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STUDY OF THE DESTRUCTION OF THE MEDICINAL VEGETABLE *MOMORDICA CHARANTIA* (KARELA) BY THE SERIOUS PEST *BACTROCERA CUCURBITAE* COQUILLETT (DIPTERA, TEPHRITIDAE).A CASE STUDY AT RAMGARH, (JHARKHAND, INDIA)

***Rajesh Kumar Upadhyay**

Zoology Department, Ramgarh College Ramgarh, Pin code 829122, Vinoba Bhave University, Hazaribagh,, Jharkhand, India

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****Corresponding author:***
Rajesh Kumar Upadhyay

ABSTRACT

Momordica charantia (Karela) is the natural gift to human being in the form of a green vegetable, helpful to control the various serious disease as diabetes, cholesterol, heart-attack etc. The common name of *Momordica charantia* (karela) is also known as Bitter gourd or bitter melon, the special vegetable, bitter in taste, popular, high consumption and special dish preparation for kitchen and restaurants. It is a healthy vegetable containing various essential nutrients, more fibres, vitamin A, vitamin C, minerals and releasing very low quantity of sugar, nil cholesterol and one of the most popular natural medicine of the population living in all parts of the world. It is a useful vegetable lowering the blood sugar level, improving the immunity, strengthening the bone and releasing very low calories makes it a very special food for mankind. It is one of the best de-oxidant and anti-toxicant to improve immunity to prevent corona. The pest *Bactrocera cucurbitae* coquillett is a serious pest of musk-melon and pumpkins, also damages the cucurbitaceous vegetables viz. cucumber, torai etc. The present study was the destruction of the medicinal vegetable *Momordica charantia* (karela) by the serious pest *Bactrocera cucurbitae* coquillett, A case study at Ramgarh (Jharkhand,India). The experimental pest damages the cultivated host plant and fruits of the host plant. Sometime the destruction rises up to 60% to 70% and the vegetable becomes un-consumable. The damage was caused by the maggots, which feed on the internal contents of the fruit and making a tunnel in the fruit. The fruit in turn is liable to bacterial infection and become un-consumable. Adult fly also puncture the fruit for oviposition and seal the tunnel by gummy secretion. The farmers of Ramgarh cultivate vegetables throughout the year, they cultivated different types of vegetables as on the demand of market. The green vegetable *Momordica charantia* (karela) is a cash crop, its natural established medicinal value attracts the people and always make the demand, the farmers like it to cultivate, sale and supply it to different parts of the state. The pest *Bactrocera cucurbitae* coquillett, is a serious pest damage the fruits of *Momordica charantia*, in such a way that it looks fresh from outside. The pest destruct the vegetables in their shape, size, number and the taste of the fruits. The pest not only destructs the vegetable but also resulting in weak financial condition of the farmers. The life cycle was studied during the year 2018 -2020 at Ramgarh .During the study it was found that the life-cycle of the pest was very complex, generally it was completed 12 to 18 overlapping generations of the year. In winter season the pest get in hibernating phase of life, the eggs and the maggots stay in the fruit, the maggots and the pupa hidden under the fallen leaves, cracks and crevices or in the soil. The pest damage the cultivated vegetable plants and loss not only the quality, quantity, and taste of the vegetables but also the profit of the farmers. Ramgarh is a beautiful district town, the rural area is specified for cultivation and gross vegetable production, the climatic condition is moderate and suitable for vegetable production. The farmers are advised to control the pest by spraying the chemical pesticides as carbaryl 0.2%, Malathion 0.05%, or dimethoate 0.03%. Biological control was also advised to farmers, some hypo-parasites may introduced which parasitized the maggot and pupa stage and control the pest population.

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INTRODUCTION

*Bactrocera cucurbitae Coquillett.*is a serious pest of pumpkins and musk-melon commonly known as melon fruit fly, it also infest other cucurbitaceous vegetable plants. These flies are universally distributed. In India it is the countrywide distribution. The life-cycle of this pest need moist and moderate hot climate. Ramgarh is a district town located at Latitude: 23.38^{o}N and Longitude: 85.34^{o}E, situated 40 km South-East from Ranchi. The temperature is moderate with more humidity. This climate is favourable for vegetable cultivation. Cucurbitaceous vegetables are the main vegetable crops cultivated by the farmers of Ramgarh, it is easy to cultivate and produce more crop. *Momordica charartia* is a common vegetable with high production at Ramgarh, most of the farmers cultivated it as a safe cash crop**.** This peculiarity makes it easy to cultivate, since it doesn't spread more on ground. Considerable works had been done by workers on the life-cycle of *Bactrocera cucurbitae* Coquillett, pest on cucumber and musk-melon the cucurbitaceous vegetable plants, but none of the scientists studied the life cycle of *Bactrocera cucurbitae Coquillett* on *Momordica charantia at Ramgarh*. The present author deals with the life cycle of *Bactrocera cucurbitae Coquillett on the plant Momordica charantia*, the medicinal vegetable at Ramgarh. It's a medicinal vegetable with bitter taste and bagful of nutrition**.** It is the established natural medicine to control the blood sugar and its ability of reducing cholesterol, and enhancing immunity. It is also the special vegetable for kitchen and restaurant on public demand. The pest not only reduces the quality, quantity and taste of the vegetable but also makes the financial condition of the farmers worse. The pest completed 12 to 18 overlapping generation in a year.

The favourable season for the flies comes after the onset of monsoon as they become active. After mating with the females they lay eggs in the flowers or inserted into the fruits**.** The tender fruit of host plant was more susceptible, the female fly puncture the fruit with the help of ovipositor, make a tunnel and start oviposition, the tunnel was sealed by a gummy secretion by the oviposition. The fruit in turn is liable to bacterial infection and become un-consumable, decay and finally the fruit dropdown. Within 02 to 10 days of incubation the eggs hatched in to small maggots in the fruit. The tinny maggot feed continuously on the pulp of fruit and destruct. The larval period lasts from 02 to 25 days during it larva passes full grown stage .The full grown maggot jump from the fruit. They can jump 01 to 1.5 feet once they reach to the ground, they burrow into the soil and get pupation in the soil up to the depth of 15cm. The adult fly emerges out in the morning after 05 - 30 days of pupation and take parts in reproduction. Prevention is very difficult of this pest, farmers are advised to spray the chemical pesticide as, malathion 0.05% or dimethoate 0.03% or carbaryl 0.2%. farmers were also advised to apply some natural enemies as braconids like Opius, parasitized the pupa of the pest and control the pest population.

MATERIALS AND METHODS

Standard methodology was applied for the study of life history of *Bactrocera cucurbitae Coquillett*, on the vegetable *Momordica charantia*. The life-cycle of the experimental pest and the nature of damage of the host plant were studied in the crop field as well as in laboratory. The life-cycle was studied during the year 2018—2020. Five healthy selected plants of *Momordica charantia* were completely and carefully covered by a small mesh mosquito net separately. One pair (one male and one female) of experimental pest were introduced on the plant covered by mosquito net and make observation daily. One pair (one male and one female) of the experimental pest were kept in the cage of 20 cm X 20 cm X 30 cm, a branch of host plant having flowers, buds and fruits introduced into the cage and provided them space and food for egg laying and hatching , the observation were recorded for further study. Methods of prevention of crop and control of pests by chemical and biological methods were applied and recorded.

OBSERVATION: Moderate temperature and moist weather makes Ramgarh suitable for the vegetable cultivation. *Bactrocera cucurbitae* Coquillett, is one of the serious cucurbitaceous pest, it infests vegetables and fruits especially cucumber and musk-melon. Now the present author deals the destruction of medicinal vegetable *Momordica charantia by the pest Bactrocera cucurbitae Coquillett, at Ramgarh*. It is a common medicinal vegetable of Ramgarh (Jharkhand,India), cultivated throughout the year. It was observed that the pest *Bactrocera cucurbitae* Coquillett also infest the host plant *Momordica charantia* seriously, the Bitter gourd or bitter melon or karela.

Morphology of the pest: The experimental adult fly is common in India. It is reddish-brown in colour having black and white spots. The thorax was curved and lemon-yellow in colour. The wings provided vertical strips and brown marking on the apex. Commonly it was found sitting in wing-spread position. It is measured about 07 mm in length and 03 mm in breadth, with a wing expense of about 14 mm.

Morphology of eggs: The freshly laid eggs were white, shining and cylindrical, slightly curved and with one end tapered in shape and about 01.20mm in length and 0.40mm in breadth. Morphology of the maggot (larva): Elongated, white flashy and wrinkled body about 07 to 10 mm long, and 02.04mm wide

Morphology of the pupa: It is barrel shaped and light brown in colour.

Life cycle of pest: The adult fly emerges out from pupa in summer and rainy season within 01 to 07 days and in winter it takes up to 30 days, after the emergence the adult flies take part in reproduction. With the onset of monsoon the activity of adult fly increases and it became very much active and take part in breeding, at the dusk the female fly selects suitable site for egg laying, by the help of ovipositor it makes a tunnel in to flower or fruit and inserted the eggs singly or in cluster of 04 to 10 and in 02 to 04 mm deep. After egg laying the female releases a resinous secretion which seal the puncture place. This is the mechanism to protect the eggs from predator and adverse climate. The oviposition takes place at the intervals of 02 days in summer and 05 to 10 days in winter and continues up to 12 to 60 days. There are 02 to 30 eggs were laid per day. One female lays on and average 50 to 70 eggs in 10 to 60 days. The total egg laid by a female was 100 to120. After 02 to 05 day in summer, 03 to 07 days in rainy and 07 to 10 days in winter and in extreme cold days it may extend up to 30 days of incubation period the eggs hatched in to maggots. The maggot bores deep into the fruit and continuously feed on the internal

contents or the pulp of the fruit resulting in its complete destruction of the fruit. The larval life varies from 02 days in summer to 25 days in winter. The fully grown larva come out from the fruit, fall to the ground and enter in the crevices or in the soil.

Metamorphosis takes place in the pupa. The average life of male fly was 50 to 55 days and female fly was 60 to 65 days, but the climatic condition and the availability of food increases its longevity. The life-cycle of the pest was completed in 08 days in summer and 35 to 60 days in winter. During extreme cold days the pest hibernate and the adult congregate under the fallen leaves, cracks and crevices. The pest breed throughout the year and completed 12 to 18 overlapping generation.

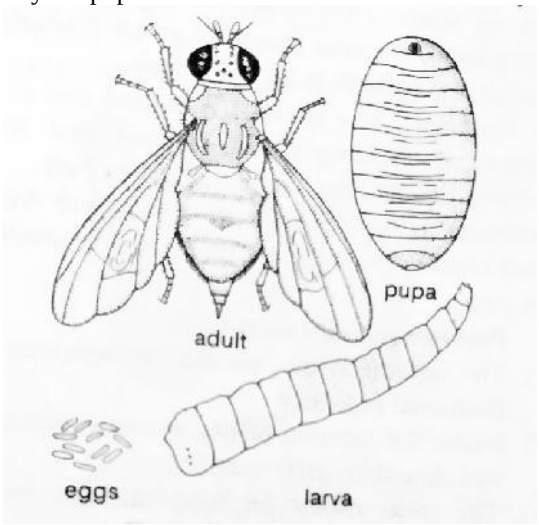
Table.

Name of season	No. of eggs laid/day	Incubation period of eggs in days	No. of days of larva (maggot) mature	No. of days of pupation (emergence of adult)	Life-cycle completed in days
Summer	08—10	02 –05	01—04	05—07	08--16
Rainy season	05—07	03—07	04—07	08—10	15—24
Winter season	01—04	07—10	07—30	10---30	22—70

Tabular representation of life-cycle of pest *Bactrocera cucurbitae Coquillett.* , on host plant *Momordica charantia* .

SUGESSION FOR CONTROL OF PESTS

- Farmers are advised to spray any of the chemical pesticides like Diazinon (0.2%), Parathione (0.02%), Malathione (0.05%) or Carbaryl (0.2%).This can be minimized the pest population on host plant.
- If the infestation occur during later stage, spray the malathion 0.05% mix with the molasses 0.1% was effective to control the pest population.
- Biological control was advised to introduced of Opius fletcheri, O.incisus etc.as hypoparasites which destruct the pupa stage and the maggot fallen on ground.
- Regular raking up of soil of the cultivated field help to destroy the pupa.



Life cycle *Bactrocera cucurbitae* Coquillett. on the host plant *Momordica charantia(karela).*

DISCUSSION

Momordica charantia is a natural gift to human being in the form of green vegetable. It is a well- known natural medicine to control the blood sugar, weight- loss, improve immunity. The high nutritional values, high in fibres, low in calories, cholesterol, rich in vitamin A and vitamin C, makes it a good health supplement (Upadhyay 2021). Regardless of its bitter taste its demand is increasing because people across the world likes it. The serious pest *Bactrocera cucurbitae* Coquillett, destruct the vegetable fruits in such a way that it looks fresh from outside, and total damage from inside, during preparation. *Bactrocera cucurbitae* Coquillett is a serious pest of pumpkin and musk-melon it is also known as melon fruit fly but the present author deals with the destruction of the medicinal vegetable *Momordica charantia* (karela) by the serious pest *Bactrocera cucurbitae Coquillett, a case study at Ramgarh (Jharkhand,India).* This pest *(fly) was very active*, female fly puncture the tender fruits as well as the ripening fruits by the help of its ovipositor and laid eggs inside the fruits. It also laid eggs in the flower, through which the eggs enter into the fruit. After egg laying the female releases a resinous secretion which seal the puncture. It gives a perfect protection to the eggs and larvae (upadhyay2020). The pest was very active during the summer season it completed its life-cycle in 08 days only. In winter it hibernates and all the vital activities gets slowdown, its life-cycle completed in and up to 60 days. The life-cycle was directly influenced by temperature, humidity, pH. etc (Upadhyay and Verma2004,2005, Upadhyay2009, Mala and Kumar2019 and Upadhyay2020).The pest damage the cultivated host plants and the fruits become un-consumable. The pest decline the production of fruits, in their size, their number and the taste of the crops.

The pest not only decline the production of the crop but also decline the financial status of the farmer (Upadhyay2017, Upadhyay and baxi2019). The medicinal vegetable *Momordica charantia* is a very useful food item for mankind it control the blood sugar, heart attack, strengthening the bone, boost up the immunity. It is so called as the *Momordica charantia* improve the immunity to fight with COVID-19.Vegetable cultivation is primary farming of Ramgarh(Upadhyay 2020). Wide 4 lane N.H. and good connectivity of railway makes Ramgarh good and prime market for vegetable sale (Upadhyay 2017 ,Upadhyay & Bakshi 2019 ,Upadhyay 2020). The life-cycle of this fly was very complex. The eggs were deposited inside the fruit of *Momordica charantia*, the larva drop out from the fruit to the ground, and get dispersed, the mature maggot enters to the soil, cracks or the crevices, and pupate there. The adult emerges out in the morning and takes part in reproduction. The total life span of male fly was 50 to 55 days and female fly was 60 to 65 days, it may increase on the availability of food and favourable temperature. Eggs and larva were protected in the fruit, matured larva and pupa were protected under the soil. The fly was very active and not restricted at one cultivated farm only. Prevention and control of the pest was a very difficult phenomena. The spray of carbaryl 0.2% or dimethoate 0.03% or malathione 0.05% or endrin 0.04% these chemical kill the eggs, larvae and adults on the surface of the host plant (Kumar &Tiwari 2009, Prabhakar & Roy 2009). To control the pest population the farmers were advised to spray the malathion 0.05% mix with molases in water. Some natural

enemies like Opius fletcheri, O.incisus etc. were introduced in crop field to parasitized the larvae

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