REVIEW

Management of Major Insect Pests of Rice in Tanzania

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Abstract

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The major insect pests on rice in Tanzania are listed and described. They are from five orders (*Coleoptera, Diptera, Hemiptera, Lepidoptera* and *Orthoptera*) and are discussed as stem borers, stem and root feeders, and leaf and panicle feeders. This review puts together the hitherto fragmented information available on the distribution, host range, biology/life-cycle and ecology, and the management measures of the insect pests of rice. Areas for future research are also mentioned.

Keywords: insect pests; rice; management; Tanzania

Rice (*Oryza sativa* L.) is one of the most important cereal foods in the world. It provides about 80% of energy intake of one billion Asians and one-third of the energy intake of one billion persons in Africa and Latin America (CHANG 1985).

Rice is a popular food almost everywhere in Africa south of the Sahara (FAO 1994). The major rice producing areas of Africa are concentrated in the eastern and western part of the continent. In East, Central and Southern Africa (ECSA) region, Tanzania is the second largest producer and consumer after Madagascar (CHINGANGA 1985).

Tanzania has an agrarian economy and rice is considered second to maize in both production and consumption (MOA 1999). Rice in Tanzania is grown in all regions of the country but at different levels of importance. It is grown mainly by peasant farmers under varied ecological conditions. Lowland conditions account for about 80% (irrigated and rainfed) and upland for about 20% of the production (KANYEKA *et al*. 1995).

Many factors lower rice yields in Tanzania. These include weeds, insect pests and diseases (KIHUPI & PILAI 1989). For a long time, however, have Plant Protection studies received low emphasis in favour of agronomic and breeding studies by the National Rice Development Programme in Tanzania. Very little work has been done in Tanzania to study the insect pests of rice. Though not as a primary object of study, the first and only report containing information on the insect pests of rice in Tanzania was by BOHLEN (1973) who reported about 13 species of insects as present on rice. Several species that had not been reported earlier have recently been observed to become major pests, indicating that the number of important insect species on rice might have increased over the years (BANWO *et al*. 2001b). In addition to direct damage, many insects also act as vectors of rice diseases. The purpose of this review is, therefore, to update the list of major insect pests associated with rice in Tanzania. Information on synonyms, host plants, distribution (where found in Tanzania), type and extent of damage, life cycle, ecology and the management strategies of the insect pests are provided. However, in the case of a few or newly recorded species, little or no information on their life cycle is available for inclusion.

STEM BORERS

White Stem Borer

Maliarpha seperatella Ragonot (*Lepidoptera: Pyralidae*)

Synonym: *Aerastia pallidicosta* Hampson; *Rhinaphe vectiferella* Hampson; *Enosima vectiferella* Ragonot

Distribution: Mbeya, Morogoro, Mwanza, Shinyanga, Zanzibar

Host plants other than rice: sorghum and wild grasses

The white stem borer is considered the most common of the three stem borers found in Tanzania. Due to its peculiar habit of remaining at the inner internodes of the rice plant, the larva does not usually produce 'dead hearts' or white 'earheads'. The growing apical portion of the plant is not cut off from the base, therefore panicles can be initiated at the last node. The infestation reduces plant vigour and tiller number and results in unfilled grains. The male moth is about 110–130 mm long, while the female is about 130–150 mm long. Both have long pale yellow wings which overlap along the body when the moth is at rest. The female has longer antennae than the male. It lays eggs grouped in long masses on the upper surface of rice leaves. The eggs are attached to the leaf by a strong adhesive. The egg mass is enclosed in a foliar envelope; eggs are 0.6–0.7 mm long and about 0.4 to 0.5 mm broad and are laid close together. The entire mass may contain up to 100 eggs (ODNRI 1976). They are clear yellow when laid but become paler and finally darken to brownish black. The incubation period is 7 to 10 d. As the larva grows it turns yellow, and can be dispersed by the wind suspended on a silken thread. The pupa is brown with a dorsal red spot on the fifth abdominal segment of the female which becomes less visible as the case dries out. An important characteristic of this species is that its larvae can go into a resting stage of up to 36 weeks on rice stubble (AKINSOLA & AGYEN-SAMPONG 1984). It prefers lowland to upland conditions and there are usually three to four generations per year.

African Pink Borer

Sesemia calamistis Hmps. (*Lepidoptera: Noctuidae*)

Synonym: *Sesamia vueteria* (auct.)

Distribution: Mbeya, Morogoro, Mwanza, Shinyanga, Zanzibar

Host plants other than rice: maize, sorghum, sugarcane, wheat, wild grasses

The insect has a wide host range and its infestation on rice is highest at the flowering stage. Larvae feed on the stalk which then becomes a "white head". The adult moth is light beige with brown stripes. The posterior wings are white with a yellowish margin. The moths are nocturnal in habit and can travel long distances. Mating takes place as early as the first night after emergence and egg laying begins the same night. Eggs are spherical and flattened at the poles. The egg stage lasts 7–12 d. The larvae are yellowish pink on their dorsum, with greyish lateral and dorsal stripes. The caterpillars first feed within the leaf sheath tissues, and then enter the culm through a horizontal cavity. The larval period is between 28 and 42 d. The pupal stage lasts for 10 to 15 d and pupation takes place within the base of the stem or in the folds of the withered leaf sheath. It usually takes 2 months for the completion of one generation (BRIENIERE 1977). Upland rice is severely attacked by this pest.

Spotted Stem Borer

Chilo partellus Swinh. (*Lepidoptera: Pyralidae*)

Synonym: *Chilo zonellus* Swinh.

Distribution: Mbeya, Morogoro, Mwanza, Shinyanga, Zanzibar

Host plants other than rice: maize, sorghum, sugarcane, wheat, wild grasses

The insect is primarily a pest of maize and sorghum. Moths are yellowish to yellowish brown with a slender body. Male moths are darker and slender than the female. Eggs are laid in two 13 mm overlapping rows on any part of the plant. Larvae emerge after 4–8 d and are attracted to light. They bore into the stem about an hour after hatching. The larval period ranges from 18 to 195 d depending on the season, while pupation lasts 6–13 d in the stem (DALE 1994). The adult emerges through an exit made by the full grown larva just after sunset. The pest enters a larval diapause after the rainy season and pupates after first showers, with moths emerging a few days later. It is found in lowland (irrigated and rainfed) and upland rice ecosystems.

Management

The measures suggested by MBAPILA (1987), KAKEMA (1994) and KIBANDA (2001) for the management of stem borers include:

Cultural

a) Early planting
b) Close/proper spacing
c) Use of early maturing varieties

Chemicals

a) Regent 3G @ 33.2 kg a.i/ha
b) Rogor (Dimethoate 40 EC) @2.0 l/ha in two applications at 14 d interval

STEM AND ROOT FEEDERS

Stalked-eyed Borer

Diopsis thoracica Westwood (*Diptera: Diopsidae*)

Synonym: *Diopsis macrophthalma* Dalman.

Distribution: Pwani, Morogoro, Mwanza, Shinyanga, Zanzibar

Host plants other than rice: grasses and wild rice

Diopsis thoracica is not known to attack crop plants other than cultivated rice. The pest infestation delays booting and leads to a lower number of panicles. Adult flies are typical diopsids with eyes situated on the tips of long stalks. They live near water and aquatic plants and prefer a shady habitat. May become economically im-

portant in irrigated rice. *D. thoracica* has a characteristic red colouration on the abdomen. The female lays eggs on the upper surface of young leaves and affixes them with an adhesive which prevents their being washed off in heavy rains. Each female adult lays about 20 eggs over a 10 d period. The emerged larva moves down the inside of the leaf sheath and feeds above the meristem causing the 'dead heart' symptom. Larvae are about 12–18 mm long and 3 mm wide, whitish cream with yellow markings on the terminal segments and have very small heads. The larval stage lasts 25 to 35 d. Pupae are red with brown dorsal bands. Adults emerge after a 10–12 d pupal period. The pest prefers lowland (irrigated and rainfed) rice.

Management

The most effective technique would seem to be the use of systemic insecticides. The chemicals suggested by MTWAENZI and LAIZER (1988) and KIBANDA (1994) for the management of stalked-eyed borer include:

a) Endosulfan 4%D @ 30 kg a.i/ha, Endosulphan 5% D @ 25 kg a.i/ha
b) Regent 3G @ 33.2 kg a.i./ha

The African Rice Gall Midge

Orseolia oryzivora Harris and Gagne (*Diptera: Cecidomyiidae*)

Distribution: Morogoro, Mbeya
Host plants other than rice: grasses and wild rice

The main external symptom of gall midge attack is a 'silver shot' or gall that resembles an onion leaf. Galls appear within a week after the larvae reach the growing point. An attack on rice seedlings leads to tillering and stunting of plants. The gall midge attacks rice from nusery to the tillering stage. It is a pest in the vegetative phase only. The adult gall midge is similar in appearance to a mosquito. Adult males are about 3 mm long with yellowish brown bodies; females are larger and about 3.5 to 4.0 mm long and their bodies are reddish brown. Fertilised females start egg laying within a few hours, and can lay up to 100 to 300 eggs. Incubation lasts 3–4 d. On hatching, the larva grows to about 3 mm and its colour darkens from cream to pale red. Soon after hatching the larvae move to the growing point of the apical buds and feed at the base of the growing point. Due to their presence a gall is formed, and no panicles develop. Pupation takes place in the gall. Male and female pupae can be distinguished by the size and colour of the abdomen (PANDA & MONHANTY 1970); male pupae are small and brown while females are larger and pinkish. The colour turns darker before adult emergence. The pupa makes a hole at the gall tip and the adult emerges generally at night or in early morning. The pupal period varies from 2–8 d, and the entire life cycle is completed in about 25 to 38 d. The pest is more common in lowland (irrigated and rainfed) rice.

Management

The measures suggested by AKINSOLA *et al.* (1994), KAKEMA (1994) and KIBANDA (2001) for the management of gall midge include

Cultural

a) Resistant varieties (e.g. BG 380-2)
b) Early planting
c) Removal of alternate host weeds and wild rice during the dry season

Chemicals

Regent 3G @ 33.2 kg a.i/ha at an early stage

Biological

The use of the natural enemy *Aprostocetus pachydiplosisae* showed promising results.

LEAF AND PANICLE FEEDERS

Hispid Beetles (*Coleoptera: Chrysomelidae, Hispinae*)

African Rice Hispa, *Trichispa sericea* Guerin.

Distribution: Morogoro, Mwanza, Zanzibar
Host plants other than rice: other gramineae

The African Rice Hispa is known to transmit rice yellow mottle virus. Adults and larvae feed on the leaf tissues of young rice, resulting in wafer thin and bleached leaves. The initial attack is localised but spreads rapidly and a severe attack kills the plant. The adult female lives for 2 weeks and lays about 100 eggs within this period. Hatching takes place after 3–4 d. The larval period lasts about 10 d, with the larvae mining inside the leaves. In general, the pupal period lasts about 6 d with the emerging adult migrating to alternate host plants (DALE 1994). The insect is found more in lowland irrigated rice.

Dicladispa gestroi Chapman

Distribution: Zanzibar
Host plants other than rice: other gramineae

This insect is known to transmit rice yellow mottle virus. Adults appear at the beginning of the rainy season after a long diapause of about 7 months (RECKHAUS & ANDRIAMASINTSEHENO 1997). After a short feeding period, females produce a small crack in the lower side of the rice leaves to lay eggs. Five to eight eggs are produced daily over a period of several weeks. Larvae mine the leaves, while adults eat the leaf surfaces. Their attack results in withered leaves and white patches. The entire

life cycle takes about 21–28 d. After three to four generations, the insects form large swarms that invade rice fields. This pest is found more in lowland (irrigated and rainfed) rice.

Dactylispa lenta Weise

Distribution: Morogoro

Host plants other than rice: other gramineae

Recently reported as a vector of rice yellow mottle virus in Tanzania, but otherwise there is only scant information on the biology and life cycle of this afrotropical species (BANWO *et al*. 2001a). Larvae mine in leaves, while adults eat the surface through the leaves parallel to the veins. The insect is found mostly in lowland rainfed rice.

Management

The measures recommended by KAKEMA (1994) and FAKIH *et al*. (1997) for the management of hispid beetles include:

Cultural

a) Early planting
b) Simultaneous planting by all farmers
c) Controlling water levels in fields since Hispa readily attacks tender plants deeply immersed in water
d) Keeping the bunds around rice fields clean
e) Use of *Tephrosia vogeliii* (syn. *Cracca vogelii*) as an insect repellent

Chemicals e.g.

Furadan @ 10 kg a.i/ha

Rice Flea Beetles (*Coleoptera: Chrysomelidae, Alticinae*)

Chaetocnema spp. **(***C. pulla* Chapuis; **syn.** *C. zea***) and a species near** *Chaetocnema varicornis* Jacoby**)**

Distribution: Dar-es-Salaam, Dodoma, Kilimanjaro, Mbeya, Morogoro, Mwanza, Shinyanga, Pwani, Tanga, Zanzibar

Host plants other than rice: other gramineae, cyperaceae, marantaceae, zingerberaceae

Both insects transmit rice yellow mottle virus. The species near *Chaetocnema varicornis* is a newly recorded species first reported in Tanzania (BANWO *et al*. 2001c). Little information exists on the biology of the over 100 afrotropical species of *Chaetocnema*. BAKKER (1974) suggested that the larval stages of *C. pulla* take place in the soil. Adult beetles of both species feed by scratching the leaf surface leaving short, straight and narrow transparent lines (NWILENE 1999). However, the damage is more pronounced in species near *Chaetocnema varicornis* which cut the leaf completely through in a parallel manner. Both insects are found in lowland (irrigated and rainfed) and upland rice.

Management

Measures suggested by KAKEMA (1994), KIBANDA (2001) and BANWO *et al.* (2002) for the management of these beetles include:

Cultural

a) Early planting
b) Resistant varieties (e.g. Cabacu)
c) Avoiding rice yellow mottle virus hotspot areas
d) Field sanitation/crop hygiene

Chemicals e.g.

Regent @16.6 kg a.i./ha

Small Rice Grasshopper

Oxya spp. (*Orthoptera: Acrididae*)

Distribution: Dar-es-Salaam, Kilimanjaro, Mbeya, Morogoro, Mwanza, Pwani, Tanga, Shinyanga

Host plants other than rice: other gramineae

Nymphs and adult insects feed on the leaves of nursery plants. In the field, adults attack the base of rice panicles causing it to wither (RAMAKRISHNA AYYAR 1963). The grasshopper is green or pale brown with a dark stripe running from the eye through the thorax to the base of the wings. Eggs are laid in a gummy froth which hardens to form a protective pod. In areas where rice is grown throughout the year, breeding is continuous throughout the year. Eggs hatch in 14–21 d. There are six instars with many females going through an extra moult. The insect is found in all rice ecologies.

Management

MTWAENZI and LAIZER (1988) and KAKEMA (1994) suggested the following management strategies:

Cultural

Ploughing after harvesting to bring eggs to surface and destroy them

Chemicals

a) Endosulfan 4%D @ 30 kg a.i/ha
b) Furadan 10 kg a.i/ha

Rice Stink Bug

Nezara viridula L. (*Hemiptera: Pentatomida*e)

Distribution: Dar-es-Salaam, Kilimanjaro, Mbeya, Morogoro, Mwanza, Pwani, Tanga, Shinyanga

Host plants other than rice: many, including legumes, cotton and tomato

Nezera viridula, the southern green stink bug, can be seen in large numbers on the crop. At harvest some grains may be misshapen or speckled. An adult *N. viridula* can produce on average about 1.5 pecky rice grains per day (KISIMOTO 1983). When about to breed, hibernating

adults emerge and feed on grasses before migrating to rice. Eggs are laid in parallel rows on the lower side of rice leaves in masses of 60–130 and each female lays about 3–8 egg masses. Eggs are yellow when laid but turn red just before hatching. The nymphal period lasts between 35 and 45 d in which nymphs undergo five moults to become adults which are 12–17 mm long. Females live about 30 d and lay their eggs toward the end of their lives. They are attracted to light and heading rice. They prefer upland and lowland rice.

Management

ODNRI (1976) suggested the use of chemicals e.g. Acephate @ 0.4 to 0.5 kg a.i/ha.

Army Worms

Spodoptera exempta (*Lepidoptera: Noctuidae*)

Distribution: Arusha, Morogoro and Tanga

Host plants other than rice: other gramineae

The gregarious larvae cause the damage. They move in armies and completely eat young leaves and stems. Moths are dull brown insects up to 250 mm wingspan with an active life of 8–11 d. Eggs have an incubation period of 2–4 d and are laid in the leaves of the host plant. Larvae are blackish and undergo six stages, reaching a maximum length of 35–50 mm before pupation. The larval period is 10–12 d and pupation of about 6 d takes place in the soil. Between the months of December and March, high numbers of caterpillars suddenly appear at a locality (due to migration of the moths) and are capable of destroying a large field of rice or other cereals within a few days (BOHLEN 1973). The older stages of the caterpillar damage the leaves of the host completely or leave only the midrib, while young caterpillars scrape off the tissue of one side of the leaves. The leaves then dry up and become scorchy in appearance. The whole life cycle takes about 21 d. Outbreaks usually occur in years with favourable conditions for the reproduction of the pests. They attack mainly the upland and lowland rainfed rice.

Management

The measures suggested by BOHLEN (1973) and ODNRI (1976) for the management of army worms include:

Cultural

a) Flooding to save the irrigated crops
b) Forecasting

Chemicals

Insecticides such as
a) Sevin (WP 0.15 to 0.25% a.i.)
b) Furadan 10 kg a.i/ha

Outlook

In future, research should be geared towards the following:

1. Determining the actual yield losses caused by the prevalent pests so that the economic importance of each pest in Tanzania is known.
2. Determining the role of natural enemies in suppressing pests of rice so as to have more information regarding the feasibilty of biological control.
3. Determining the potential threat of termites to rice production (especially in Pwani region) where farmers have of late been forced to abandon their fields as a result of termite attack on rice.
4. Periodic surveys should be conducted in order to monitor the dynamic changes occurring in rice pests in Tanzania in order to have a clearer picture and hence be able to devise appropriate management strategies.

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Souhrn

BANWO O.O. (2002): **Ochrana proti hlavním hmyzím škůdcům rýže v Tanzanii**. Plant Protect. Sci., **38**: 108–113.

Práce obsahuje soupis a popis hlavních druhů hmyzích škůdců rýže v Tanzanii. Tito škůdci příslušející k pěti řádům (*Coleoptera, Diptera, Hemiptera, Lepidoptera* a *Orthoptera*) jsou rozděleni podle potravní specializace do tří skupin: druhy poškozující stonky navrtáváním, druhy živící se kořeny a stonky a druhy živící se listy a latami. Tento přehled soustřeďuje dosud kusé informace o rozšíření, hostitelských rostlinách, životních cyklech, ekologii a ochraně proti hlavním druhům hmyzích škůdců na rýži. Diskutovány jsou rovněž oblasti dalšího výzkumu.

Klíčová slova: hmyzí škůdci; rýže; regulace; Tanzanie

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