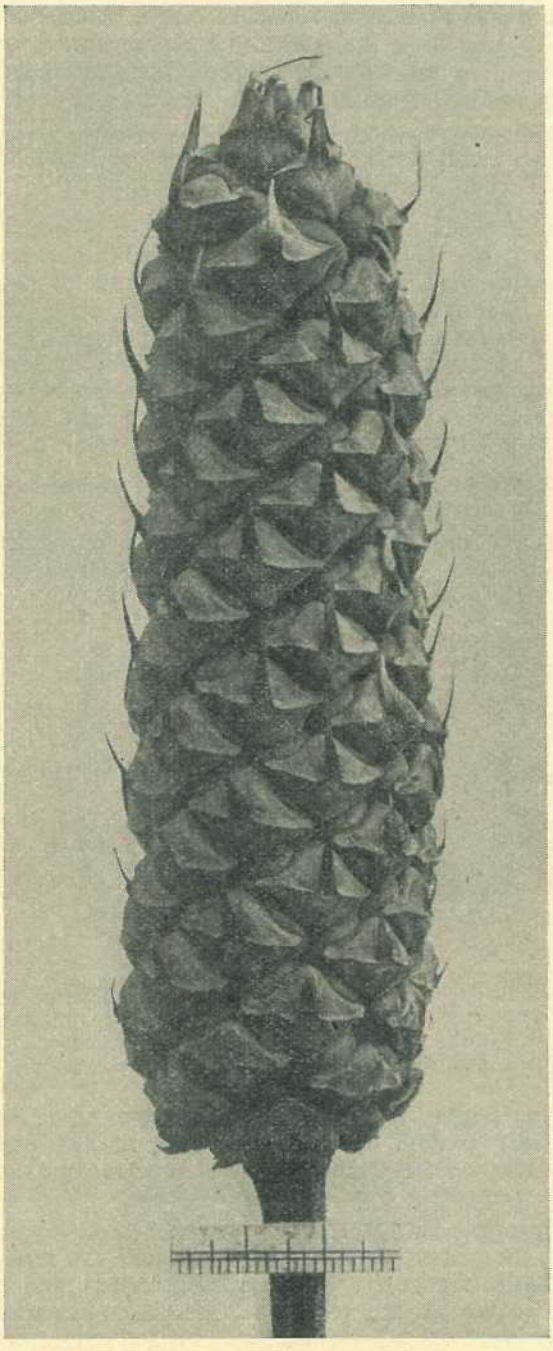

Plate 172.

CONE OF MACROZAMIA DOUGLASII (a coastal species of Zamia Burrawang or Wild Pineapple).

(3) Cone (Plate 172).—This is the typical fruit of members of the Coniferæ or Pine family, and of most of the *Cycadaceæ* or Cycads (*Macrozamia*, &c.). The male and female flowers form distinct spikes. The female bears a number of scales along its axis, at the base of which on the upper surface one or more seeds are developed, as in the Pines (*Pinus*), or a seed may be enclosed in each scale, as in *Araucaria* (Hoop Pine, &c.).

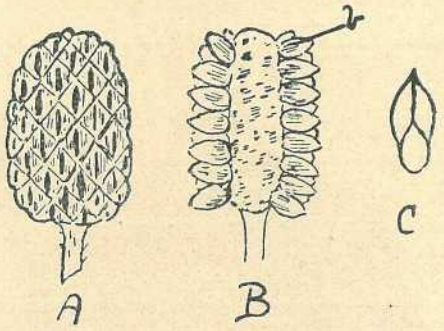

Plate 173.

A. Typical cone of a She-oak (*Casuarina*).
B. Longitudinal section of same, showing the numerous woody bracts (*b*).
C. A single samara.

(4) In the She-oaks (Plate 173), it is the fused, woody bracts which form the "cones." They open as valves at the top when ripe, and shed the samaræ or winged achenes popularly regarded as seeds. These little samaræ are compressed, a shining brown, and produced at one end into a membranous wing, which aids in their distribution.

(5) In *Syncarpia*, a genus of few species, the best known of which is the Turpentine (*Syncarpia laurifolia*), the inflorescence is a head. The calyx tubes of the individual flowers are fused in their lower portions, and when ripe the inflorescence develops into a dense head of woody capsules.

(6) In some species of *Pandanus* (Screw Pine) (Plate 174) several drupes are joined together to form a syncarp; the syncarps are borne in a large head or spike, are tightly packed together, but fall off singly when ripe.

Seeds.

After fertilization of the ovary the ovules develop into seeds, and it is on the production of fertile seed that the continuance of a species depends. In a few cases, such as the Banana and Pineapple, fertile seed is rarely produced in the cultivated races, reproduction being by suckers or other vegetative means.

The seed is distinguished by the fact that it contains an embryo, or rudimentary plant. Normally only one embryo is developed within a seed, but occasionally more than one may be formed. This is frequently seen in the Mango (*Mangifera indica*).

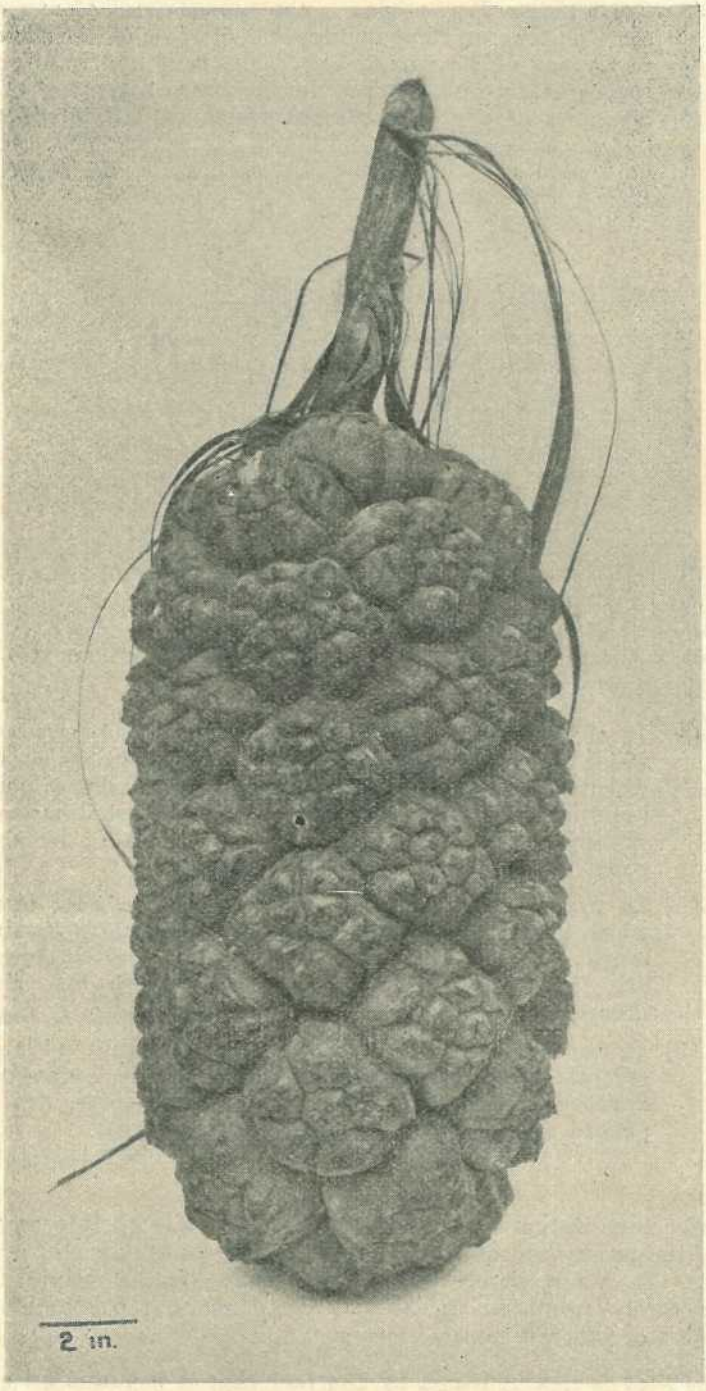

Plate 174.

Fruiting head of Pandanus. It is composed of numerous syncarps, each syncarp composed in its turn of six to eight drupes.

In the embryo can be distinguished three main parts—(*a*) the radicle, from which the primary root of the plant will be developed; (*b*) situated above it, one or more minute leaves—the cotyledons; and (*c*) above them, forming the tip of the embryo is the plumule, or embryonic shoot, which develops into the primary stem.

The Angiosperms (see Chapter I.) are divided into two great groups, the Dicotyledons and Monocotyledons, respectively. The former contains most of our fruit trees, and in this group the embryo typically possesses two opposite cotyledons or seedling leaves. The latter group contains such plants as the grasses, lilies, bamboos, palms, &c. The embryo contains only one cotyledon.

In many Gymnosperms (conifers, &c.), and occasionally in some Angiosperms, more than two cotyledons are developed in an embryo.

The outer covering of the seed or seed-coat is termed the testa. It varies considerably in texture and colour in different species, and its characters are useful features to note in plant descriptions. The colour is a useful guide in identifying the many varieties or races of such cultivated plants as the Cowpeas or Lima Beans. It is sometimes beautifully marked, especially in small seeds, with raised lines, points or tubercles, pits, &c. A study of the colour, markings, &c. of different commercial seeds and their adulterants, of weed seeds, and so on, is of inestimable value to the agriculturist, forester, or others interested one way or another in plant life. The testa may be winged, either all round or at both ends, as in some species of *Flindersia* (e.g., the Cudgerie, *F. Schottiana*), or at one end only, as in some other species of *Flindersia* (e.g., the Crow's Ash, *F. australis*). It may bear a tuft of hairs at one end, as in the Wild or Cape Cotton (*Aselepias*), or it may be completely clothed with hairs, which may be long, as in the Cotton (*Gossypium*), very short, or long at the ends only, as in *Alstonia* (Bitter Bark and Milky Pine).

Sometimes the testa is hard and enamel-like, the seed requiring special conditions to aid germination. This is sometimes accomplished by fire charring or cracking the seed coat, making it permeable to water. A familiar example is the way in which various species of Wattles or *Acacia* spring up in an area after the country has been cleared and a fire put through it. This is particularly noticeable in the "scrub" or "brush" areas of North-Eastern New South Wales and coastal Queensland, where, perhaps, after clearing and burning the country, "Sally" Wattles will spring up in thousands, although in the standing "scrub" only an occasional individual tree will be noticed. Other examples are the Red Ash and Sarsaparilla trees (*Alphitonia* spp.), which come up in the same way. Seeds provided with a hard testa usually retain their vitality for a considerable time, and may germinate when suitable conditions occur, even after a lapse of over fifty years. Most testas are comparatively thin, but in the Australian Bush Nut (*Macadamia*) it is thick and woody.

Sometimes, as the seed develops, a further covering, termed an aril or arillus (Plate 175) grows over the testa, and may partly or wholly enclose the seed. It is very well developed in plants of several orders. In the Litchi and Longan, largely exported as dried fruits from China,

it is the aril which provides the edible part of the fruit. It is the aril, also, which is the very tart, edible portion of the different species of so-called Native Tamarinds (various *Sapindaceæ*). In the Nutmegs (*Myristica* spp.) it forms a beautifully lobed, red, outer covering to the aromatic seed, and is known as the "mace," and it is the red portion of the African Lucky Bean (*Afzelia africana*), the seeds of which are often to be seen used in various ways for ornamental purposes. The aril is usually developed from the funicle.

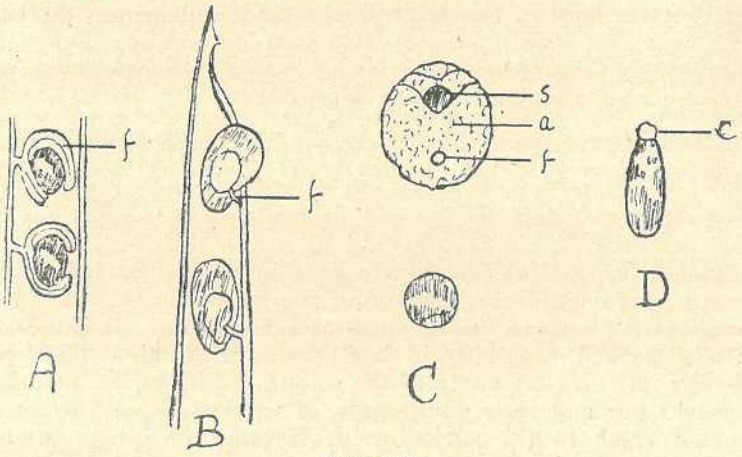

Plate 175.

FUNICLE, ARILLUS, AND STROPHIOLE.

A. Seeds of Yarran (*Acacia homalophylla*); the funicle (*f*) is long and folded round the sed.

B. Seeds of Gidgee (*Acacia Cambagei*); the funicle is short.

C. Seed of *Nephelium* (*Arytera*) *tomentosum*, above enclosed and below free from the arillus; *s*, seed; *a*, bright-red arillus; *f*, base of the funicle.

D. Seed of Wedding Bush (*Ricinocarpus pinifolius*); *c*, caruncle or strophiole.

[A and B adapted from illustrations in Maiden's "Forest Flora of New South Wales."]

Sometimes an outgrowth, similar to an aril, but smaller and localised, is formed. This is termed a caruncle or strophiole. It is seen in the Castor Oil (*Ricinus*) and many other plants of the family *Euphorbiaceæ*.

The hilum is the scar left on the seed at its place of attachment to its stalk or funicle. It is very prominent in some of the larger-seeded legumes.

Enclosed within the seed-coat is what is popularly known as the kernel. In some cases it consists of the embryo alone, in which case the cotyledons are comparatively large, or the embryo may occupy only a small part of it, the remainder of the seed in which the seed is more or less embedded being known as the albumen. Seeds in which albumen is present are known as albuminous, and those in which it is absent exalbuminous. This is an important fact to note, and one which is almost always referred to in plant descriptions. The Peach, Plum, and Almond are examples of albuminous seeds, and peas and beans of exalbuminous seeds, respectively. Examples of albuminous and exalbuminous seeds are shown in Plate 176.

The embryo and the albumen in which it is embedded are often rather difficult to distinguish, and can only be readily made out when the seed is quite ripe, or more easily during the process of germination.

The albumen varies considerably in character. It may be mealy (when it is easily broken into powder), spongy, oily (as in the Castor Oil, Tung Oil, Candle Nut), fleshy, or even hard and bony (as in the Ivory Nut).

When the albumen is puckered into narrow folds, as in the Nutmeg (*Myristica*), Bangalow or Picabeen Palm (*Archontophœnix*), &c., it is said to be ruminate.

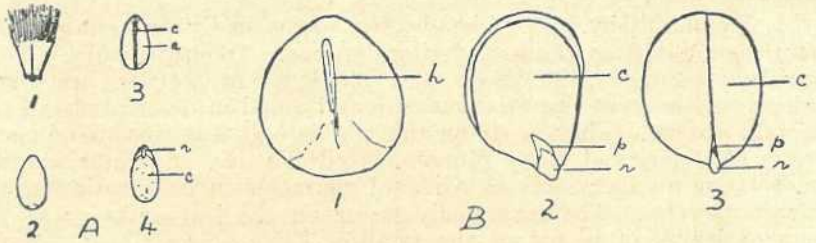

Plate 176.

SEEDS.

A. Albuminous seed of Kurrajong (*Brachychiton populneum*).
1. Seed enclosed in its hairy outer testa.
2. Seed with outer testa removed.
3. Longitudinal section of seed vertical to the cotyledons.
4. Longitudinal section parallel with the cotyledons.

B. Exalbuminous seed of Black Bean (*Castanospermum*).
1. Seed.
2. Longitudinal section parallel with the cotyledons.
3. Longitudinal section vertical to the cotyledons.

a, Albumen or endosperm; *c*, cotyledon; *h*, hilum; *p*, plumule; *r*, radicle.

On germination taking place the cotyledons may remain under the ground, as in the Peach, common garden Pea, Bean Tree, &c., when they are said to be hypogæal, or may be raised up on the growing stem above the ground level, when they are said to be epigæal, as in the French Bean, Wattles, Eucalypts, &c.

The portion of the stem of a young seedling below the insertion of the cotyledons is termed the hypocotyl. That part lying between the insertion of the cotyledons and the first foliage leaf or leaves is termed the epicotyl.

The functions of the cotyledons are various. In albuminous seeds they absorb the nutritive matters in the albumen and transfer them to the growing plant; in exalbuminous seeds, where they are epigæal, as in Eucalypts, Wattles, French Bean, &c., they form the first seedling leaves of the plant; on the other hand, where they are hypogæal, as in the Peach, common garden Pea, &c., they simply act as a storehouse of reserve food materials for the young plant to draw upon.

CHAPTER VIII.

Clothing of Plants.

A large number of terms are used in describing the clothing of the surface of plant members with hairs or wax. If quite devoid of hairs or bristles, as the Poinciana, the leaves of most Eucalypts, &c., a plant is said to be glabrous.

The young parts of plants are almost always much more densely clothed with hairs than the older ones, and in many cases where the young parts are more or less densely clothed with hairs the older parts are glabrous, or nearly so, the hairs acting as a protection to the young, tender leaves.

Glands.—The term gland is one used in a very wide sense in descriptive botany, being applied to several epidermal productions. They may be—

1. Small, fleshy, wart-like bodies, occasionally secreting small quantities of oily or resinous matter but more frequently dry. They commonly occur on the leaves and phyllodes of wattles, and their position and relative size are usually found noted in descriptions of the different species. They occur on the petiole and leaf rhachis of many species of Cassia and many pinnate-leaved Wattles, and their position and relative number serve as a useful character in differentiating the different species. They commonly occur on the leaf-stalks or at the bases of leaves in plants of the families *Euphorbiaceæ* (e.g., Candle Nut) and *Passifloraceæ* (Passion-fruit, &c.).

2. Small raised dots or streaks, usually dark coloured, but sometimes paler, and may occur on any part of the plant. They are very abundant on the under surface of the leaves of different species of *Mallotus*. In *M. philippinensis* they are red; in *M. discolor*, yellow. These two species, particularly the former, are comparatively common in Queensland, and the colour of the glands forms a useful character for differentiating the species when leaves only are available.

In the same genus glands may be abundantly produced on the stems, leaves, &c., of one species, and be entirely absent in another—e.g., the under surfaces of the leaves of *Vitex acuminata* are profusely glandular-dotted, whereas in the *Lignum vitæ* (*Vitex lignum-vitæ*) they are not.

3. Small dots or streaks full of oil embedded in the substance of different plant members. If a leaf of a Eucalypt or Tea Tree be held up so that the light strikes through it oil dots are generally plainly visible to the naked eye, and in all cases except where the leaves are very thick they are easily observable with the aid of a low-power magnifying lens.

The presence of oil dots in the leaves is characteristic of all plants of the large families of *Myrtaceæ* (Gums, Tea Trees, &c.) and *Rutaceæ* (Citrus family).

In the family *Umbelliferæ* they occur in the pericarp, and the oil they contain gives to such fruits as Carraway, Dill, Fennel, Aniseed, &c., their characteristic odour and taste. They are generally conspicuous, and can be readily seen on transverse section of the fruit.

4. The term "gland" is also applied to the lobes of the disk, and to other small, fleshy, protuberances within the flower developed on any of the floral members.

In the flowers of most *Proteaceæ* (Silky Oak family) glands (nectaries) are developed at the base of the pistil, and are termed hypogynous glands. They are secreting organs, and their form and characteristics are usually noted in descriptive work. In the Macadamia Nut they are united in a ring; in the Silky Oak (*Grevillea robusta*) in a semi-circle to one side of the pistil; in the Beef or Monkey Nut (*Hicksbeachia*) they are developed as four distinct lobes; in

Lomatia they form three or four unequal little knobs; in *Stenocarpus* they are very small or absent altogether; in the Native Honeysuckle (*Banksia*) they are scale-like.

Foveolæ and Domatia.—Very often on the under surface of leaves in the axils of the nerves, and usually of the midrib and main laterals, small pits or depressions or tufts of hairs will be observed. These are called foveolæ or domatia. They are often inhabited by minute insects or mites, which, as a general rule, apparently, have no harmful effects on the plant.

Accessory Organs.—Under the broad heading of accessory organs various external parts of plants, such as hairs, scales, thorns, prickles, &c., may be conveniently discussed.

Most of the growths here dealt with are various appendages occurring on the root, stem, or leaves, and may be described under the headings of (*a*) Hairs, and (*b*) Emergences.

Hairs.—Hairs are always developed from superficial cells, and vary considerably in form and structure. They may be simple or branched. When the branches radiate out horizontally the hairs are said to be stellate, as those on the coppice shoots of the White Stringybark (*Eucalyptus eugenioides*), on the flowers and young growth of the Kurrajong, on the leaves of the Wild Tobacco and other species of *Solanum*, &c. Sometimes the stellate hairs have their individual rays united in the lower parts, forming little flat, circular discs attached at the centre to the epidermis. They are then called scales, and the surface is said to be scaly or lepidote—e.g., the under surface of the leaves of the trees variously called Booyong, Stave Wood, Crow's Foot Elm or Hickory (*Tarrietia argyrodendron* and its varieties), of the Native Cascarilla Bark (*Croton insularis*), &c.

In the species of *Urtica* (Stinging Nettles) and *Laportea* (Stinging Trees) the surface is covered with stinging hairs of a peculiar structure, and containing a strong acid. The hairs arise from a basal cushion, and taper gradually to the apex, where they are terminated by a small head, which breaks off at the lightest touch, and the hairs piercing the skin pour out a strong acid, producing the well-known irritating effects.

Hairs often vary in structure, not only on the same plant, but on the same member. The Nettles and Stinging Trees just referred to possess, in addition to the stinging hairs, a great many more smaller, non-stinging hairs scattered all over the branchlets and leaf surfaces. On the leaves of some species of *Solanum* simple and stellate hairs may both occur. Sometimes hairs are terminated by a little rounded cell or cells secreting oil, gum, or resin, often strongly scented and giving the plant a sticky, viscid surface—e.g., the Tobaccos (*Nicotiana* spp.).

Emergences.—These differ from hairs in not being solely provided from superficial cells, but from others lying beneath them. They may occur as prickles—e.g., on stems of roses and brambles, species of *Solanum* (Devil's Needle, Devil's Apple, &c.); as glands or warts—e.g., on leaves and phyllodes of Wattles, as outgrowths from the foliage or floral leaf, as the corona of Narcissus; other more complex forms are the tentacles formed on the leaves of Sundews (*Drosera* sp.), the suckers or haustoria formed on the stems or roots of parasitic plants, such as the Dodders (*Cuscuta*), Dodder Laurels (*Cassytha*), &c.

Some botanists clearly differentiate the terms thorn, spine, and prickle. Others class the first two together. Strictly speaking, thorns are modified branches, and, in consequence, develop from the leaf axils, either where leaves are present, or where they would normally be developed—e.g., the Cockspur Thorn (*Cudrania*), Bougainvillea, Citrus, &c. Spines are modified leaves or parts of leaves, as in the Prickly or Mimosa Bush (*Acacia farnesiana*), where the stipules are so modified, and in some Thistles, where the lobes of the leaf terminate in sharp spines. Prickles are sharply pointed outgrowths of the epidermis, and may occur practically on any part of the surface. Thus, in many species of *Solanum* (e.g., Devil's Apples, *Solanum aculeatissimum* and *S. sodomæum*) they occur not only on the stem but on the leaves and calyces. Prickles are developed from more or less superficial tissues, and if the bark be stripped they come away with it—e.g., the Devil's Needle and Devil's Apple (*Solanum* spp.), the native and other Raspberries and Blackberries (*Rubus* spp.), the common garden Rose, &c. Thorns, spines, and prickles generally serve the purpose of either helping the plant in climbing, as in the Cockspur Thorn (*Cudrania*), Lawyer Cane (*Calamus*), &c., or act as a protection against the attacks of herbivorous animals, and, in consequence, are rarely found on large trees.

Many trees, however, are thorny or spiny in their young stages, but quite unarmed when older. In the young state some trees such as the Desert Lime (*Eremocitrus*) and Leopard Wood (*Flindersia maculosa*) present masses of tangled branches bearing very few leaves, and with each branchlet ending in a thorn; when at a height of 4 or 5 feet a leading shoot grows up into a small tree, the lower part of the stem continuing to bear a mass of thorny branches. The upper branches are quite unarmed, and as the trees increase in age and size these lower branches are shed until the trunk presents a smooth appearance, bearing a head consisting of a number of unarmed leafy branches.

CHAPTER IX.

Habit.

The general appearance of a growing plant is called its habit. This depends largely on the character of the stem, whether erect or ascending, prostrate, &c., its mode of branching, and so on.

A shrub differs from a tree in its smaller size and generally in habit of growth, shrubs usually branching out from near the base. Sometimes plants that occur as shrubs in some localities attain tree size in others. In some plants such as certain Eucalypts in Western Australia there is a tree form and shrub (mallee) form of the same species.

Plants in which the aerial stem is more or less succulent or herbaceous, and dies down annually—as in most of the common farm and garden weeds—are called herbs. Sometimes, though dying down annually, the stems are more or less woody and the plants large and shrub-like in appearance, as in the Sesbania Pea (*Sesbania aculeata*). Such plants are said to be shrubby.

An undershrub is a plant part of the stem of which persists for more than one year. Examples are the Wild Senna or Yellow Pea (*Cassia Sophera*), *Sida retusa*, &c.

The basal portion of an undershrub, or the thick, woody basal part of the stem of an herbaceous perennial lying at or just below the surface of the soil, and partly formed by the lower portion of the stem and the upper thickened woody portion of the roots, is termed the stock. In many plants the stock often attains a considerable size, forming large, woody masses just below the surface of the soil. This is particularly noticeable in Australian plants of the poor, sandy country, typical of a lot of our coast lands, and covered with such peculiarly Australian genera as *Banksia, Lomatia, Gompholobium, Boronia, Ricinocarpus,* &c. Bush fires run through this country during the more or less regular dry seasons, but after suitable rains the old stocks send out numerous new vigorous stems.

In horticultural practice the term stock is applied in grafting or budding to the plant on which the grafting is done; the part inserted into the stock is called the scion.

Plants, or parts of plants, are described as annuals, if living only for one year; biennial, if living for two; perennial if persisting longer.

Plants which are found growing thickly together, forming at times almost pure stands, are said to be gregarious. Examples in Queensland are Mulga (*Acacia aneura*), Brigalow (*Acacia harpophylla*), the Beelah (*Casuarina lepidophloia*), White Cypress (*Callitris glauca*), and Paper-barked Tea Trees (*Melaleuca* spp.). A plant the individuals of which are widely scattered the one from the other is said to be sporadic, as in most trees of the rich "scrub" or mixed forests of coastal Queensland and New South Wales.

Duration of Parts.—Many of the trees of older countries periodically completely shed their leaves, so that during the resting or winter months they are entirely bare of foliage. Such trees are called deciduous.

In Australia there are few native trees that can definitely be termed deciduous. The Flame Tree (*Brachychiton acerifolium*), commonly, though not always, is completely bare of green foliage when in full flower. The Red Cedar (*Cedrela*) and the White Cedar (*Melia*) are at times practically bare of foliage, but the time elapsing between the shedding of the old leaves and the unfolding of the new buds is very short.

Trees which bear green foliage throughout the year are termed evergreen.

[TO BE CONTINUED.]

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H. J. FREEMAN, Senior Instructor in Fruit Culture.

[*Continued from page* 501, *May*, 1936.]

The Packing House.

THIS is a most important factor in date growing. Individual effort by each grower on his own area is most unsatisfactory, for the simple reason that he cannot afford to erect a plant that would handle his output as effectively as a larger plant owned and run on a co-operative basis. It is fully realised that the growing and marketing of dates will become more specialised as the industry develops. In other parts of the world specially designed packing houses have had to be erected and operated by trained staffs, such being necessary in order to keep handling costs low and to place a high-quality product on the market. It is sincerely hoped that Queensland will reach this stage some day, but until then owners of small date acreages will find it most advantageous to handle this fruit through a co-operatively owned packing plant.

The situation of this packing house is also a very important matter. Firstly, it should be as near as possible to the areas upon which the dates are growing; and then transport by rail and road must be considered. The labour required in such a packing house would be of an intermittent nature, and in the main girls would be more suitable than men; so this fact should also be taken into consideration when choosing the packing house site.

In constructing a date-packing plant the house should be built as nearly insect-proof as possible, with all outside openings screened with wire gauze of not less than No. 36 mesh. The interior of the house should be divided into at least five well-isolated rooms, namely, receiving room, fumigating room, cleaning and grading room, ripening room, and packing room.

Fruit should be delivered to the receiving room in shallow, hardware, cloth-bottomed trays, and later placed in the fumigating room. After being fumigated the fruit is taken into the cleaning and grading room. Here the fruit is passed through the cleaners and on to the grading belts, where it is graded for marketable fruit and degree of ripeness. After grading the fruit is placed in ripening trays and conveyed to the

Plate 177.
Packing house "hands" grading and packing dates in Southern California.

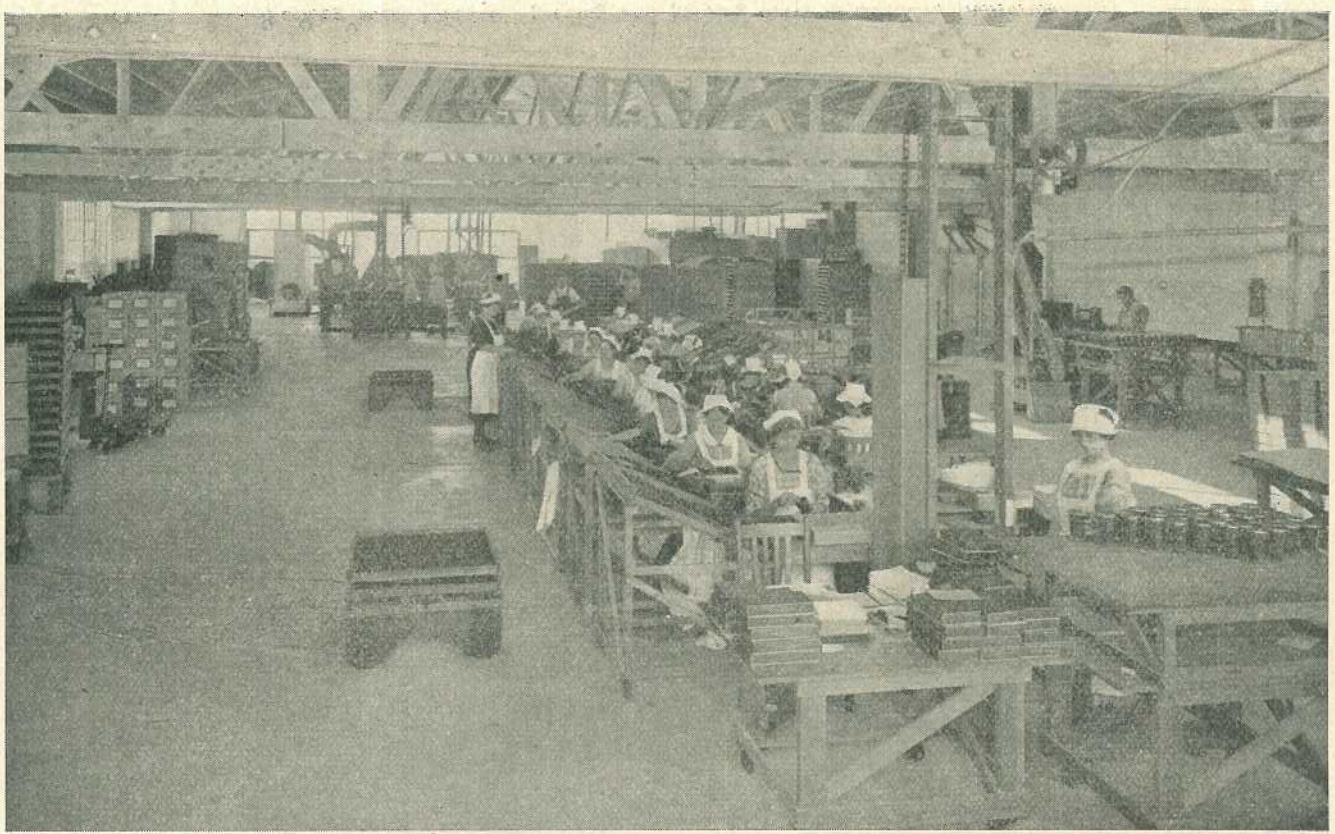


Plate 178.
General view of interior of date packing house, Southern California.

ripening room, where maturation is completed under conditions of controlled temperature and humidity. After the fruit has reached the desired degree of ripeness and moisture content it is removed to the packing room, where it is regraded and packed.

Fumigation.

When handling dates commercially fumigation of the fruit is essential, for, even with the most rigid system of hygiene, immediate destruction of over-ripe and soured fruit, &c., some insects are bound to enter the packing house as the fruit is brought in from the groves. Damage and loss due to such insects can definitely be prevented by fumigating the fruit prior to its entering the packing room.

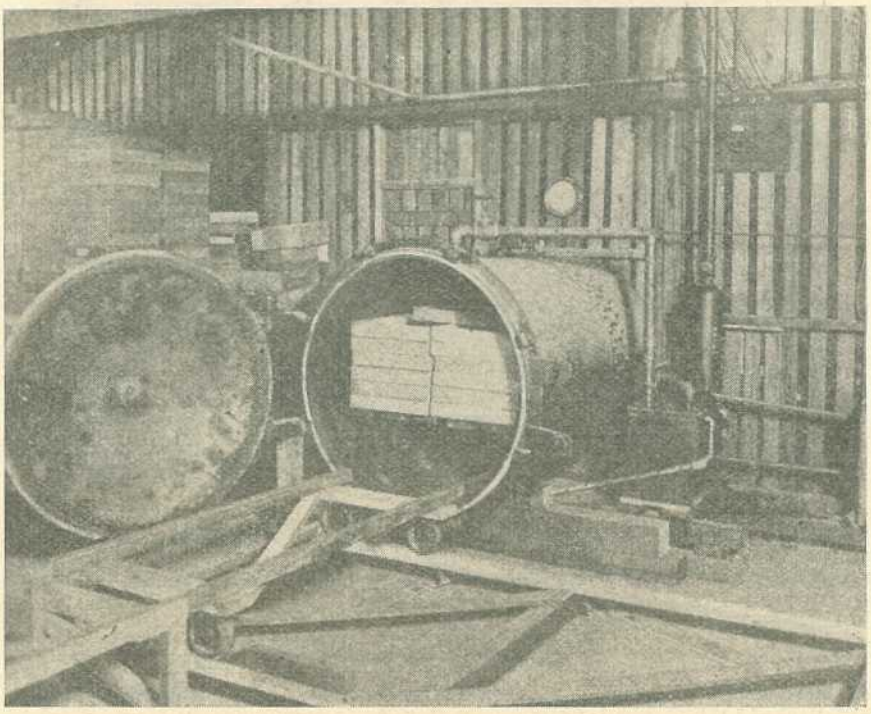


Plate 179.

California dates are now being packed in a modern plant at El Monte, owned by the Valley Packing Association, Inc., an organization of Coachella Valley date growers. Dates, fresh from desert palms, are here seen passing through a vacuum fumigator, which destroys all possible insect life.

In America a number of chemical fumigants have been used during the past ten years. Carbon disulphide, cyanide, and a mixture of carbon disulphide and carbon dioxide have given effective control, but their use has now been discontinued because of the dangers involved in handling. More recently a gas sold in America under the trade name of "Carboxide" has come into general favour, chiefly because it is non-explosive and non-poisonous to human beings. One of the disadvantages of using this gas, however, is the long period of exposure required for effective control of insects, viz., fifteen hours, but until something more

satisfactory is found the use of this gas is recommended. "Carboxide" consists of a mixture of ethylene oxide and carbon dioxide in the ratio of 9 to 1.

It is claimed that effective insect control can be obtained by subjecting the fruit to a temperature of 140 deg. Fahr. for two or three hours before it is removed from the ripening room. Unfortunately, this extreme temperature darkens the fruit, breaks down the juice cells, resulting in syrup exudation, and is deleterious to flavour and quality. For these reasons high temperatures cannot be recommended except in cases where fumigation facilities are not available.

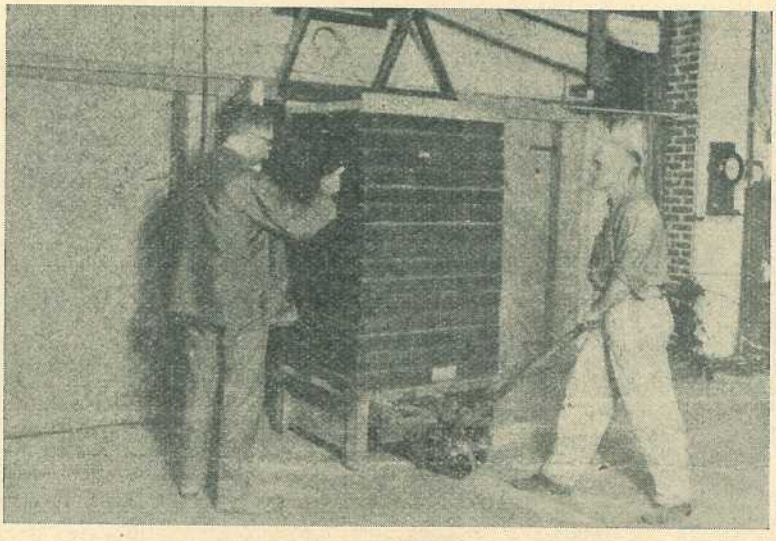


Plate 180.

Because unprocessed dates are subject to souring, fermentation and surface moulds, their moisture content is lowered in dehydrators that are under both temperature and humidity control. The time required for a lot is found by laboratory test.

Cleaning the Fruit.

Fruit ripening on the palms gathers dust and other foreign particles which should be completely removed before placing in the maturation room. Several methods of cleaning the fruit have been devised.

Semi-soft varieties such as the Deglet Noor are cleaned in a revolving cylinder lined with brushes through which a strong current of air is drawn by a suction fan. The current of air carries away the dust and dirt as it is removed from the fruit by the brushes.

Soft varieties, such as Maktoom, are either washed by means of a water spray or cleaned by rolling the fruit over dampened towelling by means of a mechanical shaker. The latter method is recommended by American growers, as it cleans the fruit more thoroughly, and any damage by the excessive absorption of water is avoided. If dates are washed by immersion or spraying all water adhering to the fruit must be removed immediately, which is easily accomplished by passing the fruit through a blast of warm air after it leaves the washer.

Only limited quantities of fruit can be cleaned by hand. The method is to place a single layer only in a ripening tray, the bottom of which has been covered with dampened Turkish towelling. The tray should then be gently shaken back and forth.

Grading the Fruit.

This is not a difficult operation. The fruit passes from the cleaner or washer and dryer to the grading belts, where graders—girls do all this work in America—separate the commercial fruit according to degree of ripeness, and remove all worthless fruit. Segregating the fruit according to the degree of ripeness materially reduces handling and sorting during the maturation process.

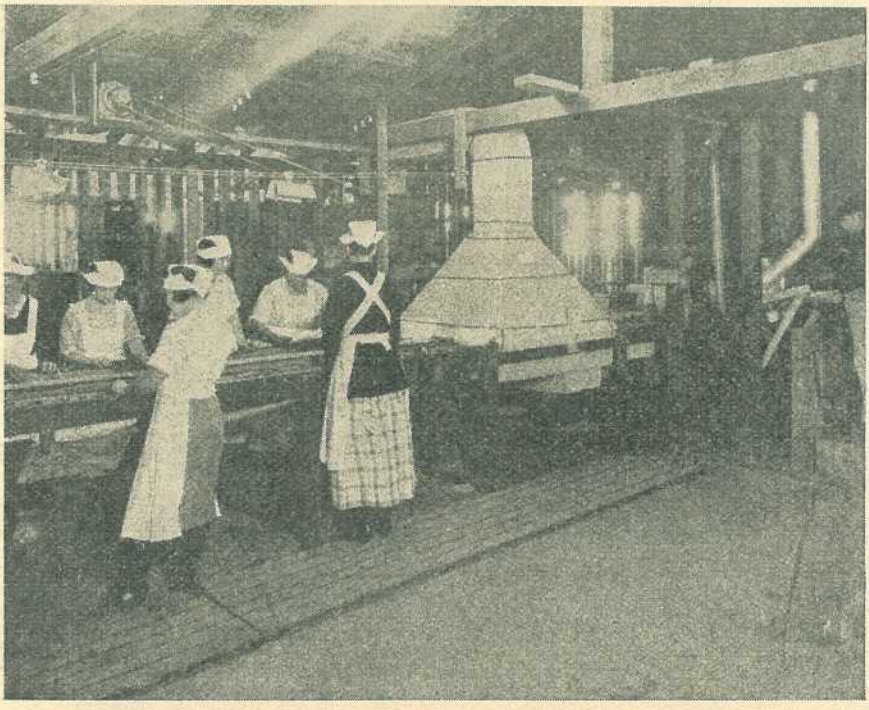


Plate 181.

From the fumigator, the dates go into the cleaner and washer, where all dust is removed. They then pass through a drying hood and on to a grading belt, where the fruit is carefully sorted. (Numbers of El Monte high school girls find profitable employment at the new date-packing plant.)

When the fruit is removed from the ripening room it should again be graded, three grades being all that are necessary commercially, namely, first quality, second quality, and fruit suitable for confectionery purposes only. Frequently this grading is done by hand at the packing table as the fruit is being packed.

The recognised American date standards are as follows:—

Fancy Grade.—Only fruits which are of uniformly large size for the variety concerned, free from all insect or fungus injury, conspicuous checks, cracks, or blisters; flesh soft, fibre around the seed cavity tender

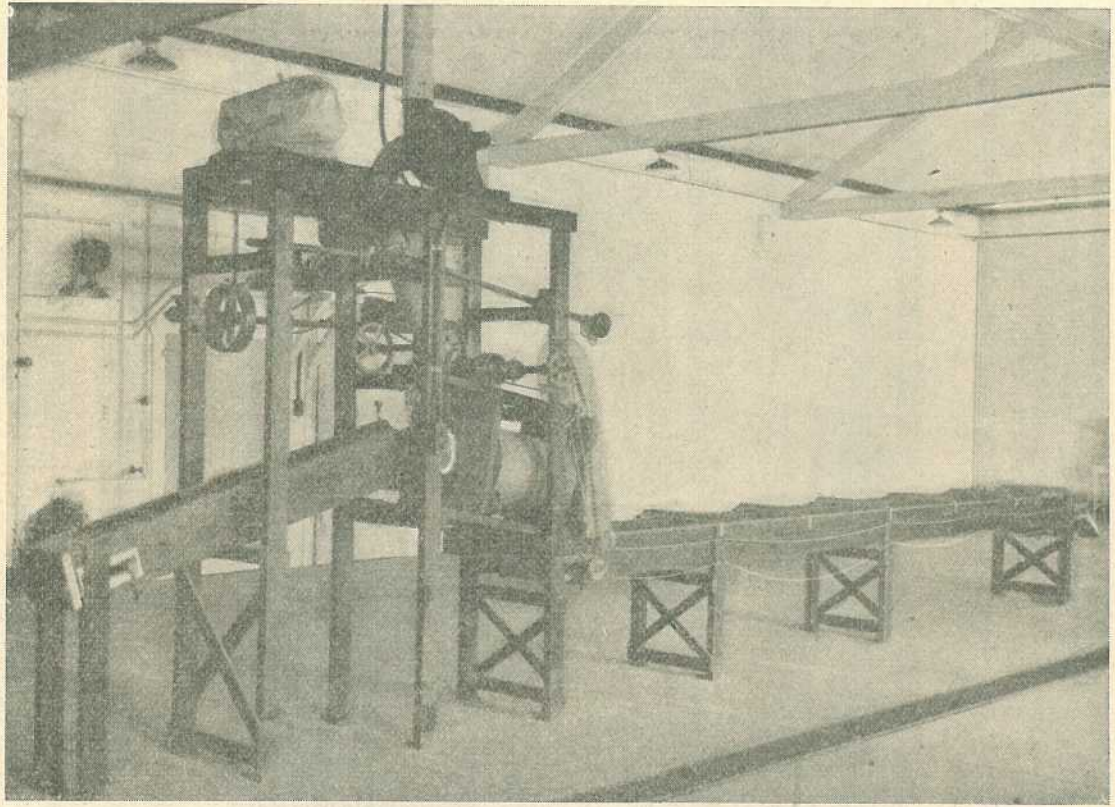


Plate 182.

PHOENIX POLISHER AND REGRADER.—Machine used for cleaning and polishing dates of the Deglet Noor and Saidy types—i.e., dry and semi-dry types.

and not all stringy; attractive uniform colour, preferably lighter than natural palm-ripened dates; and with uniform moisture content to ensure satisfactory storage for a reasonable period.

Choice Grade.—The fruits may vary to a limited extent in size and colour; should be free from all insect and fungus injury; skin may show some blistering or checking, but not to such an extent that it materially detracts from the appearance or impairs the eating qualities of the fruit; flesh and fibre well softened; and moisture content reduced to a point whereby the fruit will keep for a considerable period at ordinary room temperatures.

The lowest grade includes all dates, regardless of size or colour, moisture content or condition, provided only that they are a wholesome, palatable product free from insect or fungus injury. This grade requires to be considerably dehydrated so that it will keep for an indefinite period when packed in bulk for culinary purposes.

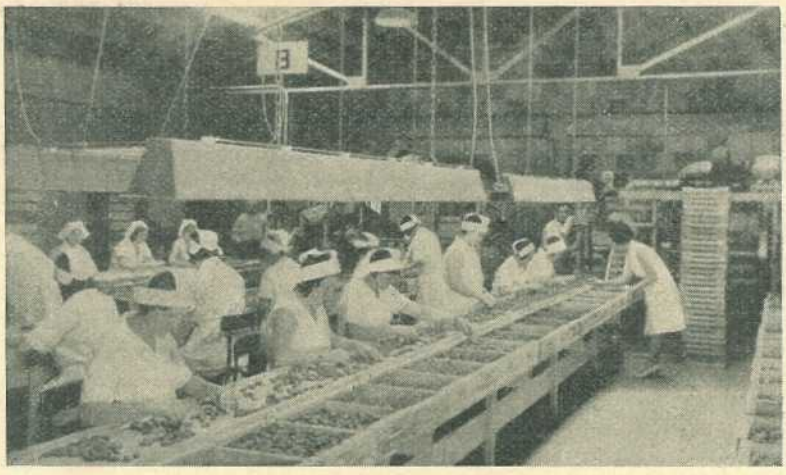


Plate 183.
Grading Deglet Noor dates.

Artificial Ripening.

The successful handling of this problem is vital to the marketing of dates, and the various methods have been studied for many years by scientists interested in date production. It has now been found that certain varieties do not mature their fruits satisfactorily on the palm. Also, it is recognised that the temperature and relative humidity required not only differ with varieties, but also must be altered according to the degree of ripeness and the moisture content of the fruit being handled. Consequently, certain experimenting would be necessary where seedling dates of unknown origin have to be handled.

It would appear that ripening temperatures range from 95 to 110 deg. Fahr., accompanied by a relative humidity ranging from 60 to 80 per cent. A constant temperature and humidity is maintained by thermostat and humidity controls, similar to those used in the latest banana ripening methods. Electricity is most satisfactory for heating, and to ensure a uniform temperature in all parts of the room the air must be kept constantly in circulation; for this purpose an electric fan

or an air-circulating system involving the use of a rotary or exhaust fan should be provided. Also, a means for expelling the air from the room and replacing it with fresh air is very necessary. This provision may easily be arranged in the air-circulation system or by the use of ventilators. Thermometers placed near the ceiling and floor of the ripening room will give a check on the uniformity of the heat and the efficiency of the fans.

The fruit is held at the ripening heat until the flesh becomes soft and the greater part of the fibre around the seed cavity has broken down into soft date meat. A satisfactory method for testing the maturity of a date is to hold it between the thumb and forefinger and press gently. If the flesh is soft and pliable ripening is complete; if it is hard and unyielding the fruit should remain in the maturation room for a longer period.

The length of time required to ripen dates properly will vary from several hours to three or four days, depending upon the variety and the condition of the fruit at the time it enters the packing house.

Nearly all varieties of soft dates—the Barcaldine dates are all of this type—must be dehydrated to some extent before being placed on the market. Dates which have a moisture content of from 25 to 27 per cent. keep indefinitely at ordinary room temperatures, and can be classed as a non-perishable product. Soft varieties dehydrated to that extent lose their round, attractive appearance, and cannot be sold as fresh fruit on the recognised date markets throughout the world. The term "fresh" when applied to dates means fruit that has been dehydrated only to a degree which makes it semi-perishable or reduces the moisture content to from 30 to 40 per cent. Such fruit must be placed on the market for immediate use or held in cold storage.

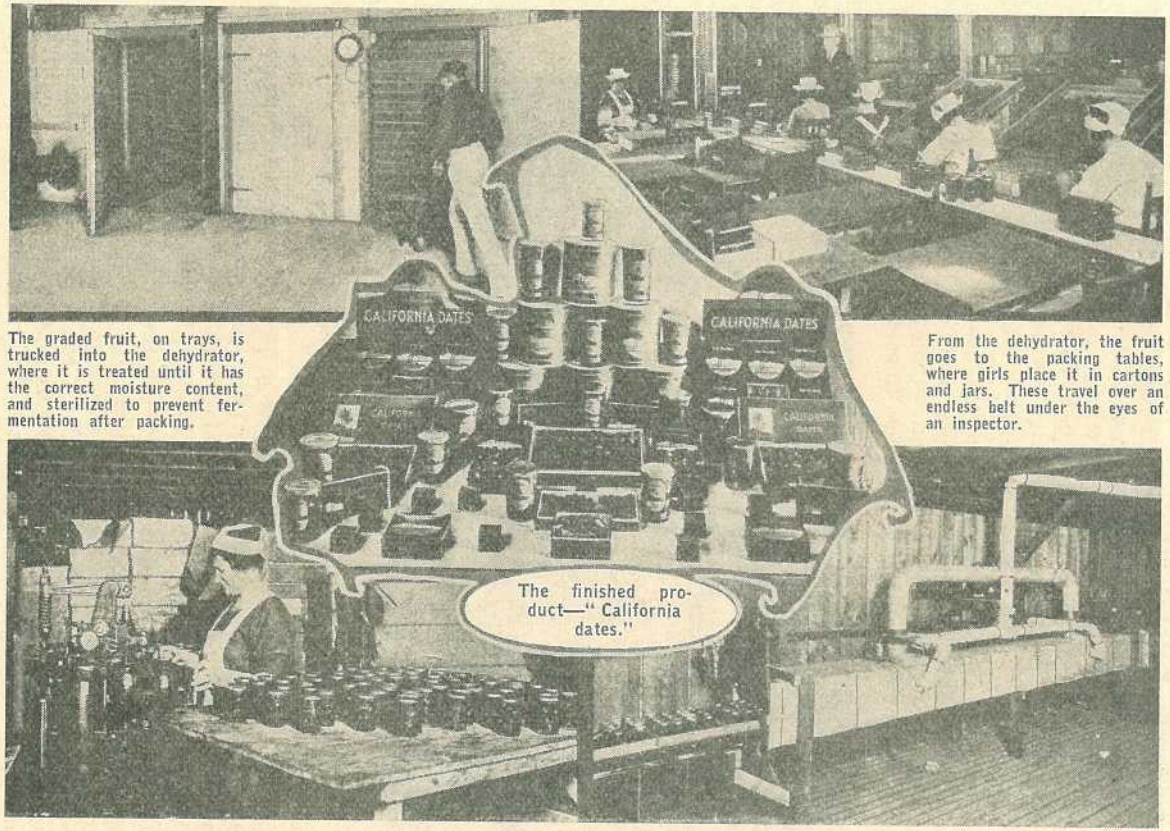
Dehydration is accomplished by raising the temperature of the ripening room to from 130 to 140 deg. Fahr., and simultaneously reducing the humidity to 50 per cent. This should be done immediately following the ripening process. It is stated that a temperature of 140 degrees darkens the fruit considerably, and could not be recommended except for those varieties which have a natural dark colour or which carry a very high moisture content. With many varieties dehydration completes the breaking down of the fibre around the seed cavity, and greatly improves the flavour. Men used to this class of work can accurately estimate the moisture content of a date by its appearance and feel, but an inexperienced person can well afford to sacrifice appearance for keeping quality and dehydrate the fruit until it is quite wrinkled.

Packing.

At this stage very little need be said about packing, but it is hoped that in days to come information on this subject will be needed in Queensland.

American growers have reached a high standard in packing dates. Under certain climatic conditions the danger of souring with soft varieties is reduced if some ventilation is provided and consequent loss of moisture permitted. Under similar conditions semi-soft dates and dates used for confectionery purposes require airtight containers to maintain a constant moisture content of the fruit.

From this it will be seen that two distinct types of containers are nearly always required. The Americans pack their "Fancy" and



The graded fruit, on trays, is trucked into the dehydrator, where it is treated until it has the correct moisture content, and sterilized to prevent fermentation after packing.

From the dehydrator, the fruit goes to the packing tables, where girls place it in cartons and jars. These travel over an endless belt under the eyes of an inspector.

The finished product—"California dates."

The jars are capped under vacuum, the natural flavour of the fruit being thereby preserved.

Filled and capped, the jars pass through the sterilizer, a final step insuring keeping qualities.

Plate 184.

"Choice" soft dates in attractive containers having a net weight of from 8 oz. to 5 lb. These containers are of any desired shape, and hold one or more layers of dates. The oblong or square types appear to be the most favoured. Either cardboard or light wooden containers appear to be equally suitable. The inside of the container is preferably treated with a paraffin wax preparation or lined with wax paper, and the individual dates are packed in such a design as to lend attractiveness to the package. It is most advisable to cover these packages with a medium weight cellophane, which not only excludes dust and insects, but also displays the fruit to better advantage. Cellophane also reduces the susceptibility of the dates to damage by surrounding atmospheric conditions.

Fancy and choice semi-soft dates are usually packed similarly to soft varieties in tight moisture-proof containers, which may contain several layers of dates. A transparent window of cellophane serves to display the fruit, and adds attractiveness to each package.

Plate 185.
Date products as they should appear when offered for sale.

The lowest grade of dates is packed in heavy cardboard or wooden boxes holding 20 lb. or more. This grade would enter into direct competition with the imported dates, and therefore care in arranging the fruit would assist in improving its appearance and sale.

Queensland growers should remember that dates are usually consumed without being washed or sterilised by cooking, and should take precautions to place only wholesome, clean produce on the market. It is considered that choice grades of dates could be sold on Australian markets in competition with fancy sweets, but in doing so it would be essential for the container and packing to be as attractive as possible.

Cold Storage.

Cold storage is a necessary operation connected with date production. The present system in California is to prepare the fruit for market and to place it in cold storage at a temperature of 32 deg. Fahr., with a relative humidity of from 65 to 70 per cent. This provides

satisfactory storage for from three to six months, but when stored for longer periods it is advisable to transfer the fruit to a lower temperature, say 18 degrees.

Varieties.

At present Queensland can boast of only a very small area under dates, and these are mostly seedlings possessing no special features whereby they can be listed as being extraordinarily good. Bearing this fact in mind, and knowing that dates will grow satisfactorily in certain districts in Queensland, the following factors should be considered.

In the development of any new horticultural industry the question of varieties best adapted to local conditions and to present and future markets must be given very careful consideration. In the planting of dates even more consideration should be given to varieties than is actually necessary in other orchard plantings, because date palms cannot be grafted or budded. Once a variety is established it cannot be changed except by destroying the planting and replacing it with another having apparently more desirable qualities.

It is estimated that there are 380 commercial varieties of dates growing in the Old World, but importations to other parts of the world have decided those responsible that less than a dozen of these varieties are worth handling when starting out into this particular industry. These varieties can be graded into three distinct types:—The soft dates, the semi-soft dates, and the dry or bread dates.

Soft types, as the name implies, possess a soft, juicy flesh, and ripen in nearly all varieties earlier than the other two types mentioned.

Semi-soft varieties have a high sugar content and a lower moisture content. When cured dates of this class may be stored for months in moisture-proof packages. In California the Deglet Noor and the Zahidi are the two principal varieties of this type grown.

Dry or bread dates have a high sugar content and a very low moisture content, and when cured they become very dry and hard. The Thoory is the outstanding variety of this bread-date class. Palms of this variety are the hardiest grown, and the fruit will keep indefinitely if properly stored.

Before very much can be done in Queensland offshoots will have to be imported from overseas, preferably from Arizona, United States of America, for, although something of value may be achieved by the planting of specially selected seed, the actual risk attached is too great to be undertaken by other than an experimentalist.

The following list records briefly the varieties that are at present growing in Arizona, and that would probably be most suitable for planting in Queensland:—

Deglet Noor.—This variety is considered the finest semi-soft date grown. Due to its high sugar content and low moisture content the fruits keep in cold storage for long periods. Whilst the fruit is ripening it is very susceptible to injury by rain and high atmospheric humidity, and consequently it would not be successfully grown except in a few specially favoured localities. The fruit is large, about 1¾ inches by ¾ inch. The colour changes from light rose to amber when ripe, and to reddish-brown when cured. From 250 to 300 lb. per palm would be very fair cropping.

Halawi.—This is claimed to be the leading variety exported from Southern Iraq to all parts of the world. It is of the soft type and particularly hardy, and could be recommended very strongly. One objection is the somewhat small size of the fruit, but the ease with which it can be artificially ripened compensates for this to a great extent. The fruit is from 1¼ to 1½ inches by ¾ inch. The colour changes from yellow to light amber when ripe, and to golden brown when cured. Production would average from 150 to 200 lb. per palm.

Hayany.—A large, soft type of date, low in sugar content, somewhat difficult to market. It is a heavy cropper, but susceptible to damage from rain or high atmospheric humidity. The fruit is very large, being 2¼ inches by 1½ inches. The colour changes from carmine to purplish black at ripening and curing. Production from 250 to 300 lb. per palm.

Iteema.—A large, soft type date, the fruit of which is very attractive and of excellent quality. The offshoots of this variety are very difficult to propagate, requiring special attention before being removed from the parent plant, and then planting in a nursery for at least two years. The fruit is large, 1¾ inches by 1 inch. The colour changes from yellow to amber at ripening, and to yellowish-brown when cured. Production would average from 200 to 250 lb. per palm.

Khadrawi.—A medium, soft type date, ripening very early, but bearing a somewhat light crop. If planted to itself the distance between the palms of this variety could be reduced from 30 feet to 25 feet. The fruit is of medium size, viz., 1⅜ inches by ⅞ inch. Colour changes from yellow to amber when ripe, and to reddish-brown on curing. Production would average from 125 to 150 lb. per palm.

Khalasa.—A medium, semi-soft type date of fine quality. In California it is reported to be resistant to rain damage. The fruit is of medium size, 1⅜ inches by ⅞ inch, and the colour changes from yellow to amber when ripe, and on curing to a light brown. Production would average from 150 to 175 lb. per palm.

Kustawi.—A hardy, medium, soft type date, the fruit of which is very similar to the Khadrawi. This date is noted for its resistance to injury by heavy rains and high humidity. Usually the heaviness of the crop is such that thinning out to approximately half is necessary, thus materially increasing the size of the fruit. The fruit is of medium size, about 1¼ inches by ⅞ inch, and the colour changes from yellow to amber when ripe, and on curing to reddish brown. Production averages from 150 to 175 lb. per palm.

Maktoom.—A large, soft type date, the fruit of which ripens late in the season and is of excellent quality. This variety should be particularly suitable for Western Queensland conditions. The fruit is large being about 1¾ inches by 1⅛ inches. The colour changes from light yellow to amber when ripe, and to a rich brown on curing. Production would average from 175 to 225 lb. per palm.

Sayer.—A large, soft type date, of hardy habits, which should be suitable for Queensland planting. The fruit is large, about 1¾ inches by ¾ inch, the colour changing from light yellow to deep amber when ripe, and to reddish-brown on curing. The production would average from 175 to 200 lb. per palm.

Sphinx.—An American seedling of outstanding soft type quality. The fruit is large, about 1¾ inches by 1 inch, with the colour changing from carmine to brown-black when ripe and cured. Production ranges from 250 to 300 lb. per palm.

Zahidi.—A small, semi-dry date of fair quality. The fruit is from 1¼ to 1½ inches by 1 inch, with colour changing from yellow to golden brown when ripe and cured. Production is from 225 to 250 lb. per palm.

Plate 186.

This photograph (enlarged) was used as an advertising poster in California under the caption: "Have a date with me!"

Thoory.—This is recognised as the best dry or bread date grown. The fruit is of medium size, with colour changing from yellow to dark brown when ripe and cured. The production is about 200 lb. per palm.

These are the varieties of dates recommended for planting in Queensland. Offshoots should necessarily be free from disease, and will be allowed entry into the State only under supervision of the Department of Agriculture and Stock.

Parlatoria blanchardi, commonly referred to as the Parlatoria Date Scale, is present in Queensland, but fortunately this appears to be the only trouble affecting the palms in this State.

This Department's date experiment block at Barcaldine, which was established in 1935, is a definite move in the right direction. There are 183 young palms growing in this plot, and observations are being recorded from time to time, such observations embracing matters of importance in connection with irrigation, suitability of soil, temperatures, &c. It is hoped that much valuable data will be obtained from these efforts, and that date growing in Queensland on a commercial basis will be an achievement shortly to be realised.

[CONCLUDED.]

FERTILIZERS SOLD IN QUEENSLAND.

A review of the fertilizers registered under the Act for the current year reveals the high standard of materials sold in this State.

The following sets out the kinds of materials sold and the respective percentages of nitrogen (N) phosphoric acid (P_2O_5 and potash (K_2O) present in such materials.

Fertilizer.	Minimum— Nitrogen %	Phosphoric Acid %	Potash %
Nitrate of soda	15.6	—	—
Nitrapo (Potassium nitrate + sodium nitrate)	15	—	15
Sulphate of ammonia	20.6	—	—
Dried blood	11-13	—	—
Superphosphate	—	20.5 (water soluble)	—
Bone dust	3-3.5	22-23.5	—
Meatworks fertilizer	3-6	14-23	—
Basic phosphate	—	17 (cit. sol.)	—
Nauru phosphate	—	37	—
Sulphate of potash	—	—	48
Muriate of potash	—	—	50

A large proportion of the fertilizers distributed in Queensland is sold in the form of mechanical mixtures, i.e., mixtures containing two or more of the above-mentioned ingredients (with the exception of basic phosphate and Nauru phosphate) in varying quantities.

In order that the purchaser may be aware of the composition of the various fertilizers, it is enacted by law that the respective minimum percentages of nitrogen, phosphoric acid, and potash, together with the forms in which they respectively occur, shall be declared on the label attached to each bag. This label should also set out the name of the fertilizer, the net weight, and the name and address of the manufacturer or dealer.

Every sale of fertilizer over the value of 10s. must be accompanied by an invoice setting out the warranty required by the Act.

The labels that must be attached to every bag of fertilizer and the invoice warranty which must accompany the sale are the purchaser's guarantee as to its quality.

It is to the intending buyer's advantage to make himself acquainted thoroughly with the constituents of each fertilizer advertised as useful for his purpose before making a purchase.

The use of the materials tabluated in this note—and mixtures made from them—is sound policy, which can be followed profitably by primary producers concerned.

AUGUST is normally a dry month in Queensland, and this year has proved no exception, as, apart from the scattered rains early in the month, no beneficial falls have been received. The South Coast received only light falls, but the Downs and south-west received from 16 points at Warwick to as high as 1 inch at Talwood. At the time of writing (24th August) pastures are rapidly drying off, and rain is required both to provide feed and to enable the sowing of spring crops.

WHEAT.

The crops are looking promising, but over the greater area now require substantial rain to promote a continuity of growth. Excellent growth was made during July, the wheat stooling out well and being unchecked by the severe frosts which are sometimes experienced. However, the lack of subsoil moisture is now being felt, particularly in the Warwick district, where some crops are reported to be withering. With increasing temperatures, drying westerly winds, and greater transpiration of moisture, it is apparent that rain is now urgently required.

In the Allora and Goombungee districts, where an increased area has been sown, a heavy infestation of wild oats is reported, in many instances to such an extent that it will be necessary to feed off or plough in the infested paddocks. This weed pest is likely to increase unless efficient fallowing and rotation of crops is practised to a greater extent in future years. It is estimated that over 300,000 acres have been sown to wheat during the present season, and owing to the substantial advance in world prices, the return to growers should be greater than that received for many years past. The State Wheat Board has paid 3s. 9d. per bushel for 1935-36 grain to date, and although deliveries were under average only 1 per cent. of the crop was disposed of as feed, no less than 79·5 per cent. of the balance being classified as Q1 standard.

GENERAL.

The harvesting of Atherton Tableland maize has proceeded under good conditions, a record yield of more than 20,000 tons being expected. Sowings of early maturing maize varieties have been made in the southern coastal areas, and are making good progress, although in need of rains at an early date. The spring crop is usually a risky one, but where a failure from grain is indicated such crops can be profitably utilised as fodder or silage.

Local onion growers can anticipate good prices for their crops this year, as, owing to a shortage in the south, values have already exceeded £20 per ton. With October harvesting growers can, therefore, cater not only for local requirements, but also for southern trade, and if due attention is given to packing in new bags and to adequate grading some excellent returns should be realised.

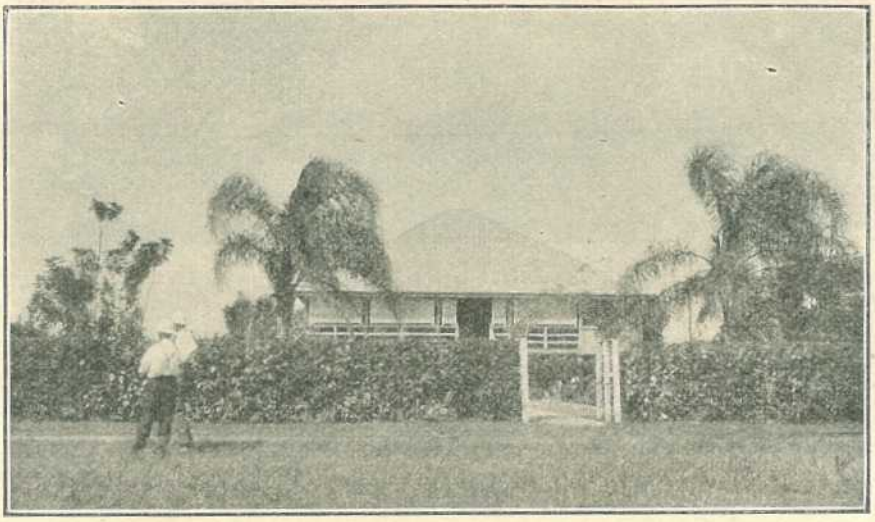


Plate 187.
A Farmer's Home on the Burdekin Delta, North Queensland.

Cotton.

The exceptionally dry weather which has been experienced during August in all the cotton-growing districts has allowed of the harvesting of the cotton crops to be continued under nearly ideal conditions. Although the rate of receivals at the ginneries has naturally slowed down as compared to the previous months, 1,181 bales of lint were ginned during the month—the total number now being 12,881 bales, composed of 9,080 at Glenmore and 3,801 at Whinstanes.

Seed distribution for the coming planting is now well under way—seed sufficient for some 20,000 acres having been distributed to date. It is apparent by the range of applications being received, that a decided increase in interest in cotton-growing is occurring. This augurs well for the desirable expansion of acreage being obtained that is necessary to produce the amount of cotton which will be required by the Australian spinners during the coming season.

Sugar.

Weather conditions during the month have been uniformly dry throughout the sugar areas, with temperatures somewhat lower than normal, and some frosts in the south.

Ratoon crops are making only fair growth. Planting was seriously delayed in northern areas, due to the prolonged wet season, while in the south it is held up pending a suitable fall of rain.

Standover cane is yielding a satisfactory sugar content in the southern districts, but it is considerably below that of last year in northern areas.

SOME TROPICAL FRUITS.

No. 11.—THE SOUR SOP.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

THE Sour Sop is a tree of frequent occurrence in the gardens of North Queensland. The fruit is of a type more suited to garden cultivation than to commercial planting, and its production is therefore more on those lines, hence it is only rarely seen in fruit shops. In the gardens of Cairns and the surrounding district odd trees are commonly met with.

The tree is known botanically as *Anona muricata,* L., and is native of tropical America. It differs from other cultivated Anonas in being practically an evergreen. Only when growing in situations inclined to dry out does it shed its old leaves before the new ones are produced.

The foliage is a dark glossy green, giving the tree an attractive, ornamental appearance. The laurel-like leaves are glabrous, comparatively thick and leathery in texture, up to about 6 inches in length. Flowers are usually produced in profusion, and may arise from any part of the tree, ranging from the trunk and main branches to the previous season's lateral growths. They are large, the three outer petals being up to 1½ inches across. These petals do not overlap one another, but are laid with their margins adjacent, consequently, as they are roughly shield-shaped, the unopened flower has somewhat the form of a three-sided pyramid.

Only a small proportion of the flowers set fruit—in fact, the setting of fruit is characteristically so light that it is regarded as one of the chief drawbacks to commercial cultivation in some countries. Of the limited number of fruit which does set there are nearly always a few that do not develop properly, and produce only malformed specimens. A dozen to twenty good fruits is usually considered an excellent crop for one tree.

The fruit is a large one, frequently up to 10 inches or more in length, quite commonly 8 inches long, and weighing 4 to 7 lb. The outline varies from heart-shaped to almost oblong. The skin is green, thin, and leathery, and its surface is studded with short, green fleshy points or spines arranged in whorled rows extending from the stem end to the apex. The flesh is snow-white and highly aromatic. In texture it is cottony, and to eat it out of hand one is given the impression of chewing a mouthful of cotton wool soaked in juice. The flavour is good, but to enjoy it to the full some preparation is needed. The pulp should be placed in a colander and the juice expressed and drained off into a dish. It may then be made into a fruit jelly with the addition of a little gelatine or it may be eaten as it is after being chilled. Such treatment renders the fruit really delicious. In the Cairns district the season for the fruit is an extended one, commencing about April and lasting over several months.

Plate 188.
Young and half-developed Sour Sop fruit on the lateral branches.

The Sour Sop is more strictly tropical than even the Sugar Apple, and thrives under the moist, humid conditions to be found in the tropical coastal wet belt. On a loose, rich, loamy soil under such conditions of climate the tree grows rapidly. Even on the sandy soil of Cairns trees 15 to 18 feet high and only six to seven years old have been noted. These, however, have been growing at the outflow of a house drain, and were, consequently, abundantly supplied with water at all times of the year.

Plate 189.
The peculiar habit of fruiting on the trunk.

The tree will commence fruiting at three to four years of age, and will continue cropping regularly with practically no attention. W. Popenoe notes, however, that in Cuba liberal dressings of fertilizer have been found beneficial in increasing the amount of fruit produced. The fertilizer used in that country is one containing 3 per cent. nitrogen, 10 per cent. phosphoric acid, and 10 per cent. potash. J. C. Brünnich's

recommendation for anonaceous fruits in Queensland is 1 to 3 lb. of superphosphate, 2 to 6 lb. of meatworks manure with blood, and 1 to 2 lb. of sulphate of potash per tree, according to age, which mixture gives a practically identical formula to that mentioned above.

Plate 190.
Sour Sop tree five years from seed.

Sour Sops are commonly raised from seed, which germinates easily. The seed should be sown in a moist, shaded situation, and may take a month to germinate. Seedlings frequently spring up spontaneously under bearing trees. Vegetative propagation is not practised in this country, but it should be adopted if a particularly desirable tree is ever located. P. J. Webster has found it may be shield-budded successfully.

The chief insect pest attacking the Sour Sop is the Mealy Bug. These insects are frequently found thickly congregated on the fruits. The customary nicotine sulphate and soap spray applied with force is quite satisfactory as a control measure.

FRUIT MARKETING NOTES.

JAS. H. GREGORY, Instructor in Fruit Packing.

DURING the past month the Royal National Exhibition was held, and many interesting contacts were made. Many were the different viewpoints on marketing met with during meetings with fruit-growers during Exhibition Week. From the aspect of a fruit display the Exhibition was most successful, much excellent fruit being shown. The frequent remarks of the public, "What beautiful fruit; we can't buy fruit like that"—afford material for serious thought. Is it because they will not pay the price? There are plenty of shops which sell good quality fruit.

One of the features of the Department of Agriculture and Stock Court at the Exhibition was a display of tropical fruits, in which an amazing interest was shown by the public. For the period of the Exhibition officers were continuously on duty to give information on the various fruits displayed, and they all remarked upon the interest shown by the public and the numerous requests as to where the fruits could be obtained and how to use them. Most of the fruits came from North Queensland, splendid specimens of granadillas and other tropical fruits being displayed. For the duration of the Exhibition these fruits kept in excellent condition, notwithstanding their previous long journey from Cairns. There is no doubt that North Queensland growers, with everything in their favour so far as the production of these fruits is concerned, are missing a golden opportunity in not making greater efforts to create a tropical fruit trade.

Market quotations have not fluctuated during the month to any great extent, although most fruits showed a tendency to rise in price. Banana prices in Melbourne and Sydney have reached much higher levels than for some time, up to 23s. per case being obtained in Sydney.

Prices on the various markets at the commencement of the last week in August were—

CUSTARD APPLES.

Brisbane prices for good quality fruit ranged from 3s. to 4s. 6d., with some special large sizes to 6s. Sydney prices were from 5s. to 7s. 6d., and Melbourne from 6s. to 8s. Owing to the season drawing to a close, most lines are on the small side.

PAPAWS.

In Brisbane locals brought from 2s. 6d. to 4s. per bushel case, and Gunalda from 3s. 6d. to 5s. 6d., Yarwun from 7s. to 9s. per tropical case. In Melbourne 10s. to 14s. per tropical case was obtained; green lines are unsaleable. Sydney prices were from 8s. to 12s., with special coloured ripe lines to 15s.

AVOCADOS.

Realisations in Brisbane were from 8s. to 10s. per case, and in Melbourne up to 15s. The season for this fruit is now rapidly drawing to a close.

PINEAPPLES.

Brisbane prices for Smooths were from 3s. to 6s. per case, and 2s. to 5s. per dozen; Ripleys brought from 3s. to 5s. per case, and from 1s. to 3s. 6d. per dozen. This market has been rather slow for pineapples during the last few weeks.

Melbourne prices were from 8s. to 9s. per case, with green fruit unsaleable, and not wanted. Prices in Sydney ranged from 8s. to 10s. per case, there being a steady demand for good ripe fruit.

BANANAS.

In Brisbane, Cavendish bananas realised for Sixes 10s. 3d. to 12s. 6d., Sevens 11s. 3d. to 12s. 6d., and Eights 13s. 3d. to 14s. 6d. Immature, thin and ribbed fruit is not popular, yet some growers are showing a tendency to cut their fruit too soon During the cooler weather there is no risk incurred by allowing the fruit to develop a little. Lady Fingers brought from 2½d. to 7d. per dozen for good lines.

Melbourne prices for Cavendish were:—Sixes 14s. to 15s., Sevens 16s. to 17s., Eights and Nines 18s. to 19s. per case, with some special lines at higher prices. In Sydney, Sixes realised from 14s. to 16s. per case, Sevens from 16s. to 18s., and Eights and Nines from 18s. to 21s. per case, with some specials to 23s.

CITRUS FRUITS.

Oranges.—Common oranges on the Brisbane market realised from 6s. to 7s. per case, a few lines from the Gayndah district from 8s. to 10s., and Redland Bay fruit from 7s. to 9s., with some special lines higher. Imported Navels brought from 6s. to 9s.

Mandarins.—Emperors brought from 7s. to 8s., with Gayndah lines to 12s.; Scarlets from 4s. to 9s.; Glens from 8s. to 13s. Many lines of small Scarlets and Glens are hard to clear.

Grapefruit.—Prices ranged from 4s. to 6s. per bushel.

Lemons.—Local lines realised from 4s. 6d. to 6s. per case, and Gayndah fruit from 9s. to 11s. Some lines give the appearance of being uncured, and are consequently hard to sell. Growers should remove lemons from the trees at the beginning of the change from the green colour, and carefully store them in a cool dry place in single layers. The fruit will sweat down and colour excellently, and if the operations have been carefully carried out, will keep for many weeks.

Melbourne citrus prices were:—Lemons, 5s. to 8s.; oranges, common, 5s. to 7s.; grapefruit, 4s. to 9s., skin-marked fruit being hard of sale; mandarins, 5s. to 9s. In Sydney local Navels realised 3s. to 7s., and local Emperors 2s. 6d. to 7s.

PASSION FRUIT.

Attention is drawn to the prices obtained in Melbourne for this fruit, viz., from 14s. to 22s. Sydney prices were from 6s. to 10s. per half-bushel, and Brisbane from 4s. to 11s.

STRAWBERRIES.

Brisbane prices for average quality were from 5s. to 7s. per dozen boxes, with specials from 9s. to 12s. a dozen. In Sydney, trays were from 3s. to 5s., and boxes from 8s. to 14s. a dozen.

TOMATOES.

In Brisbane ripe fruit realised 1s. 6d. to 3s. 6d., green fruit 1s. 6d. to 3s., with coloured lines from 2s. to 5s. In Melbourne, Queensland

re-packed half-bushels brought 6s. to 8s., Adelaide hothouse 10s. to 12s., and West Australian 7s. to 10s. In Sydney from 4s. to 5s. 6d. a half-bushel was obtained.

APPLES.

Growers with apples in cold storage would be well advised to place them on the market in small consignments. All varieties should be removed by mid-September at the latest. The present prices should be quite satisfactory, viz., Granny Smith to 13s., Dunns to 10s., and Delicious to 11s. The Delicious variety is now beginning to open up faultily. Interstate senders to the Brisbane market should take notice that the weather is now warming up, and varieties such as Rome Beauty, Jonathan, and Delicious, under these conditions, do not have a very satisfactory marketing life in Queensland. Large sizes should not be sent under any circumstances.

CUCUMBERS.

Prices in Melbourne for bushel cases were from 15s. to 17s., in Brisbane from 9s. to 11s.

LETTUCE.

Lettuce on the Brisbane market brought from 1s. to 1s. 6d. per dozen. Many growers have adopted the tropical case for packing, a leaflet describing the correct methods to adopt being procurable free upon application to the Under Secretary, Department of Agriculture and Stock, Brisbane, along with other pamphlets mentioned in these notes.

Publications.—A packing chart for lemons is now available, as is also a new publication on apple marketing.

REPLACING MISSING GRAPE VINES.

F. L. JARDINE, Plants Inspector, Stanthorpe.

The propagation of grape vines by layering is an operation usually adopted to fill up the vacant spaces in the vineyard.

After the second year, the replanting of missing vines becomes increasingly difficult and uncertain. Those that do survive are usually dwarfed and unprofitable. It is possible, however, to successfully replace missing vines at any age by layering.

Layering is a simple operation, and may be carried out as follows:—A strong cane of the previous year's growth is selected from a neighbouring vine and, without severing, it is bent down and buried where the plant is to grow, in a trench 8 to 15 inches deep, according to the class of land. The extremity of the vine is allowed to protrude above the surface with a sharp bend, leaving two buds out of the ground. The following summer the portion in the ground makes roots, and also is nourished by the mother vine.

The only care necessary to these layers during the growing season is to remove all growth on the layered cane between the mother plant and where it enters the ground, leaving only that growing from the extremity for the new vine.

After the second season the young vine is severed from the parent, when it may be permitted to carry a reasonable crop.

Growers will be well advised to attend to this matter while the grape vines are dormant. Vacancies in a vineyard, apart from the unsightly appearance, are most unprofitable.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and the Jersey Cattle Society, production charts for which were compiled during the month of July, 1936 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
May 4th of Oakvilla	W. G. Marquardt, Wondai	12,874·2	536·88	Victory of Greyleigh
Champion 9th of Oakvilla (270 days)	W. G. Marquardt, Wondai	11,976·1	498·84	Victory of Greyleigh
Shamrock 6th of Oakvilla (226 days)	W. G. Marquardt, Wondai	10,845·7	416·295	Victorious of Oakvilla
Empress 11th of Sunnyside	Paul Moore, Wooroolin	9,826·75	411·862	Emblem of Sunnyside
Champion 13th of Oakvilla (272 days)	W. G. Marquardt, Wondai	10,310·7	398·699	Gordon of Swanlea
Sunnyside Mabel 10th	Paul Moore, Wooroolin	9,199·5	372·126	Count's Lad of Cosey Camp
Pet 18th of White Park	Bruggemann Bros., Silverleigh	8,757·7	360·635	Violet's Emperor of Hill V ew
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Navillus Charm	C. O'Sullivan, Greenmount	7,391·75	306·483	Midget's Shiek of Westbrook
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Redbank Jessie	A. H. E. Black, Kumbia	7,201	268·095	Brundah Warrior
Rosemount Scarlet 8th	A. J. Bryce, Maleny	6,393·8	253·29	Springdale Jupiter
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Boah Peak Melba	Bruggemann Bros., Silverleigh	7,800·85	319·397	Glenroy Royal
College Rascal 3rd	Queensland Agricultural High School and College, Gatton	6,243·06	265·377	Duplex of Greyleigh
Navillus Mavis 3rd	Con. O'Sullivan, Ascot, *via* Greenmount	6,330	262·675	Parkview Mars

JERSEY.

Mature Cow (over 5 Years), Standard 350 lb.

Brooklands Choice Lady (365 days)	W. S. Conochie, Sherwood	12,553·61	758·331	Duster of Brooklands
Liseux Bessie	J. and R. Williams, Crawford	8,226·6	407·23	Zillah's Boy of Liseux

Senior, 4 Years (over 4½ Years), Standard 330 lb.

Gunnawah Opera Queen	F. Maurer, Darra	8,094·95	394·387	Retford Prometheus

Junior, 4 Years (under 4½ Years), Standard 310 lb.

Oxford Ginger Queen	J. E. Smith, Mudgeeraba	5,586·64	344·442	Oxford Robin

Senior, 3 Years (over 3½ Years), Standard 290 lb.

Forward Rosebud	W. S. Conochie, Sherwood	10,643·73	524·345	Forward of Brooklands

Junior, 3 Years (under 3½ Years), Standard 270 lb.

Maiwand Verbena	Queensland Agricultural High School and College, Gatton	5,011·12	324·142	Aveley Rex
Lermont Rosette	J. Schull, Oakey	4,929·8	298·223	Trecarne Fern Lad

Senior, 2 Years (over 2½ Years), Standard 250 lb.

Dawn Jess	A. L. Walker, Dawn	5,806·1	313·452	Retford Glory's Victor

Junior, 2 Years (under 2½ Years), Standard 230 lb.

Brooklands Royal Madge	E. J. and H. G. Johnson, Gleneagle	6,837·88	331·748	Retford Earl Victor
Oxford Kitty	E. Burton and Sons, Wanora	5,121·5	328·997	Overlook Nancy's Remus
Dawn Belle	A. L. Walker, Dawn	4,934·25	304·110	Retford Glory's Victor
Pineview Lucy's Queen	J. Hunter and Sons, Borallon	5,030·98	289·683	Oxford Jeweller
Wyreeme Leonie	J. B. Keys, Wyreene, Gowrie Little Plains	4,250·72	256·80	Goldfinder's Prospector of Mongo
Fauvic Bangle (267 days)	H. Cochrane, Kin Kin	4,479·95	248·677	Condong Double Prometheus
Nimbrae Promise	F. R. Nimmo, Rosewood	4,636	248·212	Oxford Tressidore

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Phalaris—Toowoomba Canary Grass.

A.A.F. (Mondure, via Murgon)—

The grass you sent bore no seed-heads and gave a little difficulty in determining. It is *Phalaris tuberosa*, the Toowoomba Canary Grass, undoubtedly one of the best winter legumes in Australia. On the whole it does better in the cooler climates than the warmer, and we were very interested to learn that it lasted through the summer with you at Mondure. The grass is extremely palatable and on this account we are not surprised that your plants do not get a chance to seed if stock have continual access to them. Seeds should be sown in autumn, but the grass really wants cultivated conditions to do well, and stock should be kept off it for a little time until its roots are established.

Three Weeds.

P.B. (Brooweena, Gayndah Line)—

(*a*) *Raphanus raphanistrum* (charlock). This is one of the weeds known as mustard weed or turnip weed. It is a very common weed of cultivations in Southern Queensland.

(*b*) *Emex australis* (Cape spinach or prickly jack), also known in Queensland as bullhead or cathead burr. This name, however, is applied to a number of burr plants in Queensland. The plant is not known to possess any poisonous properties. It is, however, a very bad weed pest, and should be eradicated when it first appears.

(*c*) *Polygonum convolvulus* (climbing buckwheat). This weed makes its appearance every now and again in cultivation areas in different parts of Queensland. Occasionally it becomes rather a bad pest, but does not seem to spread to the extent of some other weeds.

A Native Bean.

L.H.B. (Chinchilla)—

The specimen represents *Canavolia obtusifolia*, a native bean for which we have not heard the common name. It belongs to the same genus as the sword bean and jack bean—two beans cultivated to a limited extent in Queensland. The latter, which we have grown ourselves, we have found quite an edible bean, both the pods in the young stages and the nearly ripe seeds. The species you send also occurs in the Islands of the Pacific, and we have had always understood it to be dangerous, but a friend who botanised in the New Hebrides for the best part of a year informed us that the beans were a regular source of food to the natives.

Winter Rhodes Grass—"Devil's Fig."

C.S.C. (Mackay)—

1. *Chloris distichophylla* (winter-growing Rhodes grass). This grass seems to be very palatable to stock, but tests made here and in New South Wales show it to possess a prussic acid yielding glucoside in fair quantities. In spite of this, however, like many other prussic acid-yielding plants it seems to be fed on by stock in most cases with impunity. Stock, however, should never be allowed to gorge themselves with it on an empty stomach.

2. *Solonum torvum*, familiarly known in Queensland as Devil's Fig. It is rather a serious pest in some coastal localities.

Mount Larcom Specimens Identified.

W.D. (Bracewell, Mount Larcom, Q.)—

1. *Castanospermum australe* (Moreton Bay chestnut or bean tree). This is a native tree with a durable timber much prized for high-class furniture and panelling. Black bean is the official name adopted for the timber by the Queensland Forest Service. The trees are often faulty and the timber presents some difficulties in seasoning.
2. *Jacaranda acutifolia* (the jacaranda tree), a native of South America.
3. *Schinus molle* (the pepperina tree or pepper tree), a native of South America.
4. *Bauhinia candida* (white bauhinia), a native of Tropical Asia.
5. *Sterculia discolor* (scrub bottle tree).
6. *Ficus Benjamina* (weeping fig), a native of India.
7. *Ficus stephanocarpa* (sand-paper fig), also called purple fig, a native of creek banks in coastal Queensland.
8. *Tamarindus indica.* The tamarin is now widely cultivated in all tropical and sub-tropical countries, and is thought to be a native of Tropical Africa. The name Tamarin is derived from the Arabian Tamare-Hindi, meaning Indian date.

Black Nightshade.

A.G.S. (Bowen)—

Both specimens represent forms of *Solanum nigrum*, the black nightshade, or, as it is more commonly called in Queensland, blackberry. The green leaves and green berries of both plants would be harmful to stock if eaten in any quantity. These species occur in Queensland in a number of forms, and although the ripe berries are eaten freely without any ill effects, the green parts we have always regarded as dangerous, as they contain a poisonous alkaloid, solanin, which tends to disappear from the berries as they ripen. It is just possible that the purple form may contain more of the poisonous principle than the green one, but on this point we are not certain. We would like to see specimens of it later on in berry.

Generally speaking, so far as we have observed, stock seem to avoid these plants when they are growing, although on one or two occasions it has been reported to us that pigs have been poisoned by them, and in the southern States fairly definite reports of sheep having been poisoned by eating the green plants are on record.

Forestry Specimens Identified.

S.D. (Cawarral)—

1. *Eucalyptus tereticornis* (Blue gum). This is a very strong hardwood for general structural purposes. It is said to have high durability in damp situations, and to have excellent resistance to white ant attack.
2. *Euroschinus falcatus, var. angustifolius.* This tree goes under many local names, one of the commonest being maiden's blush. This name, however, we think should be reserved for a different tree with very much broader leaves. The Queensland Forestry Service has adopted the name of blush cugerie for the timber. It is a light soft timber, lacking durability and very susceptible to borer attack.
3. *Cordia dichotoma* (the Sebastian tree). This tree has a wide distribution outside Australia through the Malayan Archipelago to India. In India the wood is considered fairly strong, and is used for boat building and various purposes. So far as we know it is not used here at all. The mucilaginous fruit is used in India as a laxative and to give relief in chest and throat affections.
4. *Melaleuca leucadendron, var. coriacea* (tea tree). The correct spelling of this word is "tea," not "ti" as usually written. The origin of the name is that Dr. Anderson, who was the surgeon and naturalist on Cook's third voyage to Australia, used the leaves of an allied plant as a substitute for ordinary tea, and the drink, if not particularly palatable, was found useful in keeping down scurvy, hence the local name.

There are many varieties of *Melaleuca* in Queensland, and the Queensland Forest Service has adopted the name of Brown Tea Tree for the timber of them. If you have by this time obtained a copy of "The Timbers and Forest Products of Queensland," by E. H. F. Swain, you will find quite a lot said about the timber.

5. *Eucalpytus crebra* (narrow-leaved iron bark), one of the strongest and most durable hardwoods.

Sour or Yellow Grass.

C.F.A.R. (Caloundra)—

The specimen represents *Paspalum congugatum*, generally known in Queensland as Sour Grass or Yellow Grass. This grass is spread very widely over the tropical regions of the world and has been established in North Queensland for a number of years. More recently it has travelled south, and is now found in various localities and in the Northern Rivers of New South Wales, but does not seem to spread to any thing like the extent it does in the North. Farmers in North Queensland are very perturbed about the grass owing to its invading paspalum pastures, very much reducing their value from a dairying standpoint. We have, however, in New Guinea seen mules feed largely on it and work quite well, although, of course, they were supplied with other fodder.

A Common Tropical Legume—A Chickweed.

J.A.P. (Kairi, N.Q.)—

The specimen represents *Alysicarpus vaginalis*, a common tropical legume quite abundant in parts of North Queensland and North Australia. It is palatable to stock, and we should say a valuable addition to the native pasture. We have not heard the local name given to it.

The other specimen represents *Drymaria cordata*, a plant of the Chickweed family. It is spread widely over the Tropics, and is thought to be a native of Central America. It is a very common weed of rice fields in the East, but in Queensland and New Guinea seems to be confined to rather damp situations, as along creek banks, and rather wet scrub edges. It is not known to possess any poisonous or harmful properties, and its allies in cooler parts of the world are quite useful fodder herbs, particularly as green stuff for birds and poultry.

Prickly Poppy.

M.O. (Townson)—

The specimen represents *Argemone Mexicana*—Prickly poppy. This plant possesses poisonous properties, but having a very bitter sap stock generally leave it alone. The only record that has come under our notice of stock having been poisoned by the plant is where the weeds have been cut, allowed to wilt, and the subsequently softened plants eaten by calves.

Elephant Grass.

H.L.E.S. (Harlin, Brisbane Valley)—

The specimen represents elephant grass—*Pennisetum purpureum*. This grass strikes very readily from cuttings which may be put in any time during the spring or summer. In the taller plants the canes become very hard and woody, but if the plant is kept down it makes a bulk of quite good forage for cattle, either for chaffing or feeding off.

A Common Weed in the North.

J.F.O'N. (Richmond, N.Q.)—

The specimen represents *Pterocaulon sphacelatus*, a fairly common weed in North Queensland, but for which we have not heard a distinctive local name. It is sometimes called stink weed, sometimes rag weed. These names, however, are applied to a number of different plants in Queensland. It is not known to possess any poisonous or harmful properties, but seems to be left untouched by stock. It is not new to the North-west, as we have a number of specimens from various localities in Western Queensland, and we have collected it ourselves along Julia Creek.

Burr Medic.

J.R.M. (Goondiwindi)—

The specimen is *Medicago laciniata*, a species of burr medic or burr trefoil, naturalised in Queensland and some of the north-western and western districts of New South Wales. It is nothing like as common as the common burr trefoil (*Medicago denticulata*). It is said to be earlier than the ordinary burr trefoil, and Brakewell, in his "Grasses and Forage Plants of New South Wales," says it is more nutritious, but it does not seem to us to bear the same amount of leafy forage.

General Notes

Staff Changes and Appointments.

The following officers of the Department of Agriculture and Stock have been transferred:—

Messrs. O. L. Hassell, Senior Instructor in Agriculture, from Townsville to Atherton; T. G. Graham, Instructor in Agriculture, from Dimbulah to Townsville; E. W. Baird, Field Assistant, from Townsville to Mareeba; and H. McNee, Cadet, from Mareeba to Dimbulah.

Mr. T. Herbert, Fairymead Sugar Mill, has been appointed an Assistant Cane Tester for the remainder of the season.

Mr. James Purcell, Toowoomba, has been appointed Chairman of the Dairy Products Stabilisation Board until 31st December, 1938.

Mr. A. S. Nicolson, Lindeman Island, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. S. Theodore, care of Tully Sugar Mill, has been appointed Millowners' Representative on the Tully Local Sugar Cane Prices Board, vice Mr. F. N. King, resigned.

The following transfers of Inspectors of Stock, Slaughter-houses, and Dairies have been approved:—Messrs. R. J. O'Sullivan, from Maryvale to Allora; A. R. Betts, from Upper Pilton to West Haldon; S. C. Allan, from Crow's Nest to Grantham; and R. Pusey, from Grantham to Crow's Nest.

Messrs. A. Fordyce (North Side, Mackay) and J. Trevaskis (Farleigh) have been appointed Canegrowers' Representatives on the Farleigh Local Sugar Cane Prices Board.

Mr. Harry Hooper, A.F.I.A., Department of Agriculture and Stock, has been appointed also an Inspector of Accounts under the Pig Industry Act.

Constable J. H. Clay, Dobbyn, has been appointed also an Inspector under the Slaughtering Act.

Mr. A. McDowall, Slaughtering Inspector, has been transferred from Maryborough to Coolangatta.

Constable B. H. Porter, Wandoan, has been appointed also an Inspector under the Brands Acts and the Slaughtering Act.

Mr. W. Peterson, South Bundaberg, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. A. Canty (Red Hill), a qualified candidate, has been appointed an Inspector on probation under the Dairy Produce Acts, the Diseases in Stock Acts, and the Slaughtering Acts, Department of Agriculture and Stock.

The Officer in Charge of Police, Dayboro, has been appointed also an acting inspector of stock.

Messrs. L. J. Pritchard and W. H. Sawford, of the Austinville Banana Settlement, have been appointed honorary rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. W. A. Winchester, of Bundaberg, has tendered his resignation as an honorary ranger under the abovementioned Acts.

The Egg Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, modifying and adding to the Orders in Council constituting the Egg Board, in respect of the acceptance by the Board of the commodity, the payment for eggs, equalisation deductions, the delivery of eggs elsewhere than at Brisbane, the freight on eggs, and the Board's decision regarding the quality of eggs.

The amount of levies heretofore made by the Egg Board may be assigned by way of security to any bank or institution to which the Egg Board may be indebted for financial accommodation for the cost of acquiring land or constructing depots or buildings. The Board may invest the proceeds of any levies or funds of the Board in any approved investment.

Regulations have also been issued under the abovementioned Acts empowering the Board to expend the amount of any levies for the purpose of acquiring land and erecting buildings, or for administrative purposes; and to assign the amount of any levies by way of security to any financial institution to which the Board may be indebted for financial accommodation for the cost of erecting buildings or acquiring land.

Peanut Board.

The election of a growers' representative for District No. 1 (Weinholt and Nanango) of the Peanut Board took place at the Department of Agriculture and Stock, on the 21st August, with the result that the present member, Mr. Young, was returned by a majority of 130 votes.

The voting was—

Leslie V. Young, Wooroolin .. .. 253 votes.
Norman J. Christiansen, Wooroolin .. .. 123 votes.

Mr. Albert George Whiting, of Atherton, was returned unopposed for the Northern District of the Peanut Board.

Bingera Mill Levy.

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts empowering the Bingera Mill Suppliers' Committee to make a levy of one-farthing per ton on growers whose sugar-cane is loaded at Uping, McIlwraith, Maroondan, and Delan railway sidings, and supplied to the Bingera Mill, such levy to be used for administrative purposes by the Maroondan Branch of the Bingera Mill Suppliers' Committee. Fifty per cent. of the growers concerned may, on or before the 21st September next, lodge a petition for a poll on the question of whether or not the levy should be made.

Banana Levy.

Existing regulations under the Fruit Marketing Organisation Acts covering banana levies have been rescinded, and a new regulation has been issued in lieu thereof, empowering the Committee of Diretion of Fruit Marketing to make a levy on all growers of bananas in Queensland for the period from 8th August, 1936, to 31st December, 1939.

The levy shall be at the following rates:—

On all bananas sold or consigned, whether by rail, road, or boat to any agent or company in the Greater Brisbane Area, at the rate of ½d. per case containing 1½ bushels or less; or when marketed in the bunch at the rate of 1d. for every £1 or part thereof of the gross amount realised.

On all bananas consigned by rail, road, or boat, to any agent or company in Queensland to any centre other than the Greater Brisbane Area at the rate of 1s. per ton of cased bananas containing 1½ bushels or less; or when marketed in the bunch at the rate of 10d. per ton, and in either instance a proportionate part of such amount for any fraction of a ton with a minimum of 1d. for any one consignment.

The levy on all bananas railed from any Queensland railway station (except Warwick, Toowoomba, Cairns, Townsville, Mackay, Rockhampton, Central, Roma Street, Brunswick Street, Woolloongabba, and South Brisbane may be collected by the Commissioner of Railways to the extent of 1s. per ton on cased bananas containing 1½ busheds or less, and to the extent of 10d. per ton on bunch bananas.

Slaughtering Licenses.

Regulations Nos. 6 and 7 under the Slaughtering Act have been amended to provide that, in cases where an application for the grant, renewal, or transfer of a license of a slaughter-house is adjourned to enable the applicant to provide suitable premises elsewhere, a provisional license to slaughter stock in his present premises during such time as is reasonably necessary to enable him to obtain such suitable premises elsewhere, may be issued.

Levy for Banana Industry Protection Board.

An Order in Council has been issued under "*The Banana Industry Protection Act of* 1929" providing for a levy on banana growers to be used for the maintenance of the Banana Industry Protection Board. The levy is similar to that of last year, and is at the rate of 1½d. per case containing one and a-half bushels or less, and 2d. in the £1 on the proceeds of sales of bananas marketed in the bunch.

Pineapple Levy.

Executive approval has been given to the extension for a further period of twelve months from the 20th August next of the Pineapple Levy Regulation.

Clifford Park a Sanctuary.

The Clifford Park racecourse and an adjoining property, Westwood, Toowoomba, have been declared a sanctuary under the Animals and Birds Acts.

Snakebite and its Treatment.

The marks of a snakebite were two punctures, sometimes with two or more scratches. In treating a bite on the hand the first thing was to apply a ligature above the elbow without a second's delay. Next, the place should be wiped and the punctures cut through (along and never across the limb) with a piece of broken glass or a sharp blade. Crystals or permanganate of potash should then be rubbed freely into the cut. After an hour the ligature (which should be twisted with a stick very tightly) must be loosened for 30 seconds. This allowed fresh blood to flow, and unless it was done the flesh might mortify. The loosening and retying of the ligature should be repeated every 15 minutes for another hour. When the ligature was put on within half a minute of being bitten recovery was practically assured.—J. R. Kinghorn (Australian Museum) in the "Sydney Morning Herald."

Plywood and Veneer Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, empowering the Plywood and Veneer Board to obtain from manufacturers of plywood and veneer information relating to such commodities, and authorising such Board to appoint persons to inspect the books and accounts of manufacturers or agents.

Plywood and Veneer Board Levies.

Executive approval has been given to the issue of Regulations under the Primary Producers' Organisation and Marketing Acts extending the Plywood and Veneer Board Levy Regulations empowering the Board to make a levy to provide for its administrative expenses; and further empowering the Board to make a levy at the rate of 3d. per 100 ft. face measurement on all pine plywood delivered between the 3rd May, 1936, and the 2nd May, 1939, for subsidising overseas shipments.

Membership of a District Cane Growers' Executive.

The regulation under the Primary Producers' Organisation and Marketing Acts relative to the qualification and disqualification of persons for election as members of a district cane growers' executive has been amended to provide that an officer of a district executive who receives any payment or remuneration at a rate greater than £75 per annum shall be disqualified from being elected to or from continuing to be a member of any executive.

Atherton Maize Board Levy.

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts empowering the Atherton Tableland Maize Board to make a levy on growers of maize at the rate of £1 5s. per ton of maize to provide for the administrative expenses of the Board and for the yearly instalment of interest and redemption due and payable to His Majesty the King.

Members of the Council of Agriculture.

A regulation has been issued under the Primary Producers' Organisation and Marketing Acts prescribing the members of commodity boards who shall be members of the Council of Agriculture. These are:—

Messrs. J. McRobert (Maryborough) and W. J. Sloan (Malanda), the Butter Board; D. G. O'Shea (Southbrook), the Cheese Board; H. R. Brake (Wowan), the Cotton Board; P. G. Martin (Kairi), the Atherton Maize Board; C. Brumm (Woongoolba), the Arrowroot Board; A. G. Whiting (Atherton), the Peanut Board; R. V. Woodrow (Woodford), the Honey Board; H. Kessler (Cambooya), the Barley Board; M. H. Campbell (Albany Creek), the Egg Board; S. Zischke (Hatton Vale), the Broom Millet Board; G. D. O'Neill (Allora), the Canary Seed Board; J. E. Foxwell (Kureen), the Northern Pig Board; K. R. Hack (Nerang), the Committee of Direction of Fruit Marketing; G. Johnson (Mirani, Mackay), the Queensland Cane Growers' Council; W. J. Brimblecombe (Pirrinuan), the Wheat Board; G. A. Duffy (Chairman, Timber Advisory Committee), the Plywood and Veneer Board and the Northern Plywood and Veneer Board.

The following representatives of districts embracing Local Producers' Associations have also been appointed members of the Council of Agriculture:—

Messrs. R. R. Nothling (Hut Creek, via Ambrose), Central Queensland; R. H. Jamieson (Monto), Burnett; W. L. Osborne (Wondai), South Burnett; P. Daley (Maleny), Wide Bay; C. Bateman (Nundah), East Moreton; W. A. Fielding (Laidley), West Moreton; J. Cameron (Millmerran), Darling Downs; W. E. Ashford (Hannaford), Western Downs; J. P. McCarthy (Tolga), Atherton Tableland.

Rural Topics

Premature Calving.

Premature calving is prevalent in many parts of the State, more particularly in the coastal areas, where the rainfall diminishes towards the end of each year, and where there are no introduced grasses.

The trouble is more frequent in dairy herds, which is attributed to restricted pastures and lack of feed containing sufficient nutriment. Other factors predisposing to its incidence are exposure to cold and wet weather.

Premature calving is frequently mistaken for contagious abortion. Many valuable cows—and calves—are lost annually through this trouble, principally for the want of knowledge on the part of owners.

As a measure of prevention, stock owners should conserve fodder—lucerne for choice—chaff it up as required, and feed it as soon as the cows commence to lose condition. Even bush hay will do if nothing else is available.

To ensure that each animal gets its share the chaffed feed should be supplied in separate boxes—the stronger beasts cannot then rob the weaker ones. Damp the mixture before feeding, thus preventing the beast from blowing it about when breathing. Hand feed in this way at least every second day.

Pineapple Marketing.

A substantial percentage of cased pines arrive at the market bruised, of which the cause is the use of unsuitable packing material or none at all. It is generally agreed in the markets that good pines packed in woodwool realise at least 6d. per case above the same quality packed in grass or without any packing. Also, a case so packed is more suitable for despatch up country.

Another point is that pines packed in old cases arrive at market at a distinct disadvantage. Buyers definitely prefer new cases. Further—and this, obviously, is very important—old cases cannot be despatched to New South Wales buyers, and so one good market for them is closed.

The old mistake of sending insufficiently coloured pineapples to market is still being made, and good returns are consequently being sacrificed by certain suppliers who would do much better to realise that the market will not pay for what it does not want.

Black Spot of Plums.

In the Stanthorpe district, a number of varieties of Japanese plum have, for the past few seasons, been affected with black spot. This is a bacterial disease which disfigures the fruit and causes a shot-hole effect on the leaves and cankers on the stems. Large limbs or even whole trees may be lost from the canker stage, and the fruit spot often renders a considerable portion of the crop unsaleable. The disease is worse in low-lying and poorly-drained situations, but is by no means confined to such places.

Spraying experiments have been conducted for several years in an attempt to check the trouble. At first, summer cover sprays with zinc lime were tried, as successful results had been reported from America with this spray used against a similar disease. The only result of these experiments was to prove conclusively that zinc lime was without effect on the disease.

Last season, a number of other sprays were tried. The results indicated that copper sprays, such as Bordeaux mixture, will control the disease. Sulphur sprays, such as lime sulphur and colloidal sulphur, have no effect. Unfortunately, Bordeaux mixture cannot be used on plum trees after blossoming. Dormant spraying alone does not give full protection, and it is not yet certain that the disease can be adequately controlled by sprays prior to blossoming. Experiments to determine the best schedule of sprays are now under way. In the meantime, growers are advised to spray susceptible varieties of plum, such as October Purple, Doris, Shiro, and Santa Rosa, with Bordeaux mixture at bud burst and again between bud burst and the opening of the blossoms. The first application can be made at full strength, namely 6:4:40, but for the second, it may be advisable to reduce the strength to 3:2:40.

Picking Bags and their Pitfalls.

How often do fruit growers, when harvesting fruit, think of the amount of damage caused by the use of picking bags? Observation has shown that the amount of stalk injury to fruit when handled is much greater when picking bags are used.

As it takes twelve months to produce a crop of fruit, surely the exercising of caution by using picking tins and handling each individual fruit should more than repay the little extra time involved.

With citrus, the grower protects the stalk end from fractures by clipping all fruit, and then rolls the fruit through the picking bag, allowing the buttons to damage the cheeks of the fruit.

Observations in the apple packing sheds disclosed that stalk damage for which the packing was often blamed took place before the fruit reached the sizing machines.

These observations give rise to the thought, "Are picking bags worth while?"

Mammitis Milk.

There is undoubtedly need for a fuller appreciation of the losses that may accrue from mammitis milk.

Many dairy farmers are well aware of the seriousness of such infected cows, but perhaps do not realise the full significance from an economic standpoint.

Such udder infections must be regarded as of outstanding importance, which result in great annual financial losses.

The loss of cows, loss of supply, decrease in quality of milk and cream, and diminution in nutritive value illustrate briefly the consequences involved. Acute mammitis has been known to cause the death of dairy cows. However, of equal importance is the lower milk yield which inevitably follows the loss of the milking function in a quarter.

Compared with normal milk, mammitis milk contains less casein, fat, and sugar, with increased alkalinity and salt, and also possesses a disagreeable flavour. Such properties make mammitis milk entirely unsuitable for butter and cheese manufacture.

Unknowingly, the farmer loses many pounds per annum from defective milk and cream being graded down.

This illustrates the need for early action, and the following advice will prove helpful to the farmer in detection and control of this defect:—

1. Look out for lowered milk yield, and especially loss of the milking function in a quarter of the udder. At the same time examine the foremilk for clots or flakes.

2. The curd remaining after straining each cow's milk through fine black silk will also give a rough indication of infected cows.

In considering control methods, it must be borne in mind that such an udder infection is contagious, so that by far the most important consideration consists of:—

1. Segregation of infected cows and increased hygiene.
   (*a*) If cows are being machine milked, it is advisable to hand milk for a period in order to pick out the infected cows and then isolate these.
   (*b*) The use of weak Condy's or potassium permanganate as a disinfectant and strict cleanliness will prevent the spread to other cows.
   (*c*) Before milking, wash hands in weak Condy's and repeat with each cow.
2. Cows that show abnormal milk or any signs of udder infection should be milked last.
3. Cloths used in wiping their udders should not be used on normal cows.
4. The foremilk should not be milked on to the floor.
5. Use milking machines only on healthy cows.
6. Older cows are more commonly infected.

With these few considerations, we see the need for early detection of such a disease in your herd, and also the immediate application of control measures.

Such a matter urgently requires attention in order that losses may be reduced to a minimum.

Green Cestrum—A Dangerous Weed.

Several cases of a poisoning of cows and poultry by the green cestrum have been brought under the notice of the Department within recent months. Horses seem rarely to touch the plant, but cows will eat it if fresh feed is scarce, even if, as in the case of many town cows, they are fed on chaff and are in first-class condition. They seem to have a particular liking for the plant at this time of the year.

The poisoning by the plant is rapid, the symptoms at first being constipation with blood-stained fæces. This is rapidly followed by a general paralysis, and death in great pain. As the plant is very much on the increase, and suckers very badly, it should be eradicated immediately on introduction into a locality.

For the purposes of identification, it may be said that the plant is a shrub 4 to 5 feet high, with dull-green leaves, and yellowish-green or brownish-green flowers in bunches at the ends of the branches. The plant rather prefers shady situations, though it is by no means confined to them. Cases of poisoning of poultry have occurred where the plant has been growing against netting fences, and fowls have picked at the green leaves.

The plant is a native of Chili and the Argentine, South America, and the poisonous principle is due to an alkaloid, and is not destroyed by drying.

Farmers suspecting they have the plant in their districts are advised to send specimens to the Department for correct identification.

The Feeding and Management of Poultry Breeding Stock.

The development of the embryo chicken during the process of incubation depends to some extent on the nutrients in the egg, and, of course, it is readily understood that the quality of the contents of an egg is in accordance with the food consumed by the fowl. For the embryo to develop into a strong vigorous chicken, the egg should be rich in vitamin A; therefore it is necessary to supply to the breeding stock foodstuffs containing this vitamin. Without it the growth of the young will stop and death will eventuate.

Foods that are rich in vitamin A are green food, yellow maize, milk, and cod liver oil, whilst meat or protein meals, wheat, bran, and pollard are deficient.

Having a knowledge that this vitamin is so essential to the life of the embryo, and knowing the foods that contain it, consideration must now be given to the most economical method to adopt in supplying it. Without doubt the best and cheapest method of supplying vitamin A is by feeding ample freshly cut green feed. In addition, greenstuff is rich in vitamins C, E, and G, and also contains minerals. It might be pointed out that vitamin E aids fertility, whilst G is another valuable aid to the growth and development of the embryo and young. In the feeding of greenstuff supply the birds with as much as they will consume. If wet mash is fed, greenstuff could comprise to upwards of one-third by measure of the bulk of the mash; when the system of feeding is dry mash, moisten the greens, if not moist, and add a few handfuls of mash to the greens, mixing thoroughly, and give as a mid-day meal; the addition of the mash will increase the palatability of the greens. Green lucerne chaff could be soaked in cold water overnight, if fresh green feed is not available.

Maize is an excellent food, and it would be an advantage to feed this grain to breeding birds even though it is more costly at present than wheat. Milk, unless available on the farm, would probably be too costly, whilst the cost of cod liver oil is prohibitive compared with greenstuff.

In feeding breeding birds it is an advantage for them to consume more grain than mash, as the grain will have the effect of reducing any tendency to the stimulation of egg production; therefore always feed as much grain as the birds will eat.

In the management of breeding birds do not tolerate broody hens on the nests. Get them away, otherwise germination may take place and the eggs will be spoilt for incubation purposes. The eggs should be gathered frequently, at least twice daily. The eggs should be cleaned by scraping if soiled and stored in a cool place, but not in draughts. Draughts cause a rapid evaporation of the contents which is detrimental to the hatching quality of eggs.

Make regular inspections of the perches for mites, as these parasites are sucking blood from the birds, weakening their vitality, with the natural sequence of poor hatches and weak chickens. Occasionally examine male birds for body lice, and if necessary give them a dusting with some insecticide so as to relieve them of these pests.

The Mons Marie Banana.

Many inquiries are being received from various centres throughout the banana-growing areas in Queensland as to the possibility of planting the Mons Marie variety of bananas during the coming planting season. Such inquiries embody a request for information as to where clean plants are available and the price that would be asked for same per hundred.

For the benefit of those growers who have not produced this variety of fruit previously, it is advised that certain conditions must be strictly observed if satisfactory returns are to be obtained from the planting of the Mons Marie.

Firstly, there are two distinct types listed under the heading of Mons Marie. The first is a tall-growing variety possessing very many characteristics that definitely ally it with the variety Gros Michel. This particular type has a definite characteristic inasmuch as the lower portion of the bunch stem discards every trace of the small immature fingers so typical of the Cavendish variety, and from the actual flower up to the last hand of mature fruit there remains an absolutely bare stem.

The second type is more dwarfed, being taller than the Cavendish but possessing many characteristics which definitely ally it with this variety. The bunches are of Cavendish type, but whereas in the first type mentioned the bared stem is so noticeable, in the second type this stem carries the small immature fingers as does the Cavendish.

Both types produce fruit that is absolutely similar in appearance and quality, but favour is given the more squat growth owing to the greater amount of wind resistance that this particular type possesses.

Another feature to be considered is that this variety generally is not as hardy in its growing habits as is the Cavendish, and therefore requires to be grown on rich land in a sheltered position, the shelter being essential because of the somewhat weak character that this variety possesses; that is, the breaking-off of the bunches when possibly three parts matured, the actual break always occurring just inside the pseudo-stem. Propping under such conditions is a difficult task owing to the section that appears so weak in this plant and also on account of the height that the plants attain. Observations indicate that land that will produce Cavendish fruit of fair quality would in many instances be incapable of producing fair quality Mons Marie. As mentioned before, rich land, a good rainfall, and abundance of shelter are positive essentials for the production of the latter variety. Attempts made to produce Mons Marie on land other than that mentioned above have resulted in failure, the bunches being very small, the plants of a wind-stricken and stunted nature, and an excessive leaf fall always being noticeable.

Growers would be well advised to seek the advice of the Department prior to planting this variety not only for guidance in respect to the locality in which it is desired to plant, but also to definitely ascertain a reliable source from which plants of this variety may be obtained.

Sweet Potatoes as a Pig Feed.

Sweet potatoes have a high value as pig feed; both the roots and vines are very palatable to pigs, and it is not necessary to boil the roots before feeding; in fact, the most economical way to feed this crop is by allowing pigs to do the harvesting.

Where the paddock system of pig raising is adopted, a pig paddock may be planted in sweet potatoes, then by erecting a temporary fence across the paddock, the pigs may be turned on to the crop when it is ready to harvest, the temporary fence being moved along as each section of the crop is cleaned up by the pigs.

Sweet potatoes may satisfactorily replace a large part of the grain in a pig's diet, provided sufficient separated milk or meat meal is fed in conjunction.

Approximately 3½ lb. of sweet pototoes are equal in feeding value to 1 lb. of maize, and when the vines are fed also, it may be estimated that about 3 lb. of sweet potatoes and their vines are equal to 1 lb. of maize, which means that a 3 tons-per-acre crop is required to give the same pig food as a 40-bushel crop of maize. Under conditions which would produce a 40-bushel crop of maize in the Queensland coastal districts, at least a 6-ton crop of sweet potatoes may be expected, which means that sweet potatoes may be expected to give twice as much pig feed per acre as maize grain.

Although it is claimed that sweet potato vines are good cattle food, caution is necessary as cases of supposed stock poisoning as a result of eating the vines have been reported from time to time.

Poultry—How to Cull.

Very definite characters are associated with high egg production, and the breeder who is to make a success of poultry raising must acquaint himself with these characters, discarding from his flock all birds which do not possess them. There are birds, however, which are exceptionally good layers that do not look the part. They are the exception to the rule, and it is better to lose a few good birds in the process of culling than to retain a lot of indifferent ones by not making an effort to get rid of the undesirable.

The good producer in the first place will be active, alert, and strong in appearance. Cull the sluggish and the weak. The sluggish will invariably be overfat, indicating for what purpose she has been using her food; and the weak thin, suggestive of her inability for sustained production.

The body of a good layer should have length, depth, and width proportionate to the breed. Females are usually deeper at the rear than in front, but the bird lacking in front is to be avoided. Look for the female with a back wide throughout its entire length, avoiding birds which have not well sprung ribs and narrow to the base of the tail. Judge the width of back by running the hand down the entire length, thumb one side and fingers the other. Width can also be judged by the distance the legs are apart.

Many of these features can be judged while the bird is at liberty in the pen, and those appearing undesirables caught with a catching hook for further examination. As the catching of birds frequently disturbs the whole flock, with a consequent fall in production, it is suggested that a lot of the examination of poultry can be done at night when the bird is on the perch. It is possible to ascertain the exceptionally fat and those not in good enough condition. Such birds can definitely be marketed with advantage. It is possible also to ascertain at night if a bird is laying or not by the condition of the pelvic bones and the distance between the pelvic bones and the keel.

With a bird in lay, it should be possible to place two fingers between the pelvic bones and three or more between the pelvic bones and the keel. The good layer should have a soft, pliable abdomen, full, but not hard. If she is a good producer, she should have a full crop, indicating her appetite. As all good fowls of suitable age should now be in a production stage, those not showing these qualities could be removed from the pen for market purposes or at least for further examination. As the measurement of pelvic bones and distance between pelvic and keel are variable in nature, it cannot be used as an accurate method of culling, except during the period when all birds should be in a production stage.

The head of the bird is one of the best means of culling, provided it is associated with a bird carrying the body characters referred to.

The comb and wattles should be of medium size, fine and waxy in texture. High producers generally have a head of good width, flat on top and width carried well back. The eye bright, round, and prominent, and placed high in the head. The bird with the sunken eye, and one lacking expression or brightness, is to be avoided. The face should be bright, skin of fine texture, and as free from feathers as possible. Beak strong and slightly curved.

In all directions look for quality, but avoid building up an over-refined class, as strength is essential to production.

Kookaburras and Snakes.

Thus, Alec Chisholm, in "The Australasian":—

In reply to J.M.T., of Bendigo (V.), I suggest that kookaburras rarely attack large snakes since their poor equipment would not allow them to do so with safety. A Victorian bushman some years ago told a good story on the subject:—A kookaburra had grabbed a snake about 3 feet long, and his mate rallied to his assistance.

One bird had the snake gripped behind the head and the other near the tail. The bird holding it near the head was silent, and trying every now and then to knock the snake's head against the ground, the hen bird at the tail end making all the flapping and noise. When the observer tried to get closer the birds carried off the snake for about 200 yards, the male bird getting on to a limb, but the other one could not get her end up, and she and the snake were dangling beneath the limb.

Finally they dropped it, and running up lest the snake should get away, the man found that the snake's head had been almost bitten off. He left it to the birds to finish the job.

Orchard Notes

OCTOBER.

THE COASTAL DISTRICTS.

OCTOBER is frequently a dry month over the greater part of Queensland, consequently the advice that has been given in the notes for August and September regarding the necessity of thorough cultivation to retain moisture is again emphasised. Thorough cultivation of all orchards, vineyards, and plantations is therefore imperative if the weather is dry, as the soil must be kept in a state of perfect tilth, and no weeds of any kind must be allowed to grow, as they only act as pumps to draw out the moisture from the soil that is required by the trees or fruit-yielding plants.

All newly planted trees should be carefully attended to, and if they show the slightest sign of scale insects or other pests they should receive attention at once.

Bananas.

In the warmer districts banana planting may be continued. All winter trash should be removed and the stools cleaned up. If not already done, before the winter, young plantations planted the previous season should be desuckered without delay. Those desuckered last autumn should be gone over again, and also old plantations should be attended to. Grow to each stool the number of stems which experience proves to be permissible, but only allow each stem to grow a single follower. Borers will soon be active again, and trapping should be intensified towards the end of the month and supplies of Paris green and flour (one part to six by weight) made up in readiness. Caterpillar and grasshopper plagues often occur from the end of the month onwards, and it is wise to lay in a stock of a few lb. of arsenate of lead for use in the preparation of bran baits. Watch the plantation carefully for bunchy top, and kerosene and destroy any affected plants without delay. The season of vigorous growth is now commencing, and it will pay well in more and better fruit and in stronger suckers for the next crop to apply a dressing of a complete fertilizer to each stool. Cultivate well to retain moisture, aerate the soil, and kill weeds before they seed. This will also prepare the soil for the planting next month of a green cover crop such as *Crotalaria goreensis*, thus shading the soil, preventing erosion on slopes, and enriching the soil with nitrogen and humus.

Clean out all banana refuse from the packing shed, and resolve not to allow it to accumulate in future. This will reduce the risk of the development of many fungous rots in the packed fruit.

Pineapples.

From now onwards pineapples may be planted in most districts. Plough thoroughly, remembering always that in the life of a plantation will be several years during which it will not be possible nor desirable to do more than disturb the surface layer. Obtain advice from the Department of Agriculture and Stock as to whether the soil is sufficiently acid, and, if not, how much sulphur to apply. Care must be taken in the layout of the rows to save time and labour in cultivation and harvesting, and minimise erosion. Select planting material with discrimination from healthy and vigorous plants of a good bearing type. Beware of planting "collars of slips." Always strip off the base leaves and dry in the sun for a few days, and plant shallow. As soon as the roots form, apply 3 cwt. of 10-6-10 fertilizer to the acre. All established plantations are due for their spring fertilizer at not less than 5 cwt. per acre. Keep down weeds with the Dutch hoe; but do not disturb the soil deeply, always remembering that the pineapple is shallow-rooted and receives a sharp setback if the roots are interfered with by the use of horse-drawn implements. Clean out all pineapple refuse from the packing shed and surroundings, and thus eliminate much fungous trouble in the summer pack.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

MUCH of the matter contained under the heading of "The Coastal Districts" applies equally to these parts of the State; for on the spring treatment that the orchard and vineyard receives the succeeding crop of fruit is very largely dependent. All orchards and vineyards must be kept in a state of perfect tilth, and no weed growth of any kind should be allowed. In the western districts, irrigation should be given whenever necessary, but growers should not depend on irrigation alone, but should combine it with the thorough cultivation of the land so as to form and keep a fine soil mulch that will prevent surface evaporation.

All newly planted trees should be carefully looked after, and only permitted to grow the branches required to form the future tree. All others should be removed as soon as they make their appearance. If there is any sign of woolly aphis, peach aphis, or scale insects, or of any fungus disease on the young trees, these diseases should be dealt with at once by the use of such remedies as black leaf forty, Bordeaux mixture, or a weak oil emulsion. In older trees, similar pests should be systematically fought, as if kept in check at the beginning of the season the crop of fruit will not suffer to any appreciable extent. Where brown rot has been present in previous years, the trees should be sprayed with Bordeaux mixture and lime sulphur according to the schedule recommended by this Department. All pear, apple, and quince trees should be sprayed with arsenate of lead—first when the blossom is falling, and at intervals of about three weeks. Spraying for codlin moth is compulsory in the fruit district of Stanthorpe, and wherever pomaceous fruit is grown it must be attended to if this insect is to be kept in check.

In the warmer parts a careful check should be kept for any appearance of the fruit fly, and, should it be found, every effort should be made to trap the mature insect and to gather and destroy any affected fruit. If this is done, there is a good chance of saving the earlier ripening summer fruit, if not the bulk of the crop. Tomato and potato crops will require spraying with Bordeaux mixture, as also will grape vines. Keep a very strict watch on all grape vines, and, if they have not already been treated, don't delay a day in spraying if any sign of an oil spot, the first indication of downy mildew, appears on the top surface of the leaf. Spraying with Bordeaux mixture at once, and following the first spraying up with subsequent sprayings, if necessary, will save the crop, but if this is not done and the season is favourable for the development of the particular fungus causing this disease, growers can rest assured that their grape crop won't take long to harvest.

Where new vineyards have been planted, spraying is also very necessary, as if this is not done the young leaves and growth are apt to be so badly affected that the plant dies.

Farm Notes

OCTOBER.

FIELD.—With the advent of warmer weather and the consequent increase in the soil temperature, weeds will make great headway if not checked; therefore, our advice for last month holds good with even greater force for the coming month. Earth up any crops which may require it, and keep the soil loose among them. Sow maize, cowpeas, sorghums, millet, panicums, pumpkins, melons, cucumbers, marrows. Plant sweet potatoes, yams, peanuts, arrowroot, turmeric, chicory, and ginger. Coffee plants may be planted out. There are voluminous articles in previous journals giving full instructions how to manage coffee plants from preparing the ground to harvesting the crop, to which our readers are referred.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

MOTHERCRAFT.

THE term "mothercraft" implies the simple science of the art of good mothering—the essentials in regard to feeding and environment for the child—the hygiene of body and mind. We still shy at the word "science," but science really means simplification—it is just crystallised common sense.

One would urge every mother to prepare herself beforehand, not only for the birth of the baby, but in the matter of mothercraft generally. Knowledge applied in time would prevent the great majority of early weanings and many tragedies. A great French doctor has pointed out that premature separation of mother and child by early weaning or by premature birth is the greatest cause of infant death. But the ideal scheme of mothercraft commences even earlier than this "with the girls in their teens, the potential mothers of the next generation—thus providing education and supervision over the whole cycle from the expectant mother to the infant and pre-school child, and thus to the schoolgirl, and so to the mother again.

"Mothercraft" is a word to conjure with. If it is not allowed to become vague and shadowy, it serves a very useful purpose in reminding us that mothering must be learnt like any other craft. What an extraordinary thing it is that girls are trained for almost every profession and occupation under the sun except the most important of all! No profession, public or private, can match it. Motherhood may not

bring women before the public gaze as other outlets for their energies may do, but the mother should be competent to rear and nurture her children, and every mother who fulfils these duties well has played her part in the public health service of the country.

The human infant remains helpless for a longer period than any other living creature. How stupid and how cruel it is that we should allow the helpless baby to be the subject of experiment—make it the material on which the mother learns the job she should have learnt before, with the risk of "spoiling" it, or worse, in the process!

The time will surely come when we shall look back with amazement on the school curriculum for girls, so crowded that no time could be spared for the teaching of the rudiments of child-care.

The Mothercraft Home.

We hope to have a Mothercraft Home in Brisbane, where the mother whose milk supply has failed or is failing may come in for treatment, which in the great majority of cases results in the complete or partial restoration of the supply in a short time. In many cases natural feeding can be re-established after days or even weeks of complete weaning.

Mothers and babies can also be admitted for twenty-four hours' observation and test-weighing in order to ascertain just how much milk the baby is getting from the breast, with a view to accurate adjustment and correct advice. The nurses in charge of the mothercraft homes will have had wide experience in the management of difficulties in connection with natural feeding. It will be their aim to make the mother feel "at home"—that she and her baby will be considered as individuals with individual problems for solution, not "cases" in for treatment.

The second fortnight or so of baby's life is apt to be a little critical, especially in the case of a first baby. The mother, perhaps young and inexperienced, is apt to find herself unexpectedly weak, nervous, and easily upset when she returns from the nursing home or when she is left by her nurse. Unskilled in the management of the baby, possibly harassed by conflicting advice from her well-meaning friends and relations, and worried by her baby crying, the mother may lose her milk or overfeed her baby under the impression that the baby is hungry. In a very short time this sort of thing can cause the young mother to become anxious, nervy, and exhausted, and transform the beautiful, healthy, breast-fed baby into an ailing bottle-fed one. This, no doubt, is citing an extreme case, but in some form or degree the story is all too common and all too true. The mistakes are not due to carelessness, but to lack of knowledge. Only knowledge, properly applied, can correct the results and prevent recurrences.

Premature Babies.

The care of premature babies is another important part of the mothercraft homes. These tiny mites can be admitted to the home within a few hours or days of birth, if necessary. In most cases the mother will be admitted with her baby as soon as she is fit to come in.

IN THE FARM KITCHEN.

BEEF RECIPES.

[*Continued from p.* 303, *August*, 1936.]

Broiled Steak.

The best cuts for broiling are from the loin—porterhouse, short cut or club, and sirloin. Choose a tender steak at least 1 inch thick. Wipe meat with a clean, damp cloth and place on a broiler which has been oiled by rubbing with a piece of fat. If a small amount of water is put in broiling pan there is less odour and spattering of fat. The broiler should be placed 2 to 3 inches below flame. If a gas oven is used, do not close the door.

Sear meat on one side, using a high temperature (500 deg. F.), then turn and sear other side. Reduce heat and continue cooking until steak is puffy, brown, and sufficiently cooked. After steak is seared do not turn until done on one side. Avoid puncturing steak with a fork while cooking, as it permits juices to escape. Allow thirty to forty minutes for a 2-inch steak according to whether it is to be rare or well done. Remove to a hot serving dish, spread with butter, and season with salt and pepper.

Pan-Broiled Steak.

Prepare as for broiled steak. Rub a bit of fat over bottom of a smoking-hot frying pan. (An iron pan is desirable, as it retains heat well.) Place steak in pan and sear first one side, then the other. Reduce heat and cook to desired degree, turning as needed. Pour off fat as it accumulates in pan. Serve as for broiled steak.

Oven Roast of Beef.

For an oven roast a tender cut, as prime ribs or loin of beef, is best. Chuck, rump, or round may also be used. Wipe, trim into a neat shape, tying or skewering if needed. Place on a rack in a roasting pan and cook at a constant temperature in slow oven. Allow fifteen minutes per pound for rare, eighteen minutes for medium, twenty to twenty-five minutes for well-done beef. With these cuts no water or fat need be added, as meat will cook in its own juices and fat. If roast is seared either at the beginning or the end of the cooking process flavour, aroma, and colour are more pleasing, but there are greater losses. Sear in a hot oven for ten to twenty minutes, and then reduce heat to a slow oven and complete cooking.

Pot Roast of Beef.

Good cuts for pot roast are round, rump, cross-arm, or chuck. Wipe, trim, tie, or skewer into a compact shape. Dredge with salt, pepper, and flour, rubbing mixture well into cut surfaces. Brown in some of meat fat in a hot frying pan or kettle in which meat is to be cooked. Place in a kettle, if not already there; add hot water to one-fourth depth of meat; cover tightly; simmer slowly until tender. The time cannot be stated definitely. It will probably require at least three hours for a 4-lb. roast. Turn several times during cooking. Remove meat, thicken liquid with gravy, allowing two tablespoons flour for each cup broth.

Sliced carrots, onions, celery, or other desired vegetables may be added during the last hour of cooking. This allows time for blending of flavour. Potatoes are added later, as they need only to be cooked until tender.

Spanish Steak.

Select a thick steak and pound into it with a hammer all of the flour possible. Melt one-fourth cup of bacon fat in a pan, and when hot add the steak. Brown well on both sides, then pour over it one cup of water and one-half can of tomatoes, a couple of medium onions chopped fine with a minced green pepper and seasoning. Turn the flame low and simmer gently until tender, or bake in a moderate oven. A fireless cooker is excellent for preparing this dish.

Short Ribs of Beef en Casserole.

Take 3 lb. short ribs, 6 small onions, 1 carrot, 4 tablespoons fat, ¼ teaspoon pepper, 1½ teaspoons salt, 1 teaspoon sugar, 2 cups canned tomatoes, ½ cup rice, uncooked.

Melt fat in a frying pan, add onions and beef, and brown well. Put into a casserole. Mix tomatoes, rice, sliced carrots, and sugar, and pour over the beef. Add enough hot water to cover all ingredients, cover and cook in a slow oven for three hours.

Braised Beef.

Take ¼ cup each of diced carrots, turnips, and celery, ¼ cup chopped onion, salt and pepper to taste, flour, 3 lb. meat (chuck, brisket, or lower round), 2 small, thin slices fat salt pork (drippings may be used), 3 cups boiling water.

Try out pork, strain if desired. Wipe meat, rub with salt and pepper, dredge with flour, brown in hot fat. Place in a casserole, cover with the vegetables, add water, cover, and bake slowly until tender—about four hours. Eight servings.

Flank Steak en Casserole.

Take 1 flank steak, well scored, bread stuffing, salt, pepper.

Wipe steak, season with salt and pepper, spread with stuffing. Roll steak with grain of meat and skewer or tie. Brown in a little hot fat. Place in a casserole, add water or stock to half its depth in pan. Cover, bake slowly about two hours or until tender. Remove to serving dish, thicken stock, and pour over meat. If desired, the meat may be cooked on a bed of diced carrots, turnips, and celery, and tomatoes may be added for part of the liquid.

Broiled Hamburg Steak on Onion Rings.

Take 2 cups ground lean raw beef, ¼ cup ground suet, 1 cup soft fine breadcrumbs, 7 strips bacon, 7 slices Spanish onion ½ inch thick, 1 tablespoon chopped parsley, 3 tablespoons butter, 2 teaspoons onion juice, ½ teaspoon salt, ⅛ teaspoon pepper, 1 tablespoon water.

Lay the slices of onion in a buttered shallow baking dish. Pour over them two tablespoons of melted butter, sprinkle with salt and pepper, add the water, cover closely, and bake in a moderate oven for thirty minutes, or until tender. In the meantime cook the chopped parsley in one tablespoon of butter, and combine with the beef, suet, crumbs, and seasoning. Knead until thoroughly mixed. Mould into seven flat cakes and wrap each with a slice of bacon. Place each cake on an onion slice in the baking dish, and broil under direct heat for five minutes on each side. Baste occasionally with the drippings. Serve at once from the baking dish. If it is not convenient to broil the meat cakes by direct heat pan-broil them in a hot skillet and serve on the onion slices.

Chuck Stew.

Take 4 lb. chuck, cut up, 2 tablespoons bacon fat, 1 Spanish onion, minced, 2 green peppers, cut fine, 2 cups stewed tomatoes, 1 cup carrots, chopped 1 cup celery, chopped, 2 teaspoons salt, 2 cups water.

Have the beef cut up as for stew; dredge with flour and brown well in the bacon drippings. Place in a kettle with the other ingredients, cover closely and cook slowly on top of stove for about three hours. Thicken the gravy with flour rubbed smooth in a little cold water.

Braised Round Steak.

Take round of beef, 4 tablespoons fat, 1 onion, minced, 1½ green peppers, sliced, 3 tops of celery stalks, 3 sprigs parsley, minced, 2 carrots, sliced, 6 medium-sized potatoes, 2 cups milk, 1 teaspoon salt, ⅛ teaspoon pepper, 1 cup flour.

Season flour with salt and pepper and rub thoroughly into the steak. Melt fat in a frying pan and brown steak over a slow fire. Pour milk over steak and arrange vegetables around it. Cover and cook in a slow oven until the milk is practically absorbed.

Liver Loaf.

Take 1½ lb. liver, 1½ cups stale breadcrumbs soaked in 1 cup milk, 2 eggs, beaten, ½ cup stock, 2 tablespoons fat, 1½ teaspoons salt, ⅛ teaspoon pepper, 1 tablespoon parsley, 1 tablespoon onion, 1 tablespoon celery, ½ green pepper, if desired.

Run liver and vegetables through chopper. Combine with other ingredients and mix well. Pour into an oiled baking dish, set in pan of hot water, bake one and one-half hours in a slow oven (300 deg. to 350 deg. F.). If a soft crust is desired, cover until last fifteen minutes of baking.

Brain Oysters.

Take 1 brain, 2 eggs, 1 tablespoon milk, salt, breadcrumbs, parsley.

After the brain has been parboiled, separate into pieces about the size of large oysters. Dip into slightly beaten egg to which one tablespoonful of milk has been added, roll in seasoned crumbs, then dip into egg and roll again in the crumbs. Fry in deep fat until a golden brown. Serve hot, garnished with slices of hard-boiled egg and parsley.

Sweetbreads may be prepared in the same manner.

Beef Kidney, Creole Style.

Take 1 beef kidney, 1 thick slice bacon, 2 tablespoons chopped suet, 4 tablespoons flour, 1 sweet pepper, 1 pint canned tomatoes, 1 teaspoon salt, ⅛ teaspoon cayenne pepper, ½ teaspoon curry powder, 4 onions.

Trim the fat from a fresh kidney and cut in ¾-inch slices. Dredge with flour. Fry the chopped bacon and suet in a deep saucepan, add the kidney, chopped onions, and pepper, and turn until the meat is thoroughly seared and coated with a rich brown gravy. Add the tomatoes and seasoning cover closely and simmer three-quarters of an hour. Serve very hot on narrow strips of buttered toast.

Canning of Beef.

Meat is regarded as one of the more difficult foods to can since the botulinus organism may develop in it. The pressure cooker is ideal for use in canning all meat since it insures better sterilisation of the product.

Choose any cut of fresh, clean beef which has been cooled at least twenty-four hours after killing, wipe with a clean cloth, bone if desired, and then cut into neat pieces of a suitable size to fit the jar or for serving.

Method I. (Cooked Meat).—The meat is partially cooked before packing it into jars in order to shrink it and insuring thorough processing. Cut the meat into pieces one-fourth to one-third larger than that desired for packing, as this allows for shrinkage. Then roast, broil, or cook in a small amount of fat until about half done. Season, then pack into jars, filling to within ¾ inch of the top. Add pan liquor in the quantity desired, adjust the cover, and partially seal. Process about fifty minutes for pints and sixty minutes for quarts at 15 lb. of pressure, or allow ninety minutes at 10 lb. pressure. Remove jars from the canner and seal immediately.

Method II. (Raw Meat).—This method gives a product with a less desirable colour and flavour than that cooked before canning, so is seldom recommended. It is also more difficult to process, and shrinkage is greater.

Pack raw meat into jars rather tightly, as meat will shrink in processing, but allow for the circulation of heat and liquid. Use one teaspoon of salt for each quart. Adjust the cover, partially seal. It is best not to add water, as the meat will make its own liquor. Process one and three-fourths hours at 10 lb. pressure. Remove jars and seal.

Processing Beef for Home Use.

Curing beef at home is not extensively practised by those who butcher. One hundred and thirty reporters say no curing is done, while eighty parties process some meat for home consumption. Efforts seem to be rather largely centered on canning. Cold packing is general in these homes, and the pressure cooker is also utilised.

Where nearby cold-storage facilities are available many carcasses are kept under refrigeration for future use. When so handled it is customary to cut beef into pieces which can be cooked and used within a short time after taking them from the cooler. Charges made for storing meat in this way are nominal, and a minimum amount of preparation is involved—the carcass is quartered or further subdivided, the pieces wrapped in muslin, and then taken to the storage plant.

Comments on home practices follow:—

Dickinson County.—Pieces of hindquarters weighing 8 to 15 lb. are salted, packed in salt in large jars, and allowed to remain five to six weeks. Chunks are then ready to smoke.

Gove County.—Large-sized chunks are cured in brine five weeks. Brine composed of 3 gallons water, 6 lb. salt, 2 lb. brown sugar, ½ oz. saltpeter is boiled, then cooled and poured over meat. After five weeks hang up to dry. Smoke lightly and hang in dry place to keep for summer use.

Harvey County.—Can, cold-pack method. Place in cold glass jars, seal and boil three hours, then tighten, seal and put away.

Utilising Scraps.

In reply to the question of how scrap pieces of a beef carcass are handled to prevent waste, the following suggestions are made:—

1. Make hamburger or else can poorer cuts and trimmings.

2. Flanks are seasoned with hickory smoked salt and pepper, then rolled, tied and cooked until done, used as cold sliced beef.

3. Suet is used for puddings or for soap.

4. Bones are used in making stock soup which may be canned for subsequent use.

5. Scraps are ground, seasoned, cold-packed, and canned for use in croquettes and sandwiches.

6. Tongue boiled and pickled.

7. Scraps and wastage used in lieu of tankage.

Bologna Style Sausage.

Ingredients: Take 60 lb. cured beef, 40 lb. pork, 20 lb. water, 1½ to 2 lb. salt, 2 oz. mace, 1 oz. corriander, 4 oz. black pepper.

The beef should be ground, seasoning added, and the bulk stored away for thirty-six to forty-eight hours before using it for sausage. Fresh meat stuffed into casings and smoked invariably spoils. After this preliminary step the beef should again be put through the grinder, using the fine plate. Put the pork through the grinder only once, using the medium plate. Then put the beef and pork together in a container and add the spices and water. Mix thoroughly until it takes on a dull colour and becomes sticky. Stuff in weasands, large beef casings, or in beef rounds. Allow it to hang about twenty minutes in a cool place. This sausage can also be stuffed into muslin bags and paraffined. It will keep perfectly prepared in this way. Smoke for about two hours, or until a good colour is obtained, at a temperature not to exceed 140 deg. F. (After the bologna is smoked it should be boiled, the weasands and rounds about thirty minutes and the larger bolognas about one and one-half hours, at a temperature of 160 deg. F. To tell when bologna is cooked enough, squeeze it in the hand, and if done it will squeak when the pressure is released. Place in cold water for about thirty minutes, and then hang it up in a cool place to keep.

Frankfort or Vienna Style Sausage.

Ingredients: Take 70 lb. beef, 30 lb pork (not too lean), 20 lb. water, 1½ to 2 lb. salt, 2 oz. nutmeg, ¼ oz. black pepper, 1 to 2 oz. red pepper.

Cut the beef into small pieces and salt and allow it to cure for forty-eight hours in a cool place. Cut the pork into small pieces and put the beef and pork through the grinder together. Put into a container and add the water and spices. After it is all mixed, put it through the grinder again, using the fine plate. Stuff into sheep casings. After the sausage is stuffed into the casings by means of the thumb and forefinger, press the casing together about 4 inches apart. Twist the link two or three times. The next link should be twisted in the opposite direction to keep the casing from untwisting. After it is twisted into links hang it in the smokehouse for about two hours at a temperature not to exceed 125 deg. F. After it is smoked, boil it for five or ten minutes and then plunge it into cold water and hang it in a cool place.

The following directions for corning and drying are taken from Farmers' Bulletin 183, U.S.D.A.:—

Corned Beef.

The pieces commonly used for corning are the plate, rump, cross ribs, and brisket, or, in other words, the cheaper cuts of meat. The loin, ribs, and other fancy cuts are more often used fresh. The pieces for corning should be cut into convenient size joints, say, 5 or 6 inches square. It should be the aim to cut them all about the same thickness so that they will make an even layer in the barrel.

Meat from fat animals makes choicer corned beef than that from poor animals. When the meat is thoroughly cooled it should be corned as soon as possible, as any decay in the meat is likely to spoil the brine during the corning process. Under no circumstances should meat be brined while it is frozen. Weigh

out the meat and allow 8 lb. of salt to each 100 lb.; sprinkle a layer of salt ¼ inch in bottom of barrel, pack in as closely as possible the cuts of meat, making a layer 5 or 6 inches thick; then put on a layer of salt and follow with a layer of meat; repeat until the meat and salt have all been packed in the barrel, care being used to reserve salt enough for a good layer on top. After the package has stood overnight add for every 100 lb. of meat 4 lb. of sugar, 2 oz. of baking soda, and 4 oz. of saltpeter dissolved in a gallon of tepid water. Three gallons more of water should be sufficient to cover this quantity. In case more or less than 100 lb. of meat is to be cured, make the brine in proportion. A loose board cover weighted down with a heavy stone should be put on the meat to keep all of it under brine. In case any should project rust would start and the brine be spoiled.

It is not necessary to boil the brine except during warm weather. If the meat has been corned during the winter and must be kept into the summer season, the brine should be watched as spring approaches, as it is more likely to spoil at this time. If the brine appears to be ropy or does not drip freely from the finger it should be turned off and new brine added after carefully washing the meat. Meat should be kept in the brine from twenty-eight to forty days to secure a good corning.

Dried Beef.

The round is commonly used for dried beef, the inside of the thigh being considered the choicest piece, as it is slightly more tender than the outside. The round should be cut lengthwise of the grain of the meat in preparing for dried beef, so that the muscle fibres may be cut crosswise when sliced for the table. A tight jar or cask is necessary for curing. The process is as follows:—To each 100 lb. of meat weigh out 5 lb. of salt, 3 lb. of granulated sugar and 2 oz. of saltpeter; mix thoroughly together. Rub the meat on all surfaces with a third of the mixture and pack it in the jar as tightly as possible. Allow it to remain three days, when it should be removed and rubbed again with another third of the mixture. In repacking put at the bottom the pieces that were on top the first time. Let stand for three days, when the pieces should be removed and rubbed with the remaining third of the mixture and allowed to stand for three days more. The meat is then ready to be removed from the pickle. The liquid forming in the jar should not be removed, but the meat repacked in the liquid each time. After being removed from the pickle the meat should be smoked and hung in a dry attic or near the kitchen fire, where the water will evaporate from it. It may be used any time after smoking, although the longer it hangs in the dry atmosphere the drier it will get.

IN THE FARM GARDEN.

THE GARDEN COMPOST HEAP.

THE garden compost heap is a cheap means of converting garden and household vegetable refuse into valuable fertilizing material. Materials such as lawn clippings, spent crops free of disease, vegetable tops, &c., should all be used in this manner, but the coarse, woody stalks of strong-growing plants should not be used.

The production of artificial manure from garden waste, straw, &c., consists in the decomposition, by fungi and bacteria, of much of the plant material. The nitrogen in the process is converted from an inorganic to an organic form, and is present in increased amount in the material finally produced. The rapidity with which the process goes on is influenced by the type of material, its degree of maturity and chemical composition, and by the presence of nutrients such as lime, phosphate, nitrogen, and potash, for the organisms carrying on the decomposition are much akin to plants in their requirements.

Actual damage can be done to crops, other than some legumes, by the addition of uncomposted, poor-quality material to the soil. This damage is due largely to a lack of available nitrogen in the soil. Such poor-quality materials as bush scrapings, dry mature grass or straw, offer a good source of energy for the soil bacteria and fungi, which rapidly increase in numbers, and in so doing consume all the available nitrogen. This competition for soil nitrates results in the nitrogen starvation of crop plants.

The usual process of allowing plant refuse to decay without any chemical treatment results in a very acid product, providing no immediately available nitrogen. With nitrogen-poor plant residues it becomes necessary to add available nitrogen to the heap, as well as lime, which prevents the development of acidity, and phosphate, which is required in the nutrition of the organisms. With nitrogen and mineral-rich materials such as legumes (peas, beans, &c.), green vegetable tops, and other green succulent material, the use of lime alone should be sufficient to enable rapid decomposition.

With general refuse or poor-quality material, a heap can be made on a square base, and of such size that the final height is about 3 feet. Spread the chopped-up material in layers several inches deep, treating each layer in the following manner:—

Snow over with ground limestone (5 lb. per 100 lb. material), fork in loosely, give a sprinkling of superphosphate, and then add sulphate of ammonia at the rate of 1½ lb. per 100 lb. material. The material should be moistened before building up the layers, if not already moist. Ammonia may be given off slowly, so that it is necessary to keep building up and treating the successive layers quickly, so that it will not be lost. The final layer is not treated, and may be given a covering of an inch of soil. When next the heap is added to, the untreated layer can be moistened and treated.

When the heap is at the full height, after subsidence due to compaction and loss of material by bacterial action, the heap can ferment under the untreated capping, which can be used as a base for the next heap. The heap should be kept damp, but water should not be added in quantity sufficient to cause drainage from the heap.

In summer the material should be ready for use after two months, but in cold weather the process is much slower.

Artificial manure properly prepared is very similar in chemical composition to composted horse manure, and gives equally good results in promoting plant growth.

FERTILITY OF THE HOME GARDEN.

Intensive gardening demands a higher degree of soil fertility than does ordinary field crop culture. An efficient system of soil management should not only make allowance for the present crop, but should aim at an ever-increasing reserve of fertility. It should determine the necessity and value for the particular soil of organic matter, how most economically to apply this material, then attempt to supplement this where necessary, by liming and the addition of artificial fertilizers.

Organic matter has an important function in the growth of plants as a source of carbon dioxide, in improving the physical condition of the soil, in increasing the water-holding capacity, allowing root penetration, and modifying extremes of soil temperature. In addition to providing some of the mineral constituents required in greatest amount, organic matter provides certain rare, and little understood elements, usually not considered in the preparation of artificial fertilizers. Heavy soils in which the fine particles accumulate in large masses, and crack badly on drying, can only be improved in texture by liming when acid, and the addition of organic matter to prevent the clods from cementing.

In general, the richer the food of animals in fertilizing substances the richer their excreta, particularly the liquid portion. This contains most of the potash and a great deal of the nitrogen, but only a small amount of the phosphate which passes through their bodies; further, it contains these substances in a form ready for the immediate use of the plant. It is therefore important to realise that unless precautions have been taken to include it with the solid excreta, most of the valuable fertilizing constituents have been lost.

The kind of animal affects the fertilizing value of manure. Horse manure is richer and more readily decomposed than cow manure, since the mineral requirements of the milking cow are much greater than those of the horse. Poultry manure, when fresh, is a rich fertilizer compared with horse or cow manure; it contains more than twice as much nitrogen and phosphate, but has only about the same amount of potash. The bulk of its nitrogen is present in an easily available form, hence it is a quick-acting or forcing nitrogenous manure.

Animal manure as commonly procurable has not been carefully conserved against the loss of fertilizing constituents, and unless the liquid portion has been included, a considerable portion of the nitrogen present is not of use to plants. It must be regarded as an unbalanced fertilizer, and the fertilizer balance can be greatly improved by the separate use of superphosphate, and sulphate or chloride of potash.

Where the organic matter of the soil is maintained by using manure, a degree of fertility will be maintained, but an annual application of 100 to 150 lb. per 100 square feet will be necessary.

LIME FOR THE GARDEN.

Lime fulfils many functions which are essential to soil fertility. Its most useful action is in neutralising the acidity of strongly acid soils, for with the removal of acidity the other valuable effects of liming follow. Lime improves the physical condition of heavy acid soils, ensuring better drainage and aeration, and making cultivation easier, and is an essential plant nutrient, and when present in sufficient amount promotes many phases of bacterial activity, especially those ultimately bringing the reserves of nitrogenous material in the soil into the soluble forms of nitrogen which plants utilise.

There is no foundation for the common statement that exposure of acid soil to sun and air "sweetens" or reduces its acidity. Acidity is developed through an insufficiency of lime in the original soil-forming material, or by the loss of lime, through leaching, and absorption by plants. Acidity thus developed can only be counteracted in field or garden practice by the use of some form of lime. The forms of lime used for counteracting soil acidity are hydrated or slaked lime, and ground limestone or carbonate of lime.

Slaked lime is formed by the action of water on burnt or stone lime, and forms a very fine powder which can be efficiently spread. Ground limestone is a cheaper and more pleasant material to handle than slaked lime, and can nearly always be relied on to give as quick and good results as slaked lime, provided the material is sufficiently fine and well distributed, and that equivalent dressings are applied. In the last respect, 4 lb. of carbonate of lime are required to supply as much "effective" lime as 3 lb. of slaked lime contains.

The soil to be limed should be dug over and reduced to good tilth, the lime uniformly spread, and then lightly worked into the top several inches of soil. The amount of lime to be used depends on the degree of acidity of the soil, its texture, organic matter content, and the type of plant to be grown. Unless all these features can be determined, suggestions on the amount of lime that it is necessary to add to a soil can only be approximate.

On loams and heavier soils, dressings may range from 1 lb. of slaked lime, or 1½ lb. ground limestone, per square yard on loams, to double these quantities on clay loams and clays. Sandy loams or still more sandy soils can receive lighter dressings of approximately half the amount for loams. Lime is lost most rapidly from sandy soils, which are usually more acid than heavier soils under the same conditions. Under garden conditions, with frequent waterings, lime is continually being lost, especially from the sandier types of soil. After the initial liming, which may need to be heavy to counteract strong acidity, it is preferable to add light dressings each season, rather than occasional heavy dressings.

It is not always necessary to add sufficient lime to completely neutralise soil acidity, as most garden plants grow well on slightly acid soils. This slightly acid condition will only result in the majority of garden soils after liming. Only for those plants listed below as very sensitive to acidity is it advisable to completely neutralise acidity. Whilst many plants grow best on neutral soils or on slightly alkaline (opposite of acid) soils, a considerable number of plants will tolerate fairly acid soils. The latter are not adversely affected by being grown in limed soils, though many plants which require a good lime supply may fail on acid soils.

By careful planning of the garden cropping scheme, portion of the area may be set apart and only lightly limed, if at all, for certain plants (as indicated below), and the remainder limed for those crops with a higher lime requirement. Potatoes, which will grow on acid soils, do best on slightly acid soils, and in gardens where dry conditions are not experienced the danger from scab diseases in slightly acid soils is small.

The following statement shows the relative sensitiveness of a number of garden and crop plants to acid soil conditions:—

Very Tolerant.—Parsley, potato, radish, strawberry, sweet potato, tomato, cow-pea, maize, millet, oats, rye.

Tolerant.—Bean, Brussels sprouts, carrot, choko, cucumber, endive, kohl rabi, pea, pumpkin, rhubarb, squash, turnip, watermelon, crimson clover, vetch.

Sensitive.—Broccoli, cabbage, cauliflower, eggplant, sweet corn, barley, rape, red clover, sweet clover, wheat, white clover.

Very Sensitive.—Asparagus, beet, celery, lettuce, onion, parsnip, spinach, lucerne.

Evidence is available to show that excess of lime under certain conditions may depress plant growth. Overliming may result when the calculated amount of lime is applied to the surface zones of soil, and not worked to the proper depth. Overliming injury is produced only on heavily-limed acid soils, and not on non-acid soils, or soils which have previously been limed. This injury is not permanent and is usually overcome by the time the first crop is removed. Lettuce and lucerne are crops which may suffer from bad lime distribution.

Large additions of organic matter such as compost, manure, &c., are very effective in reducing overliming injury, and this fact is of importance in indicating that a liberal addition of green or stable manure should be applied to the soil if immediate liming and seeding are necessary. Where very heavy dressings of lime are necessary, it may be advisable to apply lime in two successive seasonal applications. After the preliminary liming, the lime added in a well-made compost will go far to counteract natural losses of lime from the soil.

FEED REQUIREMENTS OF DAIRY COWS.

Owing to the dry season experienced in some of the dairying districts an extreme shortage of both pasture and cultivated fodder crops has occurred, and this shortage should emphasise the great value of conserving fodder in the form of hay or ensilage.

A certain quantity of food is required to maintain the animal in a healthy, normal condition, and for milk production feed over and above the quantity used for maintenance is required.

The indigestibility of the nutrients in the different foodstuffs varies very considerably, and all young plant life contains a higher quantity of protein than does matured growth, and also all nutrient matter is in a much more digestible condition in the younger stages of plant growth.

The daily maintenance feed for a 1,000-lb. cow should contain 0.7 lb. of digestible crude protein and about 8 lb. of total digestible nutrients, and then for every gallon of milk with 3.5 per cent. fat produced the cow will require more feed containing about ½ lb. of digestible crude protein, with from 2¾ lb. to 3 lb. total digestible nutrients. The nutrients required in the daily feed for maintenance of production of 1 gallon of milk will be practically 1¼ lb. digestible crude protein with a total nutrient content of 10⅜ lb. Briefly stated, feedstuffs may be said to be composed of water, organic dry matter, and mineral matter. That cows can only consume a certain amount of dry matter must be recognised, and a general rule is that dry matter up to 3 per cent. of the body weight of the animal may be eaten daily—thus 30 lb. dry matter may be eaten by a 1,000-lb. cow. If mineral deficiency exists in the animal's feed such can be remedied by suitable stock licks.

Too great dependence for feeding is placed upon the natural grasses, for when dry times occur (unless some form of hay or silage has been conserved) the stock are frequently unable to obtain sufficient food, even for maintenance, from the old matured grass roughage of grazing paddocks.

In illustration—a sample of grass roughage upon which cows were feeding was examined, and it was found that to obtain even the amount of digestible crude protein required for maintenance 2½ times the dry matter possible of being consumed would be required. In this case 25 lb. of the grass roughage with 3¼ lb. lucerne chaff, or with 1 lb. lucerne chaff and 1 lb. cottonseed meal would be sufficient to maintain the animals, but insufficient for both maintenance and milk production.

Regarding paspalum, if not in the mature stage of growth 47 lb. would provide sufficient protein but not quite sufficient total nutrients for maintenance; the nutrients could be supplemented by maize meal. For maintenance and production of 1 gallon of milk (this low production has been quoted purposely) 84 lb. green paspalum would be sufficient.

Detailed information concerning feeds and rations for dairy cows are published in "Stock Foods" and "Rations for Dairy Cows," which pamphlets are obtained free upon application to the Department of Agriculture and Stock, Brisbane.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JULY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1936 AND 1935, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	July.	No. of Years' Records.	July, 1936.	July, 1935.		July.	No. of Years' Records.	July, 1936.	July, 1935.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In
Atherton	1·00	35	2·07	0·34	Clermont	1·05	65	0·73	3·70
Cairns	1·53	54	1·74	0·41	Gindie	1·14	37	..	3·49
Cardwell	1·36	64	1·28	0·50	Springsure	1·22	67	1·80	4·51
Cooktown	0·95	60	1·45	0·60					
Herberton	0·85	50	1·16	0·07					
Ingham	1·62	44	1·19	3·94					
Innisfail	4·59	55	7·18	3·31					
Mossman Mill ..	1·25	23	1·20	1·32	*Darling Downs.*				
Townsville	0·62	65	0·27	0·59					
					Dalby	1·73	66	2·00	1·52
Central Coast.					Emu Vale	1·59	40	2·59	1·66
					Hermitage	1·76	30	..	1·44
Ayr	0·69	49	..	0·78	Jimbour	1·53	48	2·05	1·04
Bowen	0·94	65	..	0·34	Miles	1·65	51	2·50	1·86
Charters Towers ..	0·65	54	0·30	1·75	Stanthorpe	2·04	63	2·87	2·14
Mackay	1·70	65	0·55	1·46	Toowoomba ..	2·10	64	2·40	2·01
Proserpine	1·56	33	1·36	0·52	Warwick	1·84	71	2·50	1·60
St. Lawrence ..	1·41	65	0·23	3·13					
South Coast.									
					Maranoa.				
Biggenden	1·41	37	0·34	2·85					
Bundaberg	1·86	53	0·75	5·37	Roma	1·48	62	1·69	1·92
Brisbane	2·23	85	1·31	2·06					
Caboolture	2·20	49	1·28	2·59					
Childers	1·72	41	0·54	3·99					
Crohamhurst ..	3·01	43	1·80	5·11					
Esk	1·98	49	1·56	2·44					
Gayndah	1·47	65	0·46	2·21					
Gympie	2·12	66	1·17	2·82	*State Farms, &c.*				
Kilkivan	1·62	57	0·45	1·54					
Maryborough ..	1·92	65	1·48	3·86	Bungeworgorai ..	1·43	22	1·20	..
Nambour	2·72	40	1·12	4·30	Gatton College ..	1·42	37	1·47	1·93
Nanango	1·67	54	1·24	1·49	Kairi	1·11	22	..	..
Rockhampton ..	1·79	65	0·40	4·28	Mackay Sugar Experiment Station	1·53	39	0·45	1·53
Woodford	2·39	49	1·57	2·95					

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JULY, 1936.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Means Atmospheric Pressure at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·98	79	69	82	4, 25, 27, 29, 31	60	1	145	8
Herberton	..	70	54	80	27, 28	40	1	116	14
Rockhampton	30·16	73	55	82	26	43	1	40	8
Brisbane	30·21	69	51	75	30	40	1	131	8
Darling Downs.									
Dalby	30·21	66	43	73	15	29	19	200	7
Stanthorpe	..	58	36	67	2	23	19, 20	287	14
Toowoomba	..	61	43	67	4	29	19	240	10
Mid-Interior.									
Georgetown	30·02	82	59	91	29	43	1	91	2
Longreach	30·13	73	47	81	11, 23	35	7, 8	126	3
Mitchell	30·20	67	40	76	24	26	19	157	5
Western									
Burketown	30·01	82	58	90	27, 28	49	1, 8	Nil	..
Boulia	30·10	74	50	87	25	40	7	24	2
Thargomindah	30·16	66	44	78	24	33	6	28	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	September 1936.		October 1936.		Sept. 1936.	Oct., 1936.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·7	5·37	5·33	5·51	5·23	6·21
2	6·6	5·37	5·31	5·51	6·28	7·31
3	6·5	5·38	5·30	5·52	7·34	8·41
4	6·3	5·38	5·29	5·53	8·42	9·48
5	6·2	5·39	5·28	5·53	9·49	10·51
6	6·1	5·39	5·27	5·54	10·56	11·49
7	5·59	5·40	5·26	5·54	..	..
					a.m.	a.m.
8	5·58	5·40	5·25	5·55	12·1	12·41
9	5·57	5·41	5·24	5·55	1·1	1.23
10	5·56	5·41	5·23	5·56	1·56	2·3
11	5·55	5·42	5·22	5·56	2·43	2·35
12	5·53	5·42	5·21	5·57	3·24	3·10
13	5·52	5·43	5·20	5·57	3·53	3·40
14	5·51	5·43	5·19	5·58	4·34	4·11
15	5·50	5·44	5·18	5·58	5·7	4·41
16	5·49	5·44	5·17	5·59	5·38	5·17
17	5·48	5·45	5·16	5·59	6·8	5·51
18	5·47	5·45	5·15	6·0	6·39	6·30
19	5·45	5·45	5·14	6·1	7·14	7·13
20	5·44	5·46	5·12	6·1	7·52	8·0
21	5·43	5·46	5·11	6·2	8·30	8·52
22	5·42	5·47	5·10	6·3	9·15	9·46
23	5·41	5·47	5·9	6·3	10·4	10·44
24	5·40	5·47	5·8	6·4	10·38	11·43
25	5·39	5·48	5·8	6·5	11·55	12·42
					p.m.	
26	5·38	5·48	5·7	6·5	12.55	1.45
27	5·37	5·49	5·6	6·6	1·59	2·49
28	5·36	5·49	5·6	6·7	3·2	3·54
29	5·35	5·50	5·5	6·7	4·7	5·4
30	5·34	5·50	5·4	6·8	5·13	6·13
31			5·3	6·9		7·25

MOONRISE.

Phases of the Moon, Occultations, &c.

1 Sept.	○	Full Moon	10 37 p.m.
8 ,,	☽	Last Quarter	1 13 p.m.
16 ,,	●	New Moon	3 41 a.m.
24 ,,	☾	First Quarter	8 12 a.m.

Perigee, 3rd September, at 8.48 p.m.
Apogee, 19th September, at 10.42 a.m.

The swift planet Mercury, which since the beginning of the year has travelled through fully eight constellations (at intervals with apparently retrograde motion) from Sagittarius to Virgo, will become stationary on 18th September, after which it will seem to move westward for nearly a month, but still remain in Virgo.

On the 19th Neptune will be in conjunction with the Sun and therefore invisible for some weeks.

On the 23rd Jupiter and the Moon will be separated by only one degree, but again the phenomenon will occur far below the horizon.

At 3 p.m. on the 23rd the Sun will cross the celestial equator from North to South and it will be the Australian Vernal Equinox. Technically the Sun "enters the Sign of Libra," where it was in reality in 1322 B.C. The term is still used although the event now occurs in Virgo.

At 3.51 a.m. on the 24th about an hour and a half before Sunrise there will be a very close conjunction of Mars and Regulus, the first magnitude star in Leo, the distance between them being less than a degree.

A second conjunction of Saturn and the Moon will occur on the 30th at 5 a.m. about half an hour before they set.

Mercury rises at 7.17 a.m., 1 hour 10 minutes after the Sun, and sets at 7.39 p.m., 2 hours 2 minutes after it, on the 1st.; on the 15th it rises at 6.45 a.m., 55 minutes after the Sun, and sets at 7.35 p.m., 1 hour 41 minutes after it.

Venus rises at 7.2 a.m., 55 minutes after the Sun, and sets at 6.56 p.m., 1 hour 19 minutes after it, on the 1st; on the 15th it rises at 6.53 a.m., 1 hour 3 minutes after the Sun, and sets at 7.19 p.m., 1 hour 35 minutes after it.

Mars rises at 4.53 a.m., 1 hour 14 minutes before the Sun, and sets at 3.45 p.m., 1 hour 52 minutes before it, on the 1st; on the 15th it rises at 4.28 a.m., 1 hour 22 minutes before the Sun, and sets at 3.30 p.m., 2 hours 14 minutes before it.

Jupiter rises at 11.15 a.m. and sets at 1.1 a.m. on the 1st.; on the 15th it rises at 10.24 a.m. and sets at 12.12 a.m.

Saturn rises at 6.23 p.m. and sets at 6.55 a.m. on the 1st; on the 15th it rises at 5.22 p.m. and sets at 5.58 a.m.

7 Oct.,	☽	Last Quarter	10 28 p.m.
15 ,,	●	New Moon	8 20 p.m.
23 ,,	☾	First Quarter	10 53 p.m.
30 ,,	○	Full Moon	3 57 p.m.

Apogee, 16th October, at 6.30 p.m.
Perigee, 2nd October, at 1.2 a.m.
Perigee, 31st October, at 12.36 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.