# A STUDY OF THE EFFECT OF SAP-SUCKING INSECTS ON THE INCIDENCE OF CHERELLE WILT OF CACAO

## Introduction

Cherelle wilt, the blackening and shrivelling of young cacao pods (cherelles) causes losses varying from 20 to 90 per cent of cacao fruits set, (Pyke, 1933; Hewison and Ababio, 1930), perhaps accounting for a considerable loss of the potential crop.

The factors contributing to cherelle wilt have been thought to be mainly of a physiological nature, although some evidence is now available indicating that insects are a possible cause (Shenfelt, 1960; Torres, 1950).

Although there is a potential seasonal variation in cherelle wilt, cacao pods appear to undergo a definite wilting cycle, pods showing a marked predisposition to wilt up to 80 - 100 days from fertilization, at which time they are approximately 8 - 10 cms. in length.

Rounce & Smart (1928) observed that susceptibility to wilting increased 40 - 64 days after fertilization, an observation confirmed by Akinbode (1958) and McKelvie (1956), the latter recording a second smaller peak at 70 days.

Attempts to explain this wilting of the young cacao pod at a certain age have been made by Humphries (1944), who attributed a decrease in wilt after 70 days to increased phloem activity. McKelvie (1956) found no evidence to support this view.

McKelvie (1956) has postulated a hormonal control of water and nutrient uptake as causing wilting, however the evidence using growth regulating sprays is conflicting (Gardner & Naundorf, 1950; Murray, 1957; Akinbode, 1958).

The young pod growing quickly from 40 - 70 days of age has a maximum demand for water and nutrients (Humphries, 1943) any depression of the mechanism of nutrient translocation as suggested by Alvim (1954) could lead to wilting.

Nichols (1960) gives some weight to Alvim's statement, where

he described the formation of blockages in the xylem vessels of the stalk of a wilting cherelle, these blockages have been shown to restrict the flow of sap to the pod. Nichols considered, however, that the primary cause of wilt is a cessation in growth of the fruit cambium followed by the development of the vessel occlusions.

Cope (1939) and Humphries (1940) claimed that wilt was due primarily to a nutrient and water deficiency, brought about by competition between pods borne by the same tree, and through the development of new shoots during a leaf flush, causing in effect, a 'physiological fruit thinning'.

Pound (1936) suggested that wilting is a physiological upset, induced by excessive rain and extreme dryness. Akinbode (1958) and Humphries (1940) could find no evidence that weather is an important factor, Alvim (1954) and Bartolome (1954) however associated wilting with heavy rain.

Attempts to reduce wilt by application of plant nutrients have given conflicting results (Cope, 1939; Bartolome, 1954).

Other factors which have been claimed to be contributory to wilt include mechanical injury, microbial infection and insect damage. Miller (1954) claimed that mechanical injury may accentuate wilt. Rosas (1950) claimed a 20% increase in wilting where cherelles were inoculated with Phytophthora. Leather (1953) working in Trinidad could find no more than 2 per cent loss of young pods due to fungal infection.

Lozano (1955) has shown a higher incidence of wilt in Colombia, where Monilia disease occurs, a Pentatomid is thought to be of importance as an agent in the inoculation of this disease. Most workers are agreed however, that fungal organisms are secondary invaders entering the pods after wilt has started.

Insect damage on cacao pods and stalks although observed by many workers, had not been claimed as a contributing factor to cherelle wilt until the work from Costa Rica.

Bartolome (1954) working in Costa Rica, noted that a large percentage of wilting cherelles had lesions on them, caused apparently by

insects and fungi. From the results of a cage study involving 100 cherelles caged when less than 2 cms. in length, he demonstrated the possible importance of an adult membracid as a factor in wilting, his data showing 40% wilting in cages with the adult tree hoppers, as compared to 5% in the control cages.

Following these observations, Torres (1950), conducted an experiment to evaluate the comparative significance of the nymphal and adult stages of the membracid in causing cherelle wilt.

No significant difference in the total effect of the adult and nymphal stages of the insect showed up; both stages caused an increase in wilting of the order of 30 - 40 per cent over cages without insects. Shelfelt (1960) in a further cage study in Costa Rica attributed 31 per cent wilting to the membracid Amastris obtegens F. Results from his trials involving 375 cherelles showed a faster growth rate and a greater wet bean weight at maturity of the order of 9 - 22 per cent, in those pods protected from insects.

Bartolome (1954), Torres (1950) and Shenfelt (1960) all agree however, that wilting as a result of insect damage is confined to cherelles less than 2 cms. in length, this does not however, take into account wilting arising from fungal infection, spores of which may gain entry through insect feeding punctures.

In a consideration of wilting, arising as a result of insect damage, two aspects are involved. Firstly, insect damage to the pod or pod stalk either by loss of sap, by mechanical injury during feeding, damage due to oviposition, toxic effects of saliva or the entry of fungal inoculum through the feeding punctures would account for the major loss of cherelles if insects are a factor.

Secondly, wilting as a result of indirect insect damage, could occur under certain conditions where leaf defoliation, mechanical injury to the branches or root damage can all lower the resistance of the tree, increasing wilting and in some cases causing the death of the tree.

Cacao trees harbour a variety of insect species often in abundance, but little attention has been given to the insects associated

with the pod and pod stalk and their possible economic importance.

These include some serious pests of cacao as illustrated by the family Miridae, members of which are responsible for swollen shoot in Africa. Little direct damage occurs to the pod from the activities of Sahlbergella singularis and Distantiella theobroma (Cotterel, 1927; Lavabre, 1957).

Species of Heloptelis feed almost exclusively on cacao pods and cause considerable damage as a result, black spotting, secondary fungal infection and wilting of young pods often occurring where a heavy attack occurs (Cotterel, 1927; Pagden, 1948).

South American representatives of the Miridae, Monalonion species, cause similar damage to that of Heloptelis (Silva, 1944). Species of Mecistorhinus (Pentatomidae) have been reported feeding on immature pods and pod stalks in Trinidad, Costa Rica, and Colombia. Lozano (1955) claimed that M. tripterus is important as an agent in the inoculation of Monilia disease of pods in Colombia.

Willes (1944) states that the Pentatomids Epicoris corrosas and a species of Dinocoris cause similar damage to that of the 'Mosquilla bug' of Peru, Monalonion dissimulatum on shoots and young fruits of cacao.

Another family of the Hemiptera, the Psuedococcidae, although important as vectors of virus diseases of cacao appear to cause little direct damage to the mature pod, although commonly infesting pods at all stages of growth. Kirkpatrick (1950) in an account of the mealy-bugs of Trinidad states however, 'a cacao tree frequently harbours numerous small colonies of Planococcous citri at the base of flowers and young cherelles which are often destroyed as a result'.

A Cercopid of the genus Clastoptera has been described by Williams (1923) in Panama, and more recently by Lara (1961) from Costa Rica, feeding sites being confined however to flowers and flower pedicels.

Jassids, although generally feeders on leaf tissue, have been reported from flowers and young cherelles in Costa Rica, some wilting of newly set cherelles being attributed to Polana and Gypona.