



PLATE 1.—*Lightning strike damage on a New Britain plantation.*

COCONUT LIGHTNING STRIKE

A. E. CHARLES.

Lightning, a frequent hazard of tropical storms, is a major cause of coconut palm loss in Papua and New Guinea. The author, coconut agronomist of the Department of Agriculture, Stock and Fisheries, describes the death of 23 palms surrounding an observed strike in late 1956. He compares his observations with those made overseas and surmises that it is probable that the initial strike weakens the palm, permitting invasion by some pathogenic organism. Mr. Charles also says detailed study of the phenomenon is undoubtedly warranted.

IN coconut plantations throughout Papua and New Guinea numerous gaps can be found in the palm stand where groups of palms, varying in number from three or four up to 50 or 60, have died out. These gaps are roughly circular in shape and the losses are commonly attributed to lightning strike. Over a period of years, the loss of palms is appreciable and it is probably true to say that on plantations in most areas of the Territory losses due to lightning strike are greater than those resulting from any insect or disease attack.

Similar palm losses in Malaya were studied by Sharples (1933) who investigated particularly

the possibility of palm death being the result of "bud-rot" caused by *Phytophthora*. He concluded that the symptoms observed were produced entirely by lightning or its after-effects. He considered that lightning is a factor of the first importance in the causation of loss in coconut plantations in Malaya.

Sharples described the typical case as "a group of 10 to 12 trees, of which one, two, or three central trees die rapidly. On examination the bud tissues are found to be in badly decayed condition. The surrounding trees show disease symptoms of varying intensity, e.g., stem bleeding, broken and hanging outside leaves, with the

central leaves and spike still standing erect. When left untreated some of the slightly affected trees gradually grow worse and finally succumb".

He also quoted a specific case, where the actual lightning strike was observed, in which it was noted that some palms, which did not appear affected externally, died after a lapse of several months.

Dwyer (1936) discussed the occurrence of lightning strike in New Guinea. His observations are generally similar to those of Sharples concerning the symptoms shown by palms affected by lightning, but he also records the death of the bark and the presence of fungus species on the worst-affected palms. In addition, he observed differences in the prevalence of lightning strike in different parts of the Territory, which he relates to the nature of the terrain (as it influences the frequency of electric storms) and the soil type (occurrence of magnetic minerals).

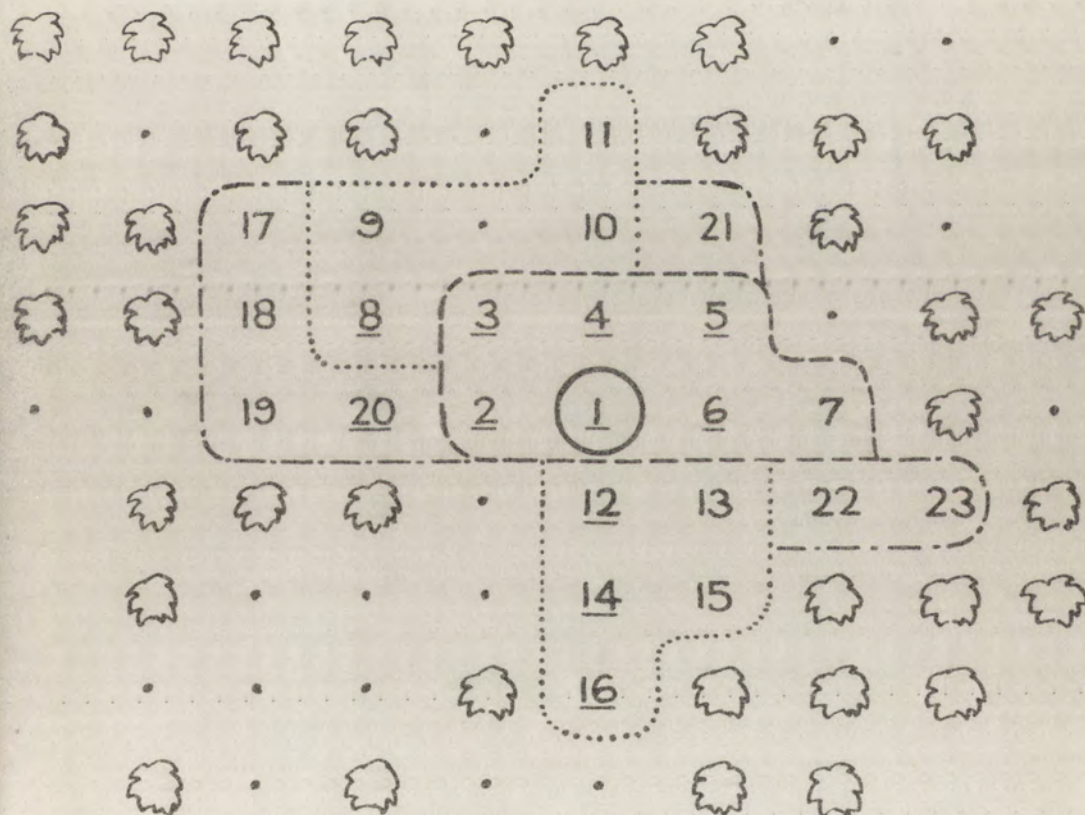
The present note is concerned with observations on a lightning strike occurring on a coconut plantation in the Gazelle Peninsula, New Britain. The actual strike was observed and observations at intervals afterwards over a period of 18 months show the sequence of events in which ultimately 23 palms died.

FIELD OBSERVATIONS

A plan of the area concerned is shown in Figure I. The palms which ultimately died are numbered, and surrounding palms which survived are marked by a palm-symbol. The palm stand is fairly old (at least 40 years) and many palms were already missing. These are indicated on the plan by a dot. Spacing is 30 feet on the square.

The lightning strike occurred on 29th November, 1956, and was observed by the plantation manager. A single palm received the main

FIG. I.—*Plan of lightning strike.*



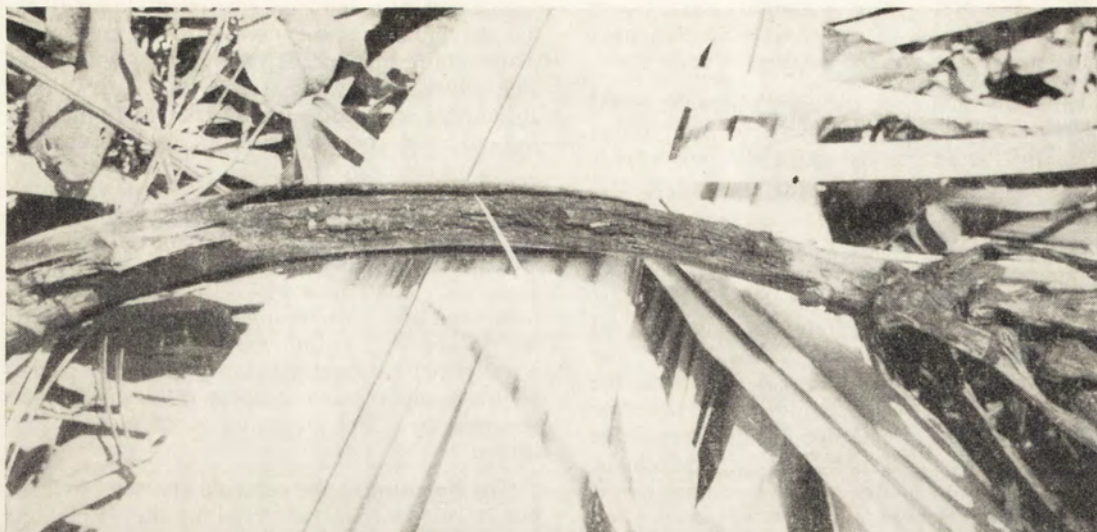


PLATE 2.—Fallen spathe from a palm struck by lightning. Note charred tissue, evidence of fire, started at time of strike.

force of the strike, as evidenced by a fire started in the grass at its base and a number of nuts of different sizes thrown to the ground. This palm is numbered 1 on the plan.

The area was first inspected by the writer five days after the strike. Palm 1 had all outer fronds hanging, while some of the central fronds, although still erect, were withered. There was no sign of damage to the trunk. Several nuts, in all stages of development, were lying at the base. All had brown scorch marks and most were split. Some of the surrounding palms had broken fronds but there were no other symptoms evident.

The palms were inspected again on 20th December, three weeks after the strike. The following notes were made :—

Palm 3 : Some broken fronds.

Palm 4 : Many broken fronds.

Palm 5 : One or two broken fronds.

Palm 2 : Several outer fronds hanging and a number of nuts shed.

Palm 1 : All but two or three central fronds hanging and dead, while the erect central fronds were withered. Almost all nuts fallen. Some of the old spathes, etc., fallen from the crown were charred.

Palm 6 : Most outer fronds hanging, and majority of nuts fallen.

Palm 7 : One or two broken fronds.

All other palms were apparently quite normal.

Another inspection was made on 8th January, 1957, about six weeks after the strike. Several more palms were now affected, as follows :—

Palm 11 : One broken frond.

Palm 9 : Possibly some fronds hanging.

Palm 10 : Possibly some fronds hanging.

Palm 8 : Several broken fronds.

Palm 3 : Some fronds hanging.

Palm 4 : Most fronds hanging.

Palm 5 : Two fronds broken.

Palm 2 : Most fronds hanging, and all nuts fallen.

Palm 1 : All fronds fallen.

Palm 6 : Central frond only remaining.

Palm 7 : Some fronds hanging.

Palm 12 : A few fronds hanging.

Palm 13 : A few fronds hanging.

Palm 14 : Most fronds hanging, and most nuts fallen.

Palm 15 : One broken frond.

Palm 16 : Most fronds hanging and most nuts fallen.

All remaining palms were unaffected.

Because of work in other districts, the area was not visited again until June, 1957, and then only general observations were made. More than 20 palms were now dead or dying, though several were only in the early stages of hanging fronds.

A detailed inspection was made again on 12th September, 10 months after the strike. All 23 palms numbered were now dead. Palm 18 was the only one with any fronds remaining as its central fronds were still standing. The rest of the palms were completely defoliated.

A closer examination of Palm 18 showed that the roots were apparently perfectly healthy. However, the bark on the trunk, except for a small patch at the base, proved to be dead and brown. Superficially the bark appeared normal, but at a depth of about a quarter of an inch the fibrous layer was dark brown and dead.

Surrounding palms all looked quite healthy, and none showed any sign of the dead bark found on affected palms.

A further inspection was made on 3rd January, 1958, 13 months after the strike. No more palms had died or showed any symptoms of disease, and it was concluded that there would be no further spread. This was confirmed in June, 1958.

However, an observation made in January was the presence of fruiting bodies of a fungus (*Ganoderma* sp. probably *G. applanatum*) on the stems of Palms Nos. 1, 2, 3, 4, 5, 6, 8, 12, 14, 16 and 20 and perhaps also on Palms 15 and 17. The affected palms were cut down shortly after this date.

DISCUSSION

Comparing these observations with those of Sharples, it is of interest that there was no stem-bleeding on these palms, whereas Sharples seems to have regarded stem-bleeding as one of the most typical symptoms. The only resemblance to stem-bleeding in the present instance came long after all fronds had fallen, when some gum exuded from the feeding holes of borers attacking the bark. This, however, is to be found in any dead coconut stem, whatever the cause of death.

Another difference is that Sharples mentions palms which showed some damage, but later recovered. In the present instance, on the contrary, at least 16 palms, which originally showed no sign of injury, subsequently died.

This delayed effect is of particular interest. If it were the growing point which was injured, it would be easy to explain a delayed effect, as the external fronds might continue to function. However, in lightning strike, the growing point is the last to die. It therefore seems probable that the mechanism of lightning injury involves an initial shock to the palm which weakens it and perhaps permits its invasion by some pathogenic organism. Such a pathogen would cause the gradual death of the palm.

It should be noted that, since in lightning strike the growing point is the last to die, lightning damage may be readily distinguished from "bud-rot" caused by *Phytophthora palmivora*, where the growing point is the first to be attacked.

Further investigation of the cause of delayed effects of lightning strike is undoubtedly warranted. Detailed studies should be made of the physiological changes occurring in the affected palms, as well as determining whether the effect is partly pathogenic. If there is a pathogen involved, it is possible that some measure could be taken to reduce the losses incurred. Various treatments, such as cutting back the fronds, ring-barking, or boring a hole into the trunks of palms around the affected area, are already used by Territory planters, but it is impossible to evaluate their effectiveness without controlled experiments.

The main difficulty in any such study is to find lightning strikes in the early stages, and it would be greatly appreciated if anyone observing an actual lightning strike (especially in the Gazelle Peninsula) would notify the Department of Agriculture, Stock and Fisheries.

REFERENCES.

- DWYER, R. E. P. 1936. Diseases of the Coconut in New Guinea. N.G. Agric. Gaz., Vol. 2 : 28-93.
SHARPLES, A. 1933. Lightning Storms and their Significance in Relation to Diseases of (1) *Cocos nucifera* and (2) *Hevea brasiliensis*. Annals Applied Biology, Vol. 20 : 1-22.