

Rice Stemborers



General Information :

1. Stemborers belonging to the orders Diptera and Lepidoptera are the most serious pests of rice in Sub-Saharan Africa.
2. They are internal stem feeders and larval feeding causes damage to rice tillers during the vegetative and reproductive stages. Stem borer attack is most damaging when it occurs after tillering is completed.

Symptoms :

Early symptoms

1. Deadhearts: attack of young plants at the vegetative stages (seedlings to panicle initiation) results in the destruction of the growing point, typically referred to as “deadhearts” caused by the drying up of the central shoots (dead inner leaves)
2. Larval damage by *Maliarpha separata* within the stem results in reduced plant vigour, fewer tillers and many unfilled grains. The larva does not produce deadhearts because the growing apical portion of the plant is not cut from the base. Thus, panicles can be initiated at the last node.



Late symptom

3. Whiteheads: attack of plant bearing panicles at the flowering stage results in a white or dry empty panicle called ‘whitehead’.



Causes of stemborer outbreaks:

1. Favourable climate
2. Presence of alternative hosts in and around rice fields
3. Crop residues (what's left after harvest), ratoons (tillers that sprout from rice stubble) and volunteers (self-seeded rice plants that grow up from shed or spilt seeds) are ideal places for borers to survive and multiply
4. Planting with high-yielding varieties – varieties that are unfortunately susceptible to attack
5. Wide range of planting dates

Control :

1. Cultural practices such as early sowing, narrow spacing of plants and maintaining weed-free fields have been observed to minimize diopsid infestation
2. Synchronized planting over a large area has been used to allow the most susceptible stage of rice to escape from *Chilo zacconius* damage
3. Management of stubble by burning, plowing and flooding after harvest destroys diapausing larvae of *Maliarpha separatella*
4. Strip- and inter-cropping of maize with NERICA was found to be effective in reducing stem borer damage on rice because maize and rice share some common stemborer species
5. Carabids, reduviids, dragonflies and spiders are known predators of *Chilo zacconius*
6. The braconids *Rhaconotus scirpophagae* Wilk. and *Bracon antennatus* Granger are gregarious endoparasitoids of *Maliarpha separatella* in Nigeria
7. The braconid *Cotesia* (= *Apanteles*) *sesamiae* Cameron and the eulophid *Pediobus furvus* Gahan are the most important wasps attacking *Sesamia* spp.

*** Resistant cultivars to rice stem borers**

Cultivars

1. *Oryza sativa* japonica sub-species: LAC 23, ITA 121, TOS 4153
2. Upland NERICAs: NERICA 1, NERICA 2, NERICA 4, NERICA 5, and NERICA 7
3. WAB 1159-2-12-11-6-9-1-2 has been reported in Uganda to trap *Diopsis thoracica* larvae with their highly hairy leaves

African Rice Gall Midge (AfRGM)



General Information :

1. The African rice gall midge (AfRGM), *Orseolia oryzivora* Harris and Gagné (Diptera: Cecidomyiidae) is a serious insect pest of rainfed and irrigated lowland rice in Africa.
2. It is a bud/stalk borer and larval feeding causes severe damage to rice during the vegetative stages (seedling to panicle initiation).

Symptoms :

1. The larvae attack the growing point of rice tillers and cause the leaf sheath tissues to form a tube-like structure called a 'silver shoot gall' that resembles an onion leaf.
2. Early gall infestation results in stunting, bushy appearance of the rice plant, with as many as 50 small tillers per hill.
3. Galls cannot be pulled out of the rice tillers unlike deadhearts caused by stemborers



Causes of AfRGM outbreaks:

1. Changes in weather (high rainfall, excessive cloud cover and humidity): outbreaks tend to occur in years that are wetter than usual
2. Staggered planting: wide range of planting dates increases the risk of AfRGM outbreaks. Late-planted fields are usually at higher risk
3. Planting of new high-yielding AfRGM-susceptible varieties: fertilizer-responsive improved varieties though high-yielding are generally more susceptible to AfRGM than the traditional land-races they are replacing
4. Increased use of fertilizer, which—with the adoption of improved varieties—has been a major aspect of rice intensification in West Africa, might have contributed to increased AfRGM infestation
5. Presence of alternative host plants

Control:

1. Early and synchronized planting: rice fields planted early are less likely to suffer serious damage than those planted late.
2. Destruction of alternative host plants such as rice ratoons, volunteers and *Oryza longistaminata*.
3. Fertiliser use: moderate levels of fertiliser (e.g. 60 kg/ha) should be used and applied in split doses.
4. Movement of seedlings should be discouraged as such seedlings can be infested by AfRGM in the nursery.
5. Plant spacing: close spacing should be discouraged because it provides a suitable micro-environment for the survival of the exposed life stages of AfRGM.
6. The gregarious endoparasitoid *Platygaster diplosisae* and the solitary ectoparasitoid *Aprostocetus procerae* are the most important wasps attacking AfRGM.
7. The combination of growing gall midge tolerant varieties with *Paspalum scrobiculatum* management at the edge of rice fields had significantly increased farmers' yields because the *Paspalum* conserve asso
8. Habitat manipulation with *Paspalum scrobiculatum* management at the edge of rice fields had significantly increased the carry-over of parasitoids from *Paspalum* gall midge (*Orseolia bonzii*) to AfRGM, such as dry-season cultivation to encourage *Paspalum scrobiculatum* abundance early in the wet season.

*** Resistant cultivars to AfRGM**

Cultivars

1. *Oryza sativa* japonica sub-species: TOS 14519 - moderately resistant to AfRGM across West Africa
2. *Oryza sativa* indica sub-species: Cisadane - gall midge tolerant variety released in Nigeria as FARO 51, BW 348-1 - gall midge and iron toxicity tolerant variety

- released in Burkina Faso and Mali, Leizhung - gall midge tolerant variety released in Mali
3. Lowland NERICAs: NERICA L-25 was found to be moderately resistant to AfrGM in Nigeria. Other promising varieties include: NERICA L-19, NERICA L-29 and NERICA L-49
 4. Traditional *Oryza glaberrima*: TOGs 7106, 7206, 7442, 6346, and 5681 could be used as donors in breeding for resistance to AfrGM

Termites



General Information :

1. Termites are the most significant soil pests of rice in Africa. They are primarily a problem in upland rice ecosystem but may also occur in lowland areas in light textured soils. Of the 19 species attacking rice in Nigeria *Macrotermes* sp. is the most common and destructive.
2. Termite damage on rice roots can also predispose the roots to secondary infection or invasion by pathogens.

Symptoms :

1. Damage is caused by the adults (workers) that consume the roots and fill the stem with soil. The reduced translocation of water and nutrients causes the attacked plant to dry up, become stunted, and to wilt or die.
2. Damaged plants can easily be pulled up by hand because the roots are severed.



Causes of termite outbreaks:

1. Presence of termite nests around field/farm
2. Warm and dry climatic conditions (i.e. lack of rainfall)
3. Introduction of exotic crop species. Indigenous crop species are better able to cope with termite infestation as they have evolved some level of resistance
4. Presence of unhealthy crop species that have been subjected to biotic and abiotic stresses such as drought, weeds, diseases, etc.
5. Lack of effective termite control measures

Control:

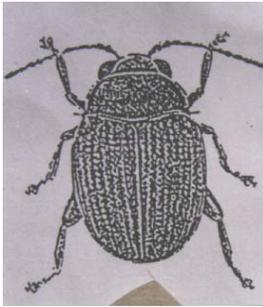
1. Effective traditional practices against termites include: use of bamboo stems, smoking the termite nest, use of salt, and flooding of termite nests with water.
2. Biopesticides such as neem oil, neem powder and powdered tobacco are effective against termites because they serve as potential replacement for persistent chemical pesticides, such as Carbofuran which has already been banned in several countries.
3. The entomopathogenic fungus *Metarrhizium anisopliae* is an effective biological control strategy against termite attack on upland rice.
4. The application of red palm oil mixed with pawpaw is an indigenous biological control practice. The mixture attracts soldier ants that attack and drive away the termites

*** Resistant cultivars to termites**

Cultivars

1. LAC 23, NERICA 1, NERICA 5, NERICA 14 are resistant to termites
2. NERICA 2 and NERICA 3 showed some levels of tolerance to the pest

Insect Vectors of Rice Yellow Mottle Virus (RYMV)



General Information :

1. The rice yellow mottle virus (RYMV) is one of the most economically damaging diseases of rice in Africa and Madagascar. First identified in irrigated rice fields at Otonglo, Kisumu, Kenya in 1966
2. RYMV is a spherical positive sense single stranded RNA (ssRNA) virus belonging to the sobemovirus group. It occurs at relatively high concentration in systemically infected plants.
3. The virus is mechanically transmitted – gains entry into rice plants through injuries. The possible routes of entry are (i) root damage during transplanting and roots intertwining in the soil, (ii) weeding operations with hoes, (iii) harvesting with sickle, and (iv) insects
4. Owing to the seriousness of the disease in limiting rice yields in Africa, the need to understand the dynamics of virus spread and the vector's role in it became vital so that control options which would be both sustainable and accessible to the low-income farming community are well targeted

Symptoms :

1. RYMV is characterized by pale yellow mottle leaves, stunting, reduced tillering, non-synchronous flowering, and yellowish streaking of rice leaves
2. Malformation and incomplete emergence of panicles and sterility are observed on infected rice plants
3. Some varieties developed conspicuous bronze or orange colouration followed by rolling of leaf margins and subsequent leaf desiccation

4. The symptoms could be mistaken for iron or nitrogen deficiency as well as iron toxicity damage adults (workers) that consume the roots and fill the stem



Causes of RYMV outbreaks

1. Newly introduced varieties from Asia which are inherently vulnerable than the traditional land races they have replaced coupled with monoculture over large acreage.
2. The availability of irrigation water that allows rice planting throughout the year facilitates the survival and penetration of pests and pathogens. It also leads to enhanced growth and continuity of weed hosts and seedling volunteers
3. Outbreaks of the insect vectors which acquire the virus from the infected rice and weeds
4. Increased use of fertilizer influenced the natural ecology of crops in favor of pest population build up and increase in the incidence of the virus
5. Wide range and non-synchronous planting dates increases the risks of RYMV outbreaks
6. Rapidly increasingly international transfer of germplasm without adequate adaptive testing may also contribute to the spread of the virus

Control:

1. The control of the insect vectors using biopesticides
2. Early transplanting before the outbreak of *Trichispa sericea*, with reduction in spacing of plants
3. Destruction of rice residues after harvest and ratoons that harbour the virus and insect vectors
4. Synchronous planting

5. Diversification of varieties on a single plot
6. Change of site for nurseries
7. Early transplanting before the outbreak of *Trichispa sericea*, with reduction in spacing of plants
8. Rouging of infected plants and immediate replanting
9. Reduction of fertilizer application (e.g. urea) on attacked plots
10. Early and double weeding to reduce the weed reservoir of the virus and insect vectors
11. Withholding irrigation water between plantings to provide a rice-free period and so restrict the build-up of the virus infection and insect population

*** Resistant cultivars to RYMV**

Cultivars

1. *Oryza sativa* japonica sub-species: LAC 23, Moroberekan, IR 47686-1-1 for direct seeded rainfed lowlands
2. *Oryza sativa* indica sub-species: WITA 9, WITA 11 and Gigante (tete) for irrigated lowlands
3. Traditional *Oryza glaberrima*: TOGs 5674, 5675, 5681, 7235, 7291 used as donors in breeding for resistance to the virus