ASEAN PLANT QUARANTINE CENTRE AND TRAINING INSTITUTE

CUSHION GALL DISEASES OF COCOA

Fusarium rigidiuscula

Fig. 1. A Green point gall amidst normal pods. B Close up of green point galls showing profusion of green "points" on the galls.

Synonym

Imperfect stage of *Calonectria rigidiuscula* (Berk & Br.) Sacc.

Common names

Green point gall
Flowery gall
Knob gall
Fan gall
Disc gall

Geographical distribution

Cushion galls have been reported in most cocoa growing countries. The galls can be found in Africa (Ghana, Ivory Coast, Nigeria, Sierra Leone), Central America (Belize, Costa Rica, Guatemala, Mexico, Nicaragua, Panama), South America (Brazil, Colombia, Ecuador, Guyana, Peru, Surinam, Venezuela), West Indies (Dominica, Dominican Republic, Grenada, Jamaica, Trinidad), Asia (Philippines, Sri Lanka, Malaysia (Sabah)), Australasia (New Britain, New Guinea, New Ireland).

Host range

The host range for green point gall has not been fully determined. No alternative hosts are known for flowery gall and other kinds of cushion gall (12).

Gall-inducing isolates of *Calonectria rigidiuscula* can invade coffee (*Coffea* sp.), mango (*Mangifera* sp.), pigeon pea (*Cajanus* sp.) and cowpea (*Vigna unguiculata*) (3).

Etiology

Cushion gall is a collective term for a number of forms of flower cushion hypertrophy. Five kinds of gall can be distinguished, two of them, green point and flowery galls are more common than knob, fan and disc galls. Green point gall is the most important kind and has received particular attention because flower production ceases and since successively more cushions and additional trees may be affected, productivity of an area can be reduced.

The taxonomy of the causal organisms is very confusing. It is unlikely that all kinds of cushion galls have the same causal organism. The pathogens for green point and flowery galls have been identified as mating types of *Fusarium rigidiuscula* (11). *C. rigidiuscula*, the perfect form of this fungus was previously considered as the causal organism.

Calonectria rigidiuscula is a wound parasite associated with cankers and dieback caused by other organisms. The fungus produces a whitish bloom over the surface of lesions; the surface mycelium being usually scanty. The microconidia are hyaline, mostly one-celled, $8 \times 4\mu$ and coiled in the head at the tip of the conidiophore. The macroconidia are found on older cankers or dead wood. The sporodochia are pale pink and emerge through cracks in the bark; the macroconidia are hyaline, sickle-shaped, up to 10-septate, and measure $53\text{–}97\mu \times 4\text{–}8\mu$. The perithecia are pinkish en masse and emerge through cracks in the bark. The ascospores are hyaline, slightly curved, three-septate, with rounded ends, and measure $27 \times 7\mu$. The vegetative stage of the fungus is *Fusarium decemcellulare* or *F. avenaceum* (2, 4, 13).

Spread

The incidence and spread of green point gall generally depend on limited insect and water dispersal of conidia (3). Wider spread may result from airborne dispersal of ascospores. There have been casual observations of various pests such as nymphs and adult mealybugs associated with cushion galls but no causal relationship has been demonstrated (9). Evidence has been found for long distance dispersal of the disease via moving propagating materials from affected trees to new areas.

Economic importance

It is a widespread disease, but generally considered to be of little economic importance. An epidemic occurred in certain parts of Central and South America during the period 1955–1960. There have been few reports on this disease since 1965 and the epidemic has presumably now passed (8).

Early records indicated close to 50% yield loss in affected trees but this was thought to be related to the low yielding trees(10). Gall development may affect pod production indirectly through diversion of nutrients to growth of galls instead of maturation of pods.

Symptoms – identification

Green point gall. Swollen flower cushions produce numerous flower initials but these do not develop into normal flowers with pedicels, instead the buds remain green and sessile, typically as a profusion of green "points" (Figs. 1A and 1B) on the corrugated, brown surface of the gall. The galls are usually globose and semi-hard, bright green at first. They generally die after about a year, when all tissues become black and easily crumble (12).

Flowery gall. Flowery galls may bear hundreds of closely packed flowers. When they die, the darkened mass of dead flowers clings to the galls for some time, but eventually falls to the ground as a mat, giving way to a new "flush" of flowers. The flowers on flowery galls develop fully (12).

Knob gall. This gall is hard, woody and with smooth surface, up to 2.5 cm or more in diameter. Knob galls occur in flower cushions but do not bear flowers (7).

Disc gall. It was first called 'hard flat gall', thereby distinguishing it from green point and flowery galls which are generally globose. Disc galls measure 5–7.6cm and are woody, very hard, and firmly attached to the tree. The surface is dark, corrugated and undulating. They may bear flowers and fruits (7).

Fan gall. It bears branched, stem-like outgrowths, having very short internodes. These outgrowths may be produced singly or as a group in the form of a fan (7).

Potential within ASEAN

Though cushion gall diseases do not appear to be causing much problem in cocoa growing areas, it is nevertheless our concern to prevent them from spreading to other ASEAN countries as they have been reported to be present in the Philippines and Malaysia (Sabah). They are a potential threat to ASEAN countries like Malaysia which is one of the world's main producers of cocoa.

Control

Until the causal organisms of the five types of galls have been clearly isolated and the method of spread is understood, sound control methods cannot be formulated.

Regular inspection for galls forming on trees and eradication of the gall-bearing trees when there are only a few such trees should be carried out (5). Propagating materials should only be taken from healthy trees devoid of galls as cushion gall diseases could be introduced with planting material (6).

Very little has been done on chemical control as the spread of the diseases is not known.