Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2021; 9(1): 2130-2133

Received: 30-10-2020
Accepted: 28-11-2020

Vrunda S Thakare
Ph.D. Scholar, Department of Agricultural Entomology, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra, India

DB Undirwade
Prof. and Head, Department of Agricultural Entomology, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra, India

US Kulkarni
Associate Prof. Department of Agricultural Entomology, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra, India

SM Ghawade
Vegetable Breeder Cum Horticulturist, Chili and Vegetable Research Unit, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra, India

Corresponding Author:
Vrunda S Thakare
Ph.D. Scholar, Department of Agricultural Entomology, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra, India

Anatomical character study in relation to brinjal shoot and fruit borer

Vrunda S Thakare, DB Undirwade, US Kulkarni and SM Ghawade

Abstract
Anatomical characters seem to be related with resistance or susceptibility of brinjal varieties/genotypes to shoot and fruit borer. Genotypes or varieties having thick cuticle, thick collenchymatous area (hypodermis), compact parenchyma cells in cortical tissue, small area in the cortical tissues, more vascular bundles with narrower spaces in the interfascicular region, and compact arrangement of vascular tissue with lignified cells and small pith were the main characters of resistant/tolerant varieties. On the other hand, susceptibility of brinjal genotypes or varieties are attributed to anatomical characters like thinner cuticle and collenchyma area (hypodermis), loose parenchyma cells in the cortical region, larger spaces between vascular bundles i.e. interfascicular region and large pith, less number of trichomes, soft parenchymatous cells in the interfascicular region. Such variation in anatomical character might be responsible for the resistance or susceptibility to brinjal shoot and fruit borer.

Keywords: plant anatomy, brinjal, shoot and fruit borer, *Leucinodes orbonalis*, resistance, susceptible

1. Introduction
Brinjal, also known as eggplant or aubergine belonging to the family "Solanaceae", is one of the common and popular vegetables grown in tropical and subtropical countries of the world [5]. The brinjal shoot and fruit borer, *Leucinodes orbonalis* is the most destructive pest which causes yield loss up to 60-80 per cent (Krishnaiah and Vijay[9]; Kaur *et al*. [8]). Brinjal shoot and fruit borer have a specific nature of feeding. After hatching, the tiny larvae bore into the growing tips of young shoots during their early growth stages. They close the entry hole with excreta and feed inside [4]. Due to the larval activity within the shoot the transmission mechanism of plant sap is affected [1]. It feeds on internal tissue causing the plants to fade and wither resulting in drying and drooping of the growing shoot which is the typical symptom produced. At later stage of growth, the larvae prefer flower buds and bores into the young fruits on the initiation of fruiting by making a very small hole around the calyx. leaving no sign of entry. The affected fruits lose their market value, besides a considerable reduction in yield. Since the larvae inhabit inside the plant shoots or fruits, management of this pest becomes difficult [2].
Currently, farmers rely solely on the application of pesticides to control *L. orbonalis*. But the use synthetic insecticides are very hazardous to human health as the crop is a staple food and consumed in its original form. Extensive and indiscriminate use of pesticides is responsible for the development of resistance in the pests; persistent effects of chemicals, constantly polluting our environment and through bio-magnification have become the part of human food chain. Thus, the most important and effective way to manage an insect pest is the use of resistant cultivars. Host plant resistance strategy serves as an excellent component when integrated with other approaches as it has several advantages over other measures.
Plants acquired insect-resistant characters due to their co-evolution with insects. The relationship between an insect and crop cultivar is influenced by the kind or mechanism of resistance, namely, antixenosis (non-preference), antibiosis and tolerance [12]. Morphological or structural qualities of host plant interfere with insect behavior such as mating, oviposition, feeding and food ingestion. Pubescence and tissue hardness limit insect mobility acting as structural barriers [16]. Various mechanical resistance factors in plants such as solidness of stem, thickness of tissues, anatomical adaptations and protective structures affect the use of a plant as a host by phytophagous insects like brinjal shoot and fruit borer. Antixenosis or no-preference of some cultivars has been attributed to anatomical charac**ters** such as compact vascular bundles in a thick layer.

Therefore, it is desirable to look for anatomical character of shoot which leads antixenosis to withstand damages caused by pest attack. Further the recognition of this resistance characters may lead to introduction of such character to favored genotypes. Therefore, the present work has been undertaken to study the anatomical characters in relation to resistance against brinjal shoot and fruit borer.

2. Materials and Methods

2.1 Research Area

Twenty-two brinjal genotypes comprised thirteen genotypes of the university, eight hybrids, and one local cultivar were grown at Chilli and Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *Kharif* 2017 in Randomized Block Design with 22 treatments replicated thrice, to determine the relative infestation of brinjal shoot and fruit borer among the selected brinjal genotypes. The site selected was uniform with typical light, medium black cotton soil having fairly good drainage. Due care was taken to maintain the proper growth of the crop. No pesticidal spraying was given. After transplanting field screening of various genotypes was carried out under natural conditions in three different phases *viz*., the seedling, vegetative and fruiting phase at an interval of 10 days. The mean per cent shoot infestation of each genotype was calculated using the formula given by Rahman *et al*. [14] and categorized them in different grades as per the infestation level adopted by Subbratnam and Butani [15].

Table 1: Categorized genotypes/varieties on the basis of shoot infestation level.

Type of Resistance	Genotypes/Varieties
Resistant	AKB-46, Jayant, Susa local
Moderately Resistant	AKB-62, AKB-31, AKLB-9, AKB-17-01, Samrat, AKB-18-3
Susceptible	Krishna, AKB-56,
Highly Susceptible	Swetha, AKB-77, AKB-17-3, Samrat

2.2 Methods of anatomical study

Based on the results obtained from the screening studies, five promising genotypes, representing one highly resistant, one resistant, one moderately resistant, one susceptible, one highly susceptible were selected for studying anatomical attributes.

For anatomical study, secondary shoots were collected on 100 days after transplantation from the infested plants from the categories group. These shoots were fixed and preserved in formalin-aceto-alcohol (FAA) solution [7]. Transverse sections of the shoot were made from fresh and fixed materials following free hand sectioning, using ordinary razor blades. Sections were made through the region 3rd and 4th leaf from the top. The uniform thin section was selected, and mounted in 50% glycerine temporarily following the general principle of Johansen [7]. The slides were examined under microscope to study the variation of anatomical characteristic of resistant, moderately resistant, susceptible, highly susceptible brinjal genotypes/varieties.

3. Results

Anatomical characteristics of different grades of resistant varieties are discussed below.

3.1 Anatomical character of highly susceptible genotypes/varieties

The epidermis of stem of susceptible variety Swetha is single-layered with thin cuticle, (Fig. 1). Epidermal cells are oval or round in shape. There are 5-6 layers thick collenchyma cells beneath the epidermis. Parenchymatous cells (4-5 layers) in the cortical region are larger in size with prominent intercellular spaces. Vascular tissues form ring with various thicknesses. The radial thickness of the interfascicular region is less compared to the fascicular (vascular bundle) region. The interfascicular region consists of less lignified cells (less number of fibers and vessels and more number of parenchymatous cells). The pith area is large. The abaxial side of pith is composed of large size cells. The epidermis bears less number of trichomes to variety. The ring of vascular tissue is sometimes interrupted by parenchymatous cells in the interfascicular region thereby the entry of the larvae of brinjal shoot and fruit borer becomes easier through this soft parenchymatous cells region.

3.2 Anatomical character of susceptible genotypes/varieties

The shoot of susceptible genotype (Krishna) has single-layered epidermis ((Fig. 1). The cells are round or somewhat oval in shape and more or less uniform in size. Epidermal cells are thin-walled and bear thin cuticle. Trichomes are very few in number. The hypodermis consists of 4-5 layers of moderately thick collenchymatous cells beneath the epidermis. The parenchymatous cells (4-5 layers) of the cortical region are thin-walled with prominent intercellular spaces. Vascular bundles are poorly developed. Vascular tissues form a ring of various thickness showing a beaded structure. The pith is large as compared to the other varieties. The pith contains parenchymatous cells, which are more or less similar in size as compared to the cortical tissue.

3.3 Anatomical character of moderately resistant genotypes/varieties

The shoot of moderately resistant genotypes (AKB-62) bears single-layered epidermis with a thick cuticle (Fig. 1). Epidermal cells are oval or tangentially elongated. The epidermis bears trichomes which are branched with or without a distinct stalk. These trichomes frequently impart general antixenosis type of resistance providing an effective barrier that prevents movement and feeding of larvae on the plant surface. There are 3-4 layers of very thick collenchymatous cells. The cortical region contains (5-6 layers) of parenchymatous tissues compared to that of other genotype/varieties. Cells are round, oval, or tangentially flattened. Vascular tissue is composed of lignified cells, which form a well-developed ring with uniform radial thickness. Fibers are more in number compared to other varieties. Phloem fibers are well developed and lignified. Interfascicular region of the moderately resistant genotype is less developed compared to fascicular region. Pith is medium is size.

3.4 Anatomical character of resistant genotypes/varieties

The shoot of resistant genotype (AKB-46) has single-layered epidermis with a thick cuticle. There are 6-7 layers of very thick collenchyma cells beneath the epidermis. Epidermal cells are round in shape. Trichomes are more in number and compact. Trichomes are branched with or without a distinct stalk. Cortical tissues are with very few intercellular spaces. Vascular tissues form a well-developed ring with uniform thickness (closely packed). The interfascicular region is composed of lignified tissues (Fig. 1).

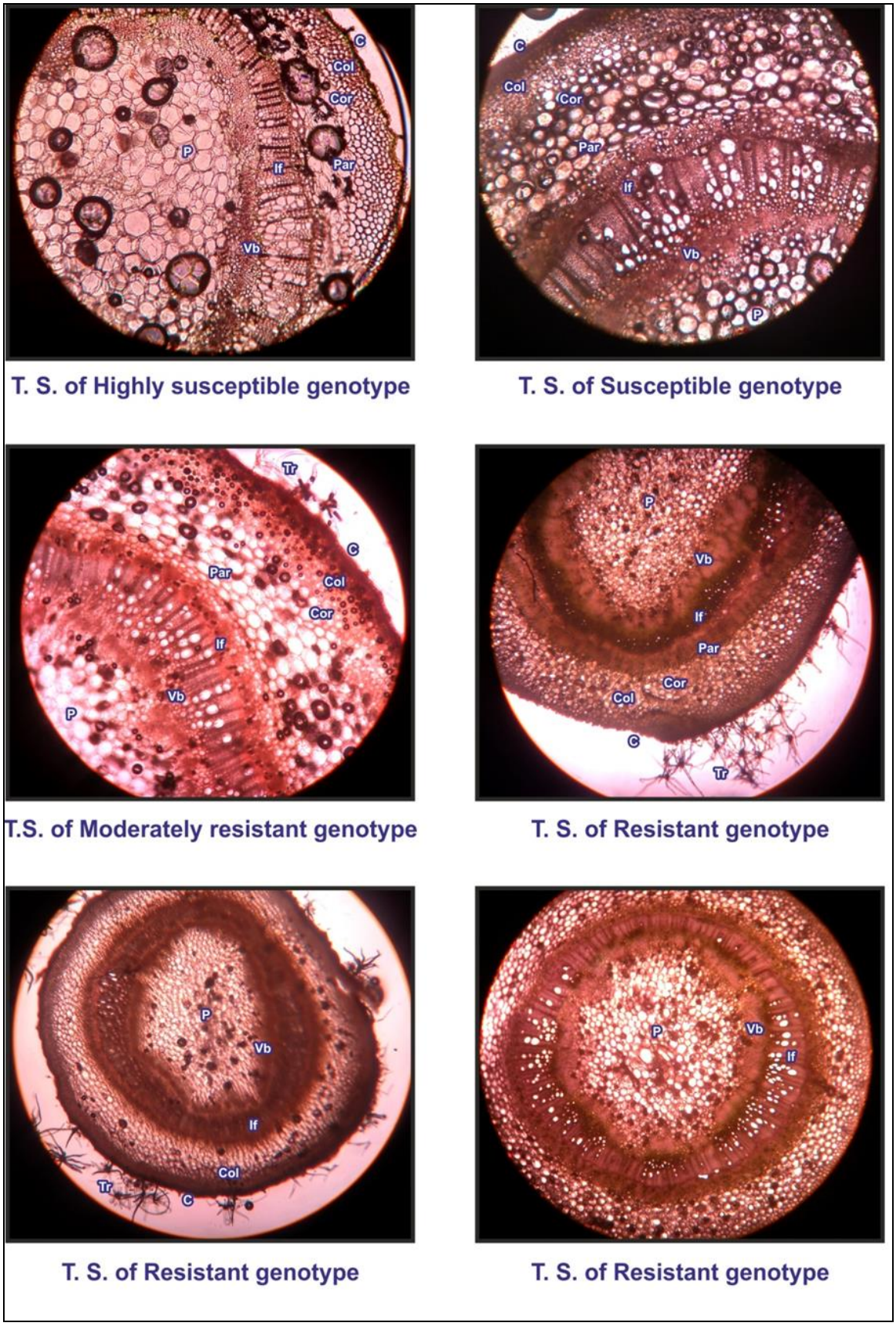

Fig 1: Variation in anatomical characters of different grades of brinjal genotypes/varieties C-Cuticle, Tr-Trichomes, Col- Collenchymatous cells, Cor-Cortical tissue, Par- Parenchymatous cells, If-Interfascicular region, Vb- Vascular bundles, P-Pith

4. Discussion

Brinjal varieties showed resistance to *L. orbonalis* by heavily lignified sclerenchyma layer and closely packed vascular bundles, reported by Ali *et al.* [3] and Lall and Ahmed [10]. Mishra *et al.* [11] and Panda *et al.* [13] observed that larval entry is also affected by thick cuticle, small pithy stem and pointed unicellular trichomes. Also, present investigation results are consistent with findings of Hossain *et al.* [6] who observed that brinjal varieties with thick cuticle, broad and thick collenchyma area (hypodermis), compact parenchyma cells in

the cortical tissue, small area in the cortical tissue, more vascular bundle with narrower spaces in the interfascicular region, compact arrangement of vascular tissue with lignified cells and small pith offer some degree of resistance against *L. orbonalis*, Whereas susceptible varieties have a thinner cuticle and collenchymatous area, loose parenchyma cells, larger spaces in vascular bundles. Large pith, a smaller number of trichomes, soft parenchyma cells, responsible for susceptibility.

5. Conclusion

The anatomical characters assessed in the selected brinjal genotypes indicated that very thick cuticle, more collenchymatous tissue, compact parenchymatous tissue, cortical tissues with less intercellular spaces, vascular tissues closely packed with lignified cells form a continuous ring and small pith (p), recorded in the resistant genotypes/varieties resulted in less shoot infestation *L. orbonalis*.

6. Acknowledgements

The first author is thankful to the University Grant Commission (UGC), India, for providing financial assistance in the form of National fellowship during Ph.D. program. The authors are also thankful to Chili and Vegetable Research Unit for providing research area and Department of Entomology for providing technical facility required for anatomical study.

7. References

1. Alam MZ, Sana DL. Biology of the brinjal shoot and fruit borer, *Leucinodes orbonalis* G. (Pyralidae: Lepidoptera) in East Pakistan. The Scientist 1962;5:13-24.
2. Alam SN, Rashid MA, Rouf FMA, Jhala RC, Patel MG, Nath LK *et al*. Development of an integrated pest management strategy for eggplant fruit and shoot borer in South Asia. In: Technical Bulletin. AVRDC-The World Vegetable Centre, Shanhu, Taiwan. 2003;28:66
3. Ali MI, Ahmed S, Rahman T. Host plant Resistance in brinjal against the brinjal shoot and fruit borer, *Leucinodes orbonalis* GueneeIn: Ann. Res. Rep., Ent Div., BARI, Joydebpur, Gazipur Bangladesh 1994, 52-53.
4. Butani DK, Jotwani MG. Insects in vegetables. Periodical Expert Book Agency, D-42, Vivak Vihar110032. India 1984, 4-293.
5. Choudhary RS Control of Brinjal shoot and fruit borer *L. orbonalis* Guenee (Pyralidae: Lepidoptera). Entomon. 1967;7:257-259.
6. Hossain MM, Shahjahan M, Prodhan AKM, Islam MS, Begum MA. Study of Anatomical Characters in Relation to Resistance Against Brinjal Shoot and Fruit borer. Pakistan Journal of Biological Science 2002;5(6):672-678.
7. Johansen DA. Plant Micro Technique. McGraw-Hill, New York 1940.
8. Kaur M, Dhatt S, Ajmer S, Sandhu J, Gosal Satbir S. Genetic transformation of Cry 1AC gene to counter fruit and shoot borer of brinjal (*Solanum melongena* L), Crop Improvement 2010:37(2).
9. Krishnaiah K, Vijay OP. Evaluation of Brinjal Varieties for Resistance to Shoot and Fruit Borer, *Leucinodes orbonalis* Guen. Indian Journal of Horticulture 1975;32(1, 2):84-86.
10. Lall BS, Ahmed SQ. The biology and control of: brinjal (eggplant) shoot and fruit borer, *Leucinodes orbonalis*. Journal of Economic Entomology 1965, 448-451.
11. Mishra PN, Singh YV, Nautiyal MC. Screening of brinjal varieties for resistance to shoot and fruit borer (*Leucinodes orbonalis* Guen.) South Indian Hort 1988;36:188-192.
12. Painter RH. Resistance of plants to insects. Annual review of entomology 1958:3(1):267-290.
13. Panda N, Mahaptra A, Sahoo M. Field evaluation of some brinjal varieties for resistance to shoot and fruit borer (*Leucinodes orbonalis* Guen.). Indian Journal of Agricultural Science 1971;41:597-601.
14. Rahman MM. Vegetables 1PM in Bangladesh. In: Redcliffe's PM World Textbook, University of Minnesota 2007, 457-462.
15. Subbratnam GV, Butani DK. Screening of eggplant varieties for resistant to insect pest complex. Vegetable Science 1981;8:149-153.
16. Webster JA. Association of plant hairs and insect resistance. An annotated bibliography. USDA-ARS Misc. Publ 1975;1297:1-18.