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CHAPTERS

Tessaratoma javaniva (Thunberg): an emerging major pest of the litchi fruit

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ABSTRACT:- Litchi is one of the tropical and deliciously juicy fruit. Litchi growers reported bug infestation. Many bug attacks the litchi but one of the bugs *Tessaratoma javanica* is the most destructive one which decreases the quantity and quality of crops. *T. javanica* is polyphagous in nature and a hemimetabolous life cycle. The reason for infestation is the migration of bugs in an alternate host plant the adult and nymph mainly cause severe loss of litchi fruit about 80% loss. To protect the litchi crops use of chemical pesticides did not give positive results because of its hard hemelytra and waxy ventral surface protection from the effect of chemical pesticides. Idea of applying *Anastatus japonicus* (Hymenoptera: Eupelmidae) and *O. phongi* (Hymenoptera: Encyrtidae) for biological control of notorious pest, resulted a positive effect in China and Thailand and also two natural enemies were found in litchi crop field, viz., *Anastatus bangalorensis* and *Ooencyrtus* sps infesting egg of litchi stink bug, if we reared in mass and released in field, it would help integrated pest management. This outbreak is an alarming situation and need an urgent response from the researchers of the country to develop pest management strategies to protect the litchi fruit.

Keywords:- *Tessaratoma javanica*, Litchi, Hemimetabolous, Polyphagous, Biological control

INTRODUCTION

Lychee (*Litchi chinensis* Sonn.) is a subtropical fruit belonging to the Sapindacea family and is cultivated worldwide; the global production of lychee is estimated to be about 2.11 million tonnes. India is the second largest producer of litchi after China, with a cultivated area and production of 77,600 ha and 497,300 t, respectively, in 2010-2011[1]. Lychee is an evergreen tree that is attacked by a variety of insects

[2] and different species of stink bug. Stink bug species are mostly herbivores or sapsuckers. The stink bug is a major pest in several countries including China, India, Thailand, Myanmar, the Philippines, Nepal, and Australia[3-6]. Several species of stink bugs damage litchi trees, including Tessaratoma javnaica, one of the most destructive species, which reduces fruit quality and quantity and leads to economic losses. They belong to the order Hemiptera and the family Tessaratomidae and are also called true bugs. It is a hemimetabolous insect with egg, nymph, and adult stages, and has five different nymphal stages, with both the adult and nymph being the most destructive. The adult female has a long fecundity and a longer life span than the adult male, which hibernates in unfavourable conditions. The life parameter of stink bug i.e., incubation period of the egg, the developmental period of the nymph, and the longevity of the adult slightly varies in different infested area. The reason might be related with difference in temperature and humidity of that infested area. This infestation is a worrying situation for farmers growing lychees, leading to a reduction in production rates and helping to develop appropriate pest control strategies to protect the delicious and juicy lychee plants in the near future

WHAT DO YOU KNOW ABOUT *Tessaratoma javanica* (THUNBERG)?

Tessaratoma javanica belongs to the class Insecta of phylum Arthropods. Order Hemiptera and family Tessaratomidae. It is a family of true bugs. *Tessaratoma javanica* also called stinkbug. It is polyphagous in nature. It is a major pest of litchi but is also found in pear, citrus plants, Mahua, and kusum. It is herbivorous and a sapsucker. The body size ranges from 1mm to around 15 cm. For this purpose, it develops a common arrangement of sucking mouthparts. Females are highly fecund and cause several damages. It is a hemimetabolous insect. The common bug species that cause infestation are - *Tessaratoma javanica* (Thunberg), *T. papillosa* (Dury), *T. quadrata*, *T. Nigripes* (Dallas), and*T. Malaya*[7,3,5,8].

WHY IT IS CALLED STINK BUG?

They belong to the order Hemiptera. Stink bugs are shield insects. They release a defensive pungent odor when they are disturbed and this odor helps the bug to protect themselves from predators. Due to its pungent smelly defensive nature, it is called a stink bug.

Fig. 1: A bug *Tessartoma javanica*

ALTERNATE HOST OF LITCHI STINK BUG

Litchi stink bug is polyphagous in nature. It is a major pest of litchi but is also reported on other plants as of kusum[9,10], *Sapindus* sp.[11,12], *Schleichera oleosa*[10], *Michelia champaca*[13], Longan, Pomegranate, Pummelo, Mahua, Kusum, Rambutan, Loquat, Castor and Eucalyptus, Mulberry, Rose[14-16,6].

DISTRIBUTION OF LITCHI STINK BUG

It is found in Southern China, Vietnam, Taiwan, Malaysia, Thailand, Myanmar, the Philippines, Nepal, India, and some countries of the eastern Pacific[3,4,16-18] also in the north-eastern part of Bangladesh under Sylhet district, which is very close to Meghalaya, Mizoram, and Arunachal. In India, it is also found in Jharkhand Bihar West Bengal and Chhattisgarh.

THE LIFE CYCLE OF LITCHI STINK BUG

Tessaratoma javanica is a hemimetabolous insect which means incomplete metamorphosis. It completes its life cycle in three stages, i.e. Egg à Nymph à Adults. The adult of the stink bug undergoes hibernation in unfavourable conditions. The hibernating adult becomes active from starting 2nd week of February to March. After copulation females lay eggs in a cluster on the lower surface of the leaves and suddenly the no. of nymphs increases and attacked the tender parts of the plant.

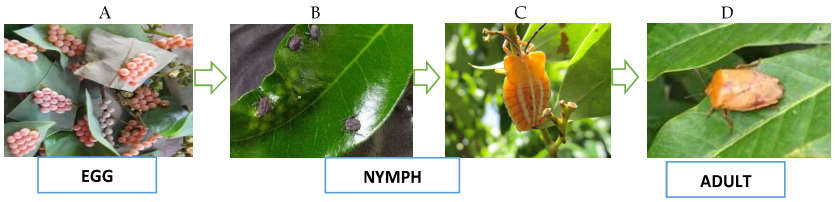

Fig 2: life cycle of stink bug[19]. (A) Eggs, (B) 1st instar nymph, and (C) 3rd instar nymph (D)Adult

EGG

Litchi stink bug generally lay eggs on the lower surface of both the new and old leaves. A newly laid egg's Shape is globular, colour is pink (sometimes white also). The color becomes slightly Blackish before hatching. They laid eggs in clusters arranged in 3–4 rows under the surface of the litchi leaf[16],[20].

Fig. 3: Egg of litchi stink bug

NYMPH

It has five nymphal stages. 1st instar nymph –Body shaped from round to oval, mandibular plates not go beyond clypeus. 2nd instar nymph –Body shaped is quadrate, mandibular plates surpass the clypeus. The size of the body never goes beyond 10mm. 3rd instar nymph- body size is always bigger than 15mm. Wing pads of insects are not developed and the body measures 20mm. 4th instar nymph- Femora is present without an apical spine, and wing pads reach up to the middle of the third abdominal segment. 5th instar nymph- Femora with a pair of apical spines, and wing pads goes beyond the middle of the third abdominal segment. The life span of the fifth instar nymph is greater than any other nymphal stage. The early nymph is more responsible for damaging the plant in the flowering stage later than the adult one.

Fig. 4: Nymph attacked the tender parts of the trees.

ADULT

The head is triangular in shape with a black lateral margin. Eyes are brown in colour and are attached with a pronotal margin. The Aedeagus which is a reproductive organ of the male is large and almost cylindrical. Female genitalia is composed of a plate-like ovipositor. Adult female size is more than that of an adult male one. The total life cycle of *T. javanica* takes 60.2 (±7.20) days for males and 72.6 (±9.30) for females. The longevity of females is more than males. Adult undergoes hibernation, an adult with high fat in tissues, a wax layer on the ventral side of the body, and hard hemielytra in hibernating adults, all of which protect them from the effects of insecticides.

Fig. 5: Litchi stink bug adult

IMPACT ON THE FIELD BY STINK BUG

They are sapsucker insects. The nymph and adult attack the tender parts of plants like stem, leaves, growing buds, inflorescence, fruit stalks, and tender branches which result in dryness of tress part like shoot, growing bud and heavy drop of fruits[21],[22]. In Jharkhand, India, it was reported that more than 80% of fruit loss by nymph and adult stink bugs [16]. The gregarious and sap sucking nature of pest, it accelerated the early green fruit dropping which result in loss or

decreased the count of fruits[23]. This infestation result in loss in quantity and quality of litchi production and ultimately economic loss which is worried create a problem for farmers, worker and consumer

WHY IT IS DIFFICULT TO MANAGE FARMERS WITH THE HELP OF USING INSECTICIDES?

Litchi comes in the category of cross pollinator crop. At the time of pollination in need some insect predators, honeybees are mostly found at the time of pollination. The pollination starts from the last week of Feb to 2nd week of March. The numbers of bugs start increasing with the emergence of inflorescences. So by using any chemical insecticides at that time will also affect the insect pollinator .The use of insecticides at the time of hibernation period of bug, it also did not give a positive result. The hibernation adult bug is different from normal as they have hard hemielytra which protect from effect of insecticides and they also have more fats in tissue with waxy ventral surface which help in hibernation. The chemical insecticides did not give a positive result. The use of *Anastatus japonicus* (Hymenoptera: Eupelmidae) and *O. phongi* (Hymenoptera: Encyrtidae) for biological control against the litchi stink bug[8], it results in effective management of the pest in China, Hong Kong and Thailand[24,7]. This will help the pest management against the stink bug.

REASON: INFESTATION OF STINK BUG IN INDIA

Litchi stink bug is major pest of the litchi crop but due to being polyphagous in nature, it has an alternate and wide range of host plants such as longan, Kusum, Pomegranate, Pummelo, Mahua, Rambutan, Loquat, Castor and Eucalyptus, Mulberry, and rose[14-16,6]. In India, Jharkhand the alternate host plant is highly distributed which help in the spread of invasive bug and may be the reason for infestation. Many researchers reported about a water-stressed woody plant that supports the outbreak. The reason of Water stress woody plants due to less rainfall and less humidity of that area. This result in infestation and increase the acceleration of the spread of the bug.

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