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Morphological, Anatomical And Biochemical Changes In Soap Nut Tree Pest, Leptocoris Augur (Fabr.), Induced By The Parasitization Of Hexamermis Vishwakarma, Dhiman

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Abstract:

In parasitized bugs, ***H. vishwakarma*** nematode brings morphological, physical anatomical and biochemical changes. Abdomen of host becomes biconvex, cuticle becomes thin, host turns lethargic, flight abilities are lost, feeding propensities increase. Thoracic, abdominal and flight muscles are reduced. Reproductive organs testes vasa deferentia, ovaries, oviducts etc. are found distorted and greatly reduced. Many biochemicals found in the hemolymph, muscles, testes, ovaries are observed depleted in parasitized bugs as compared to control one. The parasite may be used as good biocontrol agent for ***L. augur***.

Key Words: ***Leptocoris augur***, ***S. oleosa***, ***H. vishwakarma***, parasitization induced changes, morphological, anatomical, biochemicals.

Introduction:

Leptocoris augur (Fabr.) (Heteroptera Coroidea – Rhopatidae) is a pest of soap nut tree (Kusum) ***Schleichera oleosa*** Lour (Sapnidacoal). It is a gregarious feeder and by its disaping nature viability of the seeds is lost (Dhiman and Gulati, 1986, 1994). On the host plant of the bug, best quality of lac is cultivated. Although, ***S. oleosa*** is a major host plant of ***L. augur***, but Dhiman and Gulati (1985) also recorded four new host plants from Saharanpur such as ***Salmalia malabarica***, ***Adera cardifolia***, ***Justica gendarussa*** and oxalis acetosila Natural enemies of insect pests are of vital significance as they act as biocontrol agents and help in IPM various natural enemies of ***L. augur*** are reported by Jain **et.al.** (2019) and among these ***Hexamermis*** sp. was first recorded from ***L. augur*** by Dhiman (1984) since then, a good piece of work has been carried out on it time to time by Dhiman and Gayyur (1993), Dhiman and Kumar (1996), Dhiman and Singh (1991) and Gayyur (1993). In present paper an effort is made to describe various changes in ***L. augur***, due to the parasitization of ***H. vishwakarma*** Dhiman, a mermithid nematode.

Materials and Methods:-

HRI and training center Saharanpur campus was selected as study site area when host plants (***S. oleosa***) of the bug are planted in good number. Healthy and parasitized bugs were collected and brought alive in polythene bags to Ent. research lab for further study. In lab these were reared in good number on the fresh supply of fruits of host plant in hurricane glass lantern chimneys covered at top by muslin cloth and in wooden wire guaze cages.

Emerged parasite (post parasitic stage) of ***H. vishwakarma*** were separately reared by the method described by Dhiman and Ghayyur (1993) on the healthy bugs (all stages, 1st - Instar to Adults) preparasitic names were sprayed along with water by a hand sprayer in a wooden cage. Parasitized bug were reared separately to watch their behaviour by keeping close vigil on them. Several dissections of the parasitized bugs were made time to time under binocular microscope to ascertain the effect of parasitism on the internal organs of the host bug.

For knowing biochemical changes in the parasitized and healthy bugs, the collected bugs were divided into two groups (control and parasitized) with four sub groups having both male and female bugs.

Sample Collection:

Haemolymph was obtained by cutting femur of hind leg. It was pooled from bugs by both groups (controlled and parasitized) with required age and sex. Pooled haemolymph of each sex formed a sample and three such samples were collected from each group of the bugs, i.e., controlled and parasitized at a regular interval of 5 days, 10 days, 15 days and just prior to emergence of parasitic nema, small ice cooled. Centrifuge tubes which were previously coated with phenylthiourea to inhibit tyrosine activity, were used the haemolymph was centrifuged at 7000 rpm to obtained a supernatant free haemocytes aliquots of 0.05 ml supernatant were used to determine the protein, lipid, glucose and free falty acids concentration.

For determination of proteins and free amino acid concentration of controlled and parasitized bugs in muscles, testes and ovaries, a known weight of each tissue was homogenized in a mixture of chloroform and methanol and centrifuged at 7000 rpm to obtain the supernatant. The residue was directly estimated by employing the colorimetric method. The concentration is stated in mg/100mg tissue weight of gonads or muscles.

Analysis:

The paper chromatography was done according to the method of Smith and Agiza (1951). Quantitative and qualitative estimation of bio-chemicals was estimated following the procedure Lowry and coworkers using bovine serum albumen (BSA) as the standard (1951) and methods described by Kumkum (2005).

RESULTS

The studies are divided into three groups:-

A. Morphological and physical changes:

(i) The host bug stage (nymphs or adults) becomes slightly irritated as the preparasitic stage of nematode enters into its body, it becomes restless and as the entire worm enters into body, the bug turns to be normal.

(ii) As the parasitic stage grows in size and attains several coils, the abdomen of the host bug becomes swollen and biconvex in shape.

(iii) The body cuticle of the host becomes thin so that coils of the parasitic stage are visible externally and it makes easy to identify parasitized bug from healthy ones.

(iv) Flight ability of the host bug is lost due to dissolution of flight muscles, used as food by parasite.

(v) Extrinsic leg muscles also damaged and movement of the host is restricted.

(vi) Due to depletion of food reservoir of the host, used by parasite as food, feeding properties of the host stage greatly increase and use most of time in feeding on the seeds and leaves of the host plant.
(vii) External genitalia of either sex are not affected but due to the damage of their muscles, no copulation and oviposition is recorded.
(viii) Sometimes a bluish spot-on abdominal cuticle appears on either side of posteroventral part.
(ix) Moulting of nymphal stage is not observed and the growth of nymph is adversely affected.
(x) Pigmentation turns light and the host bug becomes dull in colour.
(xi) Finally, after the emergence of parasitic ***H. vishwakarma*** from the host body, the host bug dies within few minutes due to loss of haemocoelomic fluid and other vital organs of body.
(xii) Weight of the parasitized bug increases super parasitism increases slightly more weight of host bug.
(xiii) The parasitized bug stage becomes lethargic.
(xiv) Antennal movement is also observed affected by highly parasitized bug.

B. <u>Anatomical Changes:</u>

Many anatomical changes in the host bug body are scan due to parasitization by ***H. vishwakarma*** which are as under: -

1. After entrance into host, the parasitic stage takes nutrition from haemocoelomic fluid of the host by absorption through body wall. It causes quantitative loss in it.
2. The reserve food in the form of fat bodies of the host bug which lies around alimentary canal and reproductive organs are consumed by parasitic nema either by dissolution by enzymes and absorbing through body wall or directly by suctorial mouth.
3. Body muscles (abdominal, thoracic, flight muscles and even antennal intrinsic muscles are devoured by parasite.
4. No marked effect due to parasitism on the nervous system of host is observed.
5. Most of the tracheal system remain intact however, many tracheal branches are found damaged and lost.
6. Testes, vasa deferentia, accessary reproductive organs and muscles of aedeagus are greatly reduced, found dissolved in many cases causing cent percent sterility in male bugs.
7. Female reproductive organs also found greatly affected Ovaries greatly reduced, no, vitellogenesis and ovulation occurs, oviducts and accessory reproductive organs are dissolved or greatly reduced. Genital muscles are also dissolved. Like male ***L. augur***, female also becomes totally sterile.
8. Parasitized bug has negligible amount of haemocoelomic fluid because body cavity of the host is filled up by the many ribs of the host parasitic stage and taken by parasite as food.
9. At last, before emergence, alimentary canal of the host, especially post part is found damaged.

C. **Biochemical changes: -** Parasitization of ***L. augur*** by ***H. vishwakarma*** results in following biochemical changes: -

1. Concentration of protein and glucose in hemolymph muscles and gonads of parasitized bug in comparison of healthy one, is decreased in either sex.
2. There is a decrease in the majority of the hemolymph amino acid.
3. In the hemolymph of parasitized bug depletion occurs in glucose level but trehalose remains the same.
4. Along with glucose level, carbohydrate level was also found depleted in hemolymph, muscles, testes and ovaries.
5. Qualitative as well as quantitative level of amino acids, fatty acids and proteins fractions are also found depleted in haemo lymph, muscles, ovaries and testes.
6. It was further observed that concentration of total lipid in control bugs was very high as compound to that of parasitized bugs.
7. Level of cholesterol increased in parasitized bug.

8. In parasitized female, vitellogenin protein in hemolymph and ovaries was also observed depleted.
9. Super parasitism in 3rd to 5th instar nymphs of ***L. augur*** resulted increase in the level of uric acid five times in the haemolymph. Thus, parasitization decreases the efficiencies of excretory system of parasitized bugs.
10. The accumulation of toxic waste products and decrease in the nutrients of haemolymph trigger the parasitic stage of ***H. vishwakarma*** to leave the host bug.

Thus, parasitization brings drastic changes in the host bug, morphology, physical activity, anatomical and biochemicals. At last, after the emergence of parasitic stage the host bug stage dies. It brings cent percent mortality of host. In view of this, the mermithid parasite, ***H. vishwakarma*** has good potency to be used as a biocontrol agent. This open doors for further investigations.

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