International Journal for Innovative Engineering and Management Research

PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL

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IJIEMR Transactions, online available on 26th Nov 2022. Link :http://www.ijiemr.org/downloads.php?vol=Volume-11&issue=Issue 11

10.48047/IJIEMR/V11/ISSUE 11/60

TITLE: A STUDY OF GROWTH PHASES OF THE RICE PLANT MANAGEMENT WITH INSECT PESTS ON RICE

Volume 11, ISSUE 11, Pages: 486-495

Paper Authors **GLORY BODDUPALLY, DR. KAPIL KUMAR**

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www.ijiemr.org

A STUDY OF GROWTH PHASES OF THE RICE PLANT MANAGEMENT WITH INSECT PESTS ON RICE

GLORY BODDUPALLY
Research Scholar Monad University, Delhi Hapur Road Village & Post Kastla, Kasmabad, Pilkhuwa, Uttar Pradesh
DR. KAPIL KUMAR
Research Supervisor Monad University, Delhi Hapur Road Village & Post Kastla, Kasmabad, Pilkhuwa, Uttar Pradesh

ABSTRACT
The use of synthetic chemical pesticides has been crucial in preventing the spread of insect-borne illnesses and eradicating agricultural pests for almost sixty years, and this trend is not expected to change anytime soon. Yet, there are serious risks associated with pesticides as well. Some are harmful because they remain in our bodies long after we eat or drink them or after we flush them down the toilet. Even at low concentrations, many pesticides are harmful to humans and other animals. Some are even thought to be carcinogenic. As current synthetic pesticides have health risks, many scientists and farmers are looking for safer alternatives. An option that might be useful here is pesticides made from natural materials. Research in this area focuses on combining two effective natural pesticides—botanicals and entomopathogenic fungi—against three major insect pests of rice: Cnaphalocrocis medinalis (Guenee), Scirpophaga incertulas (Walker), and Nilaparvata lugens (Stal) in a lowland rice ecosystem where the microclimate encourages the action of both pesticides.
KEYWORDS: Botanicals, Insect Pests, Rice, chemical pesticides, natural materials, microclimate encourages

INTRODUCTION

The need to protect crops from pests has been around for as long as farming has. In the 1960s, India had a "green revolution," which set off a chain reaction of technical developments in plant protection. The widespread use of pesticides on rice has risen in recent decades because many popular rice cultivars are vulnerable to infestation.

Insecticide use has disrupted the ecosystem of rice, which has allowed pests to flourish. Insect resistance became a serious issue in the 1980s, particularly for the organophosphates and carbamates that had replaced organochlorines. But, farmers have responded by using higher doses or a more sophisticated combination of pesticides. The extinction of these predators and parasitoids expedited the development of pesticide resistance, which in turn posed a greater risk to human health and the environment. Measures used to boost rice production financially have been linked to a decline in the resilience of rice ecosystems, including elements such as year-round farming of rice on the same land and increased nitrogen treatments to the better-yielding rice cultivars. Even with the widespread use of insecticides—a market worth an estimated US$145 million per year—current pest control approaches still lead to yield losses of 10–15%. This highlights the critical necessity for an alternative management approach suited to the ecology of the crop.

The use of parasitoids, predators, resistant varieties, and bio-rational techniques are all methods that have been suggested as alternatives; however, when it comes to availability and adaptability, botanicals obtained from plant sources and fungal formulations have more or less suited as alternatives. On the other hand, the extent of cultural practices and insecticidal treatment in the field is constrained by the insistence on filthy field method to conserve predators and parasitoids. It is also hypothesized that the rice crop eco-microclimate, system's fauna variety, and plants' compensating ability might all lend a hand to the slow activities of botanicals and fungal formulations for pest management. Based on the aforementioned concept, the following goals will be pursued in order to meet the demand for organic rice production in the Cauvery delta region (The rice bowl of Tamil Nadu), the study area, by combating major insect pests like Scirpophaga incertulas (Walker), Cnaphalocrocis medinalis (Guenee), and Nilaparvata lugens (Stal) on rice.

For many low-income nations, rice is the backbone of their economies and a necessity for national stability. Pests are one of the most significant biotic restrictions affecting rice production worldwide. Insect pests, plant diseases, nematodes, rats, and weeds are discussed in this overview along with their biology, ecology, global distribution, and the harm and production losses they bring to plants. We explore the relationships between insects, weeds, and illnesses. This is an explanation of a proposed theoretical framework for controlling arthropods in organic farming. There are four distinct "stages" in this system for organizing arthropod pest management tactics. The framework gives preference to pest control strategies that lower the probability of a pest problem (phases 1 and 2) and the number of measures used to fix it (phase 3). (phases 3 and 4). We use this conceptual framework, which we adapt, to organize a discussion on how to deal with pests in rice fields. Methods for controlling pests in rice crops are outlined in great depth. Farmers Field Schools and public awareness initiatives on rice pest management are compared for their effectiveness in reaching farmers.

Rice, Oryza sativa L., is the basis for national stability and economic prosperity in many developing nations since it is the staple meal of an estimated 3.5 billion people worldwide. More than 200 million households in the developing world rely on it for their major source of income and employment.

Nowadays, more than 100 nations cultivate rice across 163 million hectares, yielding 715 million metric tons (MT) of paddy rice and 480 million MT of milled rice yearly, respectively. The majority of the annual rice crop comes from just 15 countries. About half of the world's rice is farmed in just China and India, which together produce 197 metric tons (MT) and 152 metric tons (MT), respectively. The vast majority of the world's rice supply comes from Asian countries. By 2035, an extra 116 Mt of rice will be required to sustain the expanding population.

Apart from being the most important use of land in Asia for centuries, growing rice is also becoming increasingly significant in Africa. Some 20 million smallholder farmers in West and Central Africa, two of the world's poorest regions, cultivate rice for sustenance using inefficient methods including slash-and-burn cultivation and a lack of locally adapted rice varieties.

Rice Types and Cultivation

Twenty of the roughly 22 species of the genus Oryza are considered wild varieties of rice [4]. Oryza sativa and Oryza glaberrima are two species of rice that are widely used for human consumption. Around 8000 to 15,000 years ago, O. sativa was first cultivated in Southeast Asia. This could have been in India, Myanmar, Thailand, North Vietnam, or even China. It is believed that O. glaberrima was first domesticated from its wild ancestor Oryza barthii around 3000 years ago by people residing in the Niger River floodplains in Africa. These days, everywhere but Antarctica grows rice. The other cultivated species, O. sativa, is grown in a smaller number of countries than O. sativa does across Asia, North and South America, Europe, the Middle East, and Africa. Only in Africa is O. glaberrima cultivated, and even there, O. sativa is rapidly displacing it.

Production methods for rice can be categorized as either lowland, upland, or deepwater. One way to cultivate rice is through lowland rice, in which the rice is kept underwater for the duration of the growing season. Rice grown in the lowlands is typically puddle-grown, whether it's irrigated or rainfed. Two or even three harvests of rice per year are possible with sufficient irrigation water. The potential for crop failure can be mitigated by the availability and management of water. In turn, farmers are more likely to use commercial inputs like fertilizer, which boosts crop production. Irrigated rice ecosystems are the most productive because of these and other factors. Like wheat or corn, upland rice is also grown in rainfed fields that are prepared and seeded when dry. Throughout Asia, you'll find over two-thirds of the world's upland rice fields. The economies of Bangladesh, Cambodia, China, India, Indonesia, Burma, Thailand, and Vietnam are also significant producers.

Rice (Oryza sativa) cultivars known as "deepwater rice" are submerged in water that's at least 50 centimeters (20 inches) deep for at least a month throughout the growing process. These plants thrive in the humid, warm conditions of tropical monsoon climates, particularly in the back swamps and natural levees that surround river deltas and their floodplains. Because to its superior elongation capacity, floating rice may thrive at water depths of more than 100 cm (39 in). Although variants of Japonica rice have been discovered in Burma, Bangladesh, and India, the India cultivar is the most common variety of deepwater rice.

Growth Phases of the Rice Plant

Depending on the type of rice and the growing circumstances, it might take anywhere from three to five months for a rice plant to mature from seed. There are three distinct phases in a rice plant's development: (1) the vegetative phase, which lasts from germination to the beginning of the panicle; (2) the reproductive phase, which lasts from the beginning of the panicle to the appearance of flowers; and (3) the ripening phase, which lasts from the appearance of flowers until the grain is fully developed.

While certain pests and diseases affect rice at any stage of development, others are more selective.

Rice Pests

The rising global population necessitates a rise in rice output. Nonetheless, in their efforts to raise rice output, farmers encounter several abiotic and biotic restrictions. Along with the development of new high-yielding varieties of drought- and flood-tolerant rice, reducing losses to insects and other pressures is essential for boosting yields. Intensifying cropping and modifying cultural practices to fulfill production demands is likely to increase pest pressure.

Insects

From planting through harvest, the entire plant is vulnerable to pest damage. There are more than 800 types of insects that can cause harm to rice, while the vast majority cause very minor problems. Just approximately 20 species are considered to be of considerable importance and occur often throughout tropical Asia, as stated by Grist and Lever. Around 15 insect species are regarded important pests of rice in Africa, whereas in the Americas there are roughly 20. Insects are categorized here according to their preferred diets.

- Root and stem feeders,
- Stem borers,
- Rice gall midges,
- Leafhoppers and planthoppers,5. Foliage feeders and
- 6. Panicle feeders.

Root and stem feeders

Insects are a common problem for rice crops. Mole crickets, like white grubs and root aphids, cause harm to both the roots and the stems. Mealybugs and rice stem maggots, on the other hand, attack just the stems. Several insect pests tend to attack rice fields at different times, depending on the plants' development [9]. Seedlings are vulnerable to pests including rice seed flies, rice midges, and mole crickets. Insects wreak havoc on young crops, killing off seedlings and creating a patchy harvest. Root-feeding insects are hampered in their ability to move around and forage for food by their underground habitats. Because of this, root-feeding insects have evolved by (1) living a long time as individuals (beetles), (2) being dependent on other social insects (mealybugs and aphids), and (3) having a wide host range (all species) [13]. Mole crickets (Orthoptera: Gryllotalpidae), tobacco crickets (Orthoptera: Gryllidae), root aphids (Hemiptera: Aphididae), mealybugs (Hemiptera: Pseudococcidae), black bugs, stink bugs (Hemiptera: Pentatomidae), seed midges (Diptera: Chironomidae Curculionidae) and black beetles (Coleoptera: Pyralidae and Noctuidae. Scarabaeidae), as per Pathak. Most stem borer damage is caused by pyralid borers, which are also very host-specific. In contrast, rice stem borers belong to the noctuid borers, which are polyphagous and rarely responsible for significant economic losses. largely consisting of members of the lepidopteran families Scirpophaga incertuIas and Chilo suppressalis are two of the most common parasites found in Asia.

Rice gall midges

Orseolia oryzae, native to Asia, and Orseolia oryzivora, native to Africa, are the two most common species of rice gall midge found worldwide. Both types of midges are major problems for irrigated lowland rice. The harm done by the two species is also comparable. The most obvious outward sign of an assault is a silver shoot or gall that looks like the leaf of an onion. In place of a panicle, the grainless gall develops.

Leafhoppers and planthoppers

Several species of the leafhopper (Cicadellidae) and planthopper (Delphacidae) families may be found in West Africa as well as Asia. The West African species resemble their Asian counterparts, although they play a much smaller role in the ecosystem. Because of the increased usage of pesticides in rice cultivation throughout Asia, their significance has grown. Many species of both African and Asian origin are highly effective vectors of rice viruses, in addition to causing direct plant damage by sucking the sap from leaves and stems. Yet planthoppers tend to cluster at the plant's base, whereas leafhoppers attack just the plant's aerial sections.

Nonetheless, the brown planthopper, Nilaparvata lugens, is a significant pest due to its role as a vector of many significant rice viruses and its direct harm caused by its removal of enormous volumes of plant sap. Changes in cultural practices accompanying the development of rice cultivation during the Green Revolution in the 1970s were blamed for the abrupt rise in prominence of these pests in Asia. Other intensification techniques that have been linked to leafhopper and planthopper outbreaks include the use of large quantities of nitrogen fertilizer, monocultures, continuous cropping, and most importantly, the use of pesticides that trigger hopper revival. Hoppers are still solely seen as potential pests in West Africa, therefore they are being constantly watched when production methods are ramped up.

Tagosodes cubanus is a pest in South and Central America that spreads the rice hoja blanca virus, which can reduce crop yields by as much as 50 percent. Tagosodes oryzicolus, often known as the rice delphacid, is a major problem in the rice-growing regions of tropical Central America, the Caribbean, and South America since it both damages the crop directly and spreads the hoja blanca virus. This bug is nomadic; it has been spotted in Texas and Louisiana and as far south as Argentina, however it has not yet established itself in any of those places.

Panicle feeders

There are two main types of insects that attack rice panicles: those that eat the flowers (mostly the pollen) and the stink bugs that feed on the milky sap that nourishes the growing grains. When insects like earwigs, blister beetles, and panicle thrips consume flower components, they hinder the spikelet from developing normally.

Rice bugs are any of several hemipteran insect species, including those in the Alydidae, Coreidae, Pentatomidae, and Pyrrhocoridae families, that feed on the milk of growing grains.

The alydids Leptocorisa acuta, Leptocorisa chinensis, Leptocorisa varicornis, and Leptocorisa oratorius are the most prevalent types of rice bugs in Asia. Nezara viridula, a species of pentatomid, may be found worldwide. Some species of Oebalus are panicle flowers.

Rice diseases

There is no part of the world where the production of rice is not severely hampered by the prevalence of rice illnesses. Diseases can be either global or regional in scope. Plant diseases are caused by a wide variety of factors, either acting alone or in concert. Both biotic (alive) and abiotic (nonliving) agents are possible (nonliving). Pathogens are defined as living creatures that cause illness. Several different kinds of fungus, bacteria, nematodes, viruses, and mycoplasma-like organisms can cause rice illnesses. These diseases can infect a whole plant or only a specific portion, such as the roots, stems, leaves, leaf sheaths, panicles, or grains, and generate outwardly noticeable illness signs.

Fungi

Many are dispersed broadly among the six rice-growing areas. One of the worst of them is rice blast, caused by the fungus Magnaporthe oryzae, which can attack the plant at any stage of development, can spread quickly, and causes extensive damage. According to historical records, it first appeared in China in 1637 and then in Japan in 1704. It is widely believed to be the oldest and most pervasive rice sickness ever documented.

The rice plant as a whole is vulnerable to blast, with just the leaf sheath being spared. Leaf last, collar blast, node blast, and neck blast (sometimes known as "neck rot") are all names for blast that are specific to the location of the disease's symptoms. To add insult to injury, leaf blast can also destroy or severely stunt established plants. Grain weight and quality are decreased, and fewer panicles are produced as a result. Yield drops by 6% and the percentage of chalky kernels rises by 5% for every 10% of neck blast infection. Losses are magnified when a panama canal explodes. The entire blade of a leaf can be destroyed by a collar blast. When an infection is particularly severe, a greyish brown lesion might form around the neck of the panicle and cause it to topple.

Bacteria

Islam and Catling report that bacterial blight is the most damaging bacterial disease of rice. That happens everywhere except Europe.

The germs that cause bacterial blight travel through the plant's vascular system, weakening the entire plant. New lesions ooze bacterial cells in the presence of dew and rain. Tiny, round beads, yellowish in color, develop as bacteria-filled water droplets dry off and are carried by the wind into the paddy water.

Poorly formed grains and decreased grain weight are the results of bacterial blight, which infects the plant from the maximum tillering stage to the booting stage. The severe 'kresek variant' of the disease frequently kills young plants in India, Indonesia, and other tropical nations; the earlier the assault, the greater the damage. Diseased stubble is the primary vector of kresek transmission. High bacterial populations are observed in irrigation water, along canals, and in rice fields, and the pathogen may easily survive on agricultural wastes such stubbles and ratoons. Irrigation water, wind, and direct touch between plants are all vectors for the transfer of bacteria from one plant or area to another. The illness often begins in isolated areas of a field and then spreads to neighboring areas until finally infecting the entire field.

Viruses

In most parts of the globe, virus infections are not given much attention since they are thought to only account for a small percentage of yearly crop losses (<1.5%).

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Nonetheless, major grain production losses in a nation or region can be caused by rare outbreaks of rice viral infections. The number of regions where the tungro virus is endemic is small compared to the region's or countries overall rice output, but the yields from the infected fields may be lost entirely. Farmers in Asia, who rely heavily on the harvests from their typically modest fields, are particularly vulnerable to such catastrophic losses.

Rice grassy stunt is transmitted by the brown planthopper Nilaparvata lugens, while rice tungro is carried by the green leafhoppers Nephotettix spp. Hoja blanca is a virus that only affects rice in Central and South America. It is transmitted by the planthoppers Tagosodes oryzicolus and Tagosodes cubanus. Leafhoppers, spittle bugs, a variety of foliage-feeding beetles and grasshoppers, and any animal movement inside the field, including farm employees, are all capable of mechanically transmitting RYMV, the only known rice virus in Africa. Bird cherry-oat aphid-transmitted rice giallume (yellow virosis) Rice is susceptible to a virus called Rhopalosiphum padi, which causes a serious illness.

Nematode diseases

Globally, plant-parasitic nematodes are considered a major danger to agricultural production. Roots, stems, leaves, fruits, and seeds are all susceptible to assault by nematodes, either alone or in conjunction with other soil microbes. The ufra or rice stem nematode (Ditylenchus angustus), white tip nematode (Aphelenchoides besseyi), root-knot nematode (RRN; Meloidogyne graminicola), rice cyst nematode (Heterodera oryzae), and RRN (Hirschmanniella oryzae) are all economically significant worms that.

Islam and Catling report that Ufra disease, caused by the stem nematode Ditylenchus angustus, is the fourth worst rice disease in Bangladesh. This disease affects both deep water and lowland rice throughout much of Asia (2012). This nematode causes significant yield losses, ranging from 20-90 percent.

Only deepwater rice and the Oryza wild rices are free of the stem nematode because of the flooding conditions required for their growth. Echinochloa colona and Leersia hexandra, both grassy weeds, have also been found to have it. It lives as an ectoparasite on meristematic tissues in the leaf sheath and stalk, where it grows and reproduces. Ufra disease causes the tips of the leaves to become white, and then brown, the stem to twist above the final node, the growth of the ear to stop, and, in severely infected plants, the plants themselves to rot. Nematodes are carried by splashing rainwater and irrigation water.

Crop leftovers left in the field provide the majority of the inoculum at the beginning of the growing season, with each stem potentially harboring hundreds of nematodes. At initially, fewer of them are present because the increasing food water drowns the infected stems. After 18 weeks, the nematodes had spread throughout the water and established a secondary infection. The final stage of infection is the water-borne inoculum that leads to the characteristic ufra patches. Nematodes stop feeding as plants age, coiling up at the plant's base and taking refuge in the glumes during the dry season.

The white of the tip the white-tip nematode, Aphelenchoides besseyi, is responsible for this disease. It spreads vegetatively and is found in both tropical and temperate regions where rice is grown. The sickness was first recorded in Japan in 1915, but it wasn't until 1948 that researchers determined a nematode was to blame.

A white tip disease outbreak in a temperate zone is likely to be more devastating than one in the tropics. In Louisiana, the white tip nematode is the most frequent pest on irrigated lowland rice crops (USA)

A dark green leaf with a white, chlorotic tip up to 5 cm in length is the most distinctive symptom. The color of infected leaves is much darker than healthy ones. There may be no boot panicles or they may be infertile due to twisted glumes and undersized, malformed kernels on badly injured plants with twisted flag leaves. There's a chance the hulls and kernels will be tiny and misshapen. White tip nematode primarily spreads through infected rice seed.

CONCLUSION

To combat major insect pests like Scirpophaga incertulas (Walker), Cnaphalocrocis medinalis (Guenee), and Nilaparvata lugens (Stal) on rice in the Cauvery delta region (The rice bowl of Tamil Nadu), the study area will focus on plant-based traditional formulations/ extracts and myco-insecticide formulations individually and in combinations. For almost sixty years, synthetic chemical pesticides have been crucial in reducing the prevalence of insect-borne illnesses and preventing the spread of agricultural pests. Insecticides, despite this, do provide genuine risks. Several of them can be found in food, drink, and the environment in unwanted amounts. Several pesticides are hazardous to humans and other animals at low concentrations, and some are even thought to be carcinogenic. Hence, many scientists and farmers are looking for safer alternatives to traditional synthetic pesticides. An option that might be useful here is pesticides made from natural materials. Hence in this line of work, the present research concentrates on selection of an important natural pesticide, the botanicals being compatible with another important natural pesticide, the entomopathogenic fungi against key insect pests on rice such as Cnaphalocrocis medinalis (Guenee), Scirpophaga incertulas (Walker) and Nilaparvata lugens (Stal) in the low land rice eco system where the micro climate is conducive to the action of botanicals and entomopathogens.

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