Tobacco Research 39 (2) : 57-61, 2013

TOBACCO TYPE MEDIATED EFFECTS ON THE GROWTH AND DEVELOPMENT OF BEET ARMYWORM, *SPODOPTERA EXIGUA* (HUB.)

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(Received on 14th December, 2013)

A study was conducted to understand the effect of seven tobacco types on the growth and development of *S. exigua* through construction of laboratory life tables of the insect. Among the seven tobacco types on which the life table of *S. exigua* were constructed, the insect could complete its life cycle only on flue-cured Virginia (FCV) and burley types of tobacco. On other types the insect could not reach pupal stage. Between FCV and burley types, FCV supported better growth and development than burley. Mean generation time (T_c) was longer on burley (33.19 days) compared to FCV tobacco (30.3 days). Net reproductive rate (R_0), intrinsic rate of increase (r_c) and doubling time were 3.11, 2.33 and 2.22 times higher, respectively on FCV tobacco compared to burley. A combination of leaf surface chemicals and secondary metabolites of the cell sap could be governing the suitability or otherwise of a particular tobacco type as host to *S. exigua*.

INTRODUCTION

The beet armyworm, *Spodoptera exigua* (Hub.) is a pest of economic importance in many parts of the world (Abdullah *et al.*, 2000; Idris and Emelia, 2001). Suitability of plants for growth and development of phytophagous insects is an important factor for the establishment of a pest population on a crop plant. The physical and volatile signals emanating from plant lure the insect on its surface whereas chemical and nutritional factors of the food substrate determine consumption, development and survival in the larval stages and egg production in adult stage (Singh and Mullick, 1997; Naseri *et al.*, 2009). Study of the effect of different host plants on the biology of insects is an important strategy in understanding host plant suitability for insects (Azidah and Sofian-Azirun, 2006). The beet army has been reported as pest on tobacco in early nursery stage both on burley and FCV tobaccos and causes considerable loss of seedlings when unchecked (Prasad, 2004). So far, there are no reports on the effect of tobacco types on the growth and development of *S. exigua*. Hence, the present study aims to understand the effect of tobacco type on the growth and development of *S. exigua* through construction of laboratory life tables of the insect.

MATERIALS AND METHODS

A laboratory culture of *S. exigua* was maintained on fresh leaves of Bengalgram at 25±5 ºC and 75±5% R.H. The host plants are seven different tobacco types *viz.*, FCV (var Siri), *bidi* (var A 145), HDBRG, *natu* (NG 73), burley (Banket A1), chewing (Abirami) and *lanka* (Lanka special). These were grown at the premises of Central Tobacco Research Institute, Rajahmundry using standard agronomic practices and no plant protection measures were taken up on these plants.

The hatchability of eggs of a cohort laid on a single day was initially determined by counting the number of eggs hatched in three replicates. One hundred larvae that hatched from one cohort of eggs were transferred to freshly plucked leaves of the host plants and maintained in ventilated plastic containers with wet cotton and filter paper to retain the turgidity of leaves. The larvae were maintained in groups of 20 for the initial five days to cater to their gregarious nature. Later the larvae were maintained individually till death or pupation. Data on mortality were recorded everyday till all the adults died.

The methods suggested by Deevey (1947), Birch (1948), Morris and Miller (1954), Atwal and Bains (1974) and Chaudhary and Bhattacharya (1986) were used for constructing the life tables and for computing various life parameters. A computer programme developed using MS-Excel was used for processing the data (Lalitha Bharathi *et al.,* 2008).

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RESULTS AND DISCUSSION

Among the seven tobacco types on which the life table of *S. exigua* were constructed, the insect could complete its life cycle only on flue cured Virginia (FCV) and burley types of tobacco. On other types the insect could not reach pupal stage. Between FCV and burley types, FCV supported better growth and development than burley. The insect took 39 days to complete its life cycle on burley compared to 34 days on FCV (Fig. 1 and 2). The life expectancy (ex) at the beginning of age-specific life table was 10.70 on FCV and 8.28 on burley indicating higher suitability of FCV as host compared to burley. About 85% mortality of young larvae was recorded on burley between 2nd and 10th day of the life table whereas it was 64% on burley during that period.

The immature stages and pre-oviposition period lasted 28.5 days on FCV tobacco and 31.5 days on burley (Tables 1 and 3). Female survivorship was 0.03 on FCV and 0.01 on burley tobacco. Mean generation time (T_c) was longer on burley (33.19 days) compared to FCV tobacco (30.3 days). Net reproductive rate (R_0), Intrinsic rate of increase (r_c) and doubling time were 3.11, 2.33 and 2.22 times higher respectively on FCV tobacco compared to burley.

Among the other five tobacco types on which *S. exigua* could not complete its life cycle, lowest survival of 14 days was recorded on *bidi* tobacco followed by 16, 20, 24 days on *natu*, HDBRG, *lanka* and chewing tobaccos, respectively (Fig. 3 to 7).

Figure 1 .Age specific survivorship (lx), death(dx) and expectation of life(ex) of *Spodoptera exigua* on FCV tobacco (var.siri)

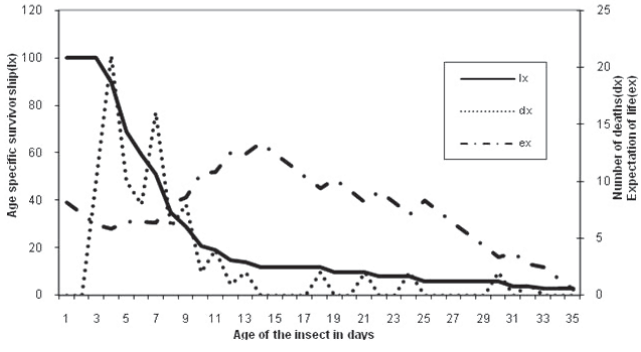


Figure 2 .Age specific survivorship (lx), death(dx) and expectation of life(ex) of *Spodoptera exigua* on burley tobacco (Var. Banket A1*)*

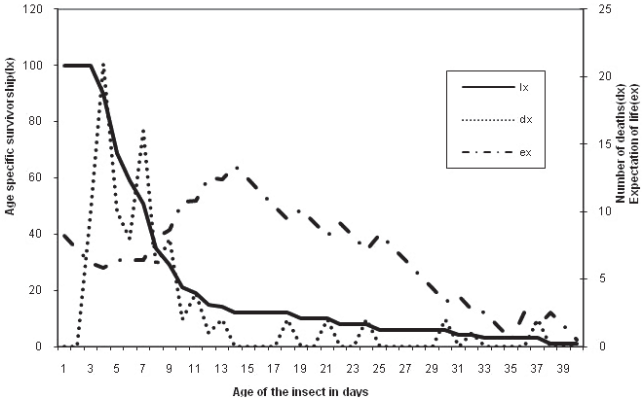


Figure 3 .Age specific survivorship (lx), death(dx) and expectation of life(ex) of *Spodoptera exigua* on Bidi tobacco (A145)

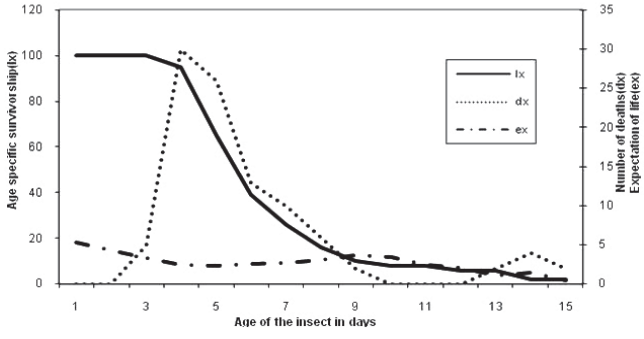


Figure 4 .Age specific survivorship (lx), death(dx) and expectation of life(ex) of *Spodoptera exigua* on *chewing tobacco* (Abirami)

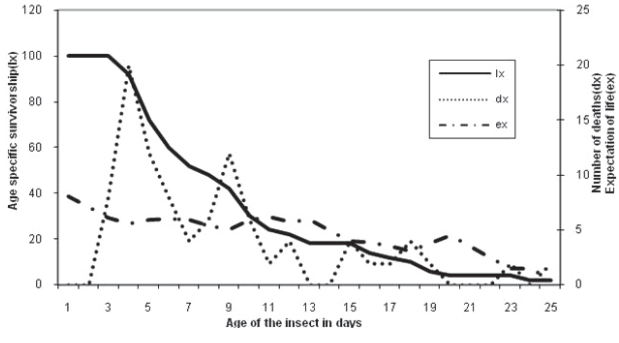


Figure 5 .Age specific survivorship (lx), death(dx) and expectation of life(ex) of *Spodoptera exigua* on *HDBRG*

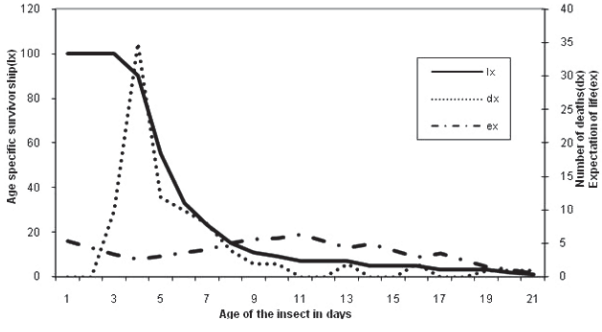


Figure 6 .Age specific survivorship (lx), death(dx) and expectation of life(ex) of *Spodoptera exigua* on *Lanka* tobacco

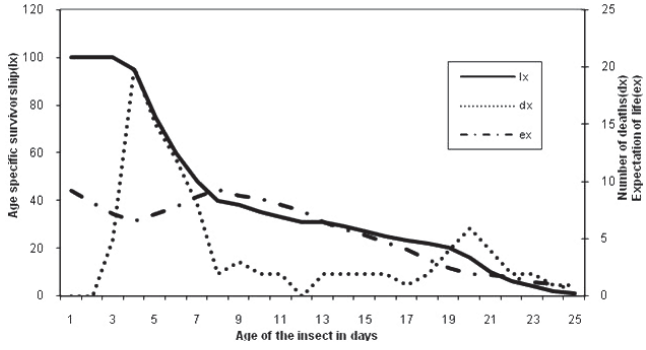
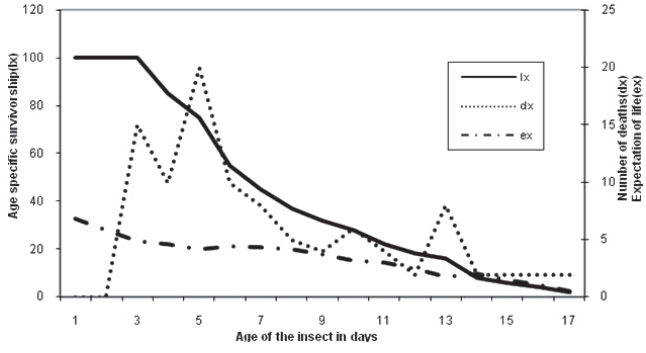


Figure 7 .Age specific survivorship (lx), death(dx) and expectation of life(ex) of *Spodoptera exigua* on *Natu (NG 73)*



The lowest life expectancy (ex) of 5.33 was recorded on *bidi* followed by 5.34, 6.83, 8.08 and 9.21 on HDBRG, *natu*, chewing and *lanka* tobacco types, respectively. Mortality of early instar larvae (between 2nd and 8th day) accounted for steep drop in survivorship in most of these tobacco types. In a study with *S. litura*, it was observed that among different types of tobacco, *hookah* and *lanka* types supported very good growth and development whereas *natu* tobacco supported very poor growth (Lalitha Bharathi, 2008). In this study it was observed that higher levels of leaf surface waxes in *natu* tobacco could be a reason for its lower suitability as host to *S. litura.* These results are in conformity with the results of present study in which *natu* supported poor growth of *S. exigua.* Leaf surface waxes containing non-volatile hydrocarbons, cutin, wax esters, free fatty acids were in high quantities in Dark Western Fire Cured (DWFC) tobacco which is resistant to *S. litura* (Gunneswara Rao, 2004). In another study with *H. virescens,* it was observed that the larvae of this budworm initiate but fail to maintain feeding on tobacco types that have higher levels of duvanes and sucrose esters which may be due to feeding non-preference and antibiosis factors (Johnson and Severson, 1982). Shah and Chakraborty (1985) reported that tobacco GT-4, a less preferred host by *S. litura* had higher glycosides, saponins and phenylalanine, all considered to be feeding deterrents or antifeedants. Laxminarayana *et al.*

Table 1: Life and fertility table of *S. exigua* on FCV tobacco (Siri)

Pivotal days X	Age specific female survivorship lx	Natality rate mx	Net reproductive rate lxmx	lxmx.X	Value of $e^{-r}x$ lxmx when r =0.10	Percent contribution of each age group to r
0.5 to 28.5 immature stages and pre-oviposition period						
28.5	0.03	38	1.14	32.49	0.1391	13.91
29.5	0.03	86	2.58	76.11	0.2924	29.24
30.5	0.03	124	3.72	113.46	0.3916	39.16
31.5	0.02	52	1.04	32.76	0.1017	10.17
32.5	0.02	34	0.68	22.10	0.0618	6.18
33.5	0.01	20	0.2	6.70	0.0169	1.69
		354	**9.36**	**283.62**	**1.0035**	**100.00**

Table 2: Life parameters of *S. exigua* on FCV tobacco (Siri)

S.No	Life parameter	Value
1	Net Reproductive Rate (R_0)	9.36
2	Potential fecundity (Pf)	354.00
3	Intrinsic rate of increase (approximate)- r_c females/female/day	0.07
4	Mean generation time (T_c) in days	30.30
5	Finite rate of increase (ë) females/female/day	1.08
6	Doubling time (DT)	9.39
7	Annual rate of increase	5.01×10^{11}
8	Weekly multiplication	1.68

Table 3: Life and fertility table of *S. exigua* on burley tobacco (Banket A1)

Pivotal days X	Age specific female survivorship lx	Natality rate mx	Net reproductive rate lxmx	lxmx.X	Value of e^{-r}x lxmx when r =0.10	Percent contribution of each age group to r
0.5 to 31.5 immature stages and pre-oviposition period						
31.5	0.01	35	0.35	11.03	0.1230	12.30
32.5	0.01	86	0.86	27.95	0.2924	29.24
33.5	0.01	116	1.16	38.86	0.3815	38.15
34.5	0.01	64	0.64	22.08	0.2036	20.36
		301	**3.01**	**99.92**	**1.0005**	**100.00**

Table 4: Life parameters of *S. exigua* on burley tobacco (Banket A1)

S.No	Life parameter	Value
1	Net Reproductive Rate (R_0)	3.01
2	Potential fecundity (Pf)	301.00
3	Intrinsic rate of increase (approximate)- r_c females/female/day	0.03
4	Mean generation time (T_c) in days	33.19
5	Finite rate of increase (ë) female/female/day	1.03
6	Doubling time (DT)	20.88
7	Annual rate of increase	1.83×10^5
8	Weekly multiplication	1.26

(2001) could not attribute the differences in epidermal characters of tobacco cultivars to susceptibility or resistance to insects pests. Hence, a combination of leaf surface chemicals and secondary metabolites of the cell sap could be governing the suitability or otherwise of a particular tobacco type as host to *S. exigua.*

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Central Tobacco Research Institute, Rajahmundry for providing the facilities required to conduct this study.

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