Plants attacked by several enemies such as insects, bacteria and fungi etc. Since they are sessile and cannot runaway from their enemies they need to have some strategies to defend themselves. Many plants are constituted with different secondary metabolite compounds which are toxic or repellent to the attacking organism. Thus acting as defense chemicals and the phenomenon known as static defense. Some plants release several distinct volatile organic compounds in response to insect herbivore feeding or pathogen attack, which serve as a chemical signal and may attract natural enemies of the herbivore towards the damaged plant as an induced defense.

The present study involves in-depth knowledge of static and induced defense mechanisms in brinjal plant (*Solanum melongena* L.) against the infestation of shoot and fruit borer, *Leucinodes orbonalis* (Guen,) taken as a model system. The research work had two important facets. The chemicals present in brinjal plants as static or constitutive defense were analyzed followed by evaluation of their role as insect control or insect behavior modifying agents. Secondly, the pest feeding induced volatile chemicals that are generated within the plant in addition to those present in normal healthy plants were analyzed and then bioassayed against the pest’s natural enemy to confirm their role in attracting the insect parasitoid as a induced defensive response of *S.*
melongena. The crude extract of plant secondary metabolites from leaves and fruits of *S. melongena* were evaluated for their toxic and growth inhibiting effect against three important agricultural pests, *L. orbonalis*, *Spodoptera litura* (Fab.) and *Achaea janata* (Linn.) and four stored grain pests, *Tribolium castaneum* (Herbst), *Sitophilus oryzae* Linn., *Callosobruchus chinensis* Linn. and *Rhyzopertha dominica* Fabr.

It was observed that crude fruit extract was more effective than crude leaf extract. The pure compounds isolated from the active fruit extract were identified as caffeic acid methyl ester (methyl-(E)-3- (3,4-dihydroxy phenyl) prop-2-enoate) and two glycol alkaloids, solasonine and solamargine using analytical techniques such as UV, IR and NMR. On evaluation caffeic acid methyl ester showed significant antifeedant and growth inhibitory activity against *L. orbonalis*, *S. litura* and *A. janata*. These products also showed good contact toxicity, repellency and adverse effects on progeny production of the four stored product pests. Whereas, two glycol alkaloids solasonine and solamargine have exhibited good potential in producing morphological abnormalities in the treated lepidopteron insects. The effect of these alkaloids on stored grain pests, however, was moderate.

In the present study lepidopteron larval midgut trypsin and chymotrypsin showed diverse level of susceptibility to fruit extracts of a solanaceous plant brinjal. Trypsin was found to be the predominant and
most active protease enzyme in lepidopterous larvae than chymotrypsin. 

The regulation of proteases in the midgut of *L. orbonalis*, *S. litura* and *A. janata* by the test compounds confers that proteases could be targeted with natural products for the active insect control.

Brinjal, *S. melongena* plants exhibited clear and obvious responses to feeding stress caused by *L. orbonalis*. The changes in the nutrient profile along with the changes in the bio-chemical and enzyme levels were observed in the pest infested plants. A significant increase was recorded in the phenol and carbohydrate contents in the *L. orbonalis* infested *S. melongena* plants as compared to normal healthy plants. Similarly, the activities of plant defensive enzymes, phenylalanine ammonia lyase, peroxidase, catalase and superoxide dismutase were increased in pest damaged plants as compared to undamaged ones.

A quantitative difference in phenolic compounds was also noted in the infested brinjal plants. Certain phenolic acids such as chlorogenic acid, caffeic acid, vanillic acid, syringic acid and p-coumaric acid were quantitatively increased in the pest infested brinjal plants. Duration of feeding by pest also had profound impact on phenolic production. A gradual increase in phenols was recorded up to 72 hr of feeding, which declined after 96 hr. Thus a maximum increase in phenolics was observed after 72 hr of *L. orbonalis* feeding, indicating a rapid response. *L. orbonalis* infested brinjal plants were found highly attractive to the egg
parasitoid, *Trichogramma chilonis* (Ishii) of the pest indicating that they release a specific blend of volatiles which help the parasitoid for locating the host plant. GC-MS analysis showed quantitative and qualitative changes in the plant surface chemicals in *L. orbonalis* infested and uninfested plants. The hydrocarbons and terpenoid chemicals found in the volatiles collected from the pest induced *S. melongena* leaf and fruit surfaces were attractive to the parasitoid, *T. chilonis* in laboratory choice and no choice bioassays.

The work will greatly enhance the understanding on the basic plant defense mechanisms against herbivores and the influence of specific biochemical signals in a plant. The work emphasizes the importance of use of pest induced plant chemicals in controlling the *L. orbonalis* population by enhancing the parasitization potential of the biocontrol agents. As an applied goal, such studies may also lead to the development of crop plants with enhanced resistance to pests. It would certainly help in understanding plant defense systems and also to develop innovative and environmentally safer pest control measures. It will also be an aid to the scientific community engaged in the development of future transgenic host plants resistant to the shoot and fruit borer, *L. orbonalis*.